Chapter 14

Impacts of Disasters and Disasters Risk Management in Malaysia: The Case of Floods

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CHAPTER 14

Impacts of Disasters and Disaster Risk Management in Malaysia: The Case of Floods

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Malaysia lies in a geographically stable region, relatively free from natural disasters, but is affected by flooding, landslides, haze and other man-made disasters. Annually, flood disasters account for significant losses, both tangible and intangible. Disaster management in Malaysia is traditionally almost entirely based on a government-centric top-down approach. The National Security Council (NSC), under the Prime Minister's Office, is responsible for policies and the National Disaster Management and Relief Committee (NDMRC) is responsible for coordinating all relief operations before, during and after a disaster. The NDMRC has equivalent organizations at the state, district and "mukim" (sub-district) levels. In terms of floods, the NDMRC would take the form of the National Flood Disaster Relief and Preparedness Committee (NFDRPC). Its main task is to ensure that assistance and aid are provided to flood victims in an orderly and effective manner from the national level downwards. Its approach is largely reactive to flood disasters. The NFDRPC is activated via a National Flood Disaster Management Mechanism (NFDMM). Members of the NFDRPC include Government departments/agencies and social organizations which provide shelter, rescue and food supplies in case of disaster. The NFDRPC meets at least once a year, normally before the onset of the northeast monsoon. The meeting is between all organizations involved with flood disaster management, and is focused on the need to get ready before the monsoon arrives (bringing floods with it). Its purpose is to ensure that its machinery will run smoothly. At the national level, the NSC is the secretariat for the NFDRPC which comprises members from the Ministries of Information, Finance, National Unity and Social development, Transport, the Federal Chief Secretary, the Federal Police Department and the Federal Armed Forces. The NFDRPC coordinates all relief operations from the Malaysian Control Centre in Kuala Lumpur. The NFDMM is basically a mechanism responding to disasters, as its name suggests. As such, its approach towards disaster management/reduction is largely reactive. Because Malaysia's main risk is flooding, the NFDMM is largely targeted towards handling monsoon flooding. Consequently, this mechanism is less than effective and should be re-modeled into something more pro-active. In terms of flood management, the Drainage and Irrigation Department (DID) is the responsible agency. However, being an engineering-based organization, DID's approach is largely focused on structural measures in controlling floods. It needs to embrace a more holistic approach towards flood management via a multi-disciplinary effort. Non-structural measures are easy to implement, less expensive and community-friendly, and need to be employed more widely. There is also a need for greater stakeholders participation, especially from NGOs at all levels in the disaster cycle. Capacity building for NGOs, local communities and disaster victims is also necessary. The disaster management mechanism should also adopt more non-structural measures, bring in state-of-the-art technology and cooperate internationally with other countries for addressing transboundary disasters. However, the politicization and mediatization of disasters should be controlled while disaster insurance should be introduced and disaster legislation strengthened.

***Keywords*:** Disaster Risk Management, Flood Management, Malaysia, Flood Damage, Politicization of Disaster

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1. Introduction

This chapter opens with a general discussion on the background and history of disaster occurrence and risk management in Malaysia. As floods are the single most severe of all disasters in Malaysia, the chapter specifically focuses on flood disaster management. This is followed by an emphasis on ex post and ex ante analysis of the past and potential socioeconomic impacts of flood disasters in Malaysia. It then reviews and assesses the effectiveness of Malaysia's flood disaster management system with respect to "Risk Identification, Emergency Preparedness, Institutional Capacity Building, Risk Mitigation, and Catastrophe Risk Financing". A detailed discussion on the current constraints that prevent people from engaging in post-disaster supports follows. Finally, the chapter ends with policy recommendations for reforms at the national level and explores the prospects for regional cooperation framework in disaster management.

1.1.Overview of Disasters in 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*. 2002a).

In the past few decades, the country has experienced various extreme weather and climatic events, including El Nino in 1997 (which led to severe droughts), La Nina in 2011 and 2012 (which brought floods), freak thunderstorms almost every year (which brought wind damage, flash floods and landslides), monsoonal floods (which brought

about heavy losses, including loss of life in many parts of the country exposed to monsoon winds), and haze (which brought about poor air quality, extreme heat and drought). Monsoonal floods are an annual occurrence which varies in terms of severity, place and time of occurrences with a recent 2010 flood in Kedah and Perlis being among the worst flood ever experienced by the country. The total economic loss and the financial burden on the government were enormous. When two or more of these events coincide such as the "Terrible twins" (La Nina and the monsoon season) that hit the federal capital of Kuala Lumpur and Selangor in December 2011, the damage is compounded (The Star, 2011). The haze phenomenon in 1997/98 also caused significant problems due to losses in tourist income, health effects and hospitalization costs, and mitigation losses (Kunii, *et al*. 2002) More recently, the 2005 haze episode in Malaysia was a week-long choking haze (at its worst on August 11) that affected mostly the central part of Peninsular Malaysia. The air quality in Kuala Lumpur was so poor that health officials advised citizens to stay at home. A state of emergency was declared in Port Klang and Kuala Selangor. The event also led to crisis talks with Indonesia and caused widespread health effects and inconvenience (Ahmad and Hashim, 2006). The Asian Tsunami which hit in December 2004 was also very severely felt on the coasts of Peninsular Malaysia, most notably in Penang, Kedah, Perlis and Langkawi (Chan, 2009). Due to Malaysia's wet equatorial climate regime with frequent heavy rain storms of high rainfall intensities, landslide disasters are common. In recent decades, landslide disasters in the Klang Valley Region and elsewhere have caused significant loss of life, property and infrastructure damage, environmental destruction and anxiety (Chan, 1998a; Periasamy, 2011). In addition, the country is also regularly hit by man-made disasters such as fires, accidents and the collapse of structures and buildings, which cause considerable damage to property and loss of life (Hussin, 2005).

In terms of human-made and human-enhanced disasters, Abdul Malek (2005) listed the following major disasters: fire and explosions at the Bright Sparklers factory in Sungai Buloh in 1991 which claimed 22 lives; fire and explosions at South Port Klang in 1992 which claimed 10 lives; collapse of the Highland Towers apartment blocks in Hulu Kelang in 1993 which claimed 48 lives; massive landslide at the Genting Highlands in 1995 which claimed 20 lives; mudslides in Pos Dipang, Perak, on 29 August 1996 which claimed 44 lives; severe haze episodes in 1997 and 1998 which

caused loss in tourist revenues in the millions of dollars and hospitalized thousands of people; landslide at Sandakan, Sabah, in February 1999 due to heavy downpour which claimed 17 lives; luxury home collapsed on 21 November 2002 in the Ulu Kelang area killing eight people.

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). According to the Drainage and Irrigation Department (DID), this flood was considered "the biggest flood in living memory" in Malaysia as it affected almost the entire length and breadth of Peninsula Malaysia, causing extensive damage. In 1996, floods brought by Tropical Storm Greg in Keningau (Sabah State), claimed 241 lives, caused more than USD 97.8 million damage to infrastructure and property and destroyed thousands of houses. In 2000, floods caused by heavy rains killed 15 people in Kelantan and Terengganu, and caused more than 10,000 people to flee their homes in northern Peninsular Malaysia. The December 2006/January 2007 floods in Johor caused 18 deaths and USD 489 million in damage. In 2008, floods occurred in Johor again, killing 28 people and causing damage estimated at USD 21.19 million. In 2010, the floods affected transportation in and around Kedah and Perlis, shutting down rail, closing roads including the North-South Expressway (The Star, 2010c) and the airport in Kedah's capital city of Alor Setar leaving helicopters as the only mode of aerial transport into Kedah and Perlis (The Star, 2010d). Water supply in Kedah and Perlis was contaminated, forcing these two states to seek supplies from their neighbor Perak (*Bernama,* 5 November 2010a). Kedah and Perlis are the "Rice Bowl" of Malaysia, and the floods destroyed an estimated 45,000 hectares of rice fields with the government pledging USD8.476 million in aid to farmers (in both states (*Bernama,* 2010c). The floods killed four people, with more than 50,000 evacuated. In Perlis, the floods

submerged over two-thirds of the state's land. Table 1 gives a list of some of the major disasters that have occurred in Malaysia.

1.2. Literature Review

The literature review on disaster management in Malaysia is largely based on a review of government reports from disaster management agencies such as the National Security Council (NSC), the Public Works Department (PWD), the Drainage and Irrigation Department (DID), the Welfare Department (WD), the Statistics Department (SD), State Governments, the Malaysian Medical Relief Society (MERCY), Red Crescent Society (RCS), Red Cross Society (RCS) and other NGOs, and other agencies/organizations. The literature review also covers research reports, academic theses, journal papers, newspaper reports and websites of reputed organizations.

1.2.1. The Top-down Government-centric Model

Historically, disaster management in Malaysia has commonly been considered as a government function and is largely based on top-down government-centered machinery (Chan, 1995). At the very top, the Government Agency responsible for disaster management (all sorts) is the National Security Division (NSD) under the Prime Minister's Department. The NSD is therefore responsible for coordinating activities related to the preparation for, prevention of, response to and handling of disasters, basically referring to natural and technological disasters. The NSD is bound by the National Security Council (NSC) Directive No. 20 on "Policy and Mechanism on National Disaster and Relief Management", issued on 11th May 1997. The NSC Directive No. 20 is an Executive Order from the Prime Minister aimed at outlining policy on disaster and relief management according to the level and complexity of disaster. The directive is also aimed at establishing a management mechanism whereby the roles and responsibilities of the various agencies involved in handling disasters are outlined/identified. Currently, the handling and resolving of disasters in Malaysia are managed via the Committee System which emphasizes the concept of coordination and mobilization of agencies involved, in an integrated and coordinated manner. At the

highest Federal level, the National Disaster Management and Relief Committee (NDMRC) is in charge of managing and handling national-level disasters. Lower down the scale, state-level disasters are managed by the State Disaster Management and Relief Committee (SDMRC). At the third level, district-level disasters are managed by at the District Disaster Management and Relief Committee (DDMRC). At the lowest village level, village-level disasters are managed by the DDMRC with inputs from the village committee (though there is, strictly speaking, no official disaster management and relief committee at the village level).

Table 1: Disaster Incidents in Malaysia

Date/Year	Incident	Natural, Human-made or Combination	Property, Material, Crop or Other Losses (USD)	Number of Deaths
1926	Flood known as "The storm forest flood"	Natural	Thousands of hectares of forests destroyed	NA
19 October 1968	Collapse of Four-Story Building – The Raja Laut Tragedy	Human-made	NA	NA
1988	Sultan Abdul Halim Ferry Terminal–Royal Inquiry	Human-made	Injured 1,634 people	32
1991	Bright Sparklers-1991(Royal Inquiry)	Human-made	Millions	22
21 June 1992	Choon Hong III oil tanker explodes and burns (Royal Inquiry)	Human-made	NA	13
1992	Fire and explosions at South Port Klang	Human-made	Millions	10
December 1993	Collapse of Highland Towers apartments	Human-made	Tens of Millions	48
June 1993	Genting Highlands Landslide	Combination	Millions	20
29 August 1996	Pos Dipang landslide-mudslide	Combination	NA	44

Date/Year	Incident	Natural, Human-made or Combination	Property, Material, Crop or Other Losses (USD)	Number of Deaths
December 1996	Floods brought by Tropical Storm Greg in Keningau (Sabah State)	Combination	300 million	241
1997	El Nino in 1997 which led to severe droughts, forest fires & haze	Combination	Millions in lost tourist revenue, health costs & business losses	NA
June 1999	Japanese Encephalitis Virus Outbreak	Combination	Millions	60
February 1999	Landslide at Sandakan, Sabah	Combination	Millions	17
2000	Floods caused by heavy rains in Kelantan and Terengganu	Combination	Millions	15
December 2004	Asian Tsunami	Natural	Millions	68
November 2002	A luxury home collapsed in Ulu Kelang area	Combination	Millions	8
November 2002-May 2003	Severe Acute Respiratory Syndrome (SARS)	Combination	Millions	NA
2003-2007	Avian Influenza 2003 - 2007	Combination	Millions	NA
2005	Haze	Combination	NA	NA
December 2006 & January 2007	Floods in Johor State	Combination	489 million	18
2008	Floods in Johor State		21.19 Million	28
2010	Floods in Kedah and Perlis	Combination	8.48 Million (Aid alone)	4
2011 & 2012	La Nina in 2011 and 2012 (which brought floods)	Natural	NA	NA

All these committees at various levels are integrated via “Vertical Coordination” (e.g. between FDMRC and SDMRC) as well as via “Horizontal Coordination” (e.g. between the State Police Department and the State Drainage & irrigation Department). Through NSC Directive No. 20, the Government hopes that the handling and resolving of disasters could be carried out in a more coordinated manner with the integrated involvement and mobilization of related agencies. All these will in turn ensure that suffering and losses as a result of disasters can be minimized.

The above disaster management mechanism has been widely applied in flood disasters which is the major type of disaster affecting the country (Chan, 2011). Before the country went through modernization and industrialization, there were also

meteorological disasters, strong winds, rain-induced monsoon floods, and other natural disasters. However, since independence in 1957, other kinds of disaster have been experienced, such as fires, explosions, structural collapse, landslides, biological/disease-related disasters, flash floods and landslides caused by slope disturbance resulting from human activities. According to Yusof (n.d.), Malaysia has transformed radically from an agrarian economy to a modern industrialized nation. This rapid process of development and transformation has given rise to the occurrence of a range of man-made disasters that are considered as "landmark" disasters whereby various safety and emergency acts and regulations were proposed, amended or formulated, resulting also in the formation of specialized teams in disaster management. This government-centric approach is employed to address both the physical/natural (Sham, 1973) as well as the human aspects of flood management (Leigh and Low, 1983). In Malaysia, the National Security Council (NSC) defines a disaster under NSC D20 (National Security Council Malaysia, 1997) as *"An incident that occurs in a sudden manner, complex in nature, resulting in the loss of lives, damages to property or the environment as well as affecting the daily activities of local community. Such incident requires the handling of resources, equipment, frequency and extensive manpower from various agencies as well as effective coordination and the possibility of demanding complex actions over a long period of time."* The types of disaster defined under NSC D-20 are classified as follows: (1) Natural disasters such as floods and landslide; (2) Industrial and technological disasters; (3) Accidents involving dangerous or hazardous materials (4) Collapse of high rise buildings and special structures (5) Aviation accidents in public areas; (6) Railway accidents; (7) Major fire incidents; (8) Collapse of hydroelectric dams or reservoirs; (9) Nuclear and radiological accidents; (10) Release of poisonous and toxic gases in public places; and (11) Air and environmental disasters such as haze. In recent years, Aini, *et al.* (2001) have discussed the evolution of emergency management in Malaysia with the authorities trying to keep up with the rest of the world.

1.2.2. The Technocentric Model

In terms of flood disasters, which are, as previously stated, the major type of disaster affecting Malaysia, much of the relevant research literature reflects a

technocentric approach which strongly emphasizes the use of structural/engineering methods in addressing floods (Chan, 1995). Consequently, it is not surprising to find that the bulk of the literature on flood studies in Malaysia is largely focused on the field of engineering and hydrology. Some notable examples are Volker (1971), Drainage and Irrigation Department (1973, 1974, 1976), Japan International Cooperation Agency (1989, 1991), Syed Mohammad, *et al*. (1988), Julien *et al.* (2010) and Ab. Ghani, *et al*. (2012). Such an approach is central within the "Society over Nature" school of thought, or technocentricism, which asserts that science can solve all flood problems. This cannot be further from the truth in an ever-changing world, especially in the context of rapidly developing Malaysia. Despite the fact that technology plays an important role in flood hazard management, it is a fallacy that it can provide the means of total protection against all floods. In fact, Jones (1991) has observed that technology can increase vulnerability to floods.

1.2.3. The Natural Science Perspective

Against the background of the technocentric approach is the "natural science perspective", which is essentially the natural scientist's explanation to the occurrence of flood hazards. Alexander (1993) states that this approach focuses on how natural processes in the "Earth-Atmosphere System" create hazards. This approach also takes into account the importance of society in altering the physical processes, but the flood hazard is principally attributed to the natural causes (e.g. monsoon winds and rains). As such, it is of paramount importance to monitor and understand the natural processes. It is also important for the natural scientist to measure and monitor these processes in order to classify them. The natural processes can also be modified by humans and this makes them more complicated and difficult to study. Natural scientists often believe that natural processes can be controlled by technological solutions, which is similar to the technocentric approach. This perspective is strongly advocated by natural and physical scientists who employ the hard sciences (e.g. geology, geomorphology, hydrology and engineering) to flood hazard management. Some good examples of the natural scientist's approach to flood hazards in Malaysia are Chan (1998b) and Lim (1988). The natural science perspective is essentially a "tech-fix" approach, although in recent years it has incorporated ecological, biological, environmental and sustainability

considerations. Because of its emphasis on technology as a means of alleviating hazards, it has often been criticized as being too narrow an approach. No field of science can predict the occurrence of hazard events with any level of certainty. Furthermore, artificial structures with high protection levels may still be "over-topped" by an extreme event. For example, the 100-year flood protection structures in the Federal capital of Kuala Lumpur were over-topped by a more than 1:100 year event in 1971, causing widespread flooding that lasted for weeks. Furthermore, the environment is ever-changing in the context of a rapidly developing Malaysia. Studies by others have also shown that disasters occur because of other factors such as the misapplication of technology, institutional ineffectiveness, warning ineffectiveness, and hazard generating socio-political systems (Winchester, 1992).

1.2.4. The Organizational Perspective

Another flood disaster management approach is that of the organizational perspective, originally an approach used by organizational analysts in explaining hazards. This approach focuses upon the ways in which organizations such as government agencies, private companies, NGOs and other civil society voluntary bodies tackle hazards. Disaster managers in the field of economics, geography, systems analysis, planning and sociology who are concerned with "collective behavior" and "collective decision-making" are probably responsible for this perspective (Parker, 1992). The role played by organizations cannot be underestimated because they are powerful and influential. The argument is that organizations may contribute in one way or another to the creation or worsening of hazards. Turner (1978) examined hazards arising out of organizational inefficiencies. Reasons for failures include organization inefficiencies (within and outside), existence of organizational "sub-cultures" which lead to "collective blindness" to the hazard, "organizational exclusivity", poor information dissemination and others. Handmer and Parker (1991) have documented the tendency for organizations to "groupthink", resulting in the narrowing of options, and noted the existence of a high level of secrecy amongst the bureaucracy of government organizations, all of which hinder emergency planning. In Malaysia, the organizational approach has been studied by Chan (1997a), who found that

organizations tend to protect and safeguard self-interest rather than expose their weaknesses.

1.2.5. The Vulnerability Model and the Structural Paradigm

Vulnerability to flood disasters in Malaysia is another approach (Chan, 2000). The study of disaster vulnerability originated from the "Structural Paradigm" in which disasters were believed to be subject to cultural, social, economic and political forces (Torry, 1979). In developing countries and poor countries, it was discovered that broader structural forces (local and national) were more powerful and pervasive than local factors in affecting the outcome of hazards and disasters (Wadell, 1983; Hewitt, 1983). This radical view gave a new insight that went beyond the conventional geophysical cause of hazards and disasters. More recently, the recognition that structural forces at the international level can strongly affect local vulnerability has resulted in an expanded version of the structural paradigm, known as the "political economy paradigm" or the "political ecology perspective of hazards" (Blaikie, *et al*., 1994; Varley, 1994). All these approaches to disasters are essentially a "structuralist" view that links social relations to disasters and is rooted in Marxist political economy. Although basically a social/structuralist perspective of hazards emphasizing vulnerability and lack of access to resources, Blaikie, *et al*. (1994) avoided using a purely deterministic approach rooted in political-economy, notions of equating vulnerability with poverty or some other specific conditions, and definitions of vulnerability that focus exclusively on the ability of a system to cope with risk or loss. They advanced the political economy perspective by explaining vulnerability as a progression from "root causes" to "dynamic pressures" and "unsafe conditions", that coincide with hazards, leading to disasters. In Malaysia, Chan (2000) has used this paradigm to study flood hazards, and has proposed measures to reduce the exposure of people to flood hazards and also to reduce people's vulnerability to floods. Chan (1996) has found that vulnerability to flood disasters in Malaysia is not solely influenced by poverty, but more importantly by awareness, perception, attitude, experience, length of residence and social relations (Jamaluddin, 1985).

2. Flood Disaster Risk in Malaysia

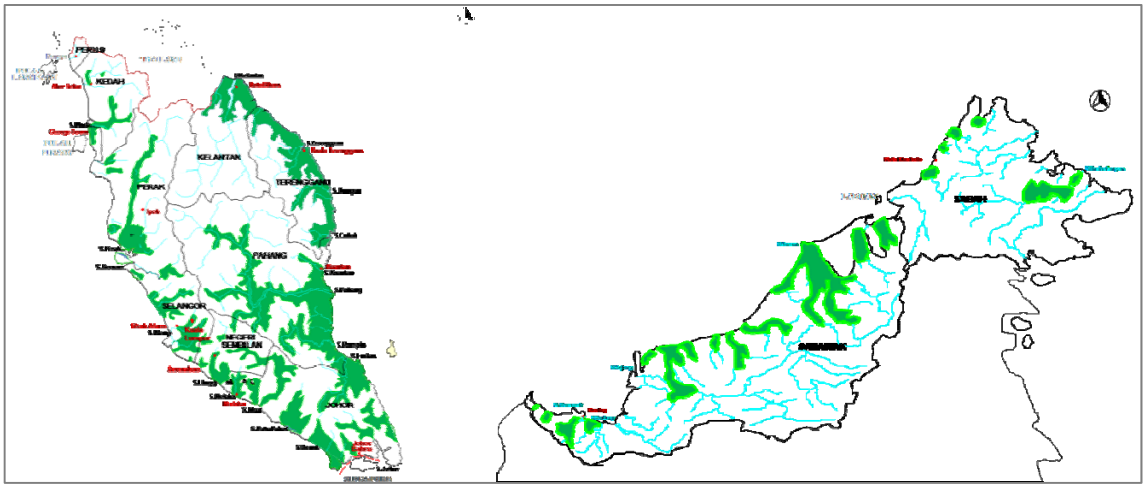
Malaysia is a country very prone to flood risks, mostly by nature of its physical (e.g. topography and drainage) as well as its human geography (e.g. settlement and land use patterns). The combination of natural and human factors has produced different types of floods, viz. monsoon, flash and tidal (Chan, 1998b). 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.* Kobe: Asian Disaster Reduction Centre http://www.adrc.asia/publications/TDRM2005/TDRM_Good_Practices/PDF/PDF-005e/Chapter3_3.3.6.pdf accessed May 14 2012) (Figure 1). With annual heavy monsoon rains averaging more than 3000mm 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 five-yearly Plans for development, the allocations for design and construction of flood mitigation projects account for USD 4.564 (1^{st} Malaysia Plan 1966-1970), USD 9.78 million (2^{nd} Malaysian Plan 1971-1975), USD 32.6million (3^{rd} Malaysia Plan 1976-1980), 65.2 million (4^{th} Malaysia Plan 1981-1985), USD 97.8 million (5^{th} Malaysia Plan 1986-1990), USD 228.2 million (6^{th} Malaysia Plan 1991-1995), USD306.44 million (7^{th} Malaysia Plan 1996-2000), USD 3.97 billion (8^{th} Malaysia Plan 2001-2005), USD1.25 billion (9^{th} Malaysia Plan 2006-2010) and USD 1.17 billion (10^{th} Malaysia Plan 2011-2015).

According to Hj Ahmad Hussaini, the Director General of the Drainage and Irrigation Department of the government of Malaysia, there are two major water-related problems affecting this country. These are excess water (floods) and water shortage (droughts). Both these problems have disrupted the quality of life and economic growth in the country and can result in severe damage and loss of property, and occasionally loss of human lives, as can be seen in the December 2006 and January 2007 floods in Johor (Hussaini, 2007). Floods occur annually in Malaysia, causing damage to property and loss of life. It is useful to distinguish "normal" from "major" flood events. "Normal floods" are seasonal monsoon floods (November to March) whereby the waters do not normally exceed the stilt height of traditional Malay houses. Thus, people living in stilt houses in the rural areas are well adapted to normal floods. It is the major floods, which are "unusual" or "extreme" events that render people helpless. "Major floods" also have their origins in the seasonal monsoon rains but statistically occur once every few years. These floods are extensive, severe and unpredictable and result in significant loss of life, damage to crops, livestock, property, and public infrastructure (Winstedt, 1927). In a major flood, people's coping mechanisms are totally ineffective and they are forced to rely on government relief for recovery. During major floods, a flood depth of 3 meters is not uncommon, and hundreds of thousands of people are often evacuated. Other classifications such as "flash flood", "tidal flood", "river flood" and "monsoon flood" may be considered as normal or major depending on the severity (Chan, 1995).

Historically, Malaysia experienced major floods in the years 1926, 1963, 1965, 1967, 1969, 1971, 1973, 1979, 1983, 1988, 1993, 1998, 2005 and most recently in December 2006 and January 2007. This latter flood occurred in Johor. The years 2009 and 2010 also saw major floods occurring in Kedah and Perlis, two northern Peninsular Malaysia states that are considered relatively dry. The January 1971 flood was a massive disaster affecting nearly the whole of Peninsular Malaysia, with Kuala Lumpur the most badly hit. This flood resulted in a loss of more than USD 65.2 million and 61 deaths. Since then floodplains in the country have undergone a rapid transformation into large urban cities with dense population and mega structures, thereby increasing flood damage potentials. As a comparison, during the 2006-2007 flood disasters in Johor, the estimated total cost was in excess of USD 0.49 billion. These two events are

ranked as the most costly flood events in Malaysian history. Recent urbanization amplifies the cost of damage in infrastructures, bridges, roads, agriculture and private commercial and residential properties. At the peak of the most recent Johor flood, around 110,000 people were evacuated to relief centers, and 18 people died. (Hussaini, 2007).

Figure 1: Flood-prone Areas in Malaysia



Source: Drainage and Irrigation Department Malaysia [Online] (2012).

In the past, natural causes such as heavy intense rainfall (monsoon or convective) and low-lying flat terrain were the main causes of flooding. However, deforestation reduces the role of forests as natural flood attenuation systems (Chan, 2003; Chan, *et al*., 2002b). As a result of deforestation, a very high proportion of rainfall becomes surface runoff, and this causes breaching of river capacity resulting in floods. Yet development has continued unabated. In more recent years, rapid development within river basins has further increased runoff and reduced river capacity, resulting in an increase in both flood frequency and magnitude. Urban areas are the most susceptible to flooding, and with more than 60% of the Malaysian population now urban, flash flooding in urban areas has become a very serious problem (surpassing the monsoon floods) since the mid 1990s. This is reflected in flood frequency and magnitude, social-economic disruption, public outcry, media coverage and the government's escalating allocation of funds for flood mitigation.

Coastal areas are also subject to tidal floods. Tidal floods are often exacerbated when high tides coincide with heavy rains or strong wind. In 2004, the Asian Tsunami also flooded many coastal areas in northern Peninsular Malaysia, resulting in huge losses and deaths (Chan, 2009). In the last decade, largely due to development on the slopes of hills, there has been an increased occurrence of other flood-related disasters, such as debris flood flow, mud flow and landslides. Flood risks are therefore ever increasing in Malaysia, despite the huge amount of effort and funds invested to mitigate them (Chan, 1997b).

3. Methodology

This chapter is based on research employing the "triangulation" strategy of combining various complementary research methods. For understanding the fundamental ethics, beliefs, and practices of human society related to disasters (especially flood disasters), the research methods employed are; historical analysis, analysis of traditional response strategies and practices, literature review, qualitative interviews with key informants (e.g. flood managers), social impact assessment, and the use of secondary data. In examining the political-economy of disasters, the federal-state dichotomy and institutional arrangements, the research looks at archives (letters, agreements, reports, government documents, etc.) institutional analysis using the "criteria approach" was employed to study and analyze institutions involved in the disaster sector. In-depth qualitative interviews with Federal and State government officers, NGO managers, and private sector consultants, and disaster victims were also carried out. As an involved party, the author also employed the "cultural insider" approach by working as a volunteer in disaster organizations and living in flood-prone areas. This is to get a feel of the actual world of the insider. This is the greatest merit of the insider approach. Without insider knowledge, the researcher has to go to great lengths before beginning to study the insider's world. Davis (1981) recognized the dangers of cultural detachment which face research workers from western developed countries working in the developing world. These researchers often fail to grasp the

realities of local cultures and are too ready to project western values, often resulting in a vast gulf in terms of academic elitism, language barriers, geographical remoteness and income levels of consultants *vis-a-vis* local families. In the case of the current research, there is no such problem. As an informed member of the culture under study the author uses this advantage to effect in the analysis of many aspects of the flood hazard in the contexts of the historical, socio-cultural, political economy and institutional forces. Living amongst the flood victims certainly helped to deepen his understanding of how individuals in the peninsula perceive and respond to the flood hazard. This "observer-participant" role is made more relevant in the context of this research as it draws upon 33 years of academic experience with numerous publications on disaster research, including an MA thesis on drought hazards (Chan, 1981) and a PhD thesis in flood hazard management in Malaysia (Chan, 1995).

4. Socioeconomic Impacts of Flood Disasters

Floods are the disasters causing the most damage in Malaysia. The annual costs incurred by the Malaysian Government in rescue and flood relief operations, as well as rehabilitation of public works and utilities, are substantial. It is estimated that the costs of damage for an annual flood, a 10-year flood and a 40-year flood are USD 0.98 million, USD 5.87 million and USD 14.34 million respectively. The 1926 flood was perhaps the biggest flood in living memory in Malaysia. During this flood most parts of the country were affected. The 1971 flood was so serious that it was declared a national disaster by the Prime Minister. Total flood loss was estimated at USD 65.2 million then and there were 61 deaths. The 1967 flood damage estimated for the Kelantan River Basin alone was USD 25.43 million. A summary of flood damage for selected floods is shown in Table 2.

Table 2: Official Flood Loss Estimates for Major Flood Events in Malaysia

Flood Event (Year)	(Place)	Damage (USD million at 1996 prices)	Deaths	No.of Victims Evacuated
1886	Kelantan & Besut Rivers ("Storm Forest Flood")	Several hundred square kilometers of forest destroyed	NA	NA
1926	Most of Peninsular Malaysia	Damage to natural environment	NA	NA
1954	Johor, Terengganu	Hundreds of acres of padi	2	Thousands
1965/66	Besut, Kelantan-Terengganu	>30,000 acres of padi destroyed	NA	Thousands
1966	Perlis	NA	1	NA
1967	Kelantan River Basin	72.31	38	320,000
1967	Perak River Basin	56.04	0	280,000
1967	Terengganu River Basin	14.57	17	78,000
1971(December)	Kuala Lumpur	30.71	24	NA
1971(December)	Pahang River Basin	33.77	24	153,000
1979	Peninsular Malaysia	NA	7	23,898
1981	Kelantan State	NA	8	2,740
1982	Peninsular Malaysia	NA	8	9,893
1983	Penang State	0.20	0	NA
1983	Other Peninsular Malaysia	NA	14	60,807
1984	Batu Pahat River Basin	7.37	0	8,400
1984	Kelantan dan Terengganu States	NA	0	Thousands
1986	Peninsular Malaysia	11,96	0	40,698
1988	Kelantan River Basin	NA	19	36,800
1988	Other Peninsular Malaysia	NA	37	100,755
1989	Johor State	NA	1	Thousands
1989	Kuala Lumpur/Petaling Jaya	0.03	0	220
1991	Other Peninsular Malaysia	NA	11	NA
1992	Peninsular Malaysia	NA*	12	NA
1993	Peninsular	NA	22	17,000
1993	Sabah State	72.57	5	5,000
1995	Shah Alam/Kelang Valley	1.76	1	8,970
1995	Klang Selangor	NA	3	0
1995	Other Peninsular Malaysia	NA	4	14,900
1996	Sahab (June)	>100 houses destroyed	1	9,000
29.8.1996	Pos Dipang, Perak	97.8**	44	Hundreds
1996	Sahab (December)	NA	241***	23,000
30.12.98	Kuala Lumpur	NA	5	0
5-9.1.99	Penampang, Sabah	NA	6	4,481
11.1.99	Sandakan Sabah	NA	3	0
23.11.2000	Kg. La	NA	6	0
Dec. 2001	Kelantan, Pahang, Terengganu	Crop loss & property damage in millions USD; USD 0.65 million texts destroyed	6	>10,000
27.12.2001	Gunung Pulai, Johor	Mudslide swept away 4 houses	5	4 families
31.12.2001	Benut Marang, Terengganu	Crop loss & property damage	4	Thousands
Dec 2006 – Jan 2007	Johor State Kelantan State	USD 489 million Property Damage USD 17.28 Damage to Infrastructures	18	110,000
2008	Johor State	65 (Relief Costs)	28	34,000
November 2010	Kedah & Perlis States	Alor Setar Airport closed, railway line flooded, USD 8.48 million padi crop damage	4	50,000

Note: NA = Not Available

* = In the state of Kelantan, 200 schools were closed resulting in 113, 000 students missing school between 6 to 11 days.

** = Damage to infrastructure and public utilities estimated at USD 42.38 million (The Star, 1st January 1997). Destruction of properties (more than 4,553 houses were destroyed), crops and livestock loss estimated at USD 55.42 million.

*** = Another 108 people are still missing more than a month after the even (The Star, 27 January 1997)

Source: Drainage and Irrigation Department Malaysia, Malaysian National Security Council and major newspaper.

The socio-economic impacts of floods in terms of flood damage are varied. However, there is now a considerable volume of literature on flood damage assessment (Chan and Parker, 1996). Flood damage in terms of losses can be direct or indirect, and both categories include tangible and intangible losses. While the assessment of tangible losses is fairly straightforward, the evaluation of intangible losses can be problematic. Despite this, there have been attempts to quantify intangible flood damages so that they can be included in cost-benefit analysis (Green, *et al*. 1988). In Northern Peninsular Malaysia, the 2004 flood resulted in tidal flooding that caused considerable damage to residential and commercial properties located on or near the eastern and northern coasts of the area. While the damage in rural areas was largely confined to residential properties (largely farms and fishermen's properties) resulting in the loss of livestock and crops, farm machinery, fishing vessels and equipment, and damage to building structure and contents, tsunami flooding in coastal urban areas involved damage to residential and commercial properties, vehicles, materials, machinery, goods and loss of business. And because of the high density of residential and commercial properties, infrastructure and public utilities in urban areas, the urban damage toll is expected to be much higher than in the rural areas. Though commercial properties suffered much greater damage in monetary terms, the households suffered the most in terms of damage in kind (intangible losses) and affected members of households are usually the victims that carry with them the trauma and mental damage for life. Jamaluddin (1985) suggests that victims need to respond positively and appropriately to flood disasters if they hope to have any chance of quick recovery.

In the flood damage assessment literature, damage or losses have been categorized as direct or indirect. Such damage is further categorized as tangible or intangible (Parker, *et al*. 1987). A typology of flood damage is given in Figure 2. According to Chan (1995), tangible flood damage refers to those effects of flooding which can be assigned monetary values. They can be direct as in the case of damage to building structures or indirect as in the case of the loss suffered as a result of drop in business volume. Direct flood damage results from the contact of flood water and its contents (sediment, oil etc.) with buildings and their contents, vehicles, livestock and crops, humans, memorabilia, etc. For residential properties, the pressure and contact of flood water may give rise to adverse effects on building structure (walls, floors, stilts etc.),

damage to garden and house contents such as furniture, electrical appliances, household utensils, carpets, wiring systems and sockets, etc. In the case of commercial properties, additional effects may include damage to shop fittings, goods, raw material, machinery, etc. The costs of clean-up after a flood may also be included as direct damage. In contrast, indirect damages usually occur at the time of, or in a period after, a flood. In Peninsular Malaysia, as flood events can last for several weeks, such damage may be substantial. Also, the post-flood period can extend for several weeks or months. In the case of residential properties, indirect damage includes the cost of alternative accommodation, costs of transportation (of family members and household contents), loss of income through disruption to work, costs of treatment for illness resulting from floods (especially children and the elderly being exposed to the cold waters), loss of schooling and subsequent costs of extra lessons to catch up with the syllabus, etc. In the case of commercial properties, such damage may include loss of production, reduced output due to inability of workers to commute to working premises, transportation of goods and raw materials to alternative locations, loss of trade due to temporary closure of business outlets, loss of business orders, increases in costs of transportation caused by disruption to usual traffic, the devaluation of the property value in the market, etc. Intangible flood damage refers to those effects of flooding to which it is not currently possible to assign acceptable monetary values (Pearce, 1976). The only common property shared by "intangibles" is that they cannot be evaluated for one reason or another (Parker, *et al*. 1987). As with tangible damages, it is possible to have both direct and indirect intangible damages. The damage of historical buildings by flooding is a direct effect but it would be difficult to evaluate the loss in monetary terms. This is then an intangible direct loss. On the other hand, the inconvenience caused by a flood is difficult to measure in monetary terms. This is then termed an intangible indirect loss.

Figure 2: A typology of Flood Damage (After Parker, *et al*., 1987)

A TYPOLOGY OF LOSSES DUE TO FLOOD DISASTERS

		Types of Losses due to Tsunami	
		Tangible Losses	Intangible Losses
Types of Losses	Direct Losses	Damage to Building & Contents	Mental/Psychological & Loss of Life (Stress)
	Indirect Losses	Loss of Work & Production	Discomfort, Stress & Sufferings due to Tsunami & Cutting Off of Water, Electricity, Transport, Food Supplies, Healthcare, etc

According to findings by Green, *et al*. (1988), the non-monetary (intangible) impacts of flooding are far more important to the households affected than the cost of the damage done. Physical damage to buildings and their contents are the most visible but not always the most serious effects of flooding (Green, *et al*. 1983). Among the notable intangible damage is disruption to the household's life caused by a flood and the stress of the flood event itself; subsequent health damage; loss of memorabilia or of other irreplaceable and non-monetary goods; and possible evacuation. Furthermore, stress and worry about the risk and consequences of future flooding may also damage a person's health. Chan and Parker (1997) have evaluated the socio-economic aspects of flood disasters in Peninsular Malaysia and found that non-monetary and intangible effects are just as significant as monetary impacts.

5. Flood Disaster Risk Management

5.1.Background

In Malaysia, the Drainage and Irrigation Department’s Flood Mitigation Policy and Strategy consists of both structural measures (for example dams and embankments to

control flood flows) and non-structural measures (for example land use planning and flood forecasting and warning systems to mitigate the impact of flooding). Hence policy guidelines for implementing flood mitigation measures 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 of strengthening flood forecasting and warning systems (Hussaini, 2007).

In terms of flood mitigation and management, Malaysia conducted a National Water Resources Study in 1982 on structural and non-structural measures for flood mitigation and management (Japan International Cooperation Agency, 1982). The government also conducted a number of flood mitigation projects but these were mostly structural mitigation measures such as canalization of rivers, raising river embankments and the building of multi-purpose dams. Interestingly, despite their high costs compared to non-structural measures, structural measures continue to this day to be favored. The financial allocations for such projects have consequently increased significantly in every one of Malaysia's subsequent five yearly development plans. Such escalating expenditures put a heavy strain on the government, and there have been suggestions that strategies be re-examined with the objective of developing a more proactive approach in finding ways and means to address the flood disasters in a holistic manner. The current 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 (including flood management) in the country.

5.2.Malaysian Flood Disaster Relief and Preparedness Machinery

The Malaysian Flood Disaster Relief and Preparedness Machinery (MFDRPM) was set up after the disastrous flood of 1971 when the National Disasters Management and Relief Committee (NDMRC) was formed. This committee was entrusted with responsibility for planning, coordinating and supervising relief operations during floods. Unfortunately, this was an entirely top-down approach as most of the organizations in the committee were governmental departments/agencies and social organizations that

are able to provide shelter, rescue, food and medical supplies. Through the various government levels, the NDMRC, SDMRC and DDMRC committees coordinate between government departments and various voluntary organizations. In terms of early warning, the Flood Forecasting and Warning Systems have been upgraded. By 2007, the following infrastructure for flood forecasting and warning systems had been installed: 233 telemetric rainfall stations; 190 telemetric water level stations; 256 manual stick gauges; 84 flood warning boards; 217 flood sirens; real-time flood forecasting and warning systems in nine river basins. The Department of Irrigation and Drainage Malaysia is responsible for providing flood forecasting and warning service to the public. It has established an Internet-based National Flood Monitoring System known as Infobanjir (http://infobanjir.moa.my), enabling rainfall and water level data can be collected for the whole country. The government has been working closely with the Canadian government to establish the GEOREX Monsoon Flood System for the Kelantan River Basin, a flood monitoring system integrating remote sensing, hydrological modeling and geographical information systems (GIS). This system allows the merging of hydrological data, such as river water levels and potential flooded areas, with geographical data on demography and transportation infrastructure.

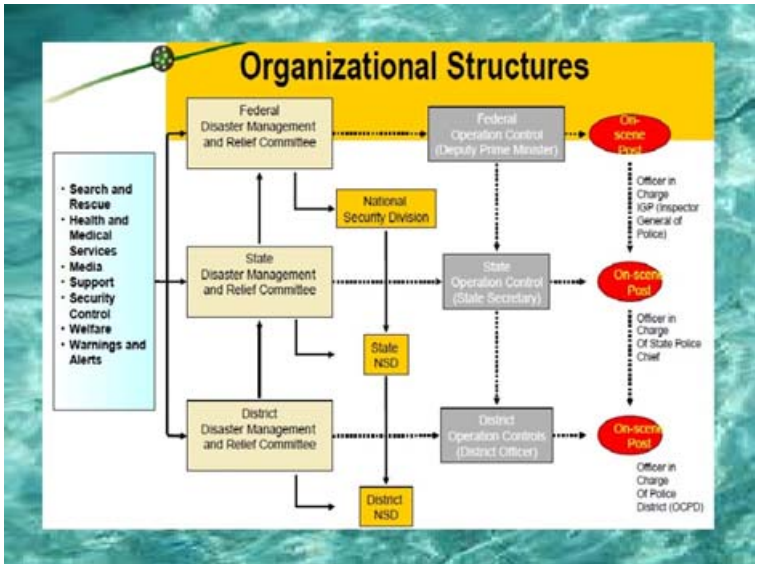
Flood management activities undertaken include the following: (i) the National Water Resources Study; (ii) development of infrastructure for flood forecasting and warning systems; (iii) “Infobanjir” (the National Flood Monitoring System); (iv) “Flood Watch” (a flood forecasting and warning system); and (v) the Urban Storm-water Management Manual for Malaysia (MSMA) (Hj Ahmad Hussaini, 2007). All these flood management activities are basically a combination of structural methods aimed at “controlling” floods and non-structural methods aimed at reducing flood impacts. One famous example of a structural method is the Storm-water Management and Road Tunnel (also known as the SMART Project), developed by the Drainage and Irrigation Department to alleviate flash flood problems in the Federal capital of Kuala Lumpur (Umar, 2007). The 9.7 kilometers long, 11.83 meters diameter tunnel integrates both storm water management and a motorway in the same tunnel. In contrast, an example of a non-structural method is the flood forecasting and warning system (Drainage and Irrigation Department, 1988).

In Malaysia, disaster management is almost entirely based on a top-down approach. At the very top is the NDMRC running a National Crisis and Disaster Management Mechanism (NCDMM). According to Chia (2004), this machinery was established with the objective of co-coordinating relief operations at the Federal, state and district levels so that assistance can be provided to flood victims in an orderly and effective manner. In the case of floods, the NCDMM would be called the National Flood Disaster Relief Machinery (NFDRM). The NFDRM is basically a reactive system, as it reacts to major floods when they occur. The coordination of flood relief operations is the responsibility of the National Flood Disaster Management & Relief Committee (NFDMRC), headed by the Minister of Information with its secretariat at the National Security Council (NSC). The committee is empowered, among other things, to declare any district, state or even the whole nation to be in a state of disaster so as to be eligible for financial assistance from the Federal Government. Members of this committee include government departments/agencies and social organizations which provide shelter, rescue and food supplies in case of disaster. On a positive note, the FFDMRC meets at least once a year, normally before the onset of the northeast monsoon. The meeting is between all organizations involved with flood disaster management on the need to get ready before the monsoon arrives (bringing with it floods). It is to ensure that its machinery will run smoothly. The entire organizational structure of the NFDRM is shown in Figure 3.

The NFDRM is theoretically responsible for all operations at the national, state, district, *mukim* and village levels. In reality, however, it coordinates operations at the national level and overseas operations at the state level. Much of the activity in each state is left to be run by the respective state authorities. Its main task is to ensure that assistance and aid are provided to flood victims in an orderly and effective manner from the national level downwards. As a result, its approach to disaster mitigation is largely reactive (Chan, 1995). For example, this body meets annually just before the onset of the northeast monsoon season to organize flood disaster preparedness, evacuation and rehabilitation work. It is also more of a welfare body than it is a flood management organization. At the federal level, the National Security Council (NSC) is the secretariat for the Disaster Relief and Preparedness Committee (DRPC) which comprises members from the Ministries of Information, Finance, National Unity and

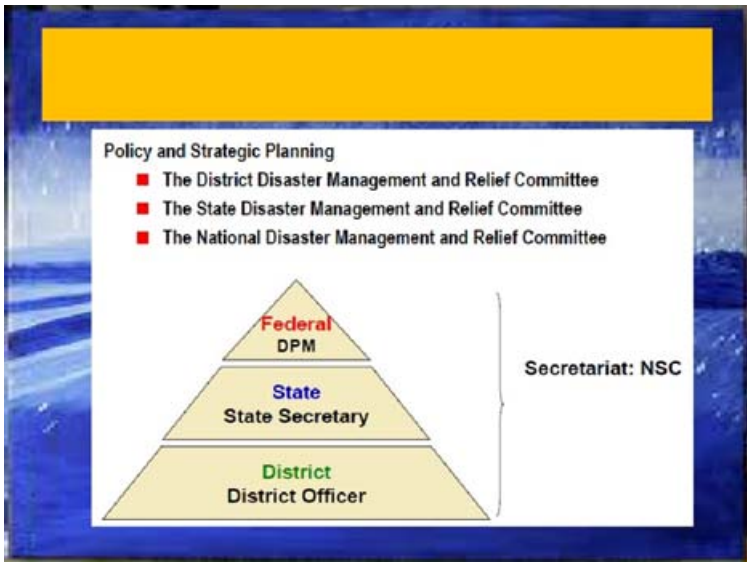
Social development, Transport, the Federal Chief Secretary, the Federal Police Department and the Federal Armed Forces. The DRPC coordinates all relief operations from the Malaysian Control Centre in Kuala Lumpur. At the state level, there are 13 State Disaster Relief and Preparedness Committees (SDRPC) for Malaysia. Each state is given funds by the Federal Government every year to enable it to run its own disaster relief operations. At the district level, there are several district committees under each state, depending on the number of districts in a particular state. Each district will have its own District Disaster Relief and Preparedness Committees (DDRPC) which receives funds and directives from the SDRPC. Below the district level, there are several *mukim* Disaster Relief and Preparedness Committees (MDRPC), again depending on the number of *mukim* in each district. Each MDRPC is headed by a penghulu (County Head). Finally, there are many Village Disaster Relief and Preparedness Committees (VDRPC) under each *mukim*. Each VDRPC is headed by a ketua kampong (village Head) (Figure 4). The National Disaster Response Mechanism (NDRM) is basically a system responding to disasters, as its name suggests. As such, its approach towards disaster management/reduction is largely reactive. Because Malaysia's main type of disaster is flooding, the NDRM is largely targeted at handling monsoon flooding. Consequently, this mechanism is less than effective and should be re-modeled into something more pro-active. There is also a serious lack in terms of stakeholder participation, although the authorities have recognized the important role of NGOs, particularly that of MERCY, the Red Cross, the Red Crescent and other NGOs. This is likely due to heavy the dependence of communities on government, and the reluctance of government to relinquish responsibilities to the public. Public apathy may also be a reason for low public participation in disaster management. Capacity building is therefore necessary. NGOs and other stakeholders should be involved right from the beginning, from pre-disaster preparedness to rescue and reconstruction. NGOs would be particularly effective in creating awareness and education on disasters. The disaster management mechanism should also adopt more non-structural measures, use state-of-the-art technology and cooperate internationally with other countries for addressing transboundary disasters.

Figure 3: The Organizational Structure of the National Disaster Relief and Preparedness Committee (NDRPC) in Malaysia



Source: Yusof, (n.d.)

Figure 4: The National Disaster Relief and Preparedness Committee (NDRPC) in Malaysia



Source: Yusof, (n.d.)

5.3.Limitations of the Malaysian Flood Disaster Management Model

As a country which is almost annually affected by flooding, there are countless measures and strategies employed to reduce floods in Malaysia. While many of these strategies have been responsible for reducing some of the impacts of flooding, they have not been entirely successful in the overall management of floods. As discussed above, this is largely due to an outdated reactive approach based on evacuation, relief and rehabilitation, the low salience of floods on government agendas, the lack of interaction and cooperation amongst government agencies dealing with floods, the bureaucratic nature of government agencies, and the victims' reluctance to relocate. In fact, floodplain encroachment has even exacerbated flood hazards, as more and more people are forced to occupy floodplains due to the shortage of land, high rents and rural-urban migration. Urban floodplains have also extensively developed as a result of rapid urbanization leading to greater flood damage potentials (Chan, 1996; Chia, 2004).

In Malaysia, flood forecasting and warning systems have also not developed as quickly as expected (Drainage and Irrigation Department, 1988). Currently, two flood forecasting models have been developed and used by the Drainage and Irrigation Department Malaysia, viz. the Linear Transfer Function Model (LTFM) at Pahang River and the Tank Model at Kelantan River (Umar, 2007). The agencies involved in flood relief have used information from the models to decide when they should mobilize their staff and equipment to the areas that are potentially to be hit. The flood warning system consists of dissemination systems such as automatic warning sirens, the Short Messaging System (SMS), telephone, fax and the website (http://infobanjir.water.gov.my Retrieved 16/5/12). The current system being used is not state-of-the-art technology, as it does not have radar or satellite rainfall forecasts as inputs into computer models. Rather, it uses river levels as inputs. The number of automated telemetric rain gauges and river level recorders is also short of the required number. As a result, the advantages of flood forecasting and warnings have not been maximized and the current system appears cumbersome and ineffective. This has led to a lack of confidence amongst floodplain users and flood victims in flood forecasts and warnings (Chan, 1997c). While every effort is made by relevant authorities to improve formal (official) FWESs, there has been little attempt to incorporate traditional

(informal) FWESs into them. Traditional FWESs are an integral part of the Malaysian cultural heritage and are closely knitted into the fabric of rural societies. Due to years of responding to flood hazards, traditional FWESs are based on practical knowledge of adaptation and have served people well. As such, the authorities should incorporate them into formal FWESs in order to maximize the effectiveness of overall flood warning and evacuation response from the people.

As a developing country, Malaysia's flood mitigation policy can be described as commendable. Since the First Malaysia Plan (1971-1975), the country's expenditure on flood mitigation has increased substantially. From a mere USD 4.56 million in this plan, it has shot up to a massive USD 228.2 million for the Sixth Malaysia Plan (1991-1995), a 50 fold increase over a 20 year period. During the 10th Malaysia Plan, the budget allocated for flood management was USD 1.17 billion, a 256 fold increase. Even after discounting inflation, the real increase is still substantial. With the many structural and non-structural measures being implemented for flood control and for flood relief, the country is moving in the right direction towards a comprehensive program of flood mitigation. Yet, there are many areas which can still be improved. While the total number of telemetric stations for rainfall and river flow in the country seems large enough, a closer scrutiny would expose the inadequacies of uneven distribution. Most telemetric stations are located in populated areas while the sparsely populated areas, especially highland watershed areas, do not have enough telemetric stations. The Malaysian Meteorological Department and the Drainage and Irrigation Department have also not utilized remotely sensed rainfall (i.e. using radar and satellite systems) as an input in its forecasting models. This could have been deliberately overlooked because of the high cost involved, but real-time flood forecasting cannot be detached from the usage of such techniques, especially in terms of flash flooding.

Legislation related to flood control is indirect as there is no flood legislation. Existing legislation is also sector-based and outdated. While there are currently some laws governing the regulation of river use (e.g. the Waters Enactment 1920, the Mining Enactment 1929, the Drainage Works Ordinance 1954, and the Land Conservation Act 1960, and others) and have some bearing on flood mitigation, they are not sufficiently clear or forceful enough as measures for flood mitigation. These laws were formulated mainly for the purpose of regulating and managing single sectoral water use. More

stringent and clear-cut laws must be passed to enable the authorities to have direct control in all aspects of water use which may affect flooding. This includes laws that clearly specify water rights administration, water resource development, flood plain management and all aspects of flood mitigation. Alternatively, the existing laws should be updated with a stronger emphasis on flood mitigation.

Finally, flood hazard management in Malaysia has not kept up in the context of its rapid development. Malaysia is a newly-industrializing country in which the pace of social, economic and political change is fast, as is the pace of physical and environmental change. Other things being equal, these are the contexts in which flood hazards can be magnified and mismanaged. The contexts themselves are also changing, and changing physical systems have given rise to increased risk, exposure and vulnerability to flood hazards. Other contexts, largely structural, such as persistent poverty, low residential and occupational mobility, landlessness, and ethnic culture have also contributed to increased vulnerability to flood hazards amongst specific communities, mainly the poor. Thus, in order to better manage floods and move towards greater flood loss reduction, flood management must be given a higher salience on official agendas. In a country where poverty reduction and income equity amongst all races are targets of policy, the reduction of flood losses appears to be an important vehicle towards achieving those targets. This is because the poor are the most vulnerable to flooding in Malaysia, and any substantial increase in flood protection and flood loss reduction will reduce the income gap between the rich and the poor. The government should also adopt a more pro-active and dynamic approach towards flood management, rather than adhere to a reactive approach.

Finally, the current flood management model lacks a multi-disciplinary approach that should include a well balanced mixture of structural and non-structural measures. In this respect, the employment of legislation to control floodplain encroachment, the development of hill land, and urbanization is vital if Malaysia is to successfully develop at a sustainable pace and yet protect and conserve its environment, and at the same time manage flood hazards effectively. If not, flood hazards will continue to put a tremendous strain on the country's economy, exacerbate poverty and income inequity, and delay its efforts as a newly industrializing country (NIC) by the year 2020 (Chan, 2011).

6. Constraints in Post-Flood Disaster Supports

6.1. Politicization of Flood Disasters

Notwithstanding the limitations and weaknesses in the current Malaysian flood disaster management system, there are other constraints which hinder the effectiveness of the system. In Malaysia, almost all facets of life, be it political, social, economic or cultural, are closely linked to politics. Hence, it is not unusual that disaster management is also closely linked to politics. Basmullah Yusuf (n.d.) calls this linkage 'the politicization of disasters". Disaster managers have been cautioned that future disasters will be best depicted as a context for framing and blaming, as politicians with some skill may turn disaster from a threat into an opportunity/political asset (Boin, *et al*. 2009). In the case of Malaysia, politicians are quick to politicize disasters. This is all the more apparent when the Federal Government and State Governments are formed from different political parties. Disaster management research has largely ignored one of the most pressing challenges the ruling government is confronted with in the wake of a disaster, viz. how to cope with what is commonly called the blame game. In order to ensure an effective response to any disaster, political leaders must understand opposition parties' responses in pointing fingers and blaming the ruling government for mishaps in the disaster. It is vital that leaders properly manage the political aspects of disasters and their inquiries. On 12 April 2012, an opposition party leader led some 200 Klang residents to stage a protest in front of the Selangor State Secretariat building, demanding that their flood damage compensation money to be increased to USD 260.8. The group claimed that the USD 163 received from the Selangor government was far too little to compensate for the damage residents suffered in the recent floods. While this claim was beneficial for the flood victims, one cannot hide the fact that previous Selangor State Governments had not previously paid flood victims any compensation at all. This case is in fact a example of the politicization of floods.

In another incident in 2007 when Johor was ravaged by floods, Johor *Mentri Besar* (Chief Minister) Datuk Abdul Ghani Othman had claimed that the devastating floods (18 deaths, USD 0.49 billion damage and 110,000 people evacuated) may have been

caused by Singapore's land reclamation at its Pulau Tekong island in a narrow sea lane between Malaysia and Singapore. The *Mentri Besar* blamed Singapore based on its land reclamation at the island which had effectively plugged the mouth of the Sungai Johor, resulting in the river overflowing its banks and inundating the town of Kota Tinggi (The Star, 2007). But Singapore's Ministry of National Development responded with the statement "The comments are unfounded" as results from technical studies commissioned separately by both the Malaysian government and the Singapore government had not proven this claim. In another incident, Selangor United Malays National Organization (UMNO) deputy chief Datuk Seri Noh Omar has blamed the Selangor State's ruling Pakatan Rakyat's (PR) poor flood mitigation works for the recent spate of flash floods in the state (Chieh, 2012). He alleged that PR-led Selangor Government had failed to set aside sufficient funds to improve drainage and reduce the risk of flooding in the nation's wealthiest state. Respondents in the study by Chan (1995) also mentioned that political parties had their own agendas, as they helped only those flood victims (in their constituencies) who supported them. For example, the UMNO Member of Parliament would pay more attention and channel more aid to the Malay majority areas. Similarly, the Malaysian Chinese Association leaders would give priority to help the Chinese victims, and the Malaysian Indian Congress would favor helping the Indians. Choosing to help victims by their political convictions or support goes against all the rules of disaster management, but it is a real problem. More recently, floods have triggered further political fallout. The Federal Minister for Housing and Local Government and Alor Setar MP criticized the Kedah State government (led by the opposition Pan-Malaysian Islamic Party (PAS), an opponent of the MP's National Front coalition) for what he considered a slow response to the floods and the government's inexperience (Bernama, 5 November 2010b; Foong, 2010). Deputy Prime Minister Muhyiddin Yassin then claimed the State government had a responsibility to assist victims of the flood (The Star, 2010a). In response, Kedah's Chief Minister Azizan argued that his government's response had been "quick" and that 300,000 ringgit in aid had been committed to the affected areas (New Straits Times, 2010). Fortunately, Kedah's Sultan Abdul Halim called publicly for politics to be set aside for the purposes of dealing with the floods (The Star, 2010b).

6.2. Mediatization of Flood Disasters

Another obvious constraint in effective flood disaster management is that of mediatization. In any account, the media are a potent force. This is a factor that significantly affects disaster management. So powerful is the role of the media that they can either help a nation address a disaster or make the country look bad. According to the Thomas Theorem: “If the media define a situation as a disaster or a crisis, be sure that it will indeed be a disaster or a crisis in all its consequences” (Thomas and Thomas, 1928). Yusof (n.d.) contends that mediatization would be one of the driving forces in the world of future disasters. The media can either use a disaster for outright sensationalism, or it can self-impose censorship on the event making it “unimportant”. The media can also apply pressure on politicians and decision makers to explain and justify the occurrence and impacts of the disaster to the public.

6.3. Lack of Awareness and Volunteerism

Lack of awareness towards donating and volunteering to flood disasters is another constraint that impedes advancement of disaster management, especially towards engaging the public and giving the public a more active role. Generally, Malaysians are very private people who have developed the conception that disasters are the responsibility of the government. Few Malaysians would volunteer in social work. This is a constraint that limits the effectiveness of volunteer groups such as MERCY, and the Red Cross and Red Crescent. Asking Malaysians to donate money or even clothes/food to disaster organizations is a difficult task. That is not to say Malaysians are poor, nor are they miserly/stingy. Malaysians do not donate towards flood disaster aid simply because they feel that is not their responsibility. They feel that it is the responsibility of the government, be it at the Federal or State level.

6.4. Climate Change

In Malaysia, floods occur throughout the country and throughout the year, although certain states and certain times experience more floods than others. Over the years,

monsoon floods have normally affected the east coast of Peninsular Malaysia and Sabah and Sarawak, but only flash floods affect the west coast of the peninsula. Hence, there is a detachment from disasters of people living on the west coast. For example, residents in the city of Kuala Lumpur would not perceive floods as dangerous. This is because floods in this city are not so frequent and occur with low magnitudes. Hence, there is a false sense of security about flooding amongst city folks.

6.5. Short Memory Span

Malaysians are a forgetful lot and have short memories when it comes to floods. Hence there is a general misconception of the relative unimportance of disasters, especially floods. It is therefore not unusual to find flood victims moving back into their flooded houses even before the flood waters have subsided. It is therefore difficult to ensure safety and healthcare when the victims expose themselves to the filth from the aftermath of a flood. In fact, there have been many incidents in which flood victims have refused to heed the call of the police or other warning authorities to evacuate their properties, and by the time the victims evacuate, they have been caught by the flood waters. Many victims think they are well in control based on their experience of flooding, but a big flood may catch them unawares.

6.6. Erosion of Social Capital

Aldrich (2010) has found that recovery from disasters is very much dependent on social capital, especially in post-crisis resilience. Hossain and Kuti (2010) similarly highlighted the importance of disaster response, preparedness and coordination through social networks. In the case of flood disasters in Malaysia, social capital as manifested by kinships and family bonds have been found to be a strong factor in helping victims cope with and recover from flood disasters. This factor is all the more important when government aid is not forthcoming to the victims. However, out-migration from families due to the search for jobs in cities has, among other reasons, broken down the extended families. Consequently, families have lost the one thing that protects them from being totally devastated by flood disasters, i.e. the social bonding and self-reliance

that has made them resilient in the past. For example, in the 1990s Makcik (Aunty) Mabee never had any problems when her house near the Sungai Pinang in Penang was flooded every month as she could call upon her own children (ten of them) to help her cope with the floods. More than that, she could rely on help from her relatives living in adjacent houses. But now in 2012, she is no longer able to rely on her own children (only two girls have stayed behind) or her relatives as they have all moved out to Kuala Lumpur or other cities looking for jobs.

7. Policy Recommendations: Towards Effective Flood Disaster Risk Management in Malaysia

Disaster preparedness is one aspect of disaster management that clearly needs to be improved, especially in the context of flood disasters. While the NDRM appears to work in the east coast flood-prone areas whereby preparations get under way during the month of October/November just before the monsoon season, residents living on the west coast of the peninsula, in the southern state of Johor and the northern states of Kedah and Perlis are not exposed to this kind of preparedness. That is because in the past the north-east monsoon seldom affected these rain-shadowed areas. Now, there is global climate change and weather systems are changing and becoming highly unpredictable. In recent years, massive floods are now not affecting the usual east coast states such as Kelatan, Pahang and Terengganu, but have moved south towards Johor and north towards Kedah and Perlis. The major floods in Johor in 2006-2007 and the massive floods in Kedah and Perlis in 2010 are indications that this trend is happening. Hence, residents in Johor, Kedah and Perlis, or for that matter in Kauala Lumpur (subjected to frequent flash floods) should also be sensitized by exposing them to awareness via flood preparedness campaigns.

Flood Disaster Risk Management in Malaysia has traditionally been over-focused on a top-down government-centric approach. This was workable in the past when population was sparse and the public largely made up of poorly educated citizens, and the role of NGOs and civil society was limited in scope. It is time for a radical change towards a more people-friendly “horizontal” or “bottom-up” approach. People,

especially disaster victims, need to be engaged and empowered to be more resilient. If not, they remain highly dependent on government aid and this is not what the Malaysian Government wants. According to Mohd Radzi Jamaludin, MERCY Malaysia Head of Human Resources and Volunteer Management and their training course coordinator, *"We must involve communities in disaster management as our focus is to rebuild communities after a disaster and educate them on how to prevent the next one"* (http://www.mercy.org.my/main/pressreleases/2009/drrandcommunitybaseddrmtrainingcourse4.html Retrieved15/5/12). When the public (who are the victims) are actively engaged and involved, their ability to respond to flood or other disasters effectively and appropriately will be enhanced. The general principles of preparedness that should be adopted are as follows: (i) preparedness is a central foundation of disaster/emergency management; (ii) preparedness is not static but a dynamic and continuous process whereby managers and victims learn; (iii) preparedness is an educational activity to increase awareness and understanding; (iv) preparedness is not just about drills but is based on knowledge (which is evolving all the time); and (v) preparedness evokes appropriate actions (from both disaster managers and victims).

Providing disaster services up to international standard should be one of the objectives of disaster managers. The authorities must introduce standards that would serve as the guiding principles for flood disaster managers and other humanitarian workers during disasters. Malaysia should try its best to adopt the new crisis assistance standards in the country. These standards, widely known in the humanitarian sector as the SPHERE Standards, are comprehensive and stress quality as well as quantity in order to achieve the best practice in providing aid during/after a disaster. These standards specify, among others, the minimum amount of uncontaminated water with which a victim should be provided per day (7.5 litres), the minimum sizes for shelters, average distances to water distribution points, specifications for toilets, healthcare, etc in the aftermath of a disaster. The SPHERE Standards have been widely adopted by disaster managers, especially managers working in the humanitarian sector. Government must ensure that all NGOs and humanitarian organizations working in a disaster area adhere to the specified quality and accountability practices (www.sphereproject.org Retrieved 15/5/12).

Other policy recommendations proposed for the Malaysian Government are as follows: (i) Develop disaster/emergency plans. Such plans should be reviewed and improved from time to time. Ensure that early warnings reach and are understood by the most vulnerable people as they need to know what to do, where to go, and how to protect themselves. Hence, the plans must include education and preparedness; (ii) Constantly improve existing flood forecasting and warning systems. Incorporate traditional systems into the official systems so that people can make the adjustment quickly. Employ state-of-the-art technology in such systems; (iii) Provide flood-prone areas/communities with emergency materials such as torch lights, batteries, water purification tablets, stretchers, chain saws, plastic sheeting, first aid supplies, generators, etc.; (iv) Identify and gazette more emergency sites/shelters such as community halls, schools, mosques, etc and assembly areas such as parks or fields when evacuating people; (v) Construct shelters/houses and infrastructure to withstand future disasters (for example, the Malay stilt house has stood the test of time but this unique flood-proof architectural design is fast disappearing due to changing needs); (vi) Healthcare centers such as hospitals and clinics should be made flood-proof (for example, the ground floor can be used only as a car park or recreational space), roads should be built on the highest ground, water supply mains should be waterproof, and electricity wires should be on high poles; (vii) Relocation should be used as a last resort, considering its negative effects on people. However, if need be, relocation should be carried out and people should be well compensated for it. Alternatively, people should get alternative housing nearby, not in an alien place that is far away from their social networks. During relocation or temporary resettlement, social networks should be preserved; (viii) Government should provide livelihood opportunities, introduce victims to suitable alternatives, and where possible, help people to be responsible for their own reconstruction; (ix) Subsidies in the form of cash or food vouchers can be provided, not as a long term subsidy but as a short-term aid. Cash is a suitable choice as it allows people to purchase their own needs rather than receive items in kind which they might already have; (x) Government must ensure that evacuation centers are always safe and well maintained. A crumbling structure may precipitate another disaster; (xi) Government must consider gender differences when giving out aid and support, as disasters often affect men and women differently.

8. Emerging Threats of Disasters at the National Level

At the national level, many factors impinge on the success or failure of flood disaster management. One of the most influential factors is politicization. In Malaysia, almost everything is political. For example, the issue of water is politically motivated (Chan, 2011), river management is politically inclined (Ujang, 2010), the business sector has political influence (Chooi, 2012) and even education is not free from politics (Thenh, 2011). It is therefore no surprise that disasters are also political. The floods in Kedah State in 2010, for example, triggered immediate political fallout. The Federal Minister for Housing and Local Government (National Front Coalition) criticized the Kedah State government (led by the opposition Pan-Malaysian Islamic Party) for what he considered a slow response to the floods and the government's inexperience (Bernama, 5 November 2010). Deputy Prime Minister Muhyiddin Yassin claimed the State government had a responsibility to assist victims of the flood (The Star, 2010a). In reply, Kedah's Chief Minister Azizan argued that his government's response had been "quick" and that 300,000 ringgit in aid had been committed to the affected areas (New Straits Times, 2010). Fortunately, the politicization was stopped when Kedah's Sultan Abdul Halim called publicly for politics to be set aside for the purposes of dealing with the floods (The Star, 2010b).

Alarmingly, disasters in the modern world are a complex mixture of natural and human-made inputs. Often, when two or more disasters collide, they change into “Compound Disasters” or can evolve into a totally different category of disaster. A good example is when the Asian Tsunami not only flooded the west coast of Penang but also caused contamination of water supplies. This is a challenge that the Malaysian Government needs to be aware of. Related to this is the mutation of disasters, as if disasters were something “alive”. Disasters mutate in form in response to population growth and urbanization, economic growth, globalization of commerce, and technological advancement. The challenge is how to contain individual disasters and stop them from evolving and mutating.

Flood disasters continue to impoverish the government coffers. During the 10th Malaysia Plan period (2011-2015), a total of USD 1.17 billion was allocated for flood

disaster management. This figure is expected to increase exponentially as it has done so during the last nine Malaysian plans. This is a challenge that the Malaysian Government has to address. Raising tax rates to increase government revenue would not be an acceptable move, given the fact that the citizenry expects the government to foot the bill when it comes to disaster spending. Perhaps a workable alternative would be to involve the private sector and help people become more flood resilient and self reliant. Even so, damaged public structures need to be repaired.

Flood losses are difficult to measure. How much is a life worth indeed? Tangible and intangible losses are complicated by direct and indirect losses. Flood loss profiles are ever changing as a result of population growth, changing needs and changing lifestyles. Technological advancement and the use of sophisticated equipment (for forecasting and warning) may see a drop in the loss of lives, but dense construction may see an increase in property losses and indirect economic losses such as loss of business. These will become major societal vulnerability.

Global warming brings with it unexpected changes in the hydrological regime. What was a 100-year flood in the past may be in fact only a 1:50 year flood in the future. This means that a mega-flood would be a distinct possibility in the near future as temperature rises, evaporation rates increase, storms get bigger, and monsoons get stronger. In addition, the rapid growth of cities and population will see the emergence of mega-cities and mega-populations, i.e. conditions that will foster the emergence of a mega-flood.

Another major challenge is Malaysia's inability to use new scientific and technological advances to mitigate flood disasters. Currently, the flood forecasting system has just started to use radar and satellite images as inputs in forecasting rains, a necessary input for flood forecasting. Warning systems using short text messages also have problems.

Another challenge is that hydro-meteorological hazards are not easily forecastable on an extended time scale, since weather can change abruptly. But today's societies require extended forecasting to increase the time available for evacuation. Sadly, evacuation clearance time has in fact increased due to increased population densities. Hence, road systems need to be markedly improved to ensure swift evacuation.

The pace of engineering advances is not in keeping with their implementation in practice. For example, building codes are not keeping pace with current engineering practice. The Environmentally-friendly Drainage Manual, for instance, is not user-friendly and contractors see it as cumbersome and costly to implement compared to the conventional open drainage system. The challenge here is to educate contractors and house buyers into buying the system.

In the future, floods and other disasters are likely to evolve into new forms yet unheard of. One of the characteristics and conditions of future disasters will be transnationalisation. For example, the original source of flooding may occur in Malaysia, but the immediate and long term impact of the disaster may be spread into neighboring countries such as Thailand or Singapore. It is therefore imperative that Malaysia and its immediate neighbors come to some sort of agreement and establish cooperation in managing disasters, especially those that can cross borders or are transboundary. Regional cooperation is also needed in the light of the effects of globalization on all countries. For example, disasters are said to have a globalization effect when a country affected by a major disaster can no longer export the goods it exports to other countries worldwide. Thus the Kobe earthquake in 1995 affected a large fraction of Japanese shipping, and forced closures of subcontractors' facilities worldwide, including in Malaysia. This affected world trade and many national economies suffered.

9. Conclusion

After more than half a century of flood management, Malaysia is still subject to severe floods. Indeed, Malaysia will never be flood-free. Floods and other disasters will continue to impact upon the people and bring negative effects on life, properties and infrastructure. This is unavoidable. However, what is avoidable is that Malaysians must not forget past disasters. Past disasters present opportunities for us to learn from past mistakes. Just like mistakes from history which we must remember and avoid, disasters are no different. Once we forget them and let our guard down, they will strike

us hard. This is attested by the evolution of various safety and emergency laws, acts and regulations since independence. The current NDRM appears rather outdated as it is based on a reactive approach. This machinery needs to be revamped and repackaged, not just with cosmetic changes but with real changes for the better. Institutional arrangements also need to be vastly improved for effective implementation of the national disaster management program. The NSC needs to be revamped to give it a fresh mandate, more funds to operate, and more qualified personnel. Malaysia is constantly revamping ministries and government agencies. This is where the role of the NSC can be better positioned. Putting the NSC under the Prime Minister's Department gives it more clout, but it also marginalizes it as the Prime Minister has other more immediate agendas. Flood management will not feature highly on the Prime Minister's agenda. However, the future looks optimistic as there are signs of cooperation between various relevant disaster agencies as well as between government agencies and NGOs. Disaster practitioners and scholars are also doing more research to bridge the gap. The NSC also needs to provide better coordination between the council and NGOs working in disaster areas. Currently, the lack of coordination makes it difficult for NGOs to bring aid where it is most needed, thus hampering the effectiveness of relief work.

Flood Disaster Risk Management in Malaysia has traditionally been over-focused on a top-down government-centric approach. This was workable in the past when population was sparse, the public largely lowly educated, and the role of NGOs and civil society limited in scope. It is time for a radical change towards a more people-friendly "horizontal" or "bottom-up" approach. People, especially disaster victims, need to be engaged and empowered so as to become more resilient. If not, they will remain highly dependent on government aid and this is not what the Malaysian Government wants. When the public (who are the victims) are actively engaged and involved, this will enhance their ability to respond to flood or other disasters effectively and appropriately. The general principles of preparedness that should be adopted are as follows: (i) preparedness is a central foundation of disaster/emergency management; (ii) preparedness is not static but a dynamic and continuous process whereby managers and victims learn; (iii) preparedness is an educational activity to increase awareness and understanding; (iv) preparedness is not just about drills but is based on knowledge

(which is evolving all the time); and (v) preparedness evokes appropriate actions (from both disaster managers and victims).

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The Malaysian flood authorities should not ignoring local leadership, as they have rich experience that can be tapped into. Local leaders such as village heads can provide information and cooperation on the ground. Moreover, these leaders can advise the authorities when distributing relief goods, reconstruction material, or other benefits, especially those which help the poor, women, children, and the elderly. Some things to avoid include rushing in with reconstruction without recycling useful materials from the disaster site, bulldozing over what could be valuable building materials, and rushing in quickly to implement ad-hoc plans. For example, establishing new institutions in short time frames or developing complex and inflexible project designs are not encouraged. The authorities should always use familiar disaster management plans and systems with the local officials/leaders. Another thing to avoid is relocation of people away from their jobs and social contacts. This is useless as they would eventually return. In the case of farmers, care must be taken so that they do not miss the next planting season. Hence, distribution of seeds should be timely. The authorities should also be sensitive, for example not imposing grief counseling where it is found to be inappropriate, especially in the context of multi-ethnic Malaysia with multi-cultural beliefs.

Because Malaysia's main disaster is flooding, the NDRM is largely targeted for handling monsoon flooding. Consequently, this mechanism is less than effective and should be re-modeled into something more pro-active. Stakeholder participation is also seriously lacking, although the authorities have recognized the important role of NGOs, particularly MERCY, the Red Cross, Red Crescent and other specific NGOs. These stakeholders need to be involved during every stage of the disaster cycle. Capacity building is necessary. The disaster management mechanism should also adopt more

non-structural measures, and state-of-the-art technology, and cooperate internationally with other countries for addressing transboundary disasters.

In terms of flood warning, there are many areas which can still be improved. While the total number of telemetric stations for rainfall and river flow in the country seems large enough, a closer scrutiny would expose inadequacies in terms of uneven distribution. Most telemetric stations are located in populated areas while the sparsely populated areas, especially highland watershed areas, do not have enough telemetric stations. The Malaysian Meteorological Department and the Drainage and Irrigation Department have also not utilized remotely sensed rainfall (radar and satellite sensed rainfall) as an input in its forecasting models. This could have been deliberately overlooked because of the high cost involved, but real-time flood forecasting cannot be detached from the usage of such techniques, especially in terms of flash flooding.

Legislation related to flood control should also be improved. While there are currently some laws governing the regulation of river use (e.g. the Waters Enactment 1920, the Mining Enactment 1929, the Drainage Works Ordinance 1954, the Land Conservation Act 1960, and others) and which have some bearing on flood mitigation, they are not sufficiently clear or forceful as measures of flood mitigation. These laws were formulated mainly for the purpose of regulating and managing single sectoral water use. More stringent and clear-cut laws must be passed to enable the authorities to have direct control in all aspects of water use which may affect flooding. This includes laws that clearly `specify water rights administration, water resource development, flood plain management and all aspects of flood mitigation. Alternatively, the existing laws should be updated with a stronger emphasis on flood mitigation.

Flood insurance is poorly developed in Malaysia, despite the country been flood-prone. In developed countries, flood insurance is an integral part of overall flood management. The Government should seriously consider introducing an insurance scheme for flood victims to help them get back on their feet after suffering huge losses. In recent years, there have been cases where victims in Johor and Kedah suffered through two major floods and ended up with a total loss twice over. Under a normal scheme to protect properties in Malaysia, insurance companies will not compensate flood victims since it is considered a natural disaster. One could purchase a special flood insurance to protect one’s property, but the premium would be very high.

Nevertheless, there should be a move by the authorities to introduce an insurance scheme so that the victims can get some compensation.

Another point is the need to create a data management system (i.e.. a data bank), which would display data spatially and temporally, and underpin a more systematic communication system in flood disaster management (Lawal, *et al*. 2006). This disaster data bank could be managed in a geographical information system environment and be put on the NSC website for all disaster organizations to access. Currently, disaster information is often treated as "confidential" and seldom released to the public. This should not be the case as the public has a right to know all the statistics related to disasters. A case in mind is the holding back of the Air Pollution Index (API) during the 1997/98 haze episodes. The excuse given was that such statistics may "frighten" tourists and drive them away, resulting in the country losing foreign revenue. But surely the health of its own citizens should be given the highest priority. Here again, the confidentiality of disaster statistics is yet another manifestation of politicization. It must be stressed that politics should not mix with disaster management, or else the disaster will just get worse. Politicians must refrain from using disasters as ammunition. All parties must put aside political differences when it comes to disaster management. After all, it is the people's lives that are at stake. Unlike political parties, floods are the same to everyone and would affect anyone.

Finally, flood hazard management in Malaysia must be viewed in the context of its rapid development. Malaysia is a newly-industrializing country in which the pace of social, economic and political change is fast, as is the pace of physical and environmental change. Other things being equal, these are the contexts in which flood hazards can be magnified and mismanaged. The contexts themselves are also changing, and changing physical systems have given rise to increased risk, exposure and vulnerability to flood hazards. Other contexts, largely structural, such as persistent poverty, low residential and occupational mobility, landlessness, and ethnic culture have also contributed to increased vulnerability to flood hazards amongst specific communities, mainly the poor. Thus, in order to better manage floods and move towards greater flood loss reduction, flood management must be given a higher salience on official agendas. In a country where poverty reduction and income equity amongst all races are targets of policy, the reduction of flood loss appears to be an important

vehicle towards achieving those targets. This is because the poor are the most vulnerable to flooding in Malaysia and any substantial increase in flood protection and flood loss reduction will reduce the income gap between the rich and the poor. The government should also adopt a more pro-active and dynamic approach towards flood management, rather than adhere to a reactive approach. Finally, a multi-disciplinary approach encompassing a well balanced mixture of structural and non-structural measures should be adopted. In this respect, the employment of legislation to control floodplain encroachment, the development of hill land, and urbanization is vital if Malaysia is to successfully develop at a sustainable pace and yet protect and conserve its environment, and at the same time manage flood hazards effectively. If not, flood hazards will continue to put a tremendous strain on the country's economy, exacerbate poverty and income inequity, and delay its efforts in becoming a newly industrialising country (NIC) by the year 2020.

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