Flood Disaster Risk Management:
The Critical Role of Awareness Building, V & A Assessment and Implementation of Mitigation & Adaptation Measures

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Introduction

Flood disasters are common in Malaysia, Kedah in particular. Usually, the weaker and the less prepared suffer most. As a flood disaster risk management strategy, therefore, it is important to make the weaker, 'stronger' and the unprepared, 'prepared'. This would mean that our response measures should be focused both on *adaptation* and *mitigation,* based mainly on carefully conducted vulnerability & adaptation assessment. While adaptation will be directed to current impacts of the hazard (e.g. flood), mitigation will enhance the *resilience* of *exposure units* in future. Such an approach would decrease the *vulnerability* of the communities to the *impacts* of the flood *hazard* by reducing the *risk* through improved *resilience* and the overall enhancement of *coping capacity*. This handout will explain the meaning of the terms in italics and clarify the concepts involved.

How to operationalise this approach?

In order to understand the principles involved in this approach, let's consider a major health hazard, such as dengue outbreak. The most vulnerable to the attack of dengue will usually be children and the elderly, especially in very poor neighbourhoods. The health authority's response to deal with the outbreak, in the short-term, will normally consist of treating the infected, accelerating mosquito eradication techniques, and general health awareness promotion. In the long-term though, strategic programs to address water and sanitation issues and promotion of healthy lifestyle among the poor have to be given priority. Such an approach would decrease the vulnerability of the communities to the impacts of dengue hazard by reducing the risk through improved resilience and capacity building.

In this approach, we notice that the focus was both on eliminating the source of the problem and on treating the disease itself. Let us try to understand this approach in a systematic way to address not only disease outbreaks, but to deal with any other hazard such as floods, for that matter.

Some fundamentals

Two equations called "risk equations" will help us here:

(i) The UNEP (United Nations Environment Program) definition:

Hazard + Vulnerability = Risk
Impact - Adaptation = Vulnerability
Realized Risk is Disaster

Hazard: a potentially damaging physical event, phenomenon, or human activity that may cause injury, loss of life, property damage, social and economic disruption or environmental degradation.
Vulnerability: the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of a community to the impact of hazards.
Risk: the probability of harmful consequences, or expected losses (deaths, injuries, property, livelihood, economic activity disrupted or environment damaged) resulting from interaction between natural or human-induced hazards and vulnerable conditions.
Impact: the manifestation of the destructive forces of hazards that destroy life and properties.
Exposure units: the sectors or groups that are impacted upon.
Adaptation: remedial action taken to adjust to the impact of a hazard (heavy rain, increasing flood waters etc) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

(ii) The ISDR (International Strategy for Disaster Reduction, UN) definition

Hazard x Vulnerability ÷ Capacity = Risk
Realized Risk is Disaster

Capacity: a combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk or the effects of a disaster.

Understanding the scope of the equations

These equations summarise the principles and practices of disaster risk management in general.

First, let us look at the UNEP definition more closely:

Step 1: Hazard + Vulnerability = Risk

In words, what it means is this: a *vulnerable* system (community, infrastructure, ecosystem, house, people, building…) faced with a *hazard* (flood, epidemic, earthquake…) is in great *risk*. The fact is that at the *risk* level, nothing has actually gone wrong, just that the potential for something to go wrong is very high. If something really does go wrong in the end because the magnitude of the impacts have exceeded the coping capacity of the exposure units, we have a *disaster*.

It should thus be clear that the right time to intervene to minimize the devastation of disasters is at the *risk* level because by the time the *disaster* occurs, it is too late; at that stage, we can only pick up the pieces and move on hoping to recover fully, which in most situations turns out to be difficult, costly and time consuming.

In simple terms, the above equation tells that in order to reduce *risk*, both *hazard* and *vulnerability* have to be reduced.

Reducing the magnitude of the hazard (i.e. the root cause of the problem) is called *mitigation*. This means that in order to reduce the severity of flood hazard for e.g., its root causes have to be reduced (such as land use changes in the river catchment areas, changes in river capacity, effectiveness of local drainage, climate change impact etc.).

Step 2: On the other hand, in order to reduce *vulnerability*, we have to understand the full meaning of the following equation:

Impact - Adaptation = Vulnerability

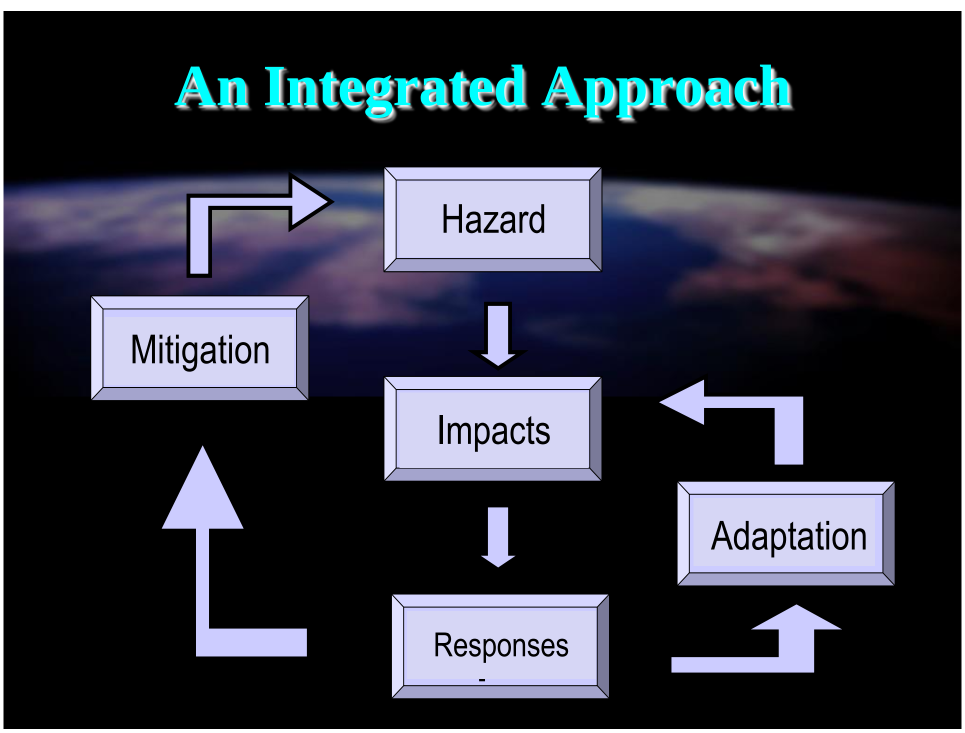
Every hazard manifests itself through impacts. For e.g., flood waters inundate land; destroy crops, houses, properties, roads & other infrastructure; and even life. If we are able to reduce the magnitude of the *hazard*, that will reduce the gravity of the *impact*, which in turn will reduce *vulnerability* according to the above equation.

Also, we could *increase* the degree of adaptation, and according to the above equation, that too will result in a decrease in vulnerability.

The net effect of *decreasing* the magnitude of the impact and *increasing* the degree of adaptation is a resulting overall *decrease* in the risk factors and, therefore, a corresponding decrease in the impending disaster, which is what we are looking for.

Secondly, the ISDR equation in (ii): Hazard x Vulnerability ÷ Capacity = Risk, also shows that whenever we increase our overall *capacity* (coping capacity of the system or exposure units) to cope with the impacts of hazards, either through mitigation or through adaptation, there will be a corresponding reduction in risk and therefore, disaster.

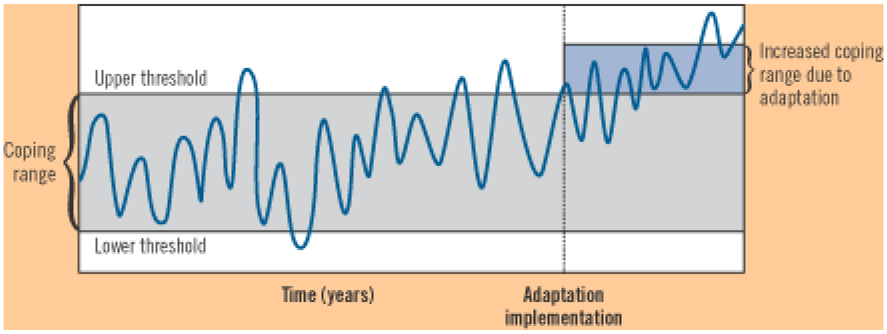
In disaster risk management thus, it is critical we pay equal attention to mitigation and adaptation capacity enhancement in an *integrated* way. As mentioned earlier, while mitigation affects the root cause of the hazard, adaptation addresses the impacts of the hazard as shown in the diagram below:



The principles involved in the above integrated model are: (i) policies (ii) participatory approaches, (iii) prioritization of available resources, (iv) action driven V&A assessments and (v) timely implementation.

Another important consideration also needs to be clarified:

In the following diagram, the flood disaster events are shown as excursions outside the coping range. Mitigation will reduce the frequency and magnitude of floods whereas adaptation expands the coping range for the extremes. However, it is important to bear in mind that these ranges cannot be expanded indefinitely, like trying to stretch a rubber band beyond its threshold. Once the thresholds are exceeded, there is no more adaptation but only *survival*. The following diagram shows a time series for a hazard variable and the importance of adaptation (e.g., flood waters):



Time series of a flood variable – river flow

Coping range: the variation in hazard stimuli that a system can absorb without producing significant impacts.
Critical thresholds: the boundaries of coping ranges; significant impacts result when critical thresholds are exceeded.

Let me try to expand the above treatment using a simple example:

The scene is a village. Imagine a ferocious dog being tied to a weak pole by the roadside using a thin chain. The dog is potentially capable of breaking lose and attacking pedestrians. We may say that the dog represents a *hazard* to the road users.

The most *vulnerable* in this situation are young school children, the disabled and old people.

We know that at this stage, no harm has happened to anyone yet, but it is a high *risk* situation to the vulnerable.

Imagine the dog somehow breaks loose; it is sure to attack (bite) people – the biting represents the *impact* and then we will have a *disaster.*

What should we do? We may wish to reduce the level of risk by requesting the owner to get rid of the dog, thus removing the very hazard itself. Failing this, we could ask the owner to at least use a stronger chain & pole and perhaps a face guard for the dog. These are to reduce the impact of the hazard and these approaches represent *mitigative* measures.

On the other hand, the pedestrians may carry sticks, take detour to avoid the dog, go in groups, use vehicles etc., to escape attack. These are *adaptive* measures. Such measures will increase the *coping capacity* of the people towards the risk or in other words increase their *resilience*.

If for some reason, the dog still manages to attack people, we know the impact will be less. In any case under such situation the immediate concern is to seek quick medical attention – this is part of *disaster management*. In all probability, once bitten, twice careful, and such people will most likely be more cautious in future to safeguard themselves against dangerous dogs.

OK, now back to Flood risk and disaster management – Group discussion

Q: How can we reduce flood impact? **A:** Carry out mitigation measures
Q: How can we reduce flood vulnerability? **A:** Carry out V&A assessment focusing on the socio-economic and biophysical vulnerability and implement adaptation options (ref to V&A methodology)
Q: How can we reduce flood risk? **A:** Focus on both mitigation and adaptation implementation

It is important to note that *adaptation* has an upfront cost, the extent of which depends on the strength of the co-dependency between humans and the ecological systems and the way the impacts of the hazard (flood) affect the relationship. Depending on the type of adaptation, *soft* (non-structural) or *hard* (structural), the cost will vary. It is safer to start with soft and 'win-win' measures such as: (i) installing monitoring and early warning systems, (ii) practicing evacuation drills, (iii) carrying out sensitization, (iv) adopting 'zero victim' goal for flood events, (v) training exercise, (vi) implementing smarter land use regulations etc, first. Almost in parallel, we need to make progress on the hard adaptation side as well - engineered structures such as: (i) higher dykes, (ii) levees, (iii) embankments, (iv) boreholes, (v) evacuation centres, (vi) toilets, (vii) storage, (viii) climate proofed buildings and infrastructure etc, for example. Always strategic areas and valuable structures must be protected by 'hard' options.

Mitigation requires more time as it might require: (i) policy changes, (ii) resolving conflicts, (iii) changing processes, (iv) habits, (v) life styles, (vi) mindsets etc. But depending on the gravity of the problem requiring urgent solution, it is possible to mitigate.

It is thus clear that a *community based adaptation and mitigation approaches,* within an enabling environment created by technical, policy and other support systems from external agents have a much better chance of success and sustainability than single entity feats.

Disaster Management

Disasters occur nonetheless!

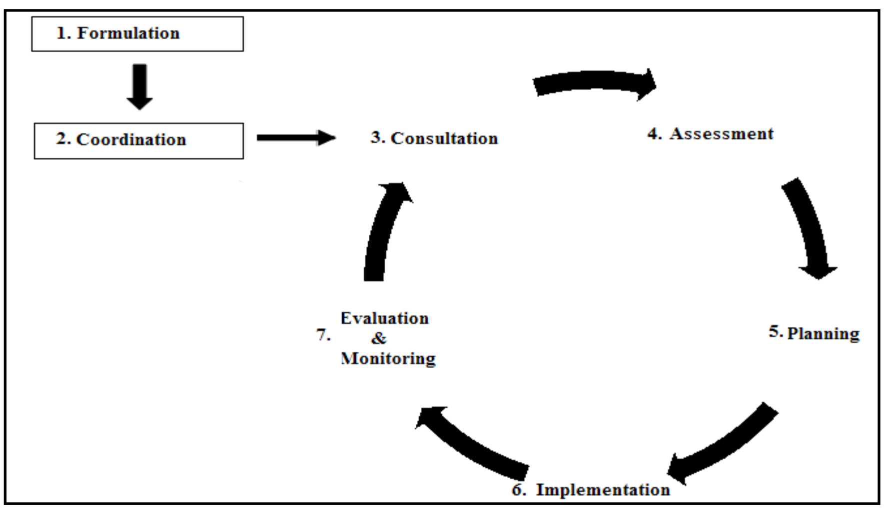
We know that some disasters are relatively easier to manage than others – those for which early warnings are available turn out to be easier to cope with (e.g. flood) than those that take everyone by surprise (e.g. earth quake).

Once a disaster occurs, quick and effective delivery of emergency assistance is the key to minimize loss of life and property. This involves: (i) rapid assessment of needs, (ii) coordination of relief efforts, (iii) quick dispatch of rescue teams, (iv) dispatch of relief goods and medical supplies, followed by expert teams for accurate assessment of damage leading to restoration work. Success here is based on the level of preparedness at all levels. While putting in place efficient disaster warning mechanisms, computer model based flood scenario generation and evacuation preparedness are the most important *pre*-disaster requirements, effective implementation of the management plans including emergency health care and mobilization of people and property will be the challenge *during* the onslaught of the disaster. Relocation, rehabilitation, recovery, restoration, rebuilding and other 're-' activities are the major and the hardest (mostly damage control at this stage) *post*-disaster challenges.

In general, developing countries have insufficient financial resources for precautionary and rehabilitation efforts, impoverished people who cannot get out of the vicious cycle of poverty and disaster damage and weak administration plagued with inefficiency and corruption. We need to guard against all these - eternal vigilance is the price of freedom – freedom from flood disasters in this case.

The USM Project Cycle

The USM *Rakyat Sejahtera* initiative is primarily a community-based flood disaster risk management project, the overall objective of which is to minimize the flood disaster risk by enhancing community coping capacity. The overall project level activities have been designed to follow the globally accepted project management strategy known as "Logical Framework Approach (Analysis)", LFA, (details of which may require another training session). We envisage 7 steps in this joint action-oriented project (see figure below). Steps 1 and 2 relate to project planning, scoping and resource securing which have already been completed in this case.



At the moment we are in the 3rd phase of stakeholder consultation for further site related planning. This will be followed by a 4th joint assessment step to gauge the extent of the problem (V&A) and a 5th planning step to prioritise strategic and implementable measures to improve the community's copying range. In step 6 the prioritized measures will be implemented as appropriate and finally the impact of the project will be evaluated during step 7. Implementing all the priorities identified during step 5 will not be within the scope of any single project. The assumption here is that by the end of this project, sufficient capacity will be built at the community level so that the project cycle may be repeated with each iteration improving the next cycle through the experience gained and the lessons learned.

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