THE MALAYSIAN FLOOD HAZARD MANAGEMENT PROGRAMME

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Abstract

Flooding is the most severe hazard in Malaysia, a country experiencing a wet equatorial climate with heavy seasonal monsoon rains. In the past, nature takes care of itself as vast expanse of forests and wetlands soak up rainfall excess and delay the flow of raindrops into rivers. Indigenous peoples are also well adapted to seasonal floods as their lifestyles and livelihood on floodplains have evolved over centuries as adaptations to floods. Officially, Malaysian flood management is based on structural and technological measures to "control" floods. This is, however, only partly successful as non-structural measures are under-employed. Moreover, the application of high-tech solutions can only be effective if the public/victims understand it, co-operate and respond effectively to them. Often, sophisticated (imported) engineering structures and flood control systems are alien to the public who are only accustomed to traditional systems. Costly structural schemes give rise to a false sense of security and may in fact be more costly to victims. Often, frequent failures of structural schemes lead to lack of confidence on the part of victims. Flood hazard in the country is also dominated by a top-down approach with little input from locals/victims who have vast knowledge of floods and proven traditional coping mechanisms. There is thus a need to integrate the official flood management programme with traditional systems to save lives and maximise flood-loss reduction. There is also a need for Malaysia to integrate the concept of sustainable development into its development policies towards flood hazard reduction.

1.0 Introduction

The annual flood loss potential in Malaysia is 26.3 million (Hj Keizul, 1999). More significantly is the fact that flooding accounts for a large number of casualties, disease epidemics, property and crop damage and other intangible losses annually. Each year, heavy seasonal monsoon rains bring about extensive floods of long duration to many riverine and coastal areas in the country (Figure 1). Monsoon floods exert a heavy toll on both people (in terms of lives lost and property/crop damage) and the government (in terms of money spent on preparedness, rescue, evacuation, relief and rehabilitation) (Table 1). Despite such losses, policy makers have failed to understand the complicated relationships between development and flood hazards and have hitherto not planned development in the country with a view to reducing flood hazards, which can be considered a manifestation of unsustainable development.

2.0 Rapid Development and Deforestation

Malaysia has developed by leaps and bounds in the last two decades or so. In terms of its GDP, the figure grew steadily at a rate of 6.7 % per annum during the New Economic Policy (NEP) period 1971 - 1990, and 8.7 % during the Sixth Malaysia Plan period from 1991 to 1995. The most impressive period was from 1988 to 1996 when the GDP averaged a sustained high growth of 8.9 % per annum. Unfortunately, however, this development is not without sacrifices. For example, deforestation, destruction of highlands and floodplain encroachment have all added more hazards to the environment (Chan, 1995a). As a result, it has been estimated that around 29,000 sq. km. or 9 % of the total land area in the country is prone to flooding, affecting some 12 % of the population (Hj Keizrul, 1999).

Logging, tin mining, agricultural conversions, construction of dams, irrigation schemes and traditional shifting cultivation have caused the depletion of Malaysian forests. Of these, logging has been singled out as having the greatest impact on natural forest ecosystems. In pre-independent Malaysia at the turn of the 20^{th} Century, the forested area was about 90 % of total land area but this declined to about 75 % during independence in 1957. Rapid agricultural development saw the forested area decline further to about 69 % and 55 % in 1966 and 1978 respectively. By 1990, total forested area in the country was only about 47 %. Today, this figure is close to the low-40s. One of the greatest problems due to deforestation is that of sediments (Douglas, 1999). Deforestation increases the amount of erosion at an exponential rate and since the load of sediment is the product of sediment concentration and discharge of rivers, any increase in sediment concentration will reduce the drainage capacities of rivers leading to more frequent downstream flooding. For example, sediment yield measured at Sg Air Terjun basin (a forested catchment) was only about 101.68 t km^{-2} year $^{-1}$ but at a deforested site in the Bukit Kiara Basin, a construction site, yields of about 16,500 t km^{-2} year $^{-1}$ were estimated (Chan et al, 2000). The classic Sg. Tekam study showed that with clearing of land from jungle to cultivated crops, the initial impact was a 157 % increase in water yield, a four fold increase in sedimentation rates and a 185 % increase in flood peak flow while time to peak increased by 65 % (Hj Keizrul, 1999).

Figure 1: Rivers and flood-prone areas in Malaysia.

Table 1: Official flood loss estimates for selected floods in Malaysia

Flood Event (Year)	(Place)	Damage ($ million at 1993 prices)	Deaths	Persons Evacuated
1967	Kelantan R. Basin	199.3	38	320,000
1967	Perak R. Basin	154.5	0	280,000
1967	Terengganu R. Basin	40.2	17	78,000
1971	Pahang R. Basin	93.1	24	153,000
1971	Kuala Lumpur	84.7	24	NA
1979	Peninsular Malaysia	NA	7	23,898
1982	Peninsular Malaysia	NA	8	9,893
1983	Peninsular Malaysia	NA	14	60,807
1984	Batu Pahat R. Basin	20.3	0	8,400
1986	Peninsular Malaysia	NA	0	40,698
1988	Peninsular Malaysia	NA	37	100,755
1988	Kelantan R. Basin	33.0	19	36,800
1988	Sabah	NA	1	NA
1991	Peninsular Malaysia	NA	11	NA
1992	Peninsular Malaysia	NA	12	NA
1993	Peninsular Malaysia	NA*	22	17,000
1993	Sabah	NA	5	5,000
1995	Peninsular Malaysia	NA	0	14,900
1996	Sabah	NA	1	9,000
1997	Kedah	>0.5	0	> 10,000
1998	Malaysia	> 3.0	12	> 20,000
1999	Malaysia	> 2.0	30	> 15,000
2000	Shah Alam & Klang,	NA	0	169 people
5.1.00	Shah Alam & Klang, Selangor	Massive traffic jams	0	Thousands
9.2.00	Federal Highway at Batu Tiga toll, Selangor	Massive traffic jams	0	Thousands
10.2.00	Kinabatangan District Sabah	> 0.5	1	> 5,000

NA = Not Available

* In the state of Kelantan, a total of 200 schools were closed during the 1993 flood resulting in 113,000 students missing school for a total of between 6 to 11 days.

(Source: DID Malaysia, Malaysian National Security Council and major newspapers)

As a result, flood risk is on the increase, especially that of flash floods in urban centers (Chan, 1997). This is because due to land use change from forest to agriculture and finally to urban. In new townships, the total built-up (impervious) area is very high resulting in an increase in areal imperviousness. It has been found that an increase from zero to 40 % would cut the time to peak discharge by about 50 % and increase the discharge magnitude by about 90 % (Hj Keizrul, 1999). Hence, the frequent flooding in urban centers.

3.0 The Malaysian Flood Hazard Management Programme (MFHMP)

The Malaysian Flood Hazard Management Programme (MFHMP) has always been based on a structural approach such as the construction of flood control structures and via the application of new technologies such as the use of remote sensing in flood forecasting and telemetry and automatic warning gadgets in flood warning and evacuation systems. In Malaysia, it is expected that flood protection to be provided by the government. Hence, the government employs a top-down approach whereby little input is sought from the public or the victims.

The MFHMP is largely based on a (i) Structural Measures of flood mitigation to modify flood hazards before they occur, and on (ii) a Flood Hazard Response Machinery (FHRM) when floods occur. Non-structural Measures of flood hazard management are unpopular and hence under-employed.

3.1 Structural Flood Management Strategies

In Malaysia, the major flood management authorities predominantly employ flood control measures classified as “Structural Flood Mitigation Measures” and this has limited overall effectiveness (Chan, 1999a). Chan (1999b) has discussed in detail the lop-sided structural measures currently employed by the Drainage and Irrigation Department (DID) of Malaysia, the recognized flood authority in the country. Coincidentally, the DID is a largely engineering department staffed by engineers. Hence, it is not surprising that the “preferred” solutions to manage floods would be engineering structures. Hence, the first prong of the MFHMP is to use these structural measures, i.e. a variety of engineering solutions to “control” floods.

River Improvement is a major structural flood reduction exercise. The DID and many local municipalities regularly dredge and deepen river channels. Rubbish and other obstacles such as tree trunks, boxes and oil drums that are dumped or have been washed into rivers are also removed regularly to ensure smooth and swift flow. Year-round channel improvement of certain stretches of major flood-prone rivers such as the Klang and Gombak rivers have proven successful but cost a lot of money (Abd Razak Mohd Nor and Chop, 1999). There are also major obstacles as squatters not only contribute to pollution of the river but also impede clean-up work as they refuse to relocate or move thereby obstructing river works. Embankments are constructed to control bank erosion. Some such as retention walls of bamboo/wooden tree trunks or cement/concrete walls have proven effective in reducing rates of river bank erosion and hence reduce siltation that minimize discharge capacities of rivers. However, embankments constrict rivers to a fixed channel, stops river from migrating, generate “bottle-necks” at downstream stretches when embankments end and kills off riverine flora and fauna. Embankments along the Perak river in Teluk Intan and along the Klang river in Kuala Lumpur are artificial looking and do not have an aesthetic or recreation value compared to natural banks.

Tidal gates are used extensively near the estuaries of rivers before they empty into the sea. They are effective on smaller rivers and can serve both as a barrier to high tide as well as to assist in irrigation. Tidal gates in Malaysia are used in tandem with water pumps and both are effective for controlling tidal flooding. However, failure of pumps can result in river water backing up and flooding many areas. In urban areas such as towns and cities, urban drains are constructed. They are expensive and need to be well maintained. Clogged drains should be cleared immediately to ensure no blockage of free flow. Furthermore, the drainage systems in most cities and towns are constructed decades ago are now inadequate and need to be upgraded via widening, deepening and enlarging. There is also a need to construct more storm drains/monsoon drains in frequently flooded areas. Urban drainage can also be constructed underground in cases where surface drains are inadequate or where there is lack of space to enlarge existing drains. However, in many urban areas, built-up areas and properties do not allow drains to be widened and land acquisition can be expensive.

Another structural measure is the relief or diversion channels/canals upstream of frequently flooded locations. These channels can be closed at normal flow but opened during high flows to siphon off a substantial amount of discharge elsewhere. Relief channels allow excess water to be drained away, thus averting flooding. Diversion channels can be used in tandem with retention ponds that retain rainwater from flowing into rivers are also commonly used. Low-lying areas along rivers can be easily converted into retention ponds that siphon off excess discharge during high flows, thus reducing the probability of floods. During normal times, the retention ponds can be used as playing fields (when dry) or maintained as scenic shallow lakes that contribute to the aesthetic aspects of river corridors. Water pumps are used to siphon excess water from a rising river into the ponds. These pumps can be activated either manually or automatically when the river rise to a certain pre-determined critical level. Dams have been known to be effective in flood control but they are highly controversial. Some such as the Kenyir Dam in Terengganu, Batu Dam and Klang Gates dam in Kuala Lumpur have effectively reduced much of the flooding downstream. However, dams are expensive and cause a great deal of environmental problems. They also have a life span and pose serious dangers to downstream populations, both humans and others. Levees or bunds are used extensively along the coast in Malaysia. Initially, bunds were built to keep out the sea, mostly for reclaiming agricultural land. Increasingly, however, many town areas need to be protected by bunds.

The government’s structural approach has also been found to be counter-productive in many areas as people develop a “false sense of security” thinking that the floods have been controlled after a dam is completed. Hence, rural-urban migration and subsequent floodplain encroachment have increased human and property exposure to flood hazards making floods even more destructive when they strike.

3.2 The Flood Hazard Response Machinery (FHRM)

The Flood Hazard Response Machinery (FHRM) is essentially a mechanism of actions set up by the National Security Council (NSC) to respond to seasonal monsoon floods each year. The NSC, which heads the machinery can institute a real-time Flood Warning System based on the above state-of-the-art forecasting system (Chan, 1999B). The FHRM is based on the government machinery comprising many government departments each with clearly defined functions. At the helm of the FHRM is the NSC which forms the secretariat during a flood emergency. The DID is the authority which forecasts the flood, and relays the message to the NSC which can then order a warning to be issued. Such a warning will initiate the FHRM –police will start warning people, the army will get their trucks ready and all other related departments put on stand-by.

The FHRM and the official flood warning and evacuation systems are a form of re-active rather than pro-active tool in disaster management. Officially, the government is responsible for flood management and many strategies have been employed to reduce the impacts of flooding, with a certain degree of success. However, official response to floods is limited by a 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. The Malaysian Government has developed and employed the FHRM as a reactive strategy to reduce flood losses. This mechanism, shown in Figure 2, is generally bureaucratic and slow.

At the federal level, the National Security Council (NSC) is the secretariat for the Flood Disaster Relief and Preparedness Committee (FDRPC) 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 FDRPC coordinates all relief operations from the Malaysian Control Centre in Kuala Lumpur. At the state level, there are 11 State Flood Relief and Preparedness Committees (SFRPC) for Peninsular Malaysia. Each

Figure 2: The Malaysian Flood Hazard Response Mechanism (MFHRM).

state is given funds by the Federal Government every year to enable it to run its own flood 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 Flood Relief and Preparedness Committees (DFRPC) which receives funds and directives from the SFRPC. Below the district level, there are several Mukim Flood Relief and Preparedness Committees (MFRPC), again depending on the number of mukims in each district. Each MFRPC is headed by a penghulu. Finally, there are many Village Flood Relief and Preparedness Committees (VFRPC) under each mukim. Each VFRPC is headed by a ketua kampung.

In essence, everything under the MFHMP is provided for and run by government officials. The Government builds the dams, levees and other structures, improves the rivers' drainage capacities, government officials do the forecasting, give out the warning, direct the evacuation and rescue operations, and take charge of distribution of food, shelter and other needs of victims. In a nutshell, victims do nothing else but appear to be herded like sheep into trucks and moved to temporary shelters and looked after by official medical teams. This is what the MFHMP is doing now, and this is making people more dependent government and less reliant on themselves. Worse of all, this over-reliance on government is making them lose the many useful on traditional coping mechanisms which their forefathers have used.

4.0 Conclusion

In Malaysia, years of control by engineers in the DID have either deliberately or inadvertently made flood management a largely structural approach, despite the DID professing to be multi-disciplinary. While the many structural measures employed hitherto have been responsible for reducing some of the impacts of flooding, they have not been entirely successful in the overall management of floods. This is largely due to a lop-sided (heavily biased) engineering approach which is inherently limited in effectiveness simply because it excludes the benefits of a more comprehensive approach. Other than building structures, the other official response is based on a "reactive" approach of evacuation, relief and rehabilitation, reacting when a flood has occurred. As a result, flood hazard reduction has not been as effective as it ought to be. Of greater concern, however, is the fact that the authorities have not totally exploited the usefulness of a rich variety of traditional flood reduction mechanisms which they can incorporated into official systems. This has led to, among other things, the reluctance of flood victims to cooperate and respond effectively to official Flood Warning and Evacuation Systems. Comprehensive flood hazard management in Malaysia can only be tackled effectively if the victims themselves are convinced that official response systems really work. More importantly, non-structural measures such as those that are traditional in which the victims are used to must be incorporated into official systems.

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