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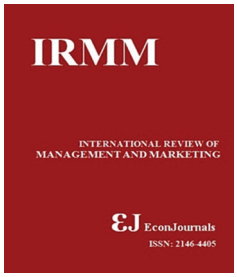

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A Review on Mechanism of Flood Disaster Management in Asia

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ABSTRACT

This paper attempts to analyze the review on mechanism of flood disaster management in Asia. Flood is amongst the most common of natural disasters and its impact is one of the most significant disasters in the world. In this paper, we have discussed the flood disaster management some selected countries in Asia such as Malaysia, Indonesia, Thailand, Bangladesh, India, Pakistan, Japan and China. For these countries, we tried to explore the flood disaster risk, pre- and post-disaster program and participants, emergency response and recovery, flood mitigation and management, relief and preparedness machinery, flood forecasting and warning system, policy, planning as well as strategic etc. This paper can make for the above countries disaster management system better respond and handle to disasters risk, and reduce the social and economic losses of disasters caused. It also required to improve data availability and evaluation, and possibly to combine with other types of information in view of increasing usefulness for policy making.

Keywords: Flood Disaster Management, Flood Hazard, Mitigation, Flood Forecasting
JEL Classification: Q54

1. INTRODUCTION

Floods have been on the increase in recent years and men have been blamed for it. Although floods do occur naturally, however, some that have taken a heavy toll on lives and property are man-made failures such as bursting of dams, urban flooding and debris flow in densely populated areas. Giddens (1990) blames modernization for the "manufactured risks" which have taken over from natural risks, causing the merging of natural and technological boundaries. Man's attempt at undertaking remedial measures against flood seems counter-productive, especially when they have chosen to live on the flood plains they have, in fact, chosen to do battle with nature. Floods are caused by natural factors or by a combination of natural and human factors. Risk is probability of loss and can be expressed as (Dutta et al., 2001; Tingsanchali and Keokhumcheng, 2006):

$$\text{Risk} = \text{Hazard} \times \text{Vulnerability}$$

Flood hazard depends on flood magnitudes such as flood depth, velocity and duration. Vulnerability may be defined as the conditions determined by physical, social, economic, and environmental factors which increase the susceptibility of a community to the impact of hazards. When flood waters physically encroach on people and infrastructure, then the vulnerability of people and infrastructure is decisive for the degree of harm and damage. Impacts due to urban floods are significant in terms of economic losses both direct and indirect. This is due to high density of population, large impervious areas, clogging of drainage systems, high economic values of properties and infrastructures, etc. The impacts of urban floods can be: Physical, economic, social and environmental. Both direct and indirect primary potential losses can be prevented through better land use planning, which also impact the potential secondary losses. Better flood emergency responses mechanisms help reduce potential secondary losses. While in rural areas the damages due to floods are mostly direct in terms of loss of agricultural production.

No single organization is generally charged on comprehensive flood risk assessment. Individual organizations typically conduct their own independent work on mapping and modelling flood risk in relation to their own assets, with no one taking a strategic or holistic overview. As organizations manage different parts of the urban drainage infrastructure, they make investment decisions based on a limited cost-benefit analysis that rarely considers the wider drainage issues. The sum total of these individual and piecemeal investment strategies is unlikely to produce the most effective solution. Performance of a municipality in flood risk management is the key factor for the success or failure of management plans. Basically, there are three main factors which are decisive for the municipal performance:

i. Organizational structure which is supposed to clearly assign tasks and responsibilities to various municipal departments and other involved institutions. Both, the overlapping of responsibilities as well as gaps of non-responsibility, within institutions or between them, hinder effective urban flood risk management.
ii. Content of urban flood management policies and plans. The plans have to state clear and overall workable targets and measures. Only if these principles of clarity and workability are realized in plans they will make a valuable contribution to municipal performance.
iii. Process of implementing plans in which the success depends on quality of plans and the municipality's ability to enforce plans in terms of financial and organizational capacities.

Flood impact is one of the most significant disasters in the world. More than half of global flood damages occur in Asia. Causes of floods are due to natural factors such as heavy rainfall, high floods and high tides, etc., and human factors such as blocking of channels or aggravation of drainage channels, improper land use, deforestation in headwater regions, etc. Floods result in losses of life and damage properties.

Flood control measures planned without participation of the affected communities and other stakeholders are unsustainable as they do not meet the needs of relevant stakeholders. These situations can be overcome by establishing participatory planning process. In this context, decision making is a combination of top-down and bottom-up approaches which enables the involvement of all stakeholders on the basis of equity. The stakeholders consist of responsible municipal authorities, river basin organizations, regional development authorities; academic institutions, private sector; non-government organizations (NGOs) and concerned citizens and communities. The involvement of stakeholder knowledge from different perspectives together enables a coherent understanding of flood risks. Members of affected communities have the chance to express the community needs and to promote the integration of their demands in the decision making. Stakeholder involvement allows for identification and implementation of flood effective and sustainable management measures because the majority of stakeholders support them (UN-HABITAT, 2001).

Urban floods can be classified as floods due to local heavy rainfall, floods due to river overbank flow and flood due to high tides or storm surges. Floods due to local heavy rainfall are caused by insufficient or poor drainages. Floods due to river overbank flow occur when river level rises above river banks. Excessive river levels are normally caused by high runoff from upstream and backwater effect of high tides at river mouth. Construction of cities in floodplains reduces storage and block floodway in the flood plains causing flood damage even worse. Flood dikes in cities may be breached due to high flood levels and cause severe flood damages. Cities in coastal areas are normally located in low lying areas where drainage is difficult without pumping. High tides or storm surges can hamper flood drainage to the sea and cause prolonged flooding with polluted flood water and health problems in cities. Effects of climate change increase more heavy rainfall, severe and frequent flooding which are more difficult to predict (IPCC, 2007).

The built environment is a key player in converting a natural hazard to a disaster. The majority of human and direct economic losses from natural hazards occur as a result of damage to the built environment (Max Lock Centre, 2009; Benson and Twigg, 2007). The vital role that the built environment performs in serving human endeavours brings severe disruption to the ability of society to function, economically and socially when its elements are damaged or destroyed by natural hazards (Haigh and Amaratunga, 2010). Thus, the ability of the built environment to withstand the impacts of hazards plays a direct role in determining the casualties and monetary costs of disasters (Ofori, 2002; Mileti, 1999). In particular, the protective characteristics of the built environment are crucial to achieve disaster risk reduction (DRR) (Haigh and Amaratunga, 2010).

Disasters can be classified according to how rapidly they begin and also in relation to their duration. According to these two criteria, there are two types of disasters: Rapid-onset or cataclysmic disasters, and long-term or continuing disasters. Rapid-onset disasters include earthquakes, floods and tsunamis. Long-term or continuing disasters include civil wars, droughts, famines and epidemics. This classification aids in defining general approaches required to respond to such disasters in each category. As an example, the feeding programs adopted in supporting refugees and displaced persons, are similar to those adopted in famines.

Disaster has been defined as a serious disruption of the functioning of a society, causing widespread human, material or environmental losses which exceed the ability of the affected society to cope using its own resources (United National International Strategy for Disaster Reduction, 2009). Disasters are considered to be a result of hazards impacting on people who are physically, economically and socially vulnerable. Also a disaster is said to have occurred when a significant number of vulnerable people experience a hazard and suffer severe damage/and or disruption of their livelihood system in such a way that recovery is unlikely without external aid. It is also believed that the root causes of vulnerability to disasters are the social and economic processes leading to poverty (Asian Disaster Preparedness Centre, 1997).

Natural disaster risk management frameworks have witnessed a paradigm shift in recent years, evolving from a process of providing a one-off emergency response towards a proactive and

holistic disaster risk management system (UN/ISDR, 2005). One of the defining characteristics of this new paradigm is its emphasis on building climate-resilient societies by enhancing the capacity of vulnerable people to cope with environmental hazards.

Regarding natural disasters, the last years have often been described as Anni Horribili. The tsunami in the Indian Ocean, Hurricane "Katrina" on the U.S. Gulf Coast and the Pakistan earthquake are the most prominent catastrophes of the recent past. In Europe, floods rank highest among natural disasters. During the past two decades, several extreme floods have occurred in Central European rivers (including the Rhine, Danube, Odra, and Wisla), culminating in the disastrous August 2002 flood in the Elbe River basin and parts of the Danube basin. Likewise, the U.S. Federal Emergency Management Agency (FEMA) calls flooding "America's #1 Natural Hazard" (FEMA, 2004). Dramatic increases in flood frequency and intensity are also likely in parts of the United States (e.g. Gleick, 1999). Questions regarding the financing of flood protection and prevention strategies are likely to raise in significance on the political agenda.

Natural, technological, social and health hazards risk affecting hundreds of thousands of people globally (Proske, 2008). In 2011, 325 disasters occurred across the world, killing around 35,000 people and causing economic damage of over US $370 bn (Swiss Reinsurance Company Ltd., 2012). For disaster response, the United Nations Foundation (2011, p10) recognizes that "good communication is essential to effective coordination" but "due to poorly adapted tools, training and strategies, responders are increasingly ill-prepared to produce useful knowledge from the flow of information and data." For response agencies, individual responders and survivors, information is a critical resource necessary to facilitate life-saving operations (Comfort, 1996). However, disasters are dynamic and their constantly changing landscape makes effective communications between such stakeholders difficult.

The destruction brought about by floods has been a global concern. The areas along river banks are areas along rivers banks, coastal flats and low lying plains are normally affected by floods. However, in recent time economic and social development shifting residential areas to hill slopes have seen landslides, mud and debris flow that worsen the impact of the floods. In Asia, floods in Bangladesh, India, Indonesia and the Philippines claiming lives and destroying the landscape are not uncommon (Hamin et al., 2013).

Preventive measures, and natural disasters themselves, have the characteristics of a local public good or local public bad, respectively. It is commonplace that individuals have no incentive to disclose their true demand for public goods. It is advantageous to understate demand when it positively affects contribution requirements and to overstate demand otherwise. No exception is to be expected in the case of natural hazards. Therefore, it is important to assess the utility losses caused by natural disasters. Moreover, the increase in risk raises the question to what extent risk transfer mechanisms such as (mandatory) catastrophe insurance can mitigate the effects of disasters. The higher the non-insurable psychic costs are, the less relief such a system will provide.

2. REVIEW ON MECHANISM IN FLOOD DISASTER MANAGEMENT FOR SELECTED COUNTRIES IN ASIA

Tingsanchali (2012) described the urban flood disaster management. Flood impact is one of the most significant disasters in the world. More than half of global flood damages occur in Asia. Causes of floods are due to natural factors such as heavy rainfall, high floods and high tides, etc., and human factors such as blocking of channels or aggravation of drainage channels, improper land use, deforestation in headwater regions, etc. Floods result in losses of life and damage properties. Population increase results in more urbanization, more impervious area and less infiltration and greater flood peak and runoff. Problems become more critical due to more severe and frequent flooding likely caused by climate change, socio-economic damage, population affected public outcry and limited funds. Flood loss prevention and mitigation includes structural flood control measures such as construction of dams or river dikes and non-structural measures such as flood forecasting and warning, flood hazard and risk management, public participation and institutional arrangement, etc.

He described concepts, policy, plan and operation on integrated urban flood disaster and risk management. In most developing countries, flood disaster management activities are handled by government. Participation of nongovernmental agencies and private sectors are very limited. Activities are exercised rather independently without proper coordination or integration. Flood disaster management in developing countries is mostly reactive responding to prevailing disaster situations (emergency response and recovery). Reactive response should be changed to proactive response to increase effectiveness of management and reduce losses of life and properties. Proactive disaster management requires more participation from various governments, non-governmental and private agencies and public participation. It involves more effort and time, more budget, equipments, facilities and human resources which leads to integration of flood disaster management for both long-term and short-term activities. Strategic framework on integrated flood disaster management includes four cyclic steps namely: (1) Preparedness before flood impact such as flood forecasting and warning; (2) readiness upon flood arrival; (3) emergency responses during flood impact and; (4) recovery and rehabilitation after flood impact. Examples on urban flood disaster and risk management in Thailand are illustrated and discussed. Conclusions and recommendations for further improvement are provided.

Flood is amongst the most common of natural disasters, gravely affecting the lives of humans and the environment from the beginning of time. Although water is a basic necessity, when in abundance, rising above its normal level, covering the land surrounding it, it could cause distress to any community. It causes a society, no matter how developed, to become extremely vulnerable. Review on flood disaster management discussed in the following selecting countries in Asia.

2.1. Malaysia

Malaysia lies in a geologically stable region which is free from earthquakes, volcanic activities, and strong winds such as tropical cyclones which periodically affect some of its neighbors. It lies geographically just outside the "Pacific Ring of Fire." Hence, it is free from volcanic eruptions and earthquakes. It also lies too far south of the major typhoon paths, although tail-ends of tropical storms have occasionally hit it. However, that does not mean Malaysia is totally "Free" from natural disasters and calamities, as it is often hit by floods, droughts, landslides, haze, tsunamis, and human made disasters (Parker et al., 1997). Annually, disasters such as floods account for a significant number of casualties, disease epidemics, property and crop damage and other intangible losses (Chan et al., 2002).

Arguably, of all the disasters in Malaysia, floods are most frequent and bring the greatest damage annually. Floods are therefore considered as the most severe type of disaster experienced in Malaysia. Historically, there have been big flood events in 1886, 1926, 1931, 1947, 1954, 1957, 1965, 1967, 1970/1971, 1988, 1993, 1996, 2000, 2006/2007, 2008, 2009, and 2010. Of these floods, the 1926 flood was known as "The storm forest flood" because it destroyed hundreds of square kilometers of lowland forest on the floodplains of the Kelantan and Besut rivers. Records show that the flood was accompanied by gale force winds (Drainage and Irrigation Department, Undated).

2.1.1. Flood disaster risk in Malaysia

Malaysia is a country very prone to flood risks, mostly by nature of its physical (e.g. topography and drainage) as well as its human geography (e.g. settlement and land use patterns). The combination of natural and human factors has produced different types of floods, viz. monsoon, flash and tidal (Chan, 1998). Malaysians are historically a riverine people, as early settlements grew on the banks of the major rivers in the peninsula. Coupled with natural factors such as heavy monsoon rainfall, intense convection rain storms, poor drainage and other local factors, floods have become a common feature in the lives of a significant number of Malaysians. Monsoon and flash floods are the most severe climate-related natural disasters in Malaysia, with a flood prone area of about 29,000 km^2 affecting more than 4.82 million people (22% of the population) and inflicting annual damage of USD 298.29 million (Asian Disaster Reduction Centre, 2005) Mitigation and Management of Flood Disasters in Malaysia.

With annual heavy monsoon rains averaging more than 3000 mm and such a large flood-prone area, flood risk is indeed high, most notably in riverine areas and coastal flat lands. With such a large population living in flood-prone areas, flood exposure is high as well. Because of such high flood risks and exposure, the Malaysian Government is forced to spend a huge amount of its annual budget to mitigate against floods. Under Malaysia's 5 yearly Plans for development, the allocations for design and construction of flood mitigation projects account for USD 4.564 (1st Malaysia Plan 1966-1970), USD 9.78 million (2nd Malaysian Plan 1971-1975), USD 32.6million (3rd Malaysia Plan 1976-1980), 65.2 million (4th Malaysia Plan 1981-1985), USD 97.8 million (5th Malaysia Plan 1986-1990), USD 228.2 million (6th Malaysia Plan 1991-1995), USD306.44 million (7th Malaysia Plan 1996-2000), USD 3.97 billion (8th Malaysia Plan 2001-2005), USD1.25 billion (9th Malaysia Plan 2006-2010) and USD 1.17 billion (10th Malaysia Plan 2011-2015).

2.1.2. Post-disaster program and participants

A key strategy to dealing with a post-disaster scenario is to have a comprehensive framework or program that comprises disaster planning, resource management and output (recovery and rehabilitation). Such a program, borne by the stakeholders, will invariably be bound to certain time and cost limitations. In this instance the proposed Malaysian Disaster Preparedness Centre (MDPC) will undertake the coordination of the program, in direct collaboration with the Malaysian National Security Council (MKN), National Hydrology Institute of Malaysia (NAHRIM), Medical Relief Society (MERCY) Malaysia, Malaysian Red Crescent Society as well as other professional bodies and agencies.

2.1.3. National security council (NSC) directive-20

The rescue operations of Highland Towers were hampered by the absence of a pre-agreed emergency response plan (Soh, 1998). Rescue work by Malaysian, Japan and France emergency responders could not be coordinated. Similar problems were already noted when responding to previous disasters such as the Bright Sparklers and Choon Hong disasters. However the collapsed of highland towers condominium on 11 December 1993 hasten the process of the setting up of a national disaster plan. On 18 May 1994, the Cabinet decided to formulate a mechanism for managing disasters in the country. The policy statement for disaster relief operations is stipulated in Directive 20 of the NSC and took effect on May 11, 1997.

2.1.4. MKN

- Has assumed the main role in post-disaster incidences
- Effectively managing and coordinating resources, equipment and extensive manpower of various agencies
- Potentially undertaking long-term recovery actions or efforts.

2.1.5. NAHRIM

- Conducts both basic and applied research on water such as water resources, river, coastal, geohydrology and water quality
- Provides support services to both the public and private sectors in addressing water and its environment problems
- Acts as the National Focal Point on water and its environment research by coordinating related national research and participating in bilateral and multilateral international research activities
- Provides advisory services on water and its environment matters in line with national interests.

2.1.6. MERCY Malaysia

- Non-profit organization focusing on providing medical relief, sustainable health-related development and risk reduction activities for vulnerable communities, in both crisis and non-crisis situation.

2.1.7. Malaysian red crescent Society

- Non-profit organization dedicated to humanitarian acts and services
- Saves lives, protect livelihoods, and strengthen recovery from disasters and crises
- Enables healthy and safe living
- Promotes social inclusion and a culture of non-violence and peace.

2.1.8. MDPC

MDPC is envisioned as the principal coordinator of all flood - and future disaster-relief programs starting at the outset with research and planning through to on-the-ground coordination within established time and cost parameters.

2.1.9. Five core principles of MDPC

i. Disaster preparedness should be safety of people most at risk, followed by the protection of critical property
ii. Welfare and self-reliance of individuals, families and communities during disaster
iii. Disaster preparedness activities should be the responsibility of government and community-based organization and integrated into development planning
iv. Disaster preparedness requires a multi-disciplinary, all-hazards approach to addressing the issues involved, and collaboration among government and non-government organizations, research and training institutions, and the private sector
v. Access to current information on the causes and consequences of disasters.

2.1.10. Operational frameworks of MDPC

MDPC will promote networking across communities, institutions and sectors, to facilitate the exchange of experience and practices. Cooperation and collaboration at all levels are central to the way the organization works. In working with different levels of society, MDPC provides:

i. Support to local organizations to enhance their capacities
ii. Links to technical specialists both local and abroad to promote relevant cutting-edge technologies and strategies
iii. Links to other similarly mandated organizations in the region with good practice.

MDPC can define their interest and concern to build up institutional core competencies, technical expertise, and trusting external partnerships within these areas, while consolidating past achievements and experience gained through working on these areas. As an important regional center, the geographical coverage of MDPC will encompass all states in Malaysia and will include disaster management, mitigation, recovery and response.

The proposed timeline strategy for relief efforts is divided into four sections which are immediate term (less than 6 months), short-term (6 months to 1-year), medium term (1-2 years) and long-term (3-5 years). The duration of the timeline is up to 5 years which is designed to tie-in with the Malaysia Plan as to maximize efforts.

2.1.11. Immediate – short-term

In immediate to short-term, implementing a dedicated means of supplying basic necessities to disaster stricken zones such as:

Clean water supply

i. Temporary electrical supply
ii. Proper sanitary system
iii. Waste management system
iv. Food and non-food items
v. Medical supply
vi. Equipment such as warning siren towers/emergency public warning system located at housing areas in potential flood disaster area
vii. Mandatory survival kits for every home.

2.1.12. Long-term

A purpose-built relief centre and dedicated food storage facility are among the advocated strategies. These make take the following forms:

i. Landlocked barge or emergency dredger as emergency food storage capable of flotation in flood mode with helipad; may or may not be self-propelling. In non-emergency mode may function as a community area/sports surface
ii. Provision of landing craft that can be loaded with supplies of water and food to assist in the humanitarian effort; bigger models can support the freight of land vehicles to areas cut off from road access
iii. As identified in Chapter 2 the earmarking of buildings such as schools that can be redesigned and retrofitted to function as a flood relief centre; open space at ground level to be assembly points.

2.1.13. Policy and strategic planning

i. The District Disaster Management and Relief Committee
ii. The State Disaster Management and Relief Committee
iii. The National Disaster Management and Relief Committee.

Effective Disaster Management requires preparedness. Krepp's (1992) mentioned the five principles of preparedness:

- Preparedness and improvisation are central foundations of emergency management
- Preparedness is a continuous process
- Preparedness is an educational activity
- Preparedness is based on knowledge
- Preparedness evokes appropriate actions.

The most severe climate-related natural disasters in Malaysia are monsoon floods and flash floods. These floods are common hydrological phenomena in Malaysia, on average affecting an area of 29,000 km^2, more than 4.82 million people (22% of the population) and inflicting annual damage of RM 915 million.

2.1.14. Flood mitigation policy and strategy

Structural measures consist of controlling flood flows, whereas non-structural measures such as land conservation regulate human activities to mitigate the impact of flooding. Another indispensable non-structural measure is the adoption of a flood forecasting and warning system (FFWS). With this in mind, policy guidelines

for implementing flood mitigation measures will include the following:

i. Implementation of structural flood mitigation in terms of engineering and socio-economic environment,
ii. Implementation of complementary non-structural measures,
iii. Implementation of non-engineering measures where there is no engineering solution, and,
iv. Continuation on strengthening FFWS.

2.1.15. Flood mitigation and management

In 1982 the government conducted a National Water Resources Study on structural and non-structural measures for flood mitigation and management. Subsequently, a number of flood mitigation projects were completed, such as canalization of rivers, raising river embankments and multi-purpose dams. The financial involvement for such projects was increased in Malaysia's 5 yearly development allocations. Such escalating expenditures require the government to be more proactive in finding ways and means to address the flood problems in a holistic manner. Government machinery allows the Economic Planning Unit of the Prime Minister's Department to coordinate all aspects of planning, design and implementation of water resources in the country.

2.1.16. Flood disaster relief and preparedness machinery

After the disastrous flood of 1971, the National Disasters and Relief Committee was formed to be responsible for planning, coordinating and supervising relief operations during floods. Most of the committee members are governmental departments/agencies and social organizations that are able to provide shelter, rescue, food and medical supplies. Through the nationwide State Security Committee, police, the armed forces, social and welfare departments and various voluntary organizations, the task of rescuing and evacuation of flood victims to predetermined relief centers could be organized effectively.

2.1.17. FFWS

According to the Ministry of Natural Resources and Environment, earlier experience has shown that the most effective approach is through the development of flood management programs using a holistic approach with respect to the following five strategies:

i. Prevention–avoiding construction of houses, properties and industries in present and future flood- prone areas for preventing damage caused by floods;
ii. Protection–to reduce the likelihood and the impact of floods in a specific location, with the Government taking structural and non-structural measures;
iii. Preparedness-to give information to the public about what to do in the event of flooding and about flood risks;
iv. Emergency Actions–in case of flood, developing the emergency response, formulates plans and actions;
v. Recovery and lessons learned–after flooding disaster, return to normal conditions as soon as possible and mitigate both social and economic impact (Hussaini, 2007).

Malaysia as a party to the World Conference has implemented the Hyogo Framework for Action, but through the NSC Directive No.20. This Directive came into existence when there was a need for a policy and a mechanism to integrate, coordinate disasters on land in a systematic manner in Malaysia. The Prime Minister will issue the NSC Directive No. 20 from Prime District levels. The Directive defined disaster resulting in the loss of lives and damage to properties and the environment, as well as interfering in the daily activities of the local community.

When floods occur, the relief and recovery process is hugely dependent on the NSC Directive No. 20 which can only be kicked into action by the NSC under the Town and Country Planning Act 1976, Environment Quality Act 1974, Local Government Act 1976, Irrigation Areas Act 1953, Drainage Works Act 1954, National Forestry Act 1984 and Uniform Building By-Laws 1984 will have to be invoked. Evidently, without a single legal framework that is concerned with flood risk management, Malaysia will theoretically face problems where solutions are designed to adapt to the needs of local communities. To facilitate the management of floods, policies and priorities have to be consistent when flooding occurs. In planning for measures to prevent and prepare for floods.

2.1.18. Emergency planning

The last few decades have witnessed a considerable increment in the number, scope and complexity of disasters and emergencies. Planning is a process; created plans should be tested and evaluated through practice. Helsloot and Ruitenberg (2004) explain that the difference between planning and preparedness comes from the practice. Planning should be the standard of preparedness. Alexander (2002) defined the emergency plan as "a co-ordinated set of protocols for managing an adverse event, whether expected or untoward, in the future". Every emergency is unique, but with enough common ground between them it will be easier to make predictions, forecasting, warning, and planning (Alexander, 2005). Therefore, it is very important to attract more attention to emergency preparedness, and the planning process to manage, overcome and recover emergencies (Alexander, 2005). Emergency planning and recovery can be a great challenge to any business, especially hospitality industry regarding to the worse situation from experiencing an emergency event far from home. In a stricken destination, tourists are coming from anywhere on earth and speak different languages (Stahura et al., 2012).

2.1.19. Disaster recovery

In the wake of disaster, resource reorganization is essential regarding the challenges facing the hotels in post-emergency and recovery stage based on flattening organizational structure, team dealing with emergencies (Burritt, 2002). Eisendrath et al. (2008) mention that recovery is the case when the business operations return back to normalities. After the disastrous event end, disaster recovery effort should begin directly to re-establish normal social, economical, political routines and encompasses multiple activities (Lindell, 2011). Faulkner (2001) mentioned that recovery is the stage where self analysis, healing, the time needed to rebuild damages, and employed the actions. Spillan et al. (2011) mention that in the stage of recovery an effective communication system should be activated with key stakeholders to share the information and manage the emergency situation.

The recovery stage offers a great opportunity to increase the local organization's capacity to facilitate all sector development

for a long time after the disaster (Berke et al., 1993). Berke et al. (1993) argued that recovery could offer multiple benefits to the organization such as reducing costs, increasing effectiveness, updating policies, and reducing future hazard vulnerability, by altering the physical development pattern and strengthen hazard mitigation immediately following a disaster. Surprisingly, Drabek (1986) mentioned that in the four phases of a disaster, the recovery phase is the least studied by scholars and the most poorly understandable.

As one of the very important stages of disaster life cycle models proposed by several scholars, recovery stage gets more attention in Roberts (1994), Fink (1986), Mitroff (1988), Pearson and Mitroff (1993) and Faulkner (2001) models (Table 1). In the recovery stage, the emergency management plan's could be measured in the ways: First, the speed which the hotel or the hospitality organization could recover and continue business operation; second, to which degree the business recover to the pre-disaster level and back to normalities; and third, to which amount of disaster resistance added to the disastrous event. In this case hospitality organization will gain the accurate knowledge and learn the lessons incorporated into the preparedness stage to avoid future disasters.

2.1.20. Disaster management in Malaysia

Geographically Malaysia is outside the Pacific edge of the fire and comparatively free from any pillage and destruction caused by natural disasters such as earthquake, volcano, and typhoons. But it's subjected to monsoon floods, landslides, and severe haze. Also, Malaysia experience from time to time some human-made disasters which affect the hospitality industry and cause remarkable damages to lives and properties (Shaluf, 2006). During the period of 1968-2004 Malaysia has experienced 39 disasters, classified as natural, human-made, and subsequent disasters, caused 1742 deaths and 2713 injuries (Aini et al., 2001; Khan and Ali, 2001). The matter raises the need for setting up for advanced warning systems, forecast future disasters, and effective disaster management in order to reduce the effect of such disasters on the hospitality industry (Shaluf, 2006).

In their study, Aini and Fakhrul-Razi (2007) mention that after several disasters affecting Malaysia the government has lunched new mechanism for disasters, and enhance the local knowledge, specialized rescue operations by establishing the Special Malaysian Disaster Assistance and Rescue Team (SMART), and the NSC to be responsible about disaster management under the Directive No. 20 "The policy and Mechanism of National Disaster Management and Relief" (National Security Council, 1997). The directive highlights the policy on disaster management and relief, also the roles and responsibilities of different agencies involved in managing disasters when occurred. Also, set up all inclusive emergency management programs to be well prepared and insure preparation, prevention, and mitigate the effect of disasters (Aini and Fakhrul-Razi, 2007). During the disaster, the organization of emergency management and decision making process could be at three levels in order to manage the disaster effectively. The first level described as catastrophic natural events such as floods, mudslides, landslides, and beach erosion. The second level described the human-made disasters like explosion, pollution, accidents. While, the third level when a disaster strike two or more states and the local authorities fail to respond to it by their resources, the federal government will involve in the disaster reliefs. Furthermore, use some foreign assistance if needed (Shaluf, 2006) (Table 2).

Table 1: Disaster life cycle models

Author	Type of disaster	Content of the model
Roberts (1994)	Natural Disaster–Flood	1. Pre-event phase 2. Emergency phase 3. Intermediate phase 4. Long-term phase (recovery)
Fink (1986)	General	1. Prodormal stage 2. Acute stage 3. Chronic stage (recovery) 4. Resolution stage
Faulkner (2001)	Natural Disaster–Flood	1. Pre-event 2. Prodormal 3. Emergency 4. Intermediate 5. Long-term (recovery) 6. Resolution
Mitroff (1988); Pearson and Mitroff (1993)	Management	1. Signal detection 2. Preparation/prevention 3. Containment/damage limitation (recovery) 4. Learning
Stahura et al. (2012)	General	1. Reduction 2. Readiness 3. Response 4. (Recovery)

Sources: Ritchie, 2004; Al Battat and MatSoma, 2014

Table 2: Disaster level in Malaysia

Disaster level	Description
Level I (District level)	Localized emergency where the disaster response could be managed by local resources
Level I (State level)	Two areas are affected be emergency situation and need support from outside
Level I (National level)	Complex disaster which affected the areas in all states

Sources: Baharin et al., 2009; Al Battat and MatSoma, 2014

Elias et al. (2013) clarified sustainable management of flood risks in Malaysia: Some lessons from the legislation in England and Wales. Malaysia lacks an effective legal mechanism on integration of policies and mechanisms in flood management. Its NSC Directive No. 20 provides comprehensive guidelines, but then has to rely on various legislations not specifically enacted for managing floods. This paper will examine the English Flood and Water Management Act 2010 Act for lessons to be learnt. A doctrinal legal approach is adopted in this study in which data will be analyzed. The expected outcome would be to examine the legal approach in flood risk management in England and Wales, which would be a benchmark for the potential Malaysian legal counterpart.

Husni et al. (2015) described demographic Influence on Muslim Flood Victim Wellbeing in Flood Prone Districts in Malaysia.

This study compares the Muslim flood victims' wellbeing and their practices of Muslim religious personality as coping strategies in dealing with disaster stress by flood victims in four different districts' in Malaysia. The studies involve a survey conducted in two separate studies involving four different districts in Peninsular Malaysia. The districts chosen were Kuala Terengganu and Dengkil for study one; while the other two districts were Besut in Terengganu and Salak Tinggi, Sepang Selangor for the second study. A total of 200 flood victim has participated in this study with majority are from Malay origin and Muslim in faith. Both studies have gathered 100 sample for each studies. The participant was randomly selected in the flood relief center to answer the questionnaire given. The result was analyzed and compared descriptively. Lower education level has serious influence towards sample understanding of the item used. It also influenced the respondent job and income which have shaped the non-significant result of all the inventories used in these two studies.

2.2. Indonesia

Indonesia is one of the most disaster-prone countries in the world, regularly experiencing earthquakes, tsunamis, landslides, volcanic eruptions, flooding, and drought. Spread across 6000 inhabited islands, communities in Indonesia face a numerous different hazards, as well as differing levels of disaster response capacity, posing a challenge to preparing for and responding to disasters. Poverty, population growth, and rapid urbanization exacerbate these vulnerabilities, along with climate change and the resulting changes in rainfall patterns, storm severity, and sea level.

Flooding has become a significant urban problem for Indonesia this past decade. Excessive rainfall caused extreme events such as 5-year floods, torrential floods and flash floods, and extreme tidal backflows have inundated the low-lying coastal area. Uncontrolled population growth in urban areas, poor land use planning, the lack of understanding among city stakeholders and communities about floods and its disaster risk, and a poor level of knowledge about disaster reduction initiatives and preparedness are the important reasons for the flood events becoming disasters.

World growth is like two sides of coin nowadays. Besides it has progress of great development to achieve human prosperity, the world also is dealing with disasters that occur to impact its welfare. Hewitt (1995) claimed if there could be such a thing as sustainable development, disasters would represent a major threat to it, or a sign of its failure. That skepticism statement must be tackled with efforts to the DRR.

As one of developing countries in South East Asia, Indonesia has had a lot of experience with disaster. Physical and social factors are the main cause to increase the risk. Overall Indonesia has 11 categorized as disasters based on Act Number 24 of 2007 about Disaster Management, which include: Earthquake, tsunami, volcano, flood, drought, hurricane, landslide, technology failure, epidemics and outbreak of disease, social conflict and terrorism.

Indonesia is susceptible to many different types of hazards, and the varied nature of threats complicates risk management in the country. Floods, earthquakes, volcanic eruptions, tsunamis, and forest fires are all common in Indonesia, and the scale of these events can sometimes be massive. The geographically dispersed population and uneven development leaves large sections of the population exposed to some level of disaster. However, Indonesia's total risk exposure is considerably lower than many other Asian nations' exposure. The United Nation's (UN) 2014 World Risk Report named Indonesia the 38th most "at risk" country for disaster.

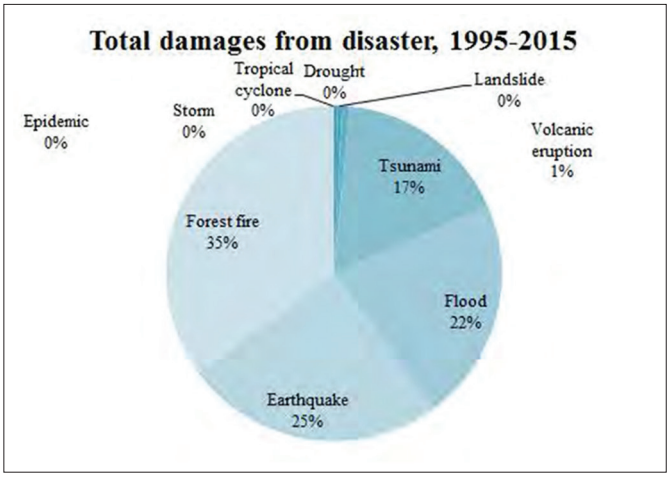
Floods are the most pervasive hazard affecting Indonesia. While the impacts vary regionally, every part of the country sustains flood related damages annually. Between 1995 and 2015, floods accounted for 43 percent of disaster occurrences which is double to the next most prevalent disaster (earthquakes). Floods also affected the second most number of people over the same time period (after earthquakes) and accounted for just slightly less total damage than earthquakes and forest fires. Disasters are defined here by EM-DAT's criteria: 10 or more people reported killed, 100 or more people reported affected, a call for international assistance, or a declaration of a state of emergency. The Indonesian government (Badan Nasional Penanggulangan Bencana [BNPB]) recognizes disasters on a smaller scale and therefore may have a different count. Current information is not available, but the following chart reflects an average year of flood damages in Indonesia (Figure 1) (as recorded by BNPB) (AIPA, 2011).

Flooding in Indonesia is driven by annual rains during the monsoon season. The wet season occurs between November and March, when Asian and Pacific air masses influence weather patterns. The dry season between June and October is dictated by the influence of the Australian continent. The areas at highest risk for flooding include the northeast coast of Sumatra, the northwestern coasts of Java, the western and southern regions of Kalimantan, the southern region of Sulawesi, and southern Papua. Rivers at a high risk of flooding include the Bengawan Solo and Benanain River (AIPA, 2011).

2.2.1. Disaster management policy of Indonesia

The policy snapshot of disaster management occurs from the history of institutional arrangement in Indonesia. The official institution, which charged with matters relating to disaster, is the National Disaster Management Agency, in bahasa BNPB. Since

Figure 1: Damages from forest fires and other hazards



it was inaugurated in 2008, this institution had a lot of homework because disasters were frequently occurred as catastrophic event, ones of the biggest are the tsunami in Aceh (it was 2004) or earthquake in Yogyakarta in 2006. Prior to BNPB, the government of Indonesia had several institutions already in place to manage natural disasters. It was begun with the institution that take care of independent victims at 1945 shifting to reduce natural disaster at 1966, has been change several times as ad-hoc institutions, until formed as a coordination agency in early 2000, and then finally defined as a permanent institution (Figure 2).

While natural hazards are generally more widespread and devastating in Indonesia, manmade hazards are a persistent threat and can occur on a very large scale in some instances. Intentionally set forest fires are a major hazard in Indonesia. Forest fires begin when farmers burn large tracts of land to clear for planting. While this practice is generally not environmentally sustainable, fires are especially dangerous because winds can turn planned fires into uncontrolled burns.

The four aspects of disaster management are: (i) Social, economic, and cultural lives, (ii) environmental conservation, (iii) benefit and effectiveness, and (iv) scope of territory. The stages of disaster management of pre-disaster, emergency response, and post-disaster are described in the law in detail together with the associated disaster management responsibilities in the various articles (Table 3).

2.2.2. Planning

Disaster management planning which emphasizes disaster prevention, mitigation, preparedness, and vulnerability reduction is integrated into the administrative levels of government. BNBP furnished all provinces with disaster management plans in 2012-

Figure 2: Disaster recovery planning cycle

Source: BNPB, 2012

Table 3: Disaster management stages and associated activities and responsibilities

Pre-disaster	Situation without disaster	• Disaster management planning, • Disaster risk reduction, • Prevention, • Integration into development planning, • Disaster risk analysis requirements, • Spatial structure plan implementation and enforcement, • Education and training, and • Technical standard requirement
	Situation with potential disaster	• Alertness, • Early warning, • Disaster mitigation
Emergency response	No sub definitions	• Quick study of location, damages, and resources, • Decide on disaster emergency status, • Rescue and evacuation of disaster affected community, • Basic necessities, • Protect vulnerable group, • Immediate recovery of essential facilities and infrastructure
Post-disaster	Rehabilitation	• Improve disaster area environment, • Repair public facilities and infrastructure, • Provide aid for home repair in the communities, • Socio-psychological recovery, • Healthcare; • Reconciliation and conflict resolution, • Socioeconomic and cultural recovery, • Security and order recovery
	Reconstruction	• Rebuilding of facilities and infrastructure, • Rebuilding of community's social facilities, • Revival of socio cultural community life, • Use of design with improved and disaster-resistant equipment, • Participate in social institutions and organizations, business world, and community, • Improve social, economic, and cultural conditions, • Improve public service functions, • Improve essential services in community

Source: Indonesia Disaster Management Reference Handbook, 2015

2013 and assisted 61 districts and cities in the development of their DM plans. As of the April 2015 HFA report, the national emergency management agency has piloted village-level DM plans in 8 villages in the District of West Pasaman, Pandeglang, Jember, and Sukabumi. The local level DM plans are anticipated to escalate mainstreaming DRR into regular development planning as facilitated by the local DRR stakeholders. The Government of Indonesia published the National Disaster Management Plan (NDMP) (Renas PB) 2010-2014 in 2012. The plan encompasses policies, strategies, program priorities and concentrates on disaster management and DRR for the 5-year time period. Themes of the plan incorporate disaster risk management, the economics of DRR, governance, and risk identification and assessment. The document aims to:

i. Identify disaster risks for nation, focus on program activities, priorities and funding
ii. Provide a reference for the ministries, government agencies, and stakeholders in disaster management to be able to manage disasters in a planned, integrated, coordinated, and comprehensive manner.

Thailand is located in mainland Southeast Asia. Thailand is bordered by Myanmar on the west, Laos on the north and east, Cambodia on the southeast, and Malaysia on the south. The southern coast of Thailand is bordered by two oceans: The Gulf of Thailand on the east and the Andaman Ocean (part of the Indian Ocean) on the west. The total area of Thailand is 513,120 km^2 (CIA-The World Factbook, 2011) with the total land boundary of 4863 km and the total coastline of 3219 km (Library of Congress, 2007). Topography and drainage divide Thailand into four main regions: North, northeast, central, and south. Each region is different in terms of geographic features. For example, high mountains are the chief topographic features of the north and the vast upland is the main characteristic of the northeast. The central part of Thailand is a lowland (plain) area drained by the Chao Phraya and its four tributary rivers. The southern region has a low-lying range of hills and is bordered by two oceans.

Thailand is one of the ASEAN member countries and a signatory to the ASEAN Agreement on Disaster Management and Emergency Response. Multi-stakeholder partnership is one of the interventions initiated by the AADMER Partnership Group to facilitate the AADMER implementation, which is part of the "Facilitating Partnerships of National and ASEAN DRR Authorities and Civil Society to Support AADMER Implementation" project The study aims to support the Thai government review of Thailand's policy on disaster management and emergency response, and spaces for stakeholder participation, particularly the CSOs and vulnerable groups in relation to AADMER. The study also presents profiles of disaster management stakeholders and documents good practices and models of multi-stakeholder partnership in disaster management in Thailand.

Thailand is one of the countries facing a high risk of disaster (Shook, 1997). There have been several cases of flood disasters, the impacts of which have been widely spread over the country especially in populous areas. This means that, in the event of disaster, the first group of people to deal with such emergencies are the local people in the affected areas, themselves. In practice, they are able to handle the situations using their local wisdom while the government authorities are providing additional help through local and regional agencies. However, disaster management has been reported to have failed in effectively solving recent problems. The likely causes of such failure may lie in the poor strategies used to deal with the flood disasters. In the case of the communities residing near the Lam Ta Kong river, Nakhon Ratchasima province, the residents in these communities have suffered from a series of flood disasters since 1958. The people in seven districts have experienced a series of unsolved problems during their time there.

Thailand nowadays is not only increasingly vulnerable to natural hazards, it is also at risk due to political hazards such as domestic terrorism or the recent border conflict with Cambodia. The long lasting political unrest in the southern region has resulted in damages to properties and loss of life of the people in the five bordering provinces including Narathiwat, Pattani, Yala, Songkla and Satun. In the northeastern region, the recent border conflict between Thailand and Cambodia has caused damages to properties and forced several thousands of people in this peaceful region to evacuate from warfare areas. During the peak of the conflict, these people were living in temporary shelters and could not go back to resume their daily living and farming activities. This, again, shows that Thailand is not only faced with natural hazards, but also man-made or political ones (Table 4).

Vulnerability is one component that is used to determine the potential impacts of disasters that might occur in one community or country. Vulnerability can be defined as "the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard (an extreme natural event or process" (Wisner et al., 2004, p.11). Such characteristics that contribute to vulnerability may include lower socioeconomic position/status/class or being minorities, seniors, illegal immigrants, poor and women. Some researchers also include such factors as built environment building/urban density (Cutter et al., 2003; Borden et al., 2007), age of buildings and infrastructure and locations of living areas (i.e. located in flood plain areas or in the hurricane paths or areas that prone to earthquake) as factors that increase vulnerability.

Emergency management in Thailand has evolved from a civil defense orientation. Early emergency management policies were formulated in response to potential air attacks resulting from World War II. It appears that an attempt to create a more systematic and comprehensive disaster/emergency management policy that incorporated all disasters in addition military threats started about a decade ago and the major factor that forced the Thai Government to substantially reform its emergency management is the 2004 southern tsunami. This paper refers to the time period before 2002 as the early era and the time period since 2002 is referred to as the new era of Thailand's emergency management.

The new era of Thailand's emergency management began during the first administration of Prime Minister Taksin Chinnawatra (2001-2005). The Government undertook the substantial reform in

Table 4: Areas of linkage between national disaster management system and AADMER

Area	National mechanism	Link with AADMER
Risk assessment	Conducted by multi-agencies • National DPM Committee/National Plan • Landslide risk assessment by Department of Mineral Resources (DMR) • Earthquake risk assessment by Thai Meteorological Department (TMD) and DMR • Flood risk assessment by Royal Irrigation Department (RID) and DDPM • Drought risk assessment by DDPM • Local risk assessment via Community-based Disaster Risk Management (CBDRM)	• Through joint activities under the AADMER Work Program, Strategic Component 1 • DDPM as the National Focal Point to coordinate with the agencies concerned and AHA Center
Warning/ Monitoring	• NDPMC/National Plan • National Disaster Warning Center (NDWC) (Tropical Cyclone, tsunami, earthquake) • TMD (Tropical cyclone, earthquake) • DDPM (Mr. Disaster Warning Project) • Provinces/local governments	• Through joint activities under the AADMER Work Program, Strategic Component 1 • DDPM as the National Focal Point to coordinate with the agencies concerned and AHA Center
Prevention and mitigation	• NDPMC/National Plan • Strategic National Action Plan for DRR (SNAP) 2010-2019 • Mainstreaming DRR into NESDP • Ministry of Education (MOED) integrate DRR in school curriculum • DDPM o CBDRM o Mr. Disaster Warning o Prevention and mitigation projects • Joint project o Hospital Preparedness and Emergency Project (HOPE) o Community Action for Disaster Response (CADRE) • Provinces/local governments	• Through joint activities under the AADMER Work Program, Strategic Component 2 (Thailand as Lead Shepherd for 2.1) • DDPM as the National Focal Point to coordinate with the agencies concerned and AHA Center • ASEAN Day for Disaster Management (ADDM)/International Day for Disaster Reduction (IDDR) campaigns
Preparedness	• NDPMC/National Plan • Provincial Cluster/Provincial/District/Tambon/Community Plans • DDPM o DPM Academy (training) o Civil Defense Volunteers o CBDRM training o Crisis Management Exercise (CMEX), provincial simulation exercise (at least twice a year) o Simulation exercise at Provincial Cluster level (once a year), provincial/BMA level (twice a year), and district level (once a year)	• Through joint activities under the AADMER Work Program, Strategic Component 3 • DDPM as the National Focal Point to coordinate with the agencies concerned and AHA Center • List of earmarked assets and capacities • ARDEX Exercise
Response	• NDPMC/National Plan • DDPM o Emergency Response Team (ERT) o CBDRM o CMEX Exercise • Military Response Team • Medical Team • Volunteers/Red Cross • Provinces/Local governments (as first responders, One Tambon One Search and Rescue Team – OTOS) • HOPE/CADRE	• Through joint activities under the AADMER Work Program, Strategic Component 3 • DDPM as the National Focal Point to coordinate with the agencies concerned and AHA Center • ARDEX, ASEAN ERAT
Disaster relief	• NDPMC/National plan • DDPM o Emergency Relief Fund/supplies o Knock-down house • Department of Social Welfare/Red Cross • Military • Provinces/Local governments	• Through joint activities under the AADMER Work Program, Strategic Component 4 • DDPM as the National Focal Point to coordinate with the agencies concerned and AHA Center
Reconstruction and recovery	• NDPMC/National Plan • Line Agencies/Ministries (e.g. (restoration of livelihoods and infrastructure, reconstruction of damaged roads and bridges)	• Through joint activities under the AADMER Work Program, Strategic Component 4

(*Contd...*)

Table 4: Areas of linkage between national disaster management system and AADMER

Area	National mechanism	Link with AADMER
Civil military coordination	• DDPM o Special projects • Provinces/local governments (infrastructure restoration) • NDPMC/National Plan o Heads of Armed Forces as NDPMC members • Armed Force (Army, Navy, Air Force) o Platform for civilian and military authorities to meet o Military and civilian planners work closely to formulate plans and procedures o Provincial military commanders work closely with provincial governors for disaster assistance and drills • Provinces/local governments	• DDPM as the National Focal Point to coordinate with the agencies concerned and AHA Center • DDPM as the National Focal Point to coordinate with the agencies concerned and AHA Center • ARDEX • ASEAN Defence Establishment and CSOs Cooperation on Non-Traditional Security: Table Top Exercise in DM and Humanitarian Assistance (DMHA)

Source: DDPM, 2009

the nation's administrative system. The Administrative Act 2002 (B.E. 2545) was enacted to improve efficiency and effectiveness of government agencies at all levels. One important result of this administrative reform was the creation of the Department of Disaster Prevention and Mitigation (DDPM), under the Ministry of Interior. This new agency is in charge of developing master plans and promoting disaster prevention, relief and recovery. In so doing, DDPM undertakes such activities as formulating national safety policy and developing disaster prevention, warning, recovery systems to ensure safety and security of life and property in the nation. In terms of disaster related laws, the Prime Minister Office's Regulations on National Accident Prevention still played an important role in the nation's emergency management until the mid of 2005.

2.2.3. Natural hazards in Thailand

Generally, disaster can be categorized into two types: Natural disaster and man-made disaster. All the same, whenever the disaster occurred, it will main and kill people, destroy property and environment and impede national sustainable development. Besides, in the past two decades, also encountered numerous man-made disasters such as industrial accident, chemical spill and chemical related plant explosion, urban fire and road accident as the undesirable consequences of rapid progress in economic and social development.

Thailand has several natural disasters such as floods, mudflows, windstorm, drought, wildfire, earthquakes, unseasonal cold weather, and tsunami. The recent earthquake occurred on the border of Myanmar and Thailand which was felt as far away as Bangkok. In some parts of the South, flood waters have risen to 3 meters. Meanwhile in Thailand's North East, there is a severe drought and in Northern Thailand, temperatures have fallen to as low as 5°C at Doi Inthanon near Chiang Mai (Table 5).

The prolonged flooding caused by a series of tropical storms during 2011 resulted in severe impact across the central part of Thailand. The 2011 Flood not only damaged the livelihoods and agricultural-based rural areas as seen in localized and recurrent annual flood, but also posed hardship in the city and semi-urban locations as the flood has wide geographical coverage. As the flood expanded, more community groups and more people realized the threats and the need to take actions. While the response interventions managed by the Government did not fully address the immediate needs of a large number of the affected population, the situation has seen the continued and vigorous efforts of various civil society groups and volunteer networks as well as the private sector in supporting relief operations. These have been undertaken through multi-stakeholder web linking activities and extending connections and collaboration with all the active players. This was supported by situation-based coordination and establishing a unique culture of prompt coordination which complemented one another to optimize the impacts. This intervention included information, knowledge and experience sharing through various channels and across various levels, collective resource mobilization and resource transfer and adopted high flexibility in coordination.

Table 5: Natural Disaster, the Level of Disaster Intensity, vulnerability, managing competence and risk Level of Thailand

Disaster	Severity	Vulnerability	Management	Tendency
Flood	High	Medium	Medium	High
Landslide	High	Medium	Poor	High
Windstorm	Medium	Medium	Medium	Medium
Drought	High	Medium	Medium	Medium
Fire	High	Medium	Medium	Medium
Explosive	High	Medium	Medium	Medium
Earthquake	Low	Low	Poor	Medium
Accident	High	Medium	Poor	High
Tsunami	High	Medium	Medium	Medium

Source: DDPM, 2009

There are several teams involved in the Volunteer Network for Crisis Response:

i. Relief Donation and Distribution Team
ii. Resource Mobilization Team
iii. Operational Team
iv. Coordination Team
v. Information Team
vi. Medias
vii. Technical Team
viii. Representatives
ix. Provincial Team.

2.3. Bangladesh

Bangladesh is one of the most flood prone countries in the world, which is situated in South-Asian Sub-continent. Flood generally experiences four types of flood and they are as follows:

i. Flash flood

ii. Rain fed flood
iii. River flood
iv. Flood due cyclonic storm surges.

A low-lying country with more than 230 waterways, Bangladesh is one of the most disaster-prone nations in the world. Fifteen per cent of its land floods annually on average. In 2004 that figure reached 34 per cent and in 2007 two floods and a cyclone together killed 4000 people and caused economic losses of about $3 billion. When such events occur water-borne diseases and mass internal displacements are inevitable consequences.

Natural disasters disrupt the nation's food supply and decimate the livelihoods of the many Bangladeshis who work in agriculture. Besides triggering flooding, severe weather frequently causes environmental damage by eroding riverbanks, directly affecting 100,000 people every year. Poor town planning, overcrowding and weak infrastructure amplifies the threat of disasters to urban communities, particularly in cities vulnerable to earthquakes (Table 6).

2.3.1. Best management practices as flood control measures

Flooding is a natural phenomenon, which cannot be prevented. Complete flood control is not in the interests of most Bangladeshi farmers (30). The flood control measures and policies should be directed to mitigation of flood damage, rather than flood prevention. Resources should be allocated to help people adopt a life style that is conformable to their natural environment (31,32). Indigenous solutions through changing the housing structures and crop patterns can help reduce flood damage (33,34,35). Moreover, good governance, appropriate environmental laws, acts and ordinances will be necessary to achieve sustainable economic development and to reduce any environmental degradation (36). In addition, implementation of an improved real-time flood and drought control warning system can reduce damage caused by floods. A greater understanding of the processes that contribute to increased flooding propensity, however, can help us mitigate the adverse effects on human lives, environment, and economy. To mitigate flooding propensity in Bangladesh, both the GOB and the people will have to shift their paradigms, as well as will have to adopt BMPs in agriculture, forestry, land use planning, water resources management, and urbanization (14, 37). The BMPs pertaining to flood control are those activities that will help reduce the run-off, will increase the carrying capacity of drainage system, and will increase land elevations with respect to sea level or riverbeds (Allen, 1999).

2.3.2. Flood management strategies

Flood management strategy has been under continuous change since early 60s of the last century. Flood Management strategies can be divided into three distinct phases of its development, which are as follow:

i. Phase-I: 1960 to 1978
ii. Phase-II: 1978 to 1996
iii. Phase III: 1996 to 2000 onwards.

Structural options being the principal strategy in all the above phases provided some benefits specially increase in agricultural production at earlier period but some adverse effects were observed latter on. Specially, the construction of high embankment along the both banks of the rivers in some cases resulted in rise in bed levels and obstruction to drainage. In the coastal areas, although the construction of polders prevented salinity intrusion, but resulted in restriction of the movement of the tidal prism, sedimentation of tidal rivers and obstruction to the gravity drainage. Another important impact on agriculture was found to be that the crop diversification was seriously rather the farmers in most cases opted for production of cereal crops, especially HYV rice enjoying a flood free situation. Structural measure caused many adverse effects on the aquatic lives especially on open water fisheries. Fish resources have been depleted rapidly. Introduction of non-structural option i.e. FFWS as a secondary strategy started from early '70s and contributed to the improvement of the capacity for flood preparedness and mitigation of flood losses. The importance of this strategy has been realized after the floods of 1987, '88, '98.

2.3.3. Flood mitigation strategies

2.3.3.1. Structural measures

Considering the issues of securing peoples' life and property, livelihood, food etc. the Govt. put emphasis on protecting Medium High and Medium Low Lands from floods through construction of embankments. Since 1960s Bangladesh has implemented about 628 nos. of large, medium and small-scale FCDI projects. Total investment was to the tune of US$ 4.0 billion. It provided flood protection to 5.37 million ha of land, which is about 35% of area. A picture flooded, non-flooded and flood protected area.

A picture structural measures works are given in Table 7.

2.3.3.2. Non-structural measures

In spite of all the structural activities, it was found that the people living in the Medium High and Medium Low Lands

Table 6: Examples of some recent floods in Bangladesh

Event	Cause		Duration
	Natural	Manmade	days
1987 flood	Heavy rainfall	• Deforestation • Huge melting of snow	30
1988 flood	Simultaneous heavy rainfall	Deforestation	14
1998 flood	• Simultaneous heavy rainfall • Tsunami • Al-Nino	Deforestation	70
2004 flodd	• Heavy rainfall • Landslide dam	• Deforestation • Debris flow	21

Table 7: Picture of structural measures for flood management

Item	Quantity
Embankment	10,000 km
Drainage channel Imp	3500 km
Drainage structure	5000 nos.
Dam	1 no.
Barrage	4 no.
Pump house	100 nos.
River closure	1250 nos.

are not immune to flooding during moderate to extreme flood events. Government considered that the minimizing flood loss through non-structural means is also very important. Earl warning on flood can save life and property. With this end in view, FFWS was established in 1972 with 10 Flood Monitoring Stations on the major river systems. After disastrous floods of 1987 and '88 the Government realized the importance of FFWS and took steps to modernize the system. New FF model was developed on the basis of Mike-II hydrodynamic model and flood-monitoring stations were increased to 30 in1996. In 1998 flood FFWS was found to be very useful providing the early warning and information on the flood. With the experience of 1998 flood the Government decided to improve it further to cover all the flood prone areas of the country under real time flood monitoring. A project was under taken from January, 2000 to improve the FFWS further. It now covers the entire country with 85 Flood Monitoring Stations and provides real time flood information with early warning for lead-time of 24 and 48 h. FFWS currently, helping the Government, the disaster mangers and the communities live in the flood prone areas in matters of flood preparedness, preparation of emergency mitigation plan, agricultural planning and rehabilitations etc.

2.3.3.3. Mechanism for effective use of flood waters and flood plains

It has already been mentioned that annual surface water volume is to the tune of about 1200 billion cum and 80% of them flow during the period from June to September. Country being a flood plains having a low topography, it is difficult to conserve such a huge volume of water anywhere in the country. Flood has some positive contributions apart from its detrimental effects, e.g. it improves the ground water recharge, soil-moisture and washes toxic materials, which are built up due to use of chemical fertilizer and pesticides. It has already been mentioned that a pilot project on controlled flooding, an innovative project, to make best use of the floodwater instead of completely restricting its entry to the flood plains.

2.3.3.4. Enforcement of relevant laws for flood plain management

Bangladesh has many laws enforced at different times for flood plain and flood management. There are some inconsistencies found in these laws. Considering the importance of brining harmony and consistencies among the laws the Govt. has decided to promulgate a unified law and work is now going on in this direction. Work is now going on framing a National Water Code.

2.3.3.5. Institution responsible for flood management

About 53 central government organizations and 13 ministries are identified to be involved in flood and water management. Principal national institution involved in the flood management is the Bangladesh Water Development Board (BWDB). Besides BWDB, many organizations are also involved in the flood management activities involved at different stages of flood management. Organizations and their responsibilities as regards flood management are given below:

- Water Resources Planning Organization: Macro planning of water resources management;
- BWDB: Feasibility Studies, Implementation, Operation and Maintenance of Flood Management Projects, Real Time Data Collection for Flood Forecasting and Warning Services, Dissemination of Flood information at national and regional levels;
- Joint River Commission: To conduct negotiation for data and information exchange on Trans-boundary rivers;
- Bangladesh Meteorological Department (BMD): Long, medium and short range weather forecasting and dissemination. Local Government Engineering Department: Implementation. O&M of Small Scale FCD projects;
- Disaster Management Bureau (DMB): Dissemination of all information on natural disaster including flood information at community level, Flood Preparedness awareness building etc.
- Directorate of Relief: Conducting Relief and Rehabilitation operation in flood hit areas;
- Local Government Institutions (LGI): Implementation and O&M of small scale flood
- management project, Flood Information Dissemination, Relief and Rehabilitation of flood victims;
- Non-Government Organizations (NGO): Advocacy for flood management, Relief and
- Rehabilitation of flood victims.

2.4. India

Flood Management has two different aspects, one relating to national water management and the other relating to national disaster management. Flood Management relating to Water Management at national level is co-coordinated by the National Water Council and particularly by the Ministry of Water Resources. Flood Management relating to Disaster Management is co-coordinated by National Disaster Management Council particularly by Ministry of Disaster Management and Relief. Both activities are also coordinated at local levels by appropriate bodies.

Flood is a major disaster recurrently being faced by India and causes huge loss to lives, livelihood and infrastructure. Assam State, a land of high rainfall and mighty river system, is one of the most flood-affected States in India. Identification of the flood-prone areas and the risk associated with each area offer significant cue for the planners for devising area-specific mitigation measures. Satellite Remote Sensing data provides information on actual flood inundation for different magnitudes of floods and various other land information which could be used for delineating the flood hazard zones.

Floods have been recurrent phenomena in India from time immemorial. Almost every year floods of varying magnitude affect some parts of the country or the other. Different regions of the country have different climates and rainfall patterns and, therefore, while some parts face devastating floods, other parts may, at the same time, experience drought conditions. The monsoon regime is a regular phenomenon. Year-to-year variations occur with regard to the onset of the monsoon, its progress over the Indian landmass, and the amount of rainfall distribution. In some years the variation is quite significant. Nevertheless, there is a fundamental regularity and dependability about the monsoon that sets the seasonal rhythms of life, although it also causes unfortunate losses across much of this part of the world.

Inadequate capacity of the rivers to contain within their banks the high flows brought down from the upper catchment areas following heavy rainfall, leads to flooding. The tendency to occupy the flood plains has been a serious concern over the years. Because of the varying rainfall distribution, many a time, areas which are not traditionally prone to floods also experience severe inundation. Areas with poor drainage facilities get flooded by accumulation of water from heavy rainfall. Excess irrigation water applied to command areas and increase in ground water levels due to seepage from canals and irrigated fields also are factors that accentuate the problem of water-logging. Floods have different dimensions – inundation due to spills over the banks, drainage congestion due to poor drainage characteristics and erosion due to changes in water courses.

2.4.1. Disaster management system in India

The subject of flood control, unlike irrigation, does not figure as such in any of the three legislative lists included in the Constitution of India. In order to mitigate the impact of floods, appropriate flood management measures have to be implemented. These measures can be classified into:

1. Structural measures
2. Non-structural measures.

2.4.2. Structural measures

In this approach physical structures are envisaged to prevent the flood waters from reaching potential damage regions. The main structural measures undertaken so far in India are as follows.

1. Embankments, floodwalls, flood levees
2. Dams and reservoirs
3. Natural detention basin
4. Channel improvement
5. Drainage improvement
6. Diversion of flood water
7. Catchment area treatment/afforestation
8. Anti-erosion works.

Table 8: Structural flood management measures undertaken through the successive 5 years plans

Serial number	Type of flood control works	Extent
1	Flood embankments	34397.61 km
2	Drainage channels	51317.50 km
3	Town protection works	2400 Nos.
4	Villages raised	4721 Nos.

Source: Ministry of Water Resources: http://mowr.gov.in/inde×3.asp

In India, systematic planning for flood management commenced with the Five Year Plans, particularly with the launching of National Program of Flood Management in 1954. During the last 48 years, different methods of flood protection, structural as well as non-structural have been adopted in different states depending upon the nature of the problem and local conditions. The various flood management measures undertaken through the successive 5 year plans are summarized in Table 8.

2.4.3. Non-structural measures

Non-structural measures strive to keep the people away from floodwater. It contemplates use of flood plains judiciously. This technique allows the use of flood plains by reducing the disaster dimension, while retaining its beneficial needs. Following are the main non-structural measures

1. Flood plain zoning
2. Flood proofing
3. Flood forecasting and warning
4. Regulation of reservoirs
5. Flood insurance.

Flood is one of the most severe disasters affecting the people across globe. India is the worst flood-affected country in the world after Bangladesh and accounts for one-fifth of global death count due to floods. Nearly 75% of the total Indian rainfall is concentrated over a short monsoon season of four months (June-September). As a result, the rivers witness a heavy discharge during these months, leading to widespread floods. About 40 million hectares of land in the country is liable to floods according to National Flood Commission, and an average of 18.6 million hectares of land is affected annually. Table 1 shows the extent of flood damages incurred during 1953-2005 in India. The annual average cropped area affected is approximately 3.7 million hectares. The most flood-prone areas in the country are the Brahmaputra, Ganga and Meghana River basins in the North and North-east India. These rivers carry 60% of the nation's total river flow. The other flood prone areas are the west flowing rivers such as the Narmada and Tapti in the north-west region; east flowing rivers like Mahanadi, Godavari, Krishna and Cauvery in the Central India and the Deccan region.

There are several causative factors for flooding. Inadequate capacity of the rivers to contain the high flows brought down from the upper catchment due to heavy rainfall, leads to flooding. Area having poor drainage characteristic gets flooded by accumulation of water from heavy rainfall. Excess irrigation water applied to command area and increase in ground water level due to seepage from canals and irrigated field accentuate the problem of water logging. Flooding is accentuated by erosion and silting of the riverbeds resulting in reduction of carrying capacity of river channel, leading to changes in river courses and obstructions to flow due to landslides, synchronization of floods in the tributary rivers and retardation due to tidal effects. With the increase in population and developmental activity, there has been tendency to occupy the flood plains, which has resulted in more serious nature of damage over the years. Because of the varying rainfall distribution, many a times, areas which are not traditionally prone to floods also

experience severe inundation. Thus flood is the single most frequent disaster faced by the country. Floods have different dimensions, inundation due to spills over the banks, drainage congestion due to poor drainage characteristics, erosion due to change in river course.

Since flood plains can be mapped, the boundary of the different return period flood is used in floodplain mitigation programs to identify areas where the risk of flooding is significant. Flood hazard maps are used to delineate areas of land which are at risk of flooding up to some extreme limit. Hazard maps show a flood boundary based on different magnitudes of flood with various specific return periods. These maps can be used to regulate developmental activities within the floodplain, so that damages can be minimized.

2.5. Pakistan

56% of the Indus river basin lies in Pakistan and covers approximately 70% of the country's area (IUCN, 2005). Generally major floods in the Indus basin occur in late summer (July-September) when South Asian region is subjected to heavy monsoon rains. In upper to mid reaches of the Basin, generally tributaries like Jhelum and Chennab are mostly the cause of flooding. Major flooding is mainly associated with the monsoon low depression that develops in the Bay of Bengal and move across India in west/north-westerly direction to enter Pakistan. River floods particularly hit Punjab and Sindh while hill torrents tend to affect the hilly areas of NWFP, Balochistan and northern areas. Districts of Charsadda, Mardan, Nowshera and Peshawar in NWFP are exposed to risks from flooding in the river Kabul. Flash floods also hit hilly and mountain areas of Punjab, which may cause landslides and road erosion. Cloud Burst Flash Floods could also occur over Lahore (as it happened in 1996), Rawalpindi, Islamabad and Jhelum[7]. Floods in Pakistan can also occur due to dam bursts; e.g. the floods in Pasni due to Shadi Kot dam burst in February 2005. In recent years, vulnerabilities of large cities to flooding have increased. Cities like Karachi, Lahore and Rawalpindi have experienced flooding due to inability of sewerage system to cope with heavy rains. Fourteen major floods that have hit the country since 1947 caused economic losses and damages worth USD 6 billion.

2.5.1. Disaster management plan in Pakistan

The NDMP is a milestone in the history of the Disaster Management System (DRM) in Pakistan. The rapid change in global climate has given rise to many disasters that pose a severe threat to human life, property and infrastructure. Disasters like floods, earthquakes, tsunamis, droughts, sediment disasters, avalanches, GLOFs, and cyclones with storm surges are some prominent manifestations of climate change phenomenon. Pakistan, which is ranked in the top ten countries that are the most vulnerable to climate change effects, started planning to safeguard and secure the life, land and property of its people in particular the poor, the vulnerable and the marginalized.

Pakistan has experienced a rapid urbanization and population growth in urban areas. To prevent widespread damage due to disasters in urban areas, it is necessary that urban planning and development should consider disaster risk management. Local governments and disaster management organizations need to make efforts to create a disaster-resistant urban structure.

2.5.2. Disaster management strategy in Pakistan

Pakistan is vulnerable to disaster risks from a range of hazards including avalanches, cyclones/storms, droughts, earthquakes, epidemics, floods, glacial lake outbursts, landslides, pest attacks, river erosion and tsunami. Human induced hazards that threaten the country include transport, industrial, oil spills, urban and forest fires, civil conflicts and internal displacements of communities due to multiple factors. High priority hazards in terms of their frequency and scale of impact are: Earthquakes, droughts, flooding, Wind Storms and Landslides that have caused widespread damages and losses in the past.

A reactive, emergency response approach has remained the predominant way of dealing with disasters in Pakistan till now. The Calamity Act of 1958 was mainly concerned with organizing emergency response. A system of relief commission rate at provincial level was established. An Emergency Relief Cell (ERC) in the Cabinet Secretariat was responsible for organizing disaster response by the federal government. The awareness of policy makers, media, civil society, NGOs, UN agencies and other stakeholders remained low about disaster risk management and the Country as a whole lacked a systematic approach towards disaster risk management.

The need for strong institutional and policy arrangements has been fulfilled with the promulgation of National Disaster Management Ordinance, 2006. Under the Ordinance the National Disaster Management Commission (NDMC) has been established under the Chairmanship of the Prime Minister as the highest policy making body in the field of disaster management. As an executive arm of the NDMC, the National Disaster Management Authority (NDMA) has been made operational to coordinate and monitor implementation of National Policies and Strategies on disaster management.

The new system envisages a devolved and de-centralized mechanism for disaster management. Accordingly, Provincial Disaster Management Commissions and Authorities have been established while similar arrangements have been made in AJ&K and Northern Areas. The District Disaster Management Authorities (DDMAs) have been notified across the country. The DDMAs are going to be the linchpin of the whole system and would play the role of the first line of defense in the event of a disaster.

The National Disaster risk Management Framework has been formulated to guide the work of entire system in the area of disaster risk management. It has been developed through wide consultation with stakeholders from local, provincial and national levels. The Framework identifies National Strategies and Policies for disaster management. Nine priority areas have been identified within this framework to establish and strengthen policies, institutions and capacities over the next 5 years: These include:

1. Institutional and legal arrangements for DRM

2. Hazard and vulnerability assessment
3. Training, education and awareness
4. Disaster risk management planning
5. Community and local level programming
6. Multi-hazard early warning system
7. Mainstreaming DRR into development
8. Emergency response system, and
9. Capacity development for post-disaster recovery.

2.5.3. Early recovery-floods

In July 2010 Pakistan was hit by the worst floods – indeed, the worst natural disaster - in its history. 20 million people across an area of over 100,000 km^2 were affected. There was widespread damage to property and infrastructure: Around 1.67 million houses were destroyed/damaged, 2.2 million hectares of standing crops destroyed and so on. In response the Government of Pakistan, provincial and local governments – supported by national and international humanitarian organisations - undertook a massive relief operation, aimed at meeting the immediate needs of the affected population: Medical treatment, food, water, shelter. The Relief Phase ended on January 31, 2011, with the exception of residual relief in five districts of Sindh and Balochistan, which subsequently came to an end on April15, 2011.

The NDMA – in collaboration with the UN and other development partners – prepared a Strategic Early Recovery Action Plan (SERAP), finalized by April 2011. This covered eight key sectors and addressed four cross-cutting themes: Protection, gender, the environment and DRR. For each sector/thematic area, the Plan identified overall early recovery (ER) needs, the response as of April 2011, strategic gap and ER strategy. It was based on a Mapping and Gap Analysis carried out by each of the Sector/Thematic Working Groups. The SERAP focused exclusively on early recovery and totally precluded any activities related to relief, or to reconstruction or longer-term development. It was prepared for a timeframe for completion of end 2011 (UNDP, 2012).

The following elements discussed in the early recovery floods:

i. Agriculture and Food security
ii. Health and Nutrition
iii. Water and Sanitation
iv. Education
v. Housing
vi. Governance
vii. Non-farm Livelihoods
viii. Community Physical Infrastructure.

2.5.4. Mitigation and preparedness

2.5.4.1. Structural measures

Measures to increase flood flow capacity of waterways are:

- River channel improvement
- Drainage channel improvement
- Construction of flood diversion channels.

Measures to control flood runoff from river basins are:

- Construction of dams/and storage facilities
- Construction of off-site flood retarding basins
- Construction of on-site flood regulation ponds in the new subdivisions
- Erosion control and Sabo works.

Flood proofing measures of individual buildings/units are:

- Raising floor levels of homesteads and industrial facilities above flood levels
- Provision of refuge areas or flood shelters
- Ensuring that water supplies and other health related facilities operate throughout floods
- Management for removal of garbage and other drifting materials in the waterway
- Prevention of encroachment into river area.

Measures to control of flood runoff from river basin are:

- Control of excessive land development in the river basin
- Legal arrangement for construction of on-site flood regulation pond by land developers
- Reforestation
- Flood warning and evacuation system
- Evacuation awareness
- Guidance to waterproof construction
- Development and dissemination of flood hazard maps
- Unification of related agencies for flood mitigation (such as establishment of a "Flood Mitigation Committee").

2.5.5. Flood risks in Pakistan

During the last 62 years, Pakistan has suffered a cumulative financial loss of billions of US $ on account of 19 major flood events, more than 10,000 precious lives have so far been lost, and additionally, the dislocation of millions of people has resulted. Flood is a major disaster to consider. 56% of the Basin is located in Pakistan comprising the Indus and its tributaries: Kabul, Jhelum, Chenab, Ravi, Beas and Sutlej.

Features of the floods in Pakistan are summarized as follows:

- These floods occur as a consequence of the monsoon rains
- Northern areas of Pakistan provide the main water source to the river Indus with snowmelt providing an 80% contribution and rainfall a 20% contribution
- In the Chenab and Jhelum Rivers, besides flash floods, the main source of water is snowmelt from India and occupied Jammu and Kashmir
- Similarly, in the Sutlej and Ravi Rivers, water inflows are due to rainfall in the upper catchments in Indian territory.

Perspectives of flood risk situations in Pakistan are described below:

- River floods
- Torrential rains in the hills
- Flash rains and consequent flash floods
- Cyclones
- Drainage issues
- Ill conceived and implemented projects
- Lack of forecasting facilities and coordination
- Haphazard land development.

2.6. Japan

Japan has a geographic area of about 378 000 km^2, which is divided between four main islands. The country has a temperate climate, subject to extensive regional variation, with three periods of heavy precipitation. The country is exposed to a series of natural

hazards – geo-seismic (earthquakes and volcanic activity, with the subsequent risk of tsunamis), as well as hydro-meteorological events – typhoons occur frequently in September and October. Floods are frequent events and have caused great damage in the past. The country is fairly mountainous, and rivers are relatively short and steep. With a population of 127 million, population density is very high. Most residential and industrial areas tend to be located in lowland areas, along rivers; these areas are highly flood-prone. According to a 1985 study, 48.7% of the population and 75% of holdings are located within flood-prone areas (MLIT, 2005). Considering the population growth in the Kanto Plain, in which Japan's second longest river, Tone, is located, these shares are probably higher today. In the eastern part of the Greater Tokyo Area, several wards and cities find themselves below the water level of several rivers, most importantly the Arakawa and Edo Rivers.

Floods and flood-related disasters, such as landslides, are a traditional and serious risk in Japan. In the 1940s and 50s, after flood disasters took thousands of lives, the creation of a comprehensive flood risk management program led to a dramatic reduction in human casualties. However, in recent years, changes in climate and several socio-economic drivers have on the one hand increased the probability of flood events, especially urban floods, and on the other hand increased vulnerability to floods, because of population density and concentration of economic assets. As a result, the probability that a flood event develops into a disaster has to a certain degree increased. Japan is exposed to all types of floods, in particular:

- Storm surge: Water pressed to shore (coast or large seas) by strong winds, which, when coinciding with tide, can create considerable rise in sea levels
- River floods: Such floods are the result of heavy rainfall over several days and over large area. The water level rises when the soil is saturated
- Flash floods: Caused by intense rain over a small area. The soil is not saturated but the rainfall exceeds the infiltration rate and runs off the surface
- Tsunamis: Waves generated by large volumes of water being displaced (by earthquakes, landslides or volcanic eruptions). Tsunamis can travel through the open sea for hundreds of kilometres without losing their energy and increase in height when they reach shore – up to 10 m.

The worst flooding in modern Japanese history was caused by the Ise-wan typhoon in 1959, which took more than 5 000 lives. It occurred at the end of a period of 25 years of extreme climatic conditions: In the years between 1934 and 1959, there were six flood disasters, mainly caused by typhoons, which killed between 1 000 and 3 000 persons each. In recent years, there have been several flooding events in Japan, including the Tokai Heavy Rain in 2000, as well as several events in 2004 related to the many typhoons which hit the country, most notably the typhoons Songda and Tokage (Table 9).

Historically, destructive natural disasters have posed greatest challenge for Japanese society. Unfavorable geographical, topographical and meteorological conditions of the country have made it one of the most disaster prone countries in the world. Although its territory accounts merely for the 0.25% of the planet's land area, Japan is subject to about 20.5% earthquakes with the magnitude 6 or more and 7% the world's active volcanoes is located on its territory.

2.6.1. Disaster management system of Japan

Various disaster management related laws adopted since late 40s has laid down the legal framework for the disaster management system of Japan. These laws cover all phases of disaster management – preparedness, prevention/mitigation, response and recovery/rehabilitation phases. According to the latest brochure of Disaster Management System in Japan, only 3 laws has been enacted to regulate disaster response activities at national level: (1) Disaster Relief Act - 1947 year (2) Fire Services Act - 1948 year (3) Flood Control Act – 1949 year - whereas the numbers of the laws regulating other phases of disaster management are considerably more: 7 Basic Acts; 18 with regard to Disaster Prevention and Preparedness; 23 Disaster Recovery and Reconstruction and Financial Measures [5; 6-7 p.] Given the interconnectedness of these laws, major aspects of some other laws will also be highlighted, while the main focus will be put on disaster response laws.

The Act plays an important role in the reduction of flood damage. It has provisions governing the following matters.

i. Flood forecast to guide evacuation, etc. (jointly issued by a river administrator and the Japan Meteorological Agency)
ii. Flood fighting warning to guide flood fighting activities (issued by a river administrator)
iii. Public announcement by a river administrator of flood prone areas along each major river and preparation of a hazard map by each municipality based on the assumed flood prone.

Table 9: Significant flooding events in Japan, 2000-2004

Event	Description	Economic loss		Human loss
		Insured loss	Total damage	
Tokai Heavy Rain, September 2000	Floods and landslides in the Nagoya area	USD 990 million (2001 value)	USD 7 billion**	18
Fukui Niigata-Fukushima Torrential Rain, July 2004	More than 12 500 hectares damaged, 5 800 homeless	USD 279 million	USD 1.95 billion	20 dead, 1 missing
Typhoon Songda/No. 18, September 2004	Winds up to 212 km/h, torrential rain	USD 3.59 billion*	USD 7.17 billion	41 dead, 4 missing*
Typhoon Meari/No. 21, September, 2004	Winds up to 160 km/h, rain, floods, landslides	USD 291 million	USD 291 million	26 dead, 1 missing
Typhoon Ma-On/No. 22, October 2004	Winds up to 162 km/h, rain, floods	USD 241 million	USD 603 million	7 dead, 4 missing
Typhoon Tokage/No. 23, October 2004	Winds up to 229 km/h, 23 210 houses destroyed	USD 1.12 billion	USD 3.2 billion	94 dead, 3 missing

Disaster management planning in Japan is implemented at three levels:

i. Basic Disaster Management Plan is prepared by the Central Disaster Management Council and basis plan for disaster management activities. The plan must be based on Disaster Countermeasure Basic Act
ii. Disaster Management Operation Plan is made by each designated government organization and designated public corporation based on the Basic Disaster Management Plan
iii. Local Disaster Management Plan is made by prefectural and municipal disaster management councils, subject to local circumstances and based on Basic Disaster Management Plan.

2.6.2. Emergency response management in Japan

As a constituent element of the entire disaster management system, emergency response phase in Japan is managed at 3 levels. It is the direct responsibility of municipalities to carry out emergency response operations, such as firefighting, rescue, ambulance service within its territory whereas prefectural governments are authorized to render assistance. National government and its relevant bodies oversee the whole coordination process during the phase and provide local governments with necessary information about the hazard while local governments provide the national government agency with the damage information, and if the scope of the disaster elevates beyond the response capabilities of the municipality puts in action its own disaster response forces. Depending on the scale of the disaster, ad hoc emergency headquarters on all 3 levels, within designated public organizations if there is such a need, (electric power corporations, Japan Railway Company etc.) as well as on-site response headquarters are established. The national government collects disaster information at the Cabinet Information Collection Center 24 h a day, and at the time of a large-scale disaster, the designated emergency response team comprised of the director-generals of the respective ministries and agencies gathers immediately at the Crisis Management Center in the Prime Minister's Office to grasp and analyze the disaster situation, and report to the Prime Minister. Inter-ministerial meetings at the ministerial or high-ranking senior official level are held to decide basic response policies if necessary. According to the level of damage, the government may establish a Major Disaster Management Headquarters (headed by the Minister of State for Disaster Management) or an Extreme Disaster Management Headquarters (headed by the Prime Minister). Additionally, a government investigation team headed by the Minister of State for Disaster Management may be dispatched, or an on-site disaster management headquarters may be established (Figure 3).

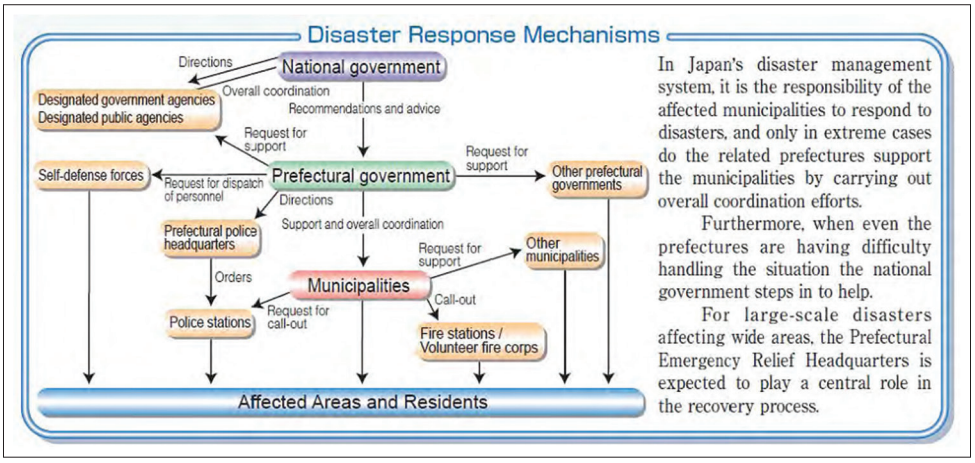
Japan has carried out hazard mapping with regard to tsunamis, tidal waves, flooding, volcanic eruptions and earthquakes. Progress has also been made in the development of dynamic flood hazard maps which predict how the flooding will spread over time. The scale of these maps varies from 1/2,500 to 1/25,000 according to purpose. Many hazard maps have been drafted by local public bodies: The Cabinet Office, the Ministry of Agriculture, Forestry and Fisheries of Japan, the Fisheries Agency, the Ministry of Land, Infrastructure and Transport and other agencies have drawn up manuals on the subject. Many of these maps have been made available to the general public on the internet and elsewhere.

Japan has such mechanisms. Provision for promoting hazard mapping and keeping the public informed regarding disaster countermeasures is included in the country's basic disaster-risk education plan. The institutions responsible are the Cabinet Office, other relevant government agencies, and local governments.

Recent developments in flood risk management in Japan include the adoption of the "National Strategy for Risk Management of Large-Scale Flood Disaster" (MLIT, 2005). This strategy introduces, in addition to traditional 'hard' structural measures, a series of new measures such as simulation of socio-economic impact and target setting, and improved cooperation and communication with citizens. The objective of the latter measures would be to improve local and individual ability to prepare against and respond to floods. Furthermore, MLIT has suggested an "Emergency Action Plan for torrential rain disaster management". The plan consists of five main elements:

- Improve disaster information services
- Ensure the sharing of disaster information
- Maintain and improve the functions of disaster prevention facilities
- Rebuild local disaster management capacity
- Thorough review of disaster preparedness.

Figure 3: Disaster response mechanisms in Japan



2.7. China

Natural disasters occur frequently in China, affecting more than 200 million people every year. In 1998, the direct economic loss exceeded 300 billion RMB. Natural disasters have become an important restricting factor for economic and social development. In China, the study of disasters has entered a phase of rapid development since the mid to late 1980s and has resulted in some important achievements. Disaster management is an applied science to improve measures for disaster prevention reduction, preparation, alarm, response and recovery by observation and analysis of disasters (Carter, 1993). In the cycle of disaster management, emergency response is the key phase although its duration is shorter than the others.

China is one of the countries that is most affected by natural disasters. Natural disasters occur frequently in China, affecting more than 200 million people every year. They have become an important restricting factor for economic and social development. China is among the countries that are most seriously affected by natural disasters of many types: Floods, droughts and meteorological, seismic, geological, maritime and ecological disasters, as well as forest and grassland fires. Due to its geographical location and meteorological conditions, more than 70% of cities and 50% of the population are located in areas that are often afflicted with major meteorological, geological and maritime disasters.

China has been traditionally vulnerable to almost all natural disasters because of its vast territory, and complicated weather and geographical conditions. Almost all kinds of natural disasters, such as floods, droughts, earthquakes, typhoons, heavy snows, landslides and so on, have occurred every year (National Disaster Mitigation Center Disaster Information Department, 2009). These disasters induced serious losses. Generally, thousands of people die of these natural disasters, and about 200 million people are affected every year. In the aspect of property losses, more than 20 million hectares of land are affected and about 300 million rooms collapse every year. There are 74% of provincial capital cities and 62% of municipal cities are situated in the regions with seismic intensity over VII degrees, and half population are in the regions where major disasters are prone to occur (National Disaster Mitigation Center, 2010). With the continuous and fast development of national economy, expansion of the production scale and the accumulation of the social fortune, the natural disasters tend to be increasingly serious, which is one of the main factors restraining the sustainable and stable development of the national economy.

2.7.1. Disaster management system of China

The response to the Wenchuan flood was the result of the Government's disaster management process (called the disaster emergency response in official documents), a comprehensive system involving various central and local government sectors. The process covers the following DRR phases:

i. Disaster preparedness, including risk assessment, institutional and technical arrangements for emergency response, mitigation, monitoring and early warning;
ii. Field responses for rescue, mitigation and relief actions, which require the active participation of the whole society and the mobilization of both civilian and military resources;
iii. Disaster rehabilitation and reconstruction.

2.7.2. Emergency response plan for flood disasters of China

The Office of State Flood Control and Drought Relief headquarters, with its office hosted by the Ministry of Water Resources, is responsible for the formulation of policies, norms and regulations on flood and drought disaster mitigation and response. It has drawn up flood disaster prevention plans for major river basins and water transfer plans across provinces for mitigating drought disasters and has been coordinating flood and drought disaster mitigation plans at various levels. When a flood or drought disaster occurs, the emergency response plan will be activated at the appropriate level when corresponding criteria are reached. A field headquarters headed by the highest administration appropriate to the level of the disaster should be established to mobilize necessary resources and technical support, to take emergency response actions and to report relevant developments to the administrative body immediately above it. The response plan's prevention and early warning mechanism comprises information systems, prevention and preparation actions, early warning systems and early warning support systems.

2.7.3. Improvement of flood disaster response plans and preparedness

The Ministry of Civil Affairs is taking the following actions to improve the disaster planning and response capacity of China:

a. Formulating a national emergency response plan for large-scale disasters and developing a series of templates to perfect disaster response plans at all levels, particularly at the county, township and community levels;
b. Enhancing coordination through the establishment of joint disaster response mechanisms among the government departments responsible for disaster field response actions;
c. Improving financing mechanisms for disaster response at all levels of government;
d. Enhancing the inventory management system for disaster response materials;
e. Establishing a disaster information management system at the community level to improve capacities in disaster information assessment, reporting and management;
f. Establishing and improving disaster donation mechanisms, disaster response volunteer systems and emergency expropriation and compensation mechanisms to enhance social mobilization capacities during major disasters.

2.7.4. Disaster management mechanisms of China

The national master plan considers the following six major components of disaster management:

a. Disaster prevention;
b. Early warning and alert dissemination;
c. Reporting to relevant government organs to activate emergency response plans;
d. Issuance and dissemination of information to the public;
e. Emergency response, including mitigation, rescue and relief;
f. Rehabilitation and reconstruction, including the mobilization of social donations.

Based on the experience accumulated through years of practice in disaster management, China has formed the current natural disaster management mechanism: The State Council provides overall leadership and guidance; local governments are responsible for leading all response actions; and the responsibilities of relevant government organs are clearly assigned, as indicated in the national emergency response plans. It should be emphasized that all disaster management authorities at the level of local government must fulfill their assigned responsibilities and the armed forces should serve as the backbone of field response actions.

China has established comprehensive coordination mechanisms for disaster prevention, mitigation and relief for all levels of government, from central to local. During severe disasters, at the central Government level, the National Committee for Disaster Reduction, the Office of State Flood Control and Drought Relief headquarters, the State Council Headquarters for Earthquake Mitigation and Relief, and the State Headquarters for Forest Fire Control are coordinated by the National Coordination Office for Disaster Mitigation and Relief. Provincial and municipal governments have established their own comprehensive coordination mechanisms to cope with major public emergency events, and all local governments have established specific offices at the county level to deal with disaster emergencies.

The disaster management framework can be divided into such different phases as prevention, mitigation, preparation, emergency rescue, and recovery and reconstruction (Wang, 2010). Understanding of disaster management system is helpful in coping with the disasters. Despite the intentions of the Flood Control Law (1997) and the subsequent MWR policy for a shift from flood control to flood management, progress in implementing the provisions of the law and policy was slow. In 2004, the Government of the PRC requested technical assistance (TA) from the Asian Development Bank (ADB) to help prepare a national flood management strategy (NFMS) (ADB, 2004). After reviewing past experience and current practice in flood management domestically and internationally, a keystone of the NFMS was the formulation of a suitable framework to guide the strategy. The NFMS also required an action plan to implement the shift from flood control to integrated flood management.

2.7.5. Strategic framework for integrated flood management

The framework proposed for a flood management strategy to serve the Province Republic of China in the 21st century relies on a risk management concept. Although there may be other definitions of flood risk, the definition accepted here is drawn from the insurance industry. Flood risk may be under stood as the product of three contributing and necessary conditions:

$$\text{Flood Risk} = \text{Hazard} \times \text{Exposure} \times \text{Vulnerability}$$

2.7.5.1. Hazard

A flood hazard exists wherever land is liable to flooding and there is a potential for harm, loss, or damage due to flood. Hazard increases with probability of inundation; but it is also dependent upon the physical attributes of the flooding, increasing with depth of inundation, velocity of flood flows, and duration of inundation. For different areas of land subject to the same probability of inundation, hazard is greater if the land is inundated to a greater depth or if flow velocities are higher. These attributes increase the potential for harm, loss, or damage. The duration of flooding is also relevant with respect to crop losses, and inundation of longer duration may aggravate structural damage to buildings and foundations.

2.7.5.2. Exposure

There cannot be risk without hazard, but there may be hazard without risk. Flood risk is only present if there are assets that may be damaged; or if people live, work, or simply transit through the land where flood hazard exists. In other words, there is only risk because people or assets are exposed to the flood hazard. Flood risk increases with increasing exposure to flood hazard; i.e., flood risk increases with higher intensity of land use, increasing value of property or assets located on the land, and higher populations that live or work on that land or use the land for purposes such as trans it or recreation.

2.7.5.3. Vulnerability

While exposure to flood hazard creates the potential for personal danger or property damage during floods, the actual consequences of flooding also depend on how vulnerable people and assets are to danger and damage. Vulnerability relates to the classic distinction in flood damage assessment between potential damages and real (or actual) damages.

Vulnerability is reduced if:

i. Assets are made less susceptible to damage by water; and
ii. People are more aware of the flood risk, are well prepared, have an appreciation of what they should do during a flood emergency, and have access to emergency services and post-flood support.

This definition of flood risk is highly relevant to flood management planning, because as Table 10 indicates, each of the three contributing and necessary conditions for flood risk are treated or managed using distinct types of measures.

Structural measures are commonly used to modify flood hazard; for example, they modify flood frequency, depth of inundation, and flood extent. However, upper watershed management that reduces rates of soil erosion and sediment transport by rivers also modifies flood hazard by reducing sediment deposition and waterway instability downstream. Land use controls in more developed parts of river basins mainly aim at reducing exposure to flood hazard by ensuring that only future development that is compatible with the flood risk proceeds or by converting the existing land use to another use which is more compatible with the flood risk. For instance, requiring building floor levels to be above flood levels modifies exposure to the flood hazard and reduces the vulnerability of the occupants. Resettlement and other forms of regulation of human activity are also directed at reducing exposure to flood hazard. Vulnerability to exposure can be modified by a range of nonstructural measures. For example, flood forecasting-coupled with flood warning-is one effective means of reducing vulnerability, providing people with more time to react positively to minimize danger and property loss. Programs to raise public

Table 10: Measures modifying the three conditions for flood risk

Modifying hazard	Modifying exposure	Modifying vulnerability
Flood control dams	Zoning of land use	Flood forecasting and warning
Detention basins	Property acquisition	Emergency response plans
Levees or dikes	Planning development controls	Community awareness
Flood diversion channels	Building codes	Community preparedness
River channel improvements	Flood proofing buildings	Post-flood recovery actions
Upper watershed management	Building on platforms	Flood insurance

Source: ADB, 2011

awareness of flood risk and improve community preparedness are another. Effective emergency response procedures and post-flood recovery services also reduce vulnerability.

3. CONCLUSION

Every country has its own resolution to deal with disaster. Malaysia has its methods which can be used in a holistic manner for giving information and assistance pre-disaster, during and post-disaster, when flooding occurs in the flood-prone areas. Malaysia needs to improve pre-disaster delivery system to prevent the negative impact and flood damage in the future because of changing climate with different pattern.

The hard experiences of big disaster events in the past have made Indonesia Government realized that the disaster management should be set up in the systemic framework and integrated into the development process. The early warning network must be extended into the high-risk communities in order to increase their response time to an incoming flood.

Previous incidents of flood disasters in Thailand hitting the community in last 55 years have resulted in increased awareness of climate change and the realization of its potential impact. This is especially the case when the community is located in a position vulnerable to flood disaster. This may indicate that disorganized urbanization and inappropriate land use are likely to invite constant flooding. However, these challenges aroused the community to develop pro-active management plans to mitigate risk and/or loss that may occur in such disasters by adapting their ways of life, cultivation areas, production methods and water source restoration.

Formulating solutions to flooding problems requires a comprehensive understanding of the geologic settings of the region, and a better knowledge of hydrodynamic processes that are active in watersheds. Structural solutions, such as the building of embankments along the rivers and polders in coastal regions in Bangladesh, will not solve the flooding problems, but will result in many adverse environmental, hydrologic, economic, ecological, and geologic consequences. Solutions to flooding problems can be achieved by adopting and exercising watershed-scale best management practices that include: Floodplain zoning, planned urbanization, restoration of abundant channels and lakes, dredging rivers and streams, increased elevation of roads and village platforms, efficient storm sewer systems, establishing buffer zones along rivers, conservation tillage, controlled runoff at construction sites, good governance, indigenous adjustment of life-style and crop patterns, and improvement on flood warning/preparedness systems.

All Indian flood plains are getting increasingly waterlogged because of indiscipline in land use systems. The embankments can protect people from floods permanently has been proved false. Newspaper photographs showing people marooned on flood control embankments are not unusual. During the monsoons water collects along all road and rail embankments and little effort is made to drain it off into natural channels. India's biggest challenge in sustainable development will lie in how it learns to use the Indo-Gangetic plains, which have the potential to feed not just India but large parts of Asia. The ecological appropriate water utilization model is yet to be developed, but the region's rich tradions should provide some useful ponters.

Pakistan will have to strengthen its early warning capacities for droughts and flooding which are two most high impact hazards in the country. The early warning system will need to be developed for hazards like cyclones and tsunami, which although might be low in frequency but can have high impact. Considering the high exposure to seismic hazards, Pakistan also needs to develop better monitoring and analysis capabilities in this area. Flood management in the Indus Basin is a multi-dimensional process that demands intensive resources and requires efficient coordination between various government agencies. However, even advanced flood management systems are no guarantee against flood disasters as it has often been proved in the more developed countries.

Being one of the most disaster prone countries in the world Japan has developed sophisticated and all-embracing disaster management system. The existing response system, although, has been form during relatively short time period put in place sophisticated mechanism which enables Japan to mobilize forces and resources and respond in a comprehensive manner any large-scale disasters promptly, considerably decreasing damage and loss. Although, complicated at first glance, comprehensively elaborated coordination enables to relevant bodies take concerted actions what increases response efficiency. In turn hierarchical supervision granting response bodies with great independence keeps accountability of them high.

To facilitate national economic and social development, efforts in disaster management should be considered a priority: Legislative documents should be formulated; disaster response plans should be prepared at all levels, from national to community; and relevant institutional and technical preparation and financial mobilization mechanisms should be established. Such preparedness efforts proved to be effective and efficient when China responded to the Wenchuan earthquake. Similar capacities should be established in all countries in the region in order to reduce losses of both human lives and property and to contribute to stable long-term social and economic growth.

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