STAKEHOLDERS' APPROACHES TOWARDS NATURAL DISASTERS IN BUILT ENVIRONMENT: A THEORETICAL FRAMEWORK

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Built environment is subject to many risks due to the unique features of construction tasks, such as long lead item procurement, complicated design processes, safety, quality and environment, financial intensity, dynamic organization structures and natural disasters. Natural disasters are becoming more frequent, expensive and devastating globally. They also jeopardize society, performance of economy, built environment, and other socio-economic and physical conditions. While natural disasters cannot be eliminated, successful construction projects are those where natural disasters are effectively managed by stakeholders. Little is known about stakeholders' responses towards natural disasters in construction projects and built environment. Furthermore, past theories on shaping stakeholders' approaches towards natural disasters have been shown to be inadequate in terms of their ability to represent real-life practice and measure the stakeholders' responses against disasters. Hence, the aim of this paper is to develop a theoretical framework on stakeholders' approaches towards natural disasters that integrates four theories, namely: (i) stakeholder theory; (ii) macroeconomic theory; (iii) disaster management theory and (iv) decision making theory. With disaster risk management theory providing the practical backbone of the theoretical framework, the other three theories are able to provide the additional explanation of various aspects of stakeholders' decision making process. Through disaster risk management theory, we are able to support the reactive or proactive approaches of stakeholders before, during and after natural disasters. Macroeconomic theory plays crucial role to choose the appropriate socio-economic variables in natural disaster management process. Decision making theory and stakeholder theory altogether pave the way to select the pivotal stakeholders and to manage their behavioural patterns against natural disasters. The paper concludes the anticipated benefits of proposed theoretical framework as (i) direct comparison of different stakeholders' approaches (reactive and proactive) against natural disasters in built environment; (ii) high-level disaster management planning decisions; (iii) contemplating disaster risk analysis and disaster risk response simultaneously.

Keywords: built environment, disaster management, stakeholder approaches, theoretical framework.

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INTRODUCTION

In devastating natural disasters not only local communities but also all people of a region or in some cases all people of a country are affected because of the fact that natural disasters have direct and indirect impacts on socio-economic and built environment conditions. Therefore, natural disaster management is highly recommended in built environment particularly from stakeholders' perspective. Although there are two approaches to tackle the natural disasters; reactive and proactive approaches, most studies have claimed that the stakeholders often resolve the predicaments arisen in natural disasters by reactive approaches (Bosher *et al.* 2009; Brilly and Polic, 2005; Loosemore and Hughes, 1998). An important matter for the natural disaster management team is to identify and analyse those stakeholders who can have an influence over natural disaster management phases. This paves the way for managing a process that maximizes stakeholder positive input and minimizes any adverse or negative consequences. The early definition of stakeholder's terminology comes back to 1980s. Freeman (1984) explained that stakeholder as an individual or group entity who can have an effect, or is influenced by, the goals and objectives of an institution. He also described that the purpose of stakeholder management was to devise methods to manage the myriad groups and relationships that resulted in a strategic fashion. Increasingly, Freeman (1984) developed the stakeholder management theory. Harrison *et al.* (2010) claimed that stakeholder theory should be considered the decision makers' roles, their decisions and who takes advantages of the outcomes of those decision. Therefore, for natural disaster management in built environment and construction projects, it is the responsibility of stakeholders to cope with devastating impact of natural disasters effectively. Built environment stakeholders are individual and institutions that are involved in the built environment life cycle or whose interests may be affected as a result of construction phase or built environment commissioning, operation and maintenance. The built environment decision making process requires a profound integrated understanding of how to avoid and mitigate the effects of risks and disasters (Bosher *et al.* 2009). In order to have a resilient built environment, stakeholders' approaches should be systematically considered in planning, execution and post-disaster reconstruction in natural disaster management process.

This paper aims to develop a theoretical framework for stakeholders' approaches towards natural disasters in built environment through a synthesis of four theories, namely: macroeconomic theory, disaster risk management theory, stakeholder theory, and decision making theory. As claimed by (e.g., Albala-Bertrand, 1993; Skidmore and Toya, 2002; Toya and Skidmore, 2007) macroeconomic theory supports the relationships between natural disaster impacts and socio-economic variables such as Gross Domestic Product (GDP), income level, population. Disaster risk management theory provides all necessary phases to mitigate the impacts of natural disasters (Bosher *et al.* 2009). Increasingly, the combination of decision making and stakeholder theories help to shape stakeholders' approaches towards natural disasters.

A FRAMEWORK FOR THE STAKEHOLDER APPROACHES AGAINST NATURAL DISASTERS IN BUILT ENVIRONMENT

An overview of literature related to natural disaster management in built environment and construction projects research works indicates that previous research efforts have dealt mainly with two research streams separately, including impact of natural disasters on socio-economic condition (e.g., Haque, 2003; Ibarrarán *et al.* 2007; Kahn *et al.* 2005) and impact of natural disasters on built environment (e.g., Hunt and Watkiss, 2010; Roberts, 2008; Wilby, 2007). Few studies have focused on stakeholders' roles and reaction behaviours against natural disasters in built environment with considering socio-economic condition (Roberts, 2008). Figure 1 shows the theoretical framework for stakeholders' approaches towards natural disasters. Moreover, Figure 1 illustrates the mainstream theories in italics, indicating their applicability for explanation and theoretical support.

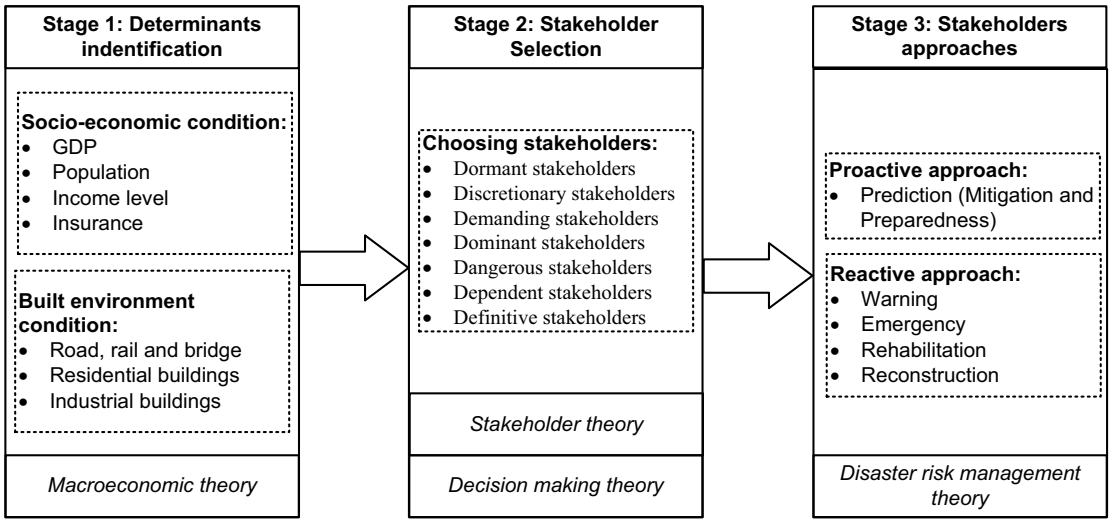

Figure 1: Stakeholders' approaches towards natural disasters

Socio-economic exposure and pertinent determinants

Understanding disaster threats requires comprehension of not only geophysical and biological processes and outcomes, but also the condition of population, economy and income levels, as well as other elements related to socio-economic condition (Haque, 2003). Natural disasters can have significant impacts on the overall economic performance of the society. Figure 1 depicts that natural disasters affect four main socio-economic related determinants, namely: GDP, population, income level, and insurance. Most of the time natural disasters have led to GDP fluctuation, economic loss, population loss, and insured loss among different income levels not only in developing countries but also in developed countries (Haque, 2003; Skidmore and Toya, 2002; Toya and Skidmore, 2007).

One of the most distinguished features of each natural disaster is population exposure. This exposure includes casualties (deaths and injuries). Many of the socio-economic and demographic variables are highly correlated with deaths and injuries associated with natural disasters (Haque, 2003). Population vulnerability describes the characteristics of individuals that make them more or less likely to be injured, killed, displaced, or to have their daily lives disrupted as the result of natural disasters

(Zahran *et al.* 2008. Hence, population vulnerability plays indispensable role in developing any disaster management indices.

Income distribution is a critical factor to determining death toll in natural disasters. Although statistical analysis shows that rich and poor countries are similarly susceptible to natural disasters (Kahn *et al.* 2005), the poor suffer higher mortality rates after natural disasters (Ibarrarán *et al.* 2007; Kahn *et al.* 2005; Pelling and Uitto, 2001).

Ibarrarán *et al.* (2007) claimed that limited access to credit markets, insurance facilities and government officials play critical role in exacerbating the impacts of natural disasters in society particularly in the poor communities. Minority and lower income people are less likely to hold earthquake and flood insurance instruments (Fothergill and Peek, 2004; Zahran *et al.* 2008). Many house owners in flood and earthquake-prone areas in USA were not insured against these dangers, although insurance was rather inexpensive and the government supported in most cases (Brilly and Polic, 2005).

There is no doubt that macroeconomic theory play essential role to not only determine socio-economic determinants but also to justify the relationship with other variables. Vulnerability is a changing feature of an economy, it can be affected by a change in the rate of economic growth due to socio-economic change. Reductions in the growth of GDP typically take place in the year that the natural disaster occurs, with the potential for sharp increases in subsequent years (Benson and Clay, 2004; Ibarrarán *et al.* 2007). Because of the fact that there is a significant impact on production, tourism industry, transportation, water supply, energy sectors, and export sectors (Albala-Bertrand, 1993; Ibarrarán *et al.* 2007; Thomalla *et al.* 2006). Considering the opposite side of the coin, Albala-Bertrand (1993) demonstrated positive impact of natural disaster on macroeconomic variables immediately after events. Interestingly, some scholars (e.g., Albala-Bertrand, 1993; Skidmore and Toya, 2002; Toya and Skidmore, 2007) have achieved an outcome from their empirical studies that GDP is generally found to increase in the periods immediately following a natural disaster. Skidmore and Toya (2002) believed that this phenomenon is owing to the fact that most of the damage caused by disasters is reflected in the loss of capital and durable goods; moreover, stocks of capital are not measured in the periods immediately after a natural disaster.

Built environment exposure

One of the earliest natural disaster impact studies on built environment and transport was conducted by the London Climate Change Partnership (LCCP) in 2002 (Wilby, 2007). Later, many scholars investigated the transportation network vulnerability against natural disasters (e.g., Hoshiya *et al.* 2004; Menoni, 2002; Sohn, 2006). Roads and bridges are most likely to be damaged by these hazards, may be of great importance as transportation hubs for post event disaster response and recovery efforts (Wood *et al.* 2002). Thus, there are a few studies scrutinizing the impact of the natural disasters on transportation networks, roads and bridges (Kim *et al.* 2002; Sohn, 2006). Sohn (2006) analysed the significance of highway network links in Maryland, USA in the case of flood damage. Ports and harbours are particularly vulnerable to natural disaster such as earthquakes, landslides, and tsunami inundation because of the fact that they are located in sea level areas (Wood *et al.* 2002). They also claimed that little attention has been given to developing hazard mitigation and preparedness strategies for ports and harbours as key community resources.

While the built environment is broad, extending from cottages to factories and airport terminals, the building sectors considered here are those that are both large in number and have high occupancy. Natural disasters like extreme weather, flooding, earthquake, bushfires, storms have devastating effects on building. Therefore, new buildings will have to be designed to cope with the effects of climate change and natural disasters. Wilby (2007) reviewed the most significant climate change impacts on the built environment. First, he found that there is an ongoing need to improve preparedness and forecasting of climate hazards. Second, there is clearly a need for improved representation of intra-urban flooding, at local, city and catchment scales. Finally, there is an urgent need to translate awareness of climate change impacts into tangible adaptation measures at all level of governance.

Selection of pivotal stakeholders

This section focuses on stakeholders who have a vested interest in built environment against natural disasters. Therefore, it is important to categorize stakeholders into different groups. Mitchell *et al.* (1997) classified stakeholders into seven main groups as following:

1. Dormant stakeholders
2. Discretionary stakeholders
3. Demanding stakeholders
4. Dominant stakeholders
5. Dangerous stakeholders
6. Dependent stakeholders
7. Definitive stakeholders

Although dormant stakeholders have little or no interaction with the firm the main criteria in dormant stakeholder is to possess power to impose their will on an organization. Discretionary stakeholders hold the attribute of legitimacy, but they have no enough power to affect a firm's decisions. Demanding stakeholders possess urgent claims but having neither power nor legitimacy. Dominant stakeholders have enough power and legitimacy to direct a firm's decision making process. Coercive behaviours making stakeholders dangerous to the firm (Mitchell *et al.* 1997).

The identification of stakeholders in built environment depend on the project life cycle from conceptual to closing phase. Furthermore, number of stakeholders increase when natural disasters affect built environment. A generic set of stakeholders in managing natural disasters in built environment would include local government, prime (general contractor), subcontractors, suppliers, emergency relief organizations, financial institutions, insurance companies and affected local community.

Altay and Green (2006) investigated a comprehensive review on operation research and decision making in disaster management. They found that most researchers have focused on mitigation, preparedness, and response and recovery phases of natural disasters. For flood disaster, Akter and Simonovic (2005) proposed a flood management decision making methodology to capture the views of multiple stakeholders using fuzzy set theory and fuzzy logic. Finally, decision making theory facilitates to select appropriate criteria to select ample stakeholders. The use of decision making techniques can be dated back to four decades. Since then, the theory and applications have been developed significantly (Shih, 2007).

Disaster risk management and its phases

Disaster Risk Management (DRM) is defined by the United Nations as: "The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards" (United Nations International Strategy for Disaster Reduction (UNISDR), 2004: 17-18). It is important to note that there is a significant difference between crisis and disaster management. Booth (1993) explained that a crisis is a critical situation which individual, group and institution are unable to tackle the predicament by the use of normal routine activities. Kumar (2000) argued that the second phase of disaster events includes the emergency and crisis. Consequently, Moe and Pathranarakul (2006) concluded that crisis term might refer to the event when crisis arises whereas disaster management covers wider scope of prediction, warning, emergency, relief, rehabilitation, and reconstruction. Furthermore, there is a substantial difference between Natural Disaster Risk Management (NDRM) and Natural Disaster Management (NDM). Moe *et al.* (2007) argued that NDRM includes phases of prediction, warning, and emergency relief while NDM consists of prediction, warning, emergency, relief, rehabilitation, and reconstruction. According to UNISDR (2004), natural disaster management includes generic five phases, namely:

- Prediction (mitigation and preparedness)
- Warning
- Emergency relief
- Rehabilitation (short-term action)
- Reconstruction (long-term action)

Some scholars have divided disaster mitigation strategies into two main groups as following (e.g., Bosher *et al.* 2009; Pelling and Uitto, 2001):

1. Structural mitigation: some sort of activities associated with strengthening of buildings, and other infrastructure exposed to disasters.
2. Non-structural mitigation: to avoid building infrastructure in disaster prone area, relocating existing assets to safer zones, maintaining protective features of the natural environment.

Stakeholders' approaches towards natural disasters

Stakeholders who are involved in construction sector can play crucial role in structural mitigation strategies, while developers, planers, emergency institutions should be able to take non-structural mitigation approaches to cope with natural disasters (Bosher *et al.* 2009).

There are two different approaches to cope with the devastating impacts of natural disasters (Moe and Pathranarakul, 2006). First, tasks that are planned and conducted before the disaster impact with an aim to effectively minimize the adverse impacts of the disasters are called proactive approach. On the other hand, activities of responses and recovery are regarded as reactive approach.
Few studies exist on stakeholders' approaches towards natural disaster management in built environment. Loosemore and Hughes (1998) investigated reactive crisis management in construction management. Brilly and Polic (2005) studied a case in

Slovenia to provide an integrated flood mitigation decision making process with considering stakeholders' approaches. Moe *et al.* (2007) proposed a balanced scorecard technique with considering pro-active and reactive approaches to provide a continuous assessment of performance in each life-cycle phase in natural disaster management project. Bosher *et al.* (2009) claimed that there is a need to proactively address strategic weaknesses in maintaining the built environment from a range of disasters. They also emphasized that there is still insufficient evidence that key construction stakeholders are playing an active role in mitigating flood risk. They identified that the pre-construction phase of building's life cycle is the most critical stages when key stakeholders such as architects/designer, structural and civil engineers, urban planners, contractors and emergency/risk managers need to adopt natural disaster mitigation strategies. In their survey on the integration of disaster risk management into UK's built environment, they indicated that knowledge and awareness of integrated disaster risk management is poor and concluded by some key recommendations as following:

- Built environment stakeholders need to become more immersed in group decision making
- Professional training for stakeholders such as architect, planners, engineers, developers, etc pertinent to risk and hazard awareness should be systematically organized.
- Performance-based contracting, and product or service oriented procurement decision should be taken in order to make designers and contractors think about long-term implications and performance of buildings and structures they design and construct.

ANTICIPATED BENEFITS OF PROPOSED THEORITICAL FRAMEWORK

The development of the stakeholders' approaches towards natural disasters brings together a body of knowledge about their responses from a wide range of disciplines to provide three principal benefits. First, the proposed theoretical allows us to develop stakeholder disaster risk response index. By creating a composite index that combines all the pertinent factors, different stakeholders can be compared directly in built environment. Such a comparison could be useful for governments, public organization, and general contractors to choose appropriate contractors who have high response index against natural disasters.

Second, closer investigation of the disaggregated stakeholder disaster risk response index conveys information about the various factors that comprise the overall disaster risk response. One can focus on a single factor, and explore how the values of that factor vary among different stakeholders. Understanding the casual factors of stakeholder response constitute the first step in designing the most effective and efficiency strategies to mitigate the natural disaster risk. In a given built environment, those factors that are contributing most substantially to the risk will emerge as the most promising targets for mitigation efforts in that built environment by stakeholder.

Third, apart from stakeholders' disaster risk response, by excluding some factors (e.g., stakeholders' approaches) the theoretical framework can be easily changed to disaster risk assessment in relevant built environment. Therefore, by collecting same data we are able to take advantage of integrated stakeholders' approaches to elaborate the natural disaster risk in the built environment. While risk assessment studies have been

performed for many regions around the world, each study focuses on a single component of the risk.

CONCLUSIONS

This paper presents a theoretical framework of stakeholders' approaches towards natural disasters particularly in built environment. Theoretical framework developed through a synthesis of four theories. With disaster risk management theory providing the practical backbone of the theoretical framework, the other three theories are able to provide the additional explanation of various aspects of stakeholders' decision making process. Through disaster risk management theory, we are able to support the reactive or proactive approaches of stakeholders before, during and after natural disasters. Macroeconomic theory plays crucial role to choose the appropriate socio-economic variables in natural disaster management process. Decision making theory and stakeholder theory altogether pave the way to select the pivotal stakeholders and to manage their behavioural patterns against natural disasters. Empirical support for the proposed theoretical framework was obtained through a literature review providing a different perspective on socio-economic variables, built environment and stakeholder approaches towards natural disasters.

The limitation of this study is realised as the theoretical framework being based entirely on a literature review, particularly the deficiency of studies on stakeholders' approaches towards natural disasters. The next stage planned for this study involves validating the proposed theoretical framework with profound quantitative analysis by gathering relevant data from natural disaster management databases and in-depth interviews with built environment stakeholders.

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