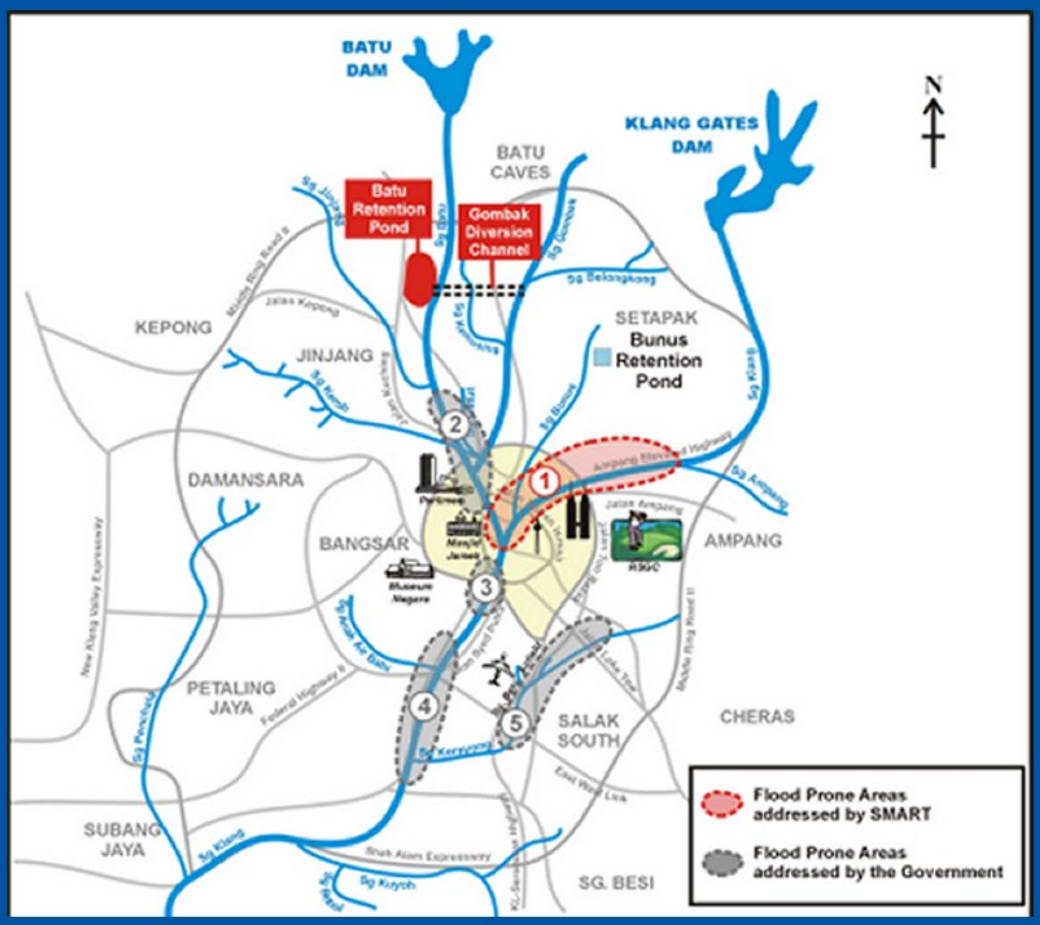
Guidelines on Integration of Water-related Disaster Preparedness and Mitigation into Socio-economic Development Process



Example of Klang River Basin Management, Kuala Lumpur Development and Storm-water Management And Road Transport Tunnel Project
(Source: Salmah Zakaria, SMART Tunnel, Expert Group Meeting, November 2006)

A "Living" Version for Inputs and Continuing Improvement

United Nations
ESCAP

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

Guidelines on Integration of Water-related Disaster Preparedness and Mitigation into Socio-economic Development Process

UNITED NATIONS

New York, 2007 **ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC**

ST/ESCAP/2488

Cover figure: Example of Klang River Basin Management, Kuala Lumpur Development and **S**torm-water **M**anagement **A**nd **R**oad **T**ransport Tunnel Project (courtesy of Dr. Salmah Zakaria, SMART Tunnel, Expert Group Meeting, November 2006)

This publication was jointly prepared by Mr. Ti Le-Huu of Sustainable Development and Water Resources Section, Environment and Sustainable Development Division of ESCAP, Mr. Chow Kok-Kee, formerly Director General of the Malaysian Meteorological Services, and Dr. Sacha Sethputra, Professor of Civil Engineering of the Khon Kaen University of Thailand. The views expressed are those of the authors and do not necessarily reflect the views of the United Nations or of the Government of Malaysia and the Royal Thai Government.

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Guidelines on Integration of Water-related Disaster Preparedness and Mitigation into Socio-economic Development Process

EXECUTIVE SUMMARY

This set of guidelines on the integration of water-related disaster preparedness and mitigation into the socio-economic development process of developing countries in the region was drawn up on the basis of the long experiences of the ESCAP secretariat working in the promotion of policies, strategies and good practices in water-related disaster risk management. The first set of principal elements adopted in this set of guidelines include on the following key achievements of ESCAP during the past six decades promoting regional cooperation in water-related disaster risk management:

The concept of integrated river basin management, especially those related to integrated watershed management for disaster reduction;

The concept of strategic planning and management approach for integrated water resources management, in which water-related disaster management plays an important role in this most vulnerable region of the world;

Advancement in multi-hazard early warning for tropical cyclone-related disasters, achieved under the framework of subregional cooperation of the Typhoon Committee and the Panel on Tropical Cyclones and on flood forecasting operations of the Mekong River Commission; and

Progress of the regional efforts on the institutionalization of community-based disaster risk management into the socio-economic development process.

The second set of key elements of the guidelines is based on the perception of the prevailing patterns of development, that characterizes the rapid economic growth in the region: economic growth centres, sectoral development, integrated rural development and river basin development.

In view of the complexity of the socio-economic development process, the development of this set of guidelines has been conceived from the outset as a product of regional efforts, which would continue to evolve through various means of regional cooperation. As such, this set of guidelines will be a "living guidelines" for which ESCAP secretariat will continue to solicit inputs to the first version posted on the ESCAP website.

This set of the guidelines will therefore consist of two parts. Part I covers five chapters: Introduction; Principles of Integrated Watershed Management for Disaster Risk Reduction; Concept of Strategic Planning and Management; Key Elements of Multi-hazard Early Warning Systems; and Institutionalization of Community-based Disaster Risk Management. Part II will include four chapters: Issues and Challenges in Disaster Risk Management for Socio-economic Development; Water-related Disasters Preparedness and Mitigation; Mainstreaming Disaster Preparedness and Mitigation into Socio-economic Development Process; and Conclusions.

The target audience of the guidelines includes policy and decision makers responsible for socio-economic development of economic growth centres, sectoral development programmes, rural development programme, river basin management as well as water resources managers.

PREFACE

The Economic and Social Survey of Asia and the Pacific (ST/ESCAP/2429) pointed out that the developing economies in the Asia-Pacific region grew at 7.9% in 2006, up from 7.6% in 2005. This fact confirmed that the ESCAP region had made major strides in economic and social progress during the past half-century. Per capita income growth has been much faster than elsewhere in the world. This remarkable achievement during such a long period represents not only success in the economic and social aspects of development, but also progress in water resources management, especially with respect to the management of water-related disaster risk management. As Asia and the Pacific is the most vulnerable region of the world to natural disasters, disaster risk management remains to be most important challenges to sustainable socio-economic development process in the region.

Water-related disasters had caused the most serious impacts in the region as they accounted for 64 per cent of the total damage and more than 85 per cent of the total number of deaths by natural disasters during the last five decades. While the progress in the reduction of the loss of lives has been impressive, which could reduce the annual number of deaths by natural disasters from 100,000 people in the last five decades to about 49,000 people during the last 15 years, the annual average damage has almost tripled from US$10 billion in the last five decades to US$29 billion during the past 15 years. For this reason, UNESCAP attaches great importance to assist developing countries in the region in the development of policies and strategies for more effective integration of disaster risk management into the socio-economic development process.

The preparation of the guidelines on integration of water-related disaster preparedness and mitigation into the socio-economic development process is part of the efforts of the ESCAP secretariat to implement the Regional Action Programme recommended by the Fifth Ministerial Conference on Environment and Development, held in Seoul in March 2005, which called for more regional efforts to effectively deal with the increasing socio-economic impacts of natural disasters in the region by including an entire chapter entitled “Integrating Disaster Risk Management into Socio-economic Development Policies and Planning” in the adopted Regional Implementation Plan for Sustainable Development in Asia and the Pacific, 2006-2010.

In the preparation of the guidelines, the great diversity of Asia and the Pacific has been taken into account not only in view of the complexity of socio-economic development of the developing countries, but also in new perspectives on land-use planning and water resources development to a considerable extent. For this purpose, experiences in land-use planning and practices were drawn from the development processes in the region, especially from the experiences of the many experts associated with ESCAP as well as those directly involved in the Ad hoc Expert Group Meeting organized by ESCAP from 23 to 25 November 2006 in Bangkok. The Expert Group Meeting was attended by 22 experts from 10 members of ESCAP, comprising China, Indonesia, Malaysia, Myanmar, Pakistan, Philippines, Republic of Korea, Sri Lanka, Thailand and Viet Nam and also by two experts representing the Secretariat of the United Nations International Strategy for Disaster Reduction (UN-ISDR) and the Asian Disaster Preparedness Center (ADPC). The preparation was directly responsible by Mr Ti Le-Huu of the Sustainable Development and Water Resources Section of ESCAP with technical support of two resource persons: Mr Chow Kok-Kee of Malaysia and Dr Sacha Sethputra of the Khon Kaen University, Thailand. The contributions of all the expert representatives at the Expert Group Meeting and also the resource persons to finalize the Guidelines and Manual, especially those included as the regional experiences, are deeply appreciated.

It is hoped that the publication will assist policy and decision making of those who are involved in the planning and development of economic growth centres, sectoral development strategies, integrated rural development programmes and river basin management, as well as water resources managers responsible for supporting the formulation of socio-economic development strategies. It is also hoped that the publication would contribute to further strengthening regional cooperation in the implementation of the Hyogo Framework for Action towards achieving the socio-economic goals of disaster risk management.

PART I: FUNDAMENTAL CONCEPTS OF DISASTER PREPAREDNESS AND MITIGATION

INTRODUCTION

Following the adoption of the Hyogo Framework for Action, 2005-2015: Building the Resilience of Nations and Communities to Disasters at the World Conference on Disaster Reduction in Kobe in January 2005, the Fifth Ministerial Conference on Environment and Development, held in Seoul in March 2005, called for more regional efforts to effectively deal with the increasing socio-economic impacts of natural disasters in the region by including an entire chapter entitled "Integrating Disaster Risk Management into Socio-economic Development Policies and Planning" in the adopted Regional Implementation Plan for Sustainable Development in Asia and the Pacific, 2006-2010. Water-related disasters caused the most serious impacts in the region as they accounted for 64 per cent of the total damage and more than 85 per cent of the total number of deaths by natural disasters during the last five decades. Great deal of achievements has been made by countries in the region in minimize the loss of lives and reduce the damage. While the progress in the reduction of the loss of lives has been impressive, which could reduce the annual number of deaths by natural disasters from 100,000 people in the last five decades to about 49,000 people during the last 15 years, the annual average damage has almost tripled from US$10 billion in the last five decades to US$29 billion during the past 15 years. For this reason, UNESCAP attaches great importance to assist developing countries in the region in the development of policies and strategies for more effective integration of disaster risk management into the socio-economic development process.

1. Purpose

This publication was conceived to provide a set of tools to facilitate policy and decision-making by those who have to address risk management of water-related disasters in their work for socio-economic development of economic growth centres, sectoral development programmes, rural development programme, river basin management. Similarly, it is also hoped to assist water resources managers to understand the complexity of the socio-economic development process so that activities on risk management of water-related disasters could be prioritized appropriately.

This set of guidelines on the integration of water-related disaster preparedness and mitigation into the socio-economic development process of developing countries in the region was conceived to combine the long experiences of the ESCAP secretariat working in the promotion of policies, strategies and good practices in water-related disaster risk management with the emerging principles of socio-economic development recognized from the prevailing economic growth patters of the region.

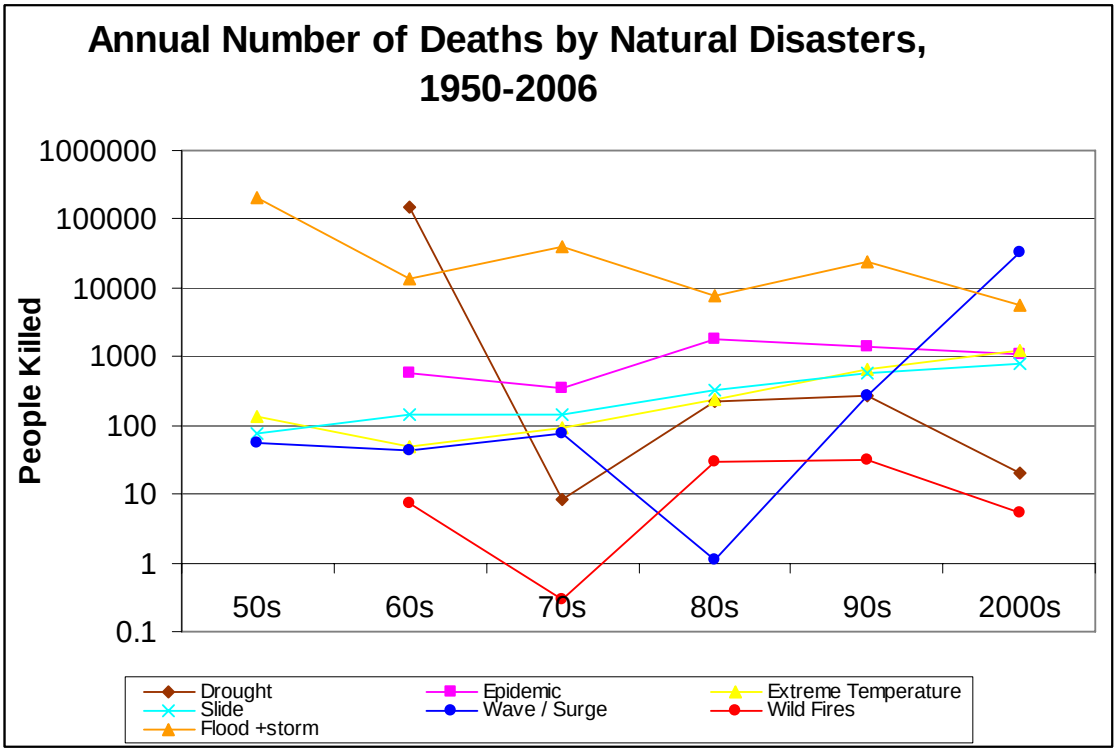
Important achievements of ESCAP during the past six decades promoting regional cooperation in water-related disaster risk management included the research on (i) the concept of integrated river basin management, especially those related to integrated watershed management for disaster reduction, (ii) the concept of strategic planning and management approach for integrated water resources management; (iii) advancement in multi-hazard early warning for tropical cyclone-related disasters; and (iv) progress in the institutionalization of community-based disaster risk management into the socio-economic development process. The perception of the prevailing patterns of development adopted in this publication includes those that characterize the rapid economic growth in the region: economic growth centres, sectoral development, integrated rural development and river basin development.

In view of the complexity of the socio-economic development process, the development of this set of guidelines has been conceived from the outset as a product of regional efforts, which would continue to evolve through various means of regional cooperation. As such, this set of guidelines will be a "living guidelines" for which ESCAP secretariat will continue to solicit inputs to the first version posted on the ESCAP website.

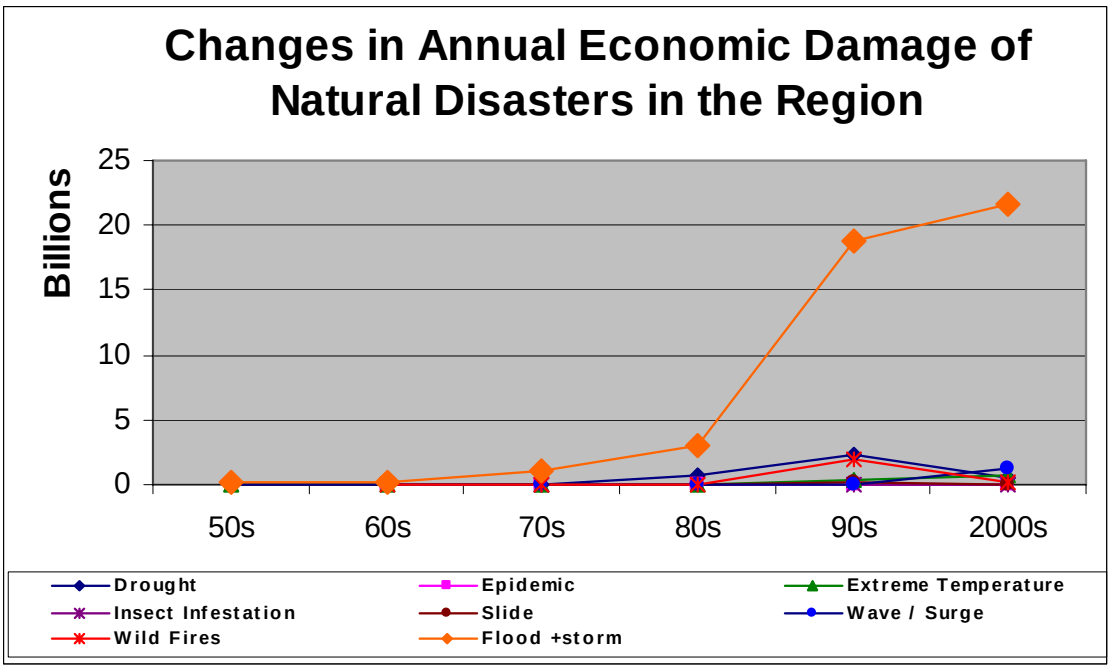
2. Water-related disasters and socio-economic impacts

Asia Pacific region is hit every year by a large number of water hazards creating critical barriers to

sustainable development and poverty reduction. In addition to various types of severe water-related events such as flood, drought, windstorm, landslide, storm-surge, tsunami, water-born disease and epidemics are also taking lives, destroying livelihood and trailing development achievements where most vulnerable people already lives in poverty.



According to a recent study prepared for the First Asia-Pacific Water Summit (Theme B on Water-related Disaster Management Concept Note, http://www.apwf.org/archive/documents/Theme_B_concept.pdf), the figures of water-related disasters in Asia-Pacific region revealed that over 600,000 people were killed and nearly 4.5 billion people were affected during the period from 1980 to 2006. This fact accounted for over 80 per cent of the causalities recorded worldwide, in addition to over US$ 8 billion worth of economic damages during the same period. This percentage could rise to as large as 95 per cent or even higher if all



direct and indirect damages triggered by water-related disasters such as loss of livelihood and long term

health impact are properly documented.

The study also showed that damages caused by water-related disasters during only three-year period from 2004 to 2006, floods and windstorms killed over 33,000 people, affected over 360 million people and caused economic damages worth of US$ 282 billion, which account for nearly one-third of the recorded damages during the period from 1980 to 2006.

As shown in the following figures, while the trends in the average annual number of people killed by most of the natural disasters has reduced significantly, especially with respect to the cyclone-related disasters including floods. This trend is reversed for the economic damage of the natural disasters. The annual economic damage by annual floods has risen from about US$1 billion during the 1970s to nearly US$22 billion during the early part of the 21st century. The impact of land slides has also shared a similar trend with a rapid increase in the economic damage. However, the impact of drought has appeared to be reduced or stabilized.

The combined effects of various social, economic and environmental factors are expected to increase in the severity of water hazards in the Asia-Pacific region, such as the excessive urbanization and rapidly increasing urban population in cities. The impact of water-related disasters is expected to aggravate with the effects of global warming and climate variability, as indicated in the recent findings of the IPCC Working Groups, as the major cause for the current increasing trends in severe torrential rain and catastrophic droughts, as well as rise in sea-level. The First Asia-Pacific Water Summit called for more efforts to focus on the challenges of integrating water-related disaster risk reduction into national development plans and to recognize the adaptation to increasing risks from climate change as an issue of the highest priority. It also pointed out an increasing need to bridge the current gaps in water-related disaster management at regional and national levels, especially those related to policy and decision making. This point reiterated the concluding statement in Asia-Pacific Regional Document of the 4th World Water Forum, reflecting the importance of regional efforts on the preparation of this publication:

"Developing and improving appropriate structural measures to reduce damage from water-related disasters is a lengthy and expensive process. However, over the long term, a precautionary approach whereby funds are allocated preemptively would significantly offset the funds currently required for recovery activities..... the key to reducing vulnerability lies in increasing preparedness through preemptive activities: early warning systems, raising awareness and evacuation planning. Coordinated efforts to adopt these measures would go a very long way towards dramatically decreasing the number of deaths caused by water-related disasters – a key priority for the region."

3. The Guidelines organization

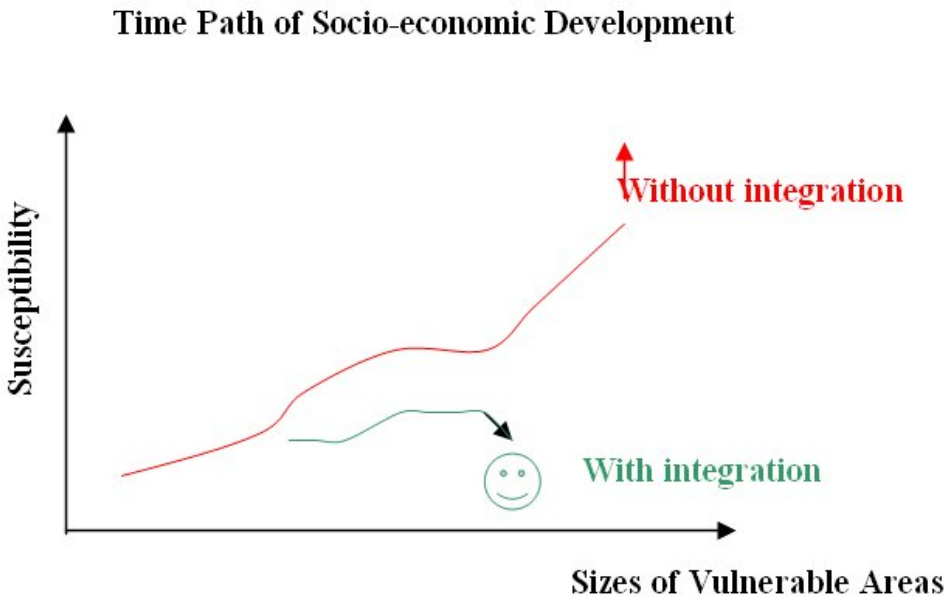
The guidelines will therefore consist of two parts. Part I is designed to address fundamental concepts of preparedness and mitigation of water-related disasters, which had been developed by ESCAP for its work on the promotion of risk management of water-related disasters over the past several decades. Part II will address issues related to the integration of water-related disaster preparedness and mitigation into the prevailing socio-economic development patterns of the region.

Part I will covers five chapters: Introduction; Principles of Integrated Watershed Management for Disaster Risk Reduction; Key Elements of Multi-hazard Early Warning Systems; Concept of Strategic Planning and Management; and Institutionalization of Community-based Disaster Risk Management. The second and third chapters deal mainly with disaster preparedness and the fourth and fifth chapters aim to provide tools and practices for mitigation.

Part II will include four chapters: Issues and Challenges in Disaster Risk Management for Socio-economic Development; Water-related Disasters Preparedness and Mitigation; Mainstreaming Disaster Preparedness and Mitigation into Socio-economic Development Process; and Conclusions. Chapter Six of the Guidelines aims to set the scene for effective integration of disaster preparedness and mitigation into the socio-economic development process by identifying key issues and challenges. Chapter Seven provides essential tools and good practices for the integration. Chapter Eight discusses existing practices of the integration through mainstreaming. The final chapter (Nine) recapitulates the main features of the Guidelines and suggests a framework for further improvement of the Guidelines through incorporating more regional experiences, especially those on the integration.

4. Socio-economic development patterns of the region and related disaster risk management issues

Without consideration on disaster risk management, the socio-economic development process in general will always increases vulnerability of communities to disaster. Increasing vulnerability can be viewed from two angles. First, areas vulnerable to disaster tend to increase their vulnerability with development due to various factors, among which improper land use is the most important factor. For example, natural flood retention areas are usually converted into housing projects. Secondly, the degree of susceptibility (to disaster) increases with intensity of development. For example, sparsely populated areas have low susceptibility than highly populated areas. Figure below depicts the paths of socio-economic development with respect to time. Without effective integration of disaster risk management, the socio-economic development process will follow the top path where both the sizes of vulnerable areas and susceptibility will increase until no more areas are available and the only way out is to put more development into the same areas, thereby increasing susceptibility. With integration, the socio-economic development process will continue on a time path asymptotic to constant values of vulnerable area and susceptibility.



In order to identify patterns, SED is looked at from four points of view: (i) regional development, (ii) basin development, (iii) sectoral development, and (iv) integrated rural development. Patterns identified in this chapter lead to challenges and issues of Chapter 3 and the guidelines in Chapter 7. Elaborations of the three points of views are in sections 2.1 to 2.3 respectively. Section 2.4 explores means for integrating DPM into SED plans.

a. Regional Development Patterns

Regional development policy and practices, which have been regarded as the main thrusts for socio-economic development of the region, have taken significant transformations over the last five decades. Its relevance has been challenged in recent years by the rapidly changing socio-economic and political conditions of the region. Among the most important concept of these development patterns is the growth pole strategy, (or its variants, development poles or growth centers), which is inarguably the most discussed and practiced among all the other regional development strategies. The concept of growth pole was first introduced by Francois Perroux, a French economist, in 1949. The original concept of growth poles was defined as: "….centers (poles or focii) from which centrifugal forces emanate and to which centripetal forces are attracted. Each center being a center of attraction and repulsion has its proper field which is set in the field of all other centers."

Growth poles or growth centres have been synonymous to major urban areas or cities, as the criteria to define a growth center in most cases were closely related to the characteristics of most major urban areas.

According to Fox (1966)[1], growth centres are defined as "an urban place which can act as a focal point for development planning". The criteria adopted by Fox to distinguish urban areas which are growth centers from those that are not, included the following: strong linkage to the national economy, the center of a labor market, a major retail trade area, high level tertiary functions, a large volume of wholesale trade, and good communications. Taking this perception of the growth centres, one could see the importance of disaster risk management in the development process of these centres, which are prone to water-related disasters.

Three Major Trends in Coastal City Development

Song Ding[2]

Since the opening and reform of the late 1970s, major policies promoting coastal development had been implemented in special economic zones, opening 14 coastal cities and Shanghai's Pudong development. As a result, China's coastal belt is now a dynamic region with most of the incoming foreign investments, and the biggest GDP shares in the nation. With recent developments, there will be a fundamental transition of the development models for them along three possible trends of development amongst these coastal Chinese cities.

1. Expansion of the Growth Pole

Larger cities along the coast will be growth centers for the neighboring areas and the experiences of world economic development show that within its radius, the urban center as a growth pole is dominant in the socio-economic development in this region. Now after twenty-odd years, the coastal cities have grown bigger and stronger and to different extents they are pumping investment, technology, management expertise and talents to Central and West China in their development. Some of the coastal provinces try to set up twin economic centers within the province to compromise, and at national level the design of the cities with independent planning power or vice-gubernatorial cities is a very peculiar way to compromise the inter-city frictions and vicious competition. These are only short-term solutions and could not solve the problems for longer-term development of these regional economic centers.

2. Vertical Integration and Coastal Urban Belts

Currently the urban competition is not only reflected in the competition among the cities, but among the urban centers. The cities in a given region, if not cooperative with each other but enter into vicious competition, their respective interests as well as the overall interests of the region will be hurt. In the two decades' of development, the coastal belt in China is now paying more attention to the coordinated development of the urban centers. There are now three major urban centers in China, the Bohai Bay urban belt, the Yangtse River Delta urban belt and the Pearl River Delta urban belt. In fact the two Delta urban centers are in real existence while the Bay urban belt is more a geographical notion, as in this Bay area; there are several small urban groups with closer economic ties and they are not so closer to each other as the two Delta cities. The Bay belt, if existent, is with Beijing as its center. Three huge urban belts do exist with huge influences economically as the engines to Chinese economic development.

3. Horizontal Integration for a China Urban Belt along the Coast

Since these seven urban belts (Bohai Bay, Yangtse River Delta, Pearl River Delta, Liaoning, Shandong, Fujian, and and Beibu Bay (Tonkin Bay) urban belts) are all along the coastline, extending their respective internal integration to externally integrating with each other is important for China in the globalization age. China's seven coastal urban belts are not comparable to other major coastal belts around the world and they are only of regional and national significance. However, it should also be noticed that along one country's coastline of 4,000 kilometers, there are over a dozen cities with over a million in population each and hundreds of smaller cities. It is the only case in the world, especially so when in the past two decades there is an economic miracle of high growth rate. The economic miracle continues for the time being. While the Chinese cities are paying attention to horizontal integration with other cities economically, the world is paying attention to China's growth, especially on this miracle producing Chinese coast.

Note: Excerpt from the original article of Song Ding.

b. Sectoral Development Patterns

Sectoral development plans are essential parts of national socio-economic development. In many developing countries of the region, sectoral development plans are regarded either as stabilizing components of the respective development processes, such as agricultural development plans or driving forces for economic growth, such as service sector development plans, including tourism and IT development. In either case, the importance of disaster risk management will evolve with the development process. For the stabilizing cases, disaster risk management tends to be affected by major natural hazards, which usually cover a large areas such as tropical cyclones or major river floods or storm surges or tsunami.

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1 Fox, C. (1966) *The Role of Growth Centers in Regional Economic Development*, Department of Economics, State University of Science and Technology, Ames, Iowa, September.

2 Song Ding, China Development Institute, 2004, www.cdi.com.cn/publication/pdf/cdireview_200401_songd.pdf

Sectoral development orientations of Viet Nam (2001-2010)

To ensure an average annual growth rate of 4.0-4.5% for agricultural output (including aquaculture and forestry). In 2010, the total food grains output is to reach about 40 million tons. The share of agriculture in GDP is to amount to around 16-17%; and that of livestock breeding in the total agricultural output approximately 25%. Aquatic production is to reach 3.0-3.5 million tons (about one third of which comes from cultivated sources). Ten million hectares of natural forest are to be placed under protection, and a 5 million-hectare afforestation program is to be accomplished. The export turnover of agricultural, forest and aquatic products is to attain USD 9-10 billion, with aquatic products worth USD 3.5 billion.

The average growth rate of value-added industry (including construction) for the upcoming 10 years is to reach 10-15% per year. In 2010, industry and construction are to account for 40-41% of GDP and employ 23-24% of the labor force. Industrial exports are to amount to 70-75% of the total export value. To ensure sufficient and safe supply of energy (electricity, oil and gas, coal); to meet adequately the demands in construction steel and phosphate, and partly demands in urea; mechanical engineering is to satisfy 40% of the domestic needs, with local content accounting for 60-70% of the motor vehicle, machinery and equipment production; electronic and informatic industries are to become cutting-edge sectors; most of export agro-products are to have been processed; and consumer goods industries are to satisfy demands at home and rapidly increase exports.

All the service activities on the value-added basis are to register an average growth rate of 7-8% per year, and account for 42-43% of GDP and 26-27% of the total labor force in 2010.

Source: Ministry of Planning and Investment of Viet Nam, Socio-economic Development Strategy, 2001-2010, http://www.mpi.gov.vn/strategy.aspx?lang=2

For the latter cases, high economic growth rates tend come from concentrated investment in small geographical areas, for which localized hazards could result in major economic damage and thus socio-economic impacts.

The Development of IT Industry of India

India's software exporting industry is one of the world's successful information technology industries. Begun in 1974, it employed 345,000 persons in 2004 and earned revenue of $12.2 bn, equal to 3.3% of global software services spending. The industry was begun by Bombay-based conglomerates which entered the business by supplying global IT firms located overseas with programmers. Their success owed to the innovative exploitation of a new global market opportunity and protection from transnational corporations and startups by policy. The explanation on origins is the same as used to explain industry origin in countries such as Korea and Japan (see, for example, Dicken (2003)) – with the difference that while government policy favored large domestic firms and discouraged TNCs and small firms in those countries, in India, government policy disfavored all types but was least hostile to large, domestic firms. A decade later, mainframe-based programming and manufacturer-specific operating systems and languages gave way to workstation-based programming and standard operating systems and high-level languages. These changes modularized the programming function, i.e., programming could henceforth be done independently of the hardware platform and from the other functions of creating software, such as system design. This, along with policy reforms that reduced costs of imported hardware and software, caused the Indian software industry to shift from supplying programmers to supplying software programs. As work moved to India, infrastructural costs increased as a proportion of total costs. This caused the industry to relocate from Bombay to Bangalore.

Note: Excerpt from **Origins and Growth of the Software Industry in India,** by Rafiq Dossani, 2005, http://iis-db.stanford.edu/pubs/20973/Dossani_India_IT_2005.pdf

c. Integrated Rural Development

The concept of integrated rural development is well described in one of the publications of ESCAP on this subject[3]. It aims to develop a network of economic growth through the provision of services required for development, such as know-how, technology, financial support and marketing. While the concept of networking tends to deal with a large areal coverage, disaster risk management needs to be planned in such a ways that could ensure continuity of services against occurrence of natural hazards. In this context, the core elements of disaster risk management strategies would be community-based disaster risk management, for which efforts must be made to instill adoption of such concept of disaster risk management as well as to integrate good practices into the local development planning process.

[3] **Integrated rural development in Asia and the Pacific: a framework for action for the 1990s,** Bangkok, Pages: vi, 183p, ST/ESCAP/752, ESCAP1989

Key elements of integrated rural development of Viet Nam

For lowland rural regions: To develop diverse ecological agriculture on the basis of rice-paddy, vegetables, fruits, animal husbandry, and extensive application of scientific and technological advances in the making, processing, storage and marketing of products. To complete electrification and effect mechanization in necessary links. To rapidly raise income per agricultural acreage unit. To shift large numbers of workhands to the industrial and service sectors. To forcefully develop small industries, handicrafts, craft villages, and networks of agricultural, forest and aquatic product processing industries and services.

For midland and mountain rural regions: To energetically develop longterm crops, cattle husbandry and processing industries. To preserve and develop forest resources. To accomplish and stabilize assuredly sedentary cultivation and settlement. To relocate the population and labor force according to plans, coupled with building socio-economic infrastructures, with a view to efficient exploitation of resources. To develop farm economy. To narrow down the development gap with lowland rural areas. To enact preferential policies for the socio-economic development in hinterland and remote areas, borderlands and border gates.

Source: Ministry of Planning and Investment of Viet Nam, Socio-economic Development Strategy, 2001-2010, http://www.mpi.gov.vn/strategy.aspx?lang=2

d. Basin Development Patterns

It may be noted that in all the three categories of development patterns discussed above, the concept of risk management of water-related disasters is usually viewed from the perspectives of needs of risk management for socio-economic development. Fundamentally, the principles of risk management of water-related disasters must respect the concept and principles of water resources ecosystems, which are usually referred to as river basin management concept. The First Asia-Pacific Water Summit, held in Beppu, Japan on 3-4 December 2007, called for more efforts to focus water-related disaster management according to the concept of integrated water resources management, for which the most important physical basis is river basins.

Integrated River Basin Management (IRBM) at the Langat River Basin

The issues arising from the developments in the Langat River Basin prompted the Department of Irrigation and Drainage Malaysia (DID) to embark as a Major Integrated River Basin Management Study and convened a Stakeholders Workshop in June 2002. Subsequently, DID Malaysia carried out an IRBM study. Some of the basic conclusions and recommendations that emerged from the First Stakeholders Workshops and from the IRBM Study are highlighted hereunder:

Planning and Policy Framework

- Develop and make available spatial information in a format that can be used to refine the implementation framework of these and other initiatives to achieve flood hazard reduction and habitat restoration.
- Consider natural resources needs to implement the multi-objective IRBM approach.
- Use land use policies to creatively strengthen existing established commercial centres outside of flood prone area and increase their drawing power instead of increasing sprawl onto flood plains.

Catchment Management

Implement fundamental strategies for managing upland areas. These strategies would include: forest conservation, managing the runoff of water where it first falls as precipitation, and managing impacts at stream crossings.

Flood Plain Management:

- Protect these existing lowland natural areas and consider restoration efforts for contiguous land parcels to expand the natural functions of these resources for habitat and flood management.
- Apply a bold and creative vision to allow the restoration of floodplain features and natural processes to demonstrate the natural resiliency of a river system to restore aquatic habitats and provide natural flood reduction capabilities.

River Corridor and Water Quality Management

- Consider the restoration benefits of setting back bunds to reduce flood elevations and protecting the bunds and berms with vegetation to reduce erosion and water pollution.
- Give equal consideration to habitat impacts from reduced water quality and the more evident physical expression of habitat, such as riparian and stream channel conditions in addressing water use issues.

Formulation and Monitoring of IRBM Plan

Development of an IRBM Plan should be a completely open process carried out with stakeholder participation and obtain a commitment among participants in an IRBM Plan to ensure availability of funding and resources for long-term monitoring to track the performance of an IRBM Plan.

Source: Good Practices in the Application of Strategic Planning and Management, ESCAP, 2006

I. PRINCIPLES OF INTEGRATED WATERSHED MANAGEMENT FOR DISASTER RISK REDUCTION

As explained earlier, the Asian-Pacific region is the most vulnerable region of the world in terms of the socio-economic impacts of natural disasters. Among these, water-related disasters accounted for more than 85 per cent of the total number of deaths and some 65 per cent of the total economic damage from the total impacts of natural disasters during the past five decades (ESCAP, 2005). Practices for water-related disaster risk management have therefore changed rapidly in several countries in the region to cope with high growth rates of economic and social development. This is particularly true with those countries having achieved high economic growth rates, which enabled important investment in the water sector. However, in several other developing countries, particularly in the least developed countries, practices in water-related disaster management have not changed significantly owing to the lack of major investments in the water resources sector. Nevertheless, the adoption of new practices is now reflected in the principle of sustainable resources management and this principle is generally being accepted throughout the region. This perception reflects the fundamental change in the practices for water-related disaster management from mainly large-scale structural or engineering measures to land-use control measures. In connection with this change, a wide variety of structural and non-structural measures have been adopted for water-related disaster risk management in the region. The most important change in the concept of these measures reflects a clear trend in the region towards increasing the participation of the community and more towards strategic planning and management. In the following section, the more common practices are discussed briefly as part of the integrated watershed management processes for disaster risk reduction.

1. Watershed management and natural disaster management

Most countries in the ESCAP region are rapidly coming to the recognition that land degradation is reaching serious proportions, causing damage to the national economy and lowering living standards. The consequences of inappropriate cultivation practices and other exploitative forms of land use are becoming manifest in the form of deep erosion gullies, bare and eroded grazing lands, over-clearing of vegetation, rising water tables, salinized soils and the movement and accumulation of sediment and erosion debris in streams and river channels.

The effects of land degradation are cumulative and far-reaching. Not only do they affect rural communities, but they also affect urban populations. Reduced agricultural productivity is often accompanied by an increase in the impact of water-related natural disasters which devastate rural and urban and communities alike.

Land degradation control is essential if future rural production is to be maintained and improved. Land restoration measures, involving soil erosion control, enhanced vegetative cover and water run-off management will help to preserve the remaining soil and vegetation resources and assist in mitigating the severity of natural disasters. However, much of the land degradation is already irreparable and no amount of effort can overcome the existing damage. Any productive soil which is already lost through erosion has already permanently left the system.

If land degradation is to be checked, there is a need for careful planning in the approach to the development and use of the land. In many countries, the need for planning is urgent because the effects of inappropriate practices of land utilization and its over-exploitation are already irreversible or rapidly approaching that state. Many practices used in the past have contributed to the present degraded state of the environment and should be discontinued if the land is to contribute to the continued prosperity of the individual countries. Any delay in implementing a comprehensive and coordinated system of land management will further exacerbate the situation.

Land management strategies should aim to achieve sustainability of natural resources - land, water, vegetation and fauna - by balancing development and the use of these resources with conservation. To be effective however, land-use management should not be restricted to isolated areas but should be applied to total watersheds. This approach is called “integrated watershed management” and is based on the concept that the components of natural resource systems, such as watersheds, are inter-connected so that changes to one part of the system will influence other parts.

Integrated watershed management should be based on a plan which sets the direction and provides a framework for the planning and development of individual catchments. These plans should ensure that there is a structural approach to the management and exploitation of natural resources, such as land, water and forests, and that these resources are managed in a sustainable fashion. They should address the issues and consider the activities which culminate in land degradation. Strategies which overcome land degradation and which mitigate the effects of natural disasters should also form an integral part of the management package.

Those strategies which are essential to the achievement of the objectives of integrated watershed management comprise:

- Coordination of policies, programmes and activities as they relate to integrated watershed management;
- Promotion of community participation in integrated watershed management;
- Identification and rehabilitation of natural resource degradation;
- Promotion of the sustainable use of natural resources;
- Provision of stable and productive soils, high quality water, and protective vegetative cover within individual watersheds.

These broad-based strategies recognize that problems with water, soil, vegetation and natural resources in urban and rural areas do not happen in isolation but are often inter-related. For example, many activities in a watershed may have only limited impact when carried out in isolation but their combined impact may be significant and require the adoption of strategies which

- prevent further land degradation
- restore degraded natural resources
- ensure that natural resources are used within their capability
- minimize the impacts arising from the use of natural resources
- ensure that native flora and fauna are protected
- promote appropriate planning and management
- preserve items and places having cultural heritage values

Integrated watershed management can be the most effective approach in mitigating the effects of natural disasters by adopting the best management practices to balance the competing and compatible uses of a watershed's natural resources to meet social, economic, environmental and other community goals. It should be stressed that when the risk of natural resources disasters is not fully appreciated the loss of life and damage to property can be dramatically increased.

2. A comprehensive approach for integrated watershed management

Land-use planning and management are important government functions. When governments fail to exercise effective controls in this and related fields, the natural environment, the community and the national economy may all become casualties. On the other hand, when good planning and management practices are adopted, many existing or potential problems are automatically overcome or avoided. A strategic approach, including effective governmental arrangements which address resource management and environmental protection issues and utilize enlightened watershed management principles, is considered to be the key to achieving an efficient and acceptable administrative system (see figure 3).

Appropriate legislative and institutional arrangements are also necessary to ensure a satisfactory level of environmental protection, social well-being and sustainable resource development.

In some countries, governmental approaches to land-use planning, environmental protection and natural resource management are under ongoing development. In the past, resource management, planning and environmental law has tended to evolve in a somewhat *ad hoc* and reactive fashion. Throughout the ESCAP region, however, much of the existing legislation is currently being redrafted or refined, with the

objectives of reducing complexity, overcoming delays and eliminating conflicts and confusion in relation to resource and environmental management. Some of the existing deficiencies, expected to be remedied through recent and current legislative and institutional developments, include:

- Adverse trends in natural resource degradation and depletion;
- A low level of strategic and policy commitment to natural resource management, with inadequate financial, legislative or operational support;
- Uncoordinated and conflicting approaches from various government agencies;
- Lack of uniformity or consistency in policies, legislation and strategies amongst different tiers of government;
- Inappropriate and inconsistent administrative structures and boundaries;
- Low levels of policing and enforcement of controls, conditions and regulations;
- Low levels of community involvement in resource management activities.

The requirements of an improved administrative system capable of meeting the challenges of protecting the environment, integrating economic and land-use planning and management and encouraging sustainable resource management include the following needs:

- A comprehensive and strongly coordinated legal and administrative system which addresses planning, environmental protection and resource management in an integrated fashion;
- Consolidated legislation based on the principles of sustainable resource management, protection of the environment and the maintenance of vital ecosystem processes;
- A land and resource management system based on watershed or river basin units and utilizing standardized regional planning policies and processes;
- Clearly defined responsibilities for each tier of government;
- Consolidation of existing legislation into a manageable number of concise but comprehensive Acts.

In some countries, recent developments in this respect have led to the consolidation of several government agencies into a single, comprehensive agency and the consolidation of existing legislation into a single omnibus Act. Within the ESCAP region, New Zealand provides an outstanding example of this approach, which is worthy of investigation. In larger and more diverse countries, particularly in large Federations where several states have resource and environmental management responsibilities, this might not be an appropriate solution. The important emphasis should be on coordination and cooperation between agencies, integration of management activity and responsibility, and the taking of a holistic view of resource and environmental management issues, rather than upon amalgamation and unification.

If the needs listed above can all be met, a basic framework is provided for the planning and implementation of new and existing plans, policies and strategies for the efficient and effective management of land and water resources. Such a management system focuses upon the effects and consequences of development, rather than upon development itself. To be effective, this management system must provide for the meaningful involvement of the watershed community, as well as, and in strong coordination with, all tiers of government.

3. Mitigation of water-related disasters through integrated land-use planning and management

Although it is not possible to avoid the occurrence of natural disasters, their physical impacts can be reduced through appropriate mitigation strategies. In many circumstances, wise land-use planning and management can be effective in reducing the adverse consequences of water-related natural disasters. On the other hand, the vulnerability of land to such hazards as flooding or landslip can be increased as a consequence of environmental degradation resulting from unwise land use and the uncontrolled exploitation of natural resources.

By way of example, the indiscriminate clearing and cultivation of virgin lands and the extension of traditional farming practices may lead to extensive soil erosion, landslip and sedimentation. These forms

of land degradation across a watershed may result in the rapid concentration of surface run-off and increased susceptibility to flood hazards and landslides. Alternatively, other kinds of land-use change can alter run-off behaviour by reducing the amount of long-term flow in rivers and streams and so increasing the severity of droughts.

Just as there may be adverse consequences of poor rural land use, intensive urban development may also contribute to increased disaster hazard. Such development can, for example, influence the hydrologic behaviour of small urbanized watersheds by concentrating run-off and increasing the peak rate of discharge. On the floodplains of large rivers, badly located urban development can expose lives and property to the increased risk of damage from inundation by floodwater.

One approach to the mitigation of the severity of floods is to retard the rate of run-off from natural watersheds. In rural areas, this can be accomplished by adopting conservation practices directed towards the increased infiltration of storm rainfall and the surface detention of flood run-off. In small urban watersheds, run-off can be retarded by providing onsite detention storage facilities, using such techniques as the provision of lot storage and the use of parking areas and sporting fields to detain storm run-off.

Land-use regulations can be used as an effective means of reducing the damage associated with natural disasters. In the context of floodplain occupation, land-use regulations attempt to minimize the effect of flood disasters by balancing land uses with flood risk. Restrictions are placed on the nature and location of urban and industrial development and the type and extent of agricultural activity. To be fully effective, such land-use control measures should be introduced in combination with other forms of disaster reduction drawn from the range of available structural and non-structural measures.

The most efficient way to deal with water-related natural disasters is to plan for their control or mitigation on a whole-of-catchment basis, taking a broad, catchment-wide view of the causes and effects of disaster occurrence. This approach is an aspect of what is termed integrated watershed management.

4. Requirements of a comprehensive watershed management system

The terms watershed, catchment, drainage area and river basin are all used to describe a land surface from which water flows downhill to a specified point on a watercourse. It is determined by topographical features which include a surrounding boundary or perimeter which is known as a drainage divide, beyond which water flows away into another catchment or catchments.

In North America, the term “watershed” is restricted sometimes to mean a comparatively small catchment, or sometimes to mean the upland, water-yielding portion of a larger river basin. In British Commonwealth countries it is sometimes restricted to mean “drainage divide”. In this document we will use it to be synonymous with catchment or river basin, particularly in the context of “integrated catchment management”, which clearly implies a whole-of-catchment approach to natural resources management.

Integrated watershed management can be defined as the coordinated, planned and sustainable management of the natural resources within a river basin. This approach to the management of land, water, vegetation and other natural resources seeks to maintain or enhance the quality of the catchment environment and, by adopting a variety of physical, social and economic policies and techniques, all aimed at minimizing the adverse consequences of natural disaster events, to improve and enhance the quality of life of the catchment community.

Watersheds are naturally occurring units of the landscape, which contain a complex array of inter-linked and inter-dependent resources and activities, irrespective of political boundaries. A watershed can be perceived as an integrated ecological system, and its effective management requires the adoption of a systems approach in which the complex interrelationships between the development of natural resources, the integrity of the ecosystem, and the quality of the watershed environment have to be understood and accounted for.

By way of illustration, the amount of watershed run-off is affected by precipitation rates and amounts, evaporation, transpiration and infiltration, as well as the nature and density of vegetation and the water-holding capacities of the soil. Activities such as logging, grazing, agricultural development and road building result in the removal of vegetation, which can result in increased run-off. This may produce soil erosion and salinity problems, which in turn affect water supply and quality. Chemical pollutants and effluent from agriculture and industry are transported by water run-off, often attached to eroded soil

particles. Thus there is a clear association between land-use decision-making, natural resources utilization and the quality of the watershed environment - with a systems approach, the likely adverse consequences of mismanagement can be anticipated and appropriate precautions taken to minimize or avoid their effects.

A watershed is a dynamic and integrated social, economic and bio-physical system which may contain people, urban and rural communities, agriculture and forestry, primary and secondary industry, communications, services and recreational facilities. The land resources of soil, water and vegetation cannot be managed for quality and sustained availability in isolation from each other or from the watershed environment. The natural balance of these resources can be easily disrupted by changes in land use, by mismanagement or simply through bad planning.

The watershed is the logical unit for coordinated land-use planning and management and effective and sustainable resource and environmental management. Integrated watershed management should aim:

(i) To encourage effective coordination of policies and activities of relevant agencies, authorities, industries and individuals which impinge on conservation and the sustainable use and management of the country's watersheds including soil, water and vegetation;

(ii) To ensure the continuing stability and productivity of soils, a satisfactory yield of water of high quality and the maintenance of an appropriate protective and productive vegetative cover; and

(iii) To ensure that land within watersheds is used within its capability in a manner which retains, as far as possible, options for future use.

If the preceding principles are adopted and implemented, the following benefits can be anticipated:

- reduction in the rate of sedimentation in major dams, rivers and harbours
- reduction of run-off and damaging floods
- conservation of soil fertility and the maintenance and improvement of agricultural productivity
- maintenance and improvement of water quality
- reduction in soil salinity and acidity
- protection of wildlife habitat
- increased public awareness of the inter-relationships within watersheds and identification of land capability
- maintenance and improvement of tree and vegetation cover.

II. KEY ELEMENTS OF MULTI-HAZARD EARLY WARNING SYSTEMS

This chapter was drawn heavily on the experience of collaboration between ESCAP and the Typhoon Committee and based mainly on the input provided by Dr. M C Wong, Assistant Director, Hong Kong Observatory, Hong Kong, China, concurrently Vice Chair of UNESCAP/WMO Typhoon Committee Working Group on Disaster Prevention and Preparedness to the programme of ESCAP aiming at the development of regional mechanisms for multi-hazard early warning systems.

1. General concept

Early warning system (EWS) is one of the most effective tools available to manage risk and reduce the toll of natural disasters, as highlighted in one of the five priority areas of the Hyogo Framework for Action 2005-2015: the need for "identifying, assessing and monitoring disaster risks and enhancing early warnings" as a critical component (of disaster risk reduction).

The primary objective of an early warning system is to empower individuals and communities to respond to protect lives and property. An effective warning system is more than just a set of technical definitions of warning status and associated criteria. It should convey essential and meaningful

information relevant to the community. It encompasses the means to communicate such information to the intended audience. It should be able to trigger established contingency measures within the government and draw orderly collective responses of the public to minimize loss of lives and damage to property. To achieve the best result, early warning systems should be integrated into DPM effectively. In the context of hydro-meteorological hazards, several studies have been conducted to strengthen EWS services. The findings and experiences of compiled by the author based on the previous studies and actual operations for National Meteorological and Hydrological Services (NMHSs) are shown in Annex 1, which recommend that NMHSs should consciously formulate strategies in the design, presentation, operation, dissemination and communication of warnings. To this end, operational scientists and meteorologists are faced with the challenges on the following areas:

(i) connecting with stakeholders,

(ii) applying advances in science,

(iii) crossing the last mile,

(iv) stimulating anticipated action, and

(v) getting the science through.

In the context of this paper, as requested by the Sustainable Development and Water Resources Section of UNESCAP, the author would like to recommend a new mechanism for regional cooperation on integrating early warning systems into socio-economic development process of the region. This proposed mechanism is built on the premises of good services on early warning systems, experiences of the work carried out under the auspices of WMO and most importantly the latest developments in the work of the UNESCAP/WMO Typhoon Committee Working Group on Disaster Prevention and Preparedness to enhance confidence of EWS service users on the one hand, to facilitate the transfer of know how on early warnings to less developed countries, and increase visibility of EWS services for more effective integration into socio-economic development process of the region.

2. Integration of EWS into the Socio-economic Development Process

Warning communication can be significantly enhanced when consistent warning information is received from multiple credible sources. Furthermore, the potential for individuals to respond appropriately would greatly increase if they are provided with information to enable them to assess their own level of risk highlighting what life-saving or property-saving actions to take.

In this respect, the WMO started formal operation of the Severe Weather Information Centre (SWIC) in March 2005 providing access to the official observations on severe weather and warnings on tropical cyclones issued by National Meteorological & Hydrological Services (NMHS). The SWIC is an internet-portal (http://severe.worldweather.wmo.int) operated by Hong Kong, China on behalf of the WMO and currently comprises 20 participating Members of WMO. The information on tropical cyclones provided by SWIC includes advisories issued by WMO's Regional Specialized Meteorological Centres (RSMC), Tropical Cyclone Warning Centres (TCWC) and official warnings issued by NMHSs for their respective countries or regions. At present only forecasts/warnings issued by organizations with specific responsibility for a region or country are presented and no effort is attempted to harmonize the different forecasts/warnings. Nevertheless, the SWIC serves the role of a trusted source of official warnings/forecasts and is an important step towards a more integrated multi-hazard warning system. Furthermore, it provides a very enabling tool to raise the awareness of the public to approaching hazards.

A similar project is the European Multiservice Meteorological Risk Awareness (EMMA) programme. EMMA produces operational vigilance charts accessible through Internet and understandable throughout Europe. The vigilance chart is a graphical information system on phenomena such as strong winds, heavy rains, fog, forest fires risks, avalanche risks, storm surges, etc. It is to be used not only by weather forecasters, but also by general public and decision-makers, easily accessible, in a form readily understood at a glance and offering the possibility to access more detailed information from the existing national warning procedures, as well as to risk qualification and behaviour information. The operational implementation of the project is expected soon when EMMA products will be available to the public.

This following outlines a potential conceptual design of an Integrated Hazard Awareness Display

(IHAD) for the Indian Ocean region modelled after the SWIC and EMMA programme. The IHAD could aim at providing multi-hazard information via the internet as a means to exchange and publicize regional observations and warnings for the promotion of regional cooperation and public awareness on natural hazards.

3. Conceptual Design for an Integrated Hazard Awareness Display (IHAD)

Participating member states of ESCAP could jointly set up a regional data centre to collect multi-hazards information and warnings (such as tsunami, flood, rainstorm, tropical cyclones, etc.) in real time via various communication means to serve as inputs to IHAD (Figure 3). The IHAD could comprise a 3-tier system which may be developed in phases. The first tier would emphasize the use of observation data as a starting point in the process of building awareness of potential hazard threats. Official observations of hazards and the level of their seriousness could be collected from relevant authorities and displayed via colour-coded manner on a common portal to reflect their risk level. Users, including members of the public, by coming to the portal, begin the process of identifying and assessing the present threat of potential hazards.

More complete and forecast information would be displayed in the second tier of IHAD. Data collected would then be used to produce operational vigilance charts accessible through the internet and understandable throughout the region. The third tier would offer access to detailed warning information from participating national warning centres. Participating Members may also gain direct access to the complete data set collected to enable development of their own national multi-hazard early warning system or other local applications.

The Multi-hazard Data Centre could be hosted by one of the participating member countries. An officer from the hosting country might serve as the co-ordinator for administrative convenience to oversee the design, development and implementation of the Data Centre and the daily operation of the web site.

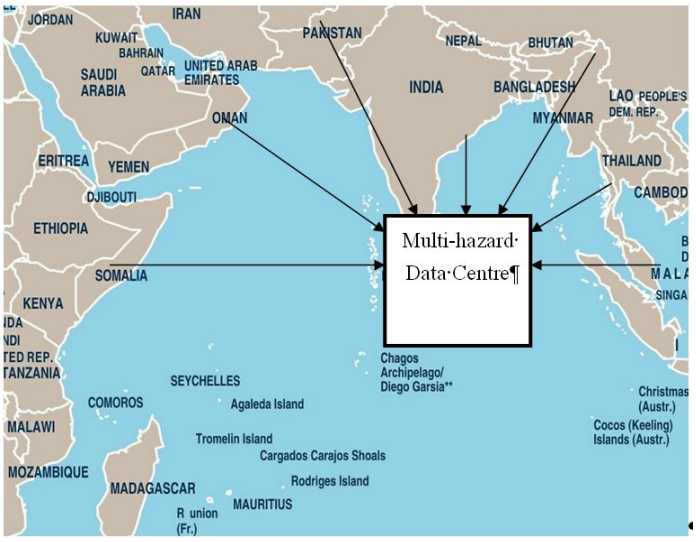


Figure 3. Proposed IHAD Dataflow for the Indian Ocean

Multi-hazard information and warnings may be exchanged via email, ftp and web form. Data content may be packaged in the form of plain text message or in XML to facilitate exchange. The former has advantage in simplicity but the latter is preferred as better data integrity could be ensured.

A pilot project could first be launched as a demonstration of the IHAD concept. This may consist of a system for a few major hazards to include initially observations on sea-level, heavy rain and tropical cyclone winds as well as warnings on tsunami, rainstorm and tropical cyclone. A task force could be set up to facilitate project implementation.

4. Challenges on the Integration of EWS into Disaster Risk Management

Early warning system (EWS) is one of the most effective tools available to manage risk and reduce the toll of natural disasters. Of the five priority areas identified by The Hyogo Framework for Action 2005-2015 which was adopted last year (January 2005) at the World Conference on Disaster Reduction (Kobe, Japan) to reduce disaster risk, the need for "identifying, assessing and monitoring disaster risks and enhancing early warnings" was highlighted as a critical component (of disaster risk reduction).

The primary objective of an early warning system is to empower individuals and communities to respond to protect lives and property. An effective warning system is more than just a set of technical definitions of warning status and associated criteria. It should convey essential and meaningful information relevant to the community. It encompasses the means to communicate such information to the

intended audience. It should be able to trigger established contingency measures within the government and draw orderly collective responses of the public to minimize loss of lives and damage to property. To achieve the best result, early warning systems should be integrated into DPM effectively. National Meteorological and Hydrological Services (NMHSs) should therefore consciously formulate strategies in the design, presentation, operation, dissemination and communication of warnings. To this end, operational scientists and meteorologists are faced with the challenges described below.

a. Connecting with stakeholders

Success of early warning rests on information from all sides being brought together and communicated to relevant parties in a timely and useful way for decision making. Understanding the decision-making process and needs for specific application is critical. The challenge here is mitigating the disconnection between meteorologists/operational scientists and decision-makers. It is important to recognize that what is of interest to meteorologists may not be of equal interest to disaster risk managers. The information needs have to be clearly defined from the perspective of the stakeholders rather than the meteorological/scientific angle.

Stakeholders need to be consulted as partners in the design and refinement of high-impact hazard warning systems, and on the larger scale, the risk management plan. Stakeholders include the public, other national government agencies, emergency management agencies, local authorities, non-government organizations, the media, social scientists, national and regional infrastructure authorities, academia, etc. Different sectors of the community have different natures of business and levels of tolerance of risks associated with natural hazards.

Involving stakeholders in developing and enhancing the end-to-end early warning system has many benefits, such as:

- improved presentation, structure, and wording of the warnings themselves;
- more effective communication of the risks and actions to take in response to high-impact weather;
- better understanding of how, and how often, stakeholders want to receive warnings;
- increased sense of ownership, and therefore, credibility in the warning system; and
- smoother buying-in of the warning system.

It is thus important for NMHSs to adopt a culture of working more closely with stakeholders to define the needs of the warning systems from the perspective of users.

As an example, consider the implementation of the EWS for natural disasters in Hong Kong. The Hong Kong Observatory, who is responsible for designing and operating the EWS, makes consultation with stakeholders on their expected use of the warning early in the design stage to define the user requirements. When the initial design of the warning (including the warning message, warning symbols and precautionary announcements) has been completed, user consultation is again made. Product consultation is often conducted with members of a special interest group, the Friends of the Observatory, comprising members of the public. The media is also consulted to provide useful feedbacks. When the design of the warning is finalized, further consultation with other emergency relief personnel to align the meteorological warning mechanism with the response plans of key response departments are conducted to ensure smooth and coordinated response to the warning.

To cater for the changes in user requirements, the Observatory conducts regular review of the warning system and services, usually on an annual basis. The review process includes communication and consultation processes with various stakeholders. Views and comments from the public are also solicited through systematic and regular public opinion surveys, press columns, radio and TV interviews, incoming emails, discussion forums on amateur weather websites and gatherings of weather interest groups. User feedbacks from other relevant government departments and key sectors and the media can also be obtained through regular liaison meetings. These meetings are effective in collecting users' views and comments and conveying messages to users, enhancing communications between the Observatory and key stakeholders. Any changes or improvements made in response to users' feedbacks are made known to the users, reflecting that the Observatory values their comments and will make efforts to meet their needs, thereby enhancing her image. Continual review and enhancement of a warning system, involving the

stakeholders, will ensure that stakeholders' expectations are met in changing times and the warning system will keep up with the pace of the society it serves.

b. Applying advances in science

An effective warning system should have the following components: (a) good observations, (b) reliable forecasts, and (c) timely incorporation of these observations and forecasts in the warnings. One of the great achievements of meteorology during the 20th century has been the increased ability of NMHSs, through improved warning systems, to provide much more reliable information for effective protection of life and property from natural hazards. With continuing scientific and technological developments, forecasters will be able to warn at longer lead-times and greater accuracy regarding the 'where', 'when' and 'magnitude' of an impending natural hazard.

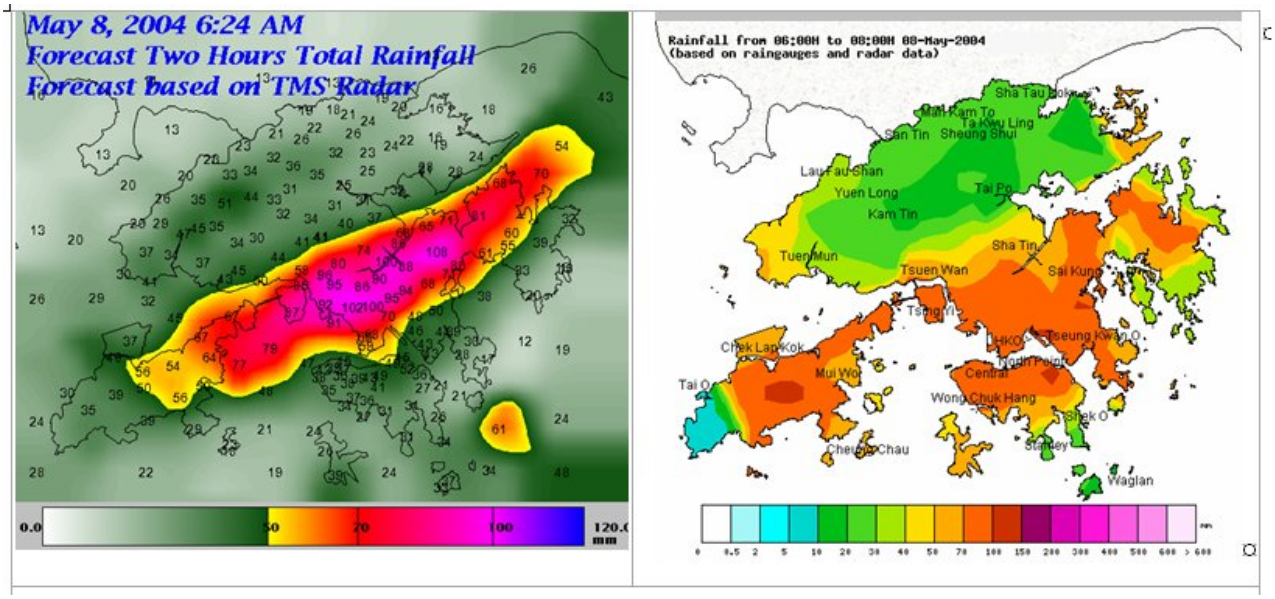


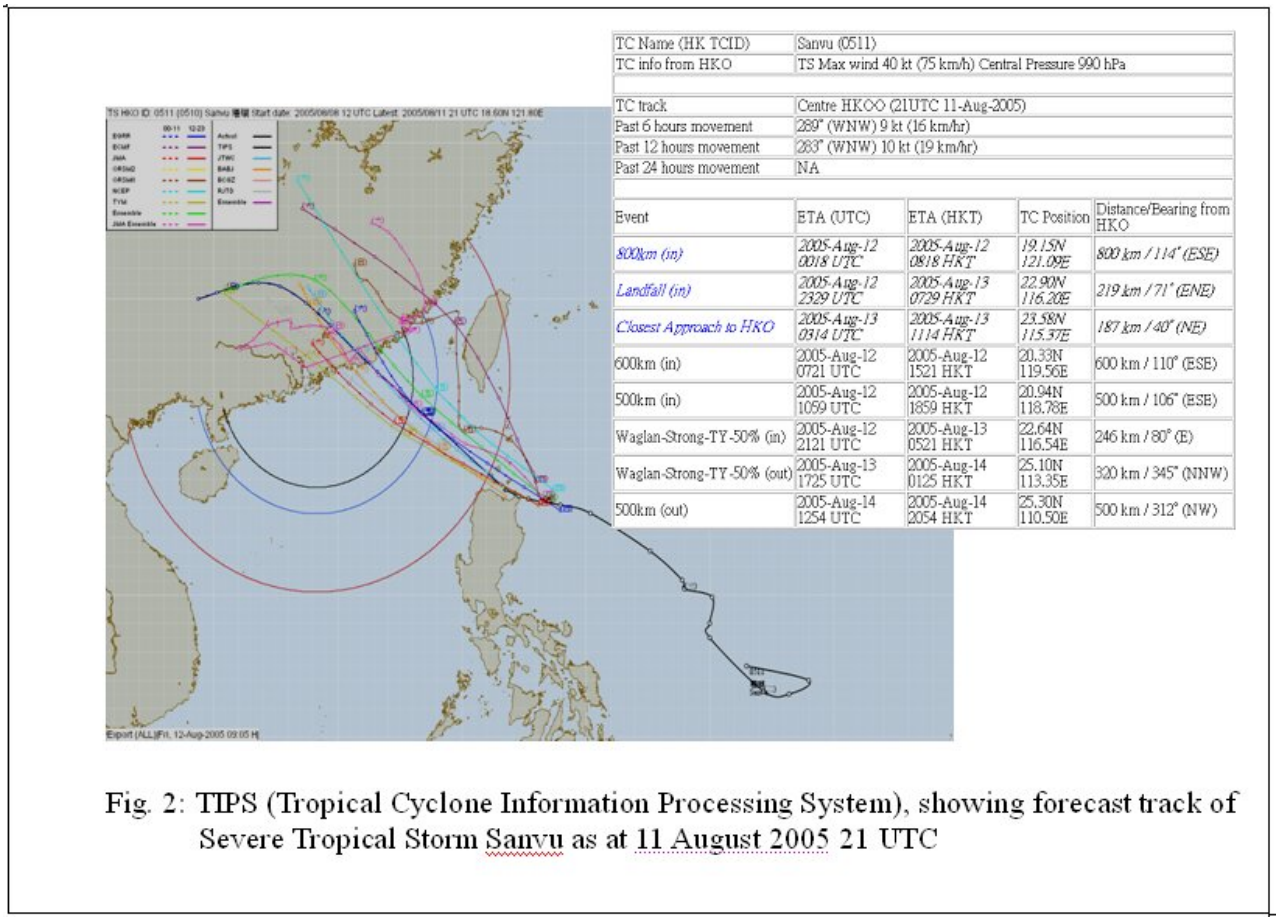
Figure 4. SWIRLS two-hour rainfall forecast valid at 6 am on 8 May 2004 (left) as compared with the actual rainfall distribution map valid at the same time (right).

Conventional observational systems are mainly ground-based in-situ measurement for a single point. Such systems are often costly to operate and, for remote areas in particular, logistically difficult to maintain. Increasingly, the emphasis is shifting towards remote sensing techniques utilizing sophisticated radars and sensors, especially satellite-borne systems that can cover a wide region of the globe. The challenge here is how to extract relevant critical information from the ever-growing volume of observations, analyses and prognoses and coming up with a coherent picture of the threat. This is of particular relevance to the warning of volatile mesoscale weather processes such as rainstorms where the forecast lead time is very short., ranging from state-of-the-art global NWP models to nowcasting systems operated by local weather offices.

Recognizing such operational reality, forecast system developers in the Hong Kong Observatory have made an effort to come up with purposely designed tools for forecasters and decision-makers. The approach is to translate all observations, guidance and numerical prognoses into instantly digestible information that can be directly associated with decision-making criteria. From the Observatory's nowcasting system SWIRLS (Short-range Warning of Intense Rainstorms in Localized Systems), tailor-made rainfall distribution maps are generated for the next three hours based on 6-minute updated radar images and 5-minute updated surface raingauge data. For example, the forecast accumulated rainfall maps for the coming hour (Figure 4) and the coming two hours gives forecasters a useful objective reference in operating the rainstorm warning system; whereas quantitative precipitation forecast (QPF) on the expected amount in the next three hours, in conjunction with the running 21-hour total, is a surprisingly effective tool for assessing the likelihood of landslip warnings.

Another example is the development and implementation of a decision-support tool in the Observatory named the Tropical Cyclone Information Processing System (TIPS). The system ingests

objective forecast storm tracks based on numerical weather prediction model outputs as well as the subjective forecast issued by official tropical cyclone warning centres, generates an ensemble forecast track and presents the integrated information graphically for reference. Once the forecaster decides on the working track, the TIPS estimates the timing as well as the probability of occurrence of high winds in Hong Kong and assess the need for issuance of tropical cyclone warnings to the public (Figure 5). The system has greatly enhanced the efficiency of forecasters in the operation of tropical cyclone warnings in Hong Kong.



TC Name (HK TCID)	Sanvu (0511)			
TC info from HKO	TS Max wind 40 kt (75 km/h) Central Pressure 990 hPa			
TC track	Centre HK◇◇ (21UTC 11-Aug-2005)			
Past 6 hours movement	289° (WNW) 9 kt (16 km/hr)			
Past 12 hours movement	283° (WNW) 10 kt (19 km/hr)			
Past 24 hours movement	NA			
Event	ETA (UTC)	ETA (HKT)	TC Position	Distance/Bearing from HKO
800km (in)	*2005-Aug-12 0018 UTC*	*2005-Aug-12 0818 HKT*	*19.15N 121.09E*	*800 km / 114° (ESE)*
Landfall (in)	*2005-Aug-12 2329 UTC*	*2005-Aug-13 0729 HKT*	*22.90N 116.20E*	*219 km / 71° (ENE)*
Closest Approach to HKO	*2005-Aug-13 0314 UTC*	*2005-Aug-13 1114 HKT*	*23.58N 115.37E*	*187 km / 40° (NE)*
600km (in)	2005-Aug-12 0721 UTC	2005-Aug-12 1521 HKT	20.33N 119.56E	600 km / 110° (ESE)
500km (in)	2005-Aug-12 1059 UTC	2005-Aug-12 1859 HKT	20.94N 118.78E	500 km / 106° (ESE)
Waglan-Strong-TY-50% (in)	2005-Aug-12 2121 UTC	2005-Aug-13 0521 HKT	22.64N 116.54E	246 km / 80° (E)
Waglan-Strong-TY-50% (out)	2005-Aug-13 1725 UTC	2005-Aug-14 0125 HKT	25.10N 113.35E	320 km / 345° (NNW)
500km (out)	2005-Aug-14 1254 UTC	2005-Aug-14 2054 HKT	25.30N 110.50E	500 km / 312° (NW)

Fig. 2: TIPS (Tropical Cyclone Information Processing System), showing forecast track of Severe Tropical Storm Sanvu as at 11 August 2005 21 UTC

Figure 5. TIPS (Tropical Cyclone Information Processing System), showing forecast track of Severe Tropical Storm Sanvu as at 11 August 2005 21 UTC

Such tools with the capability to assimilate the wealth of observation data, analyses and numerical products into meaningful parameters will help towards the understanding and utilization of available information by forecasters to facilitate decision making based upon good solid science.

c. Crossing the last mile

No matter what technology is used to generate a disaster warning and how the warning is transmitted from the originating center to users, the warning is useless unless it reaches the affected individuals in a timely manner. The challenge here is how to cross the last mile effectively to get timely and appropriate alerts to everyone who needs them. It must not only reach the population in risk, it has to be in a language that they understand and from a source they trust.

It is essential for NMHSs to constantly and proactively look for opportunities to improve the delivery processes of warnings to the public and special clients, harnessing the improvement in forecasting techniques, as well as advancement in information technology (IT). Rapid development in IT, in particular, enables fast and efficient dissemination of warning messages through multiple channels and creates opportunities for more timely forecast and warning services. In this information age, it is inevitable and logical that the media should be actively engaged as key partners in the process of triggering rational public response – before, during and after the event.

The first priority is, of course, the provision of critical warning messages and information for the media; denying the media reliable information often only leads to wild speculations and counter-productive panic within the community. But so far, the partnership is often seen in the form of the NMHSs acting as active information providers and the media as passive information carriers. Yet these days the media have eyes and ears all over the place that can actually bring them closer to the weather phenomena or other weather-related incidents. In some cases, their first-hand reports of such events may actually enhance public awareness of an impending disaster and its potential consequences, hence rendering the warning process even more effective. How to solicit the active assistance of the media in this respect and how to integrate media-derived weather information into the warning process offer exciting possibilities and challenges that would bring meteorologists-media partnership into a new era. Synergizing the power of the media and innovative IT will certainly promote the intelligent and timely usage of warnings and naturally lead to a rational overall response to warnings.

Many EWSs designers assume that everyone can be reached by the mass media supplemented by the internet. However, there are people who cannot be reached by these methods, such as communities in hard-to-reach areas and scattered in off-shore islands, undocumented immigrates, homeless people and those who live on the margins of society for any of a number of reason. Reaching out to these people represents another great challenge to emergency managers and innovative means have to be invented to handle such "invisible" populations.

d. Stimulating anticipated action

Despite the best of forecast and timely dissemination, the warning message by itself does not necessarily stimulate an immediate response from individuals. Studies have shown that (Mileti and Sorenson[4], 1990) before an indivisual at risk responds to a warning, he/she needs to believe the information presented and personalize the risk. This depends to a large extent on the content and clarity of the initial warning and the credibility of the issuing organization. The potential for individuals to respond appropriately would significantly increase if they are provided with information to enable them to assess their own level of risk highlighting what life-saving or property-saving actions to take. The challenge here is to structure the warning information in a way that the individual at risk would feel personally affected.

Another critical element of an effective warning is the assurance that there is a single authoritative source of the warning and that warnings given in the vicinity of national boundaries are consistent. Warning information from many sources can present problems. At best this is confusing; at worst, it can be life threatening when inconsistent, let alone contradictory, information is introduced to the public.

When there is a shared body of water bordering two countries, it is common practice to exchange warning information and to co-ordinate the information so that mariners receive the same warning signal from both countries. The cross-border warning information is also very useful in creating a discussion forum, possibly through the internet, that makes it possible to coordinate warnings. Communication is significantly enhanced when consistent warning information is received from multiple credible sources.

In this respect, the WMO started formal operation of the Severe Weather Information Centre (SWIC) in March 2005 providing access to the official observations on severe weather and warnings on tropical cyclones issued by NMHSs. The SWIC is an internet-portal (http://severe.worldweather.wmo.int) operated by Hong Kong, China on behalf of the WMO and currently comprises 20 participating Members of WMO. The information on tropical cyclones provided by SWIC includes advisories issued by WMO's Regional Specialized Meteorological Centres (RSMC), Tropical Cyclone Warning Centres (TCWC) and official warnings issued by NMHSs for their respective countries or regions. At present only forecasts/warnings issued by organization with specific responsibility for a region or country is presented and no effort is attempted to harmonize the different forecasts/warnings. Nevertheless, the SWIC serves the role of a trusted source of official warnings/forecasts and is an important step towards a more integrated multi-hazard warning system. Furthermore, it provides a very enabling tool to raise the awareness of the public to the threats of approaching hazards.

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[4] Mileti, D.S. and J.H. Sorenson, 1990. *Communication of Emergency Public Warnings – A Social Science Perspective and State-of-the-Art Assessment*, Oak Ridge National Laboratory, ORNL-6609, Oak Ridge, Tennessee, USA. (available on the Internet: http://emc.ornl.gov/EMC/PDF/CommunicationFinal.pdf)

e. Getting the science through

Effective warning must be based on science. However, even the best science does not enable meteorologists to deliver accurate deterministic forecasts on all occasions to decision makers. Nor can one expect public preparedness to be able to keep pace with and make best use of scientific knowledge. Innovative approaches are needed to build effective links between the various stakeholders. Well before Hurricane Katrina on 29 August 2005, US meteorologists had warned that the worst-case scenario for New Orleans would involve storm-induced failure of the protective levees around the low-lying areas. This was exactly what happened but still there were over 1000 deaths and numerous people displaced. The challenge is getting the science through to policy-makers and the public.

In Hong Kong, the Observatory attaches great importance raising the public's awareness of natural hazards in Hong Kong through reaching out to the public. To this end, an interest group "Friends of the Observatory" was established 10 years ago. Regular extension activities such as visits and lectures are organized for the 7000 members of the group which amounts to 0.1% of the Hong Kong population. Newsletters with news on the latest development of the Observatory are sent to the members as well as business partners. Members of the "Friends of the Observatory" in turn are invited to serve in focus group meetings to provide feedback on new services from the user-point-of view. To enhance partnership with the media, regular informal gatherings are organized to facilitate sharing of views and experience. A 12-month publicity schedule is prepared well in advance to facilitate planning and to maximize the impact of the launch of new services or activities. Gatherings with media representatives are conducted regularly to build up partnership and enhance mutual understanding.

The Observatory often partners with other government departments and NGOs to launch various publicity campaigns on awareness of natural disaster risk prevention and mitigation. In 2005, the Observatory together with several other government departments and NGOs jointly conducted a one-year community education programme named as 'Safer Living' to enhance the public's understanding of natural hazards in Hong Kong so that appropriate response actions can be taken by them to reduce natural disasters for a safer living. (Details of the 'Safer Living' programme can be found at http://saferliving.info.gov.hk/eng/index.htm.)

Over the past couple of years, the Observatory has gone beyond the training of meteorological personnel by embarking upon the provision of meteorological education for the public and government officers. The aim is to promote public awareness and preparedness against weather-related disasters. Introductory meteorological courses on "interpretation of radar and satellite pictures", "weather forecasting and interpretation of weather charts", "numerical weather prediction" and "weather observation practices" are organised regularly for government officers and members of the public. These courses proved to be very popular. So far, over 2500 people have attended these courses.

In an effort to reach out to the young generation, the Observatory in collaboration with the Hong Kong Education City, a government-funded organization for promoting educational services and information technology culture to the education sector, organized a "Weather Diary" activity for secondary school students from 17 May to 17 June 2005. The activity was aimed at arousing the interest and curiosity of students in meteorology through observing the weather. The "Weather Diary" involved students making observation each day of the cloud amount, state of sky and rain type, and recording them on-line. Students were free to add remarks and upload photographs they had taken of the sky and clouds. During the one month period, more than 1500 students from about 250 schools took part in the activity.

Moreover, the Observatory also maintains close liaison with government departments responsible for emergency response as well as engages more and more special user groups such as transport operators, container terminal operators, property management associations, teachers and parent associations, school bus and nanny van operators, fishermen associations etc. through organizing regular meetings and safety seminars. Such contacts facilitate better mutual understanding between the Observatory and key user groups stakeholders users. They also provide a channel to obtain feedback on the Observatory's services which will form the basis for improvement of the warning system.

5. Remarks

Multi-hazard early warning systems must be viewed as an integral element of long-term strategies in the sustainable development for a safer community. Consequently, there is an inevitable need to ensure that

multi-hazard warnings become an integral part of the DPM efforts in every community. It also follows that NMHSs need to be recognized as a major component of the corresponding infrastructure in support of DPM.

Besides improving the accuracy and lead-time of forecasts and warnings, NMHSs must also establish links with all stakeholders to make sure that the required science and information get through. In the fight against natural disasters, meteorologists and scientists must appreciate that disasters involve both Mother Nature and Mortals. Scientific endeavours constitute only half of the business. For a warning to be effective, all stakeholders must understand the warning messages and be willing to act. As pointed out by Mr. C. Y. Lam, Vice-President of Regional Association II (Asia) of WMO, NMHSs must gain the trust of people, to ensure that the community would indeed take actions upon receipt of the warnings (C.Y. Lam[5], 2005). To achieve this, NMHSs must reach out to the people. This dual nature of the business of natural disaster reduction, both as a scientific subject and as a human issue, is quite a challenge to researchers and operational forecasters. As such, apart from scientific capacity building, NMHSs should also expend no less effort in the building of trust with the community they serve.

III. CONCEPT OF STRATEGIC PLANNING AND MANAGEMENT

The integration of disaster preparedness and mitigation into socio-economic development should be seen as a process, which needs to be conceived as part of the three phases of a disaster management project: initiating, preparing and implementing phases. The level of intensity of activities in each of the three phases and the interaction among the phases will determine the depth and scale of such a disaster preparedness and mitigation (DPM) process. The integration processes of DPM would have far-reaching impact if they were initiated as part of a pro-active policy of government. However, the impact tends to be superficial and short-lived when the processes are driven by external factors and no supporting policy or infrastructure is established. In designing integration processes, the activities in each of the phases must be carefully studied and prepared to respond to the urgent needs, and properly planned to ensure consistency among the phases. Besides, the processes must be properly designed to respond to the priorities in disaster management at the local and national levels and to take advantage of the corresponding opportunities as well as of the international level. As the three phases will have to be examined in detail in chapter VI, this chapter is devoted to discussing the process linking the phases and the importance of sustaining the process.

In terms of designing the DPM process, it is of utmost importance to set out a clear strategy towards defining a programme of action to be taken in all the phases as well as to revisit the analysis of causes and motives at the beginning of a DPM project. As a DPM project involves “communities” and thus other stakeholders in its development, the linkage among the phases of the DPM process follow the same pattern of a “strategic collaborative planning” model proposed in the recent guidelines[6] of UNESCAP on strategic planning and management of water resources. The UNESCAP-proposed “strategic collaborative planning” reflects efforts of not just one organization but a group of institutions (or all key stakeholders) aiming to achieve a shared vision. The fundamental concepts and key conditions for effective implementation of these concepts, together with detailed guidelines for application of the strategic collaborative planning model are adapted in the following sections for DPM.

1. General concept of collaborative strategic planning

Collaborative planning is based on two key premises.[7] Firstly, it assumes that intelligence and

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[5] Lam, C.Y., 2005. National Meteorological and Hydrological Services and Natural Disaster Reduction, WMO Bulletin, Vol.54, No. 4, October, 2005.

[6] Webster, D. W. and Le-Huu, Ti, “Guidelines on Strategic Planning and Management of Water Resources in Asia and the Pacific”, UNESCAP, 2002

[7] Collaborative planning is based on the principle that developmental intelligence and knowledge is widely distributed in a variety of institutions throughout society (“distributed intelligence”). Accordingly, one agency cannot and should not do planning in isolation. Collaborative planning involves representatives of key interests (stakeholders, e.g. labour unions, local governments, private corporations, community groups) involved in a developmental issue negotiating (through trade-offs, cooperation, mediation of conflict, etc) a course of action (plan). Once the key interests (through their representatives) agree on a course of action, the political/bureaucratic process is likely to

know-how are widely distributed throughout society, even in technical areas such as resource management, e.g. in specialized technical government agencies, universities, NGOs, the private sector (e.g. engineering firms), users and local government. Secondly, it assumes that government does not have a monopoly on governance. Even activities such as regional planning should not necessarily be a government monopoly. Because such an approach includes many stakeholders, it makes governance more sophisticated and mediation-based. Groups can work out issues then put forward legislation to the relevant constitutionally mandated authority, e.g. local government councils. In essence, much of a government's work is done for it, yet the outcome is often more responsive to the needs of constituents. In many democratic legislative bodies, lobbyists are so powerful as to prevent change. Collaborative planning processes enable constituencies to be formed and gather momentum; accordingly, strategies, policies, instruments and other measures usually enjoy much stronger support by the time they reach the legally mandated body, reducing the probability that vested interests will stop the proposed initiative. Collaborative planning is especially valuable in planning for complex systems where multiple policy objectives exist. Disaster risk management for natural hazards exhibit many of these characteristics, especially when these hazards are large scale such as tropical cyclones, floods caused by large river systems, El Nino.

However, not all countries in Asia are ready for DPM integration processes, especially in those government does not play the lead role. Fortunately, strategic collaborative planning can be used much more conventionally. For example, a national disaster management agency or an umbrella planning agency can instigate a collaborative planning process. However, to be collaborative it must involve stakeholders outside the government, must involve all relevant agencies, and must view DPM from a perspective that transcends any related agency, no matter how powerful or dominant the latter may be within the jurisdiction in question.

Figure 6 describes the strategic collaborative planning model. Some of the key ways in which it varies from the standard strategic planning model are:

The strategic collaborative planning model may come into play because of a major societal issue; thus it is an issue (or set of issues) that drives the process, not a mission statement associated with a single institution.[8] Sometimes the process is the result of a failure of traditional government processes to deal with an issue because of disagreements among agencies. For example, disputes regarding flood control between urban and rural areas could generate the issue environment to set off this type of process. In some cases, even issue identification will be fuzzy, i.e. people or institutions will be unsatisfied about a situation, but the issue is not clearly articulated. Alternatively, it may come into play as a result of a visioning process in a country in which disaster-risk management is deemed to play a key role in realizing an envisioned future but change is needed in terms of performance delivered by various resource management and development agencies.

The strategic collaborative model may come into play because of lack of coordination among agencies in taking action. There may be a vision in place for disaster-risk management, and even implicit agreement among the agencies that the vision should be realized. However, lack of institutional coordination is hindering implementation. In this case, the strategic collaboration process may focus on how to effectively realize coordinated implementation of the vision.

Because strategic collaborative planning starts with (often ill-defined) issues, it quickly involves many institutions and a wide range of interest groups and stakeholders.[9] In this sense it is strategic planning at a more macro scale than the standard strategic planning model. This more macro level of strategic planning

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quickly approve/implement public-sector components of the action building on the outcome that has been negotiated among key stakeholders. Collaborative planning is based on the assumption that it is a sheer impossibility to control all actors (agencies) through a single plan; therefore, collaborative planning processes need to be simultaneously underway focusing on leading issues facing society, such as water resource management.

For an overview of the collaborative planning model, see Booher, D. and Innis, J., "Metropolitan Development as a Complex System: A New Approach to Sustainability", *Economic Development Quarterly*, 13 (2): pp141-156

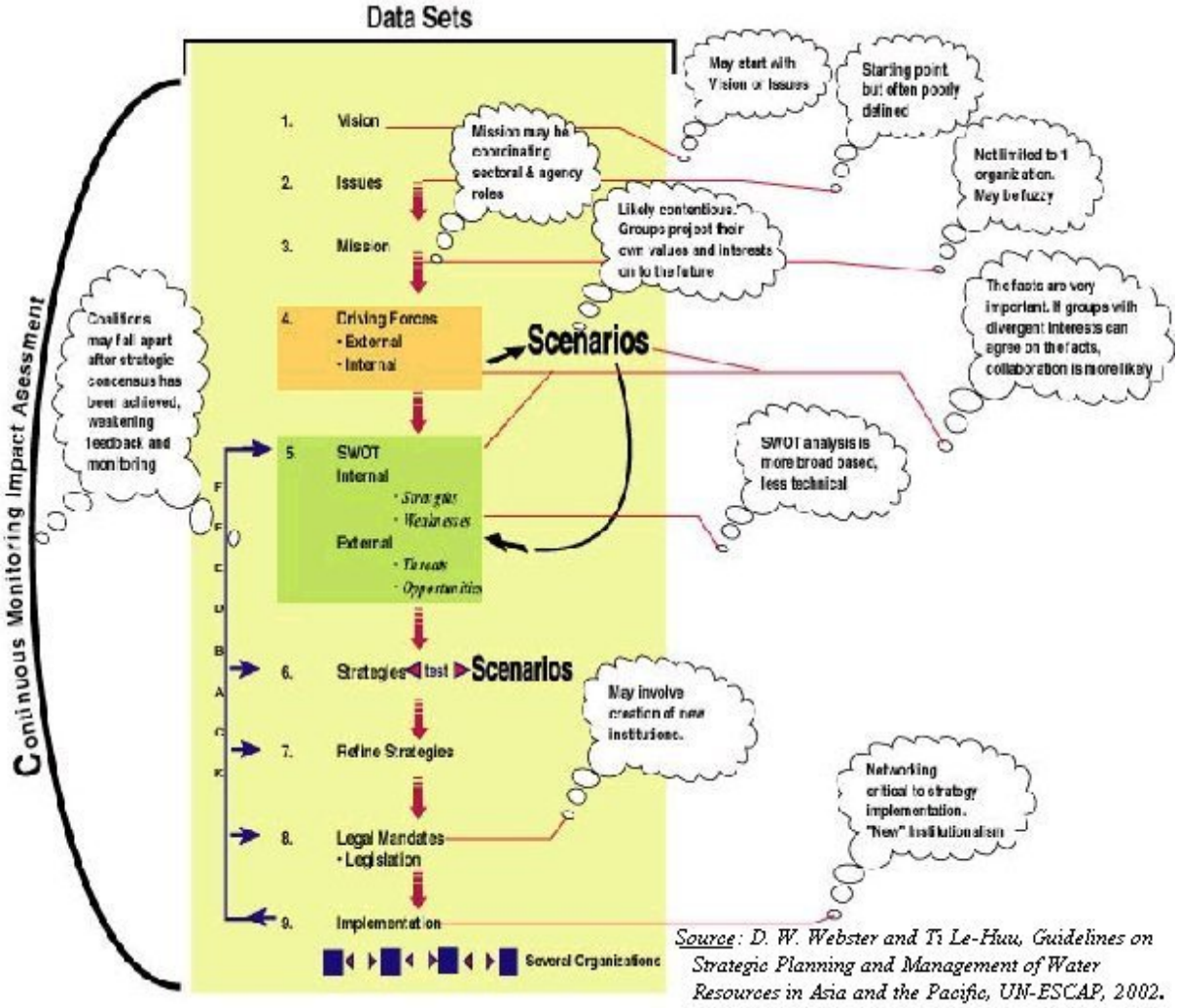
[8] An issue is a failure to meet social or economic expectations. The severity of an issue is determined by, and changes, according to social values.

[9] For an informed discussion of techniques to involve stakeholders and interest groups in strategic planning processes, see Priscoli, J.D., *Participation, River Basin Organizations and Flood Management*, Bangkok: ESCAP, 2001.

may occur at a higher level than the organizational level and is characterized by the involvement of many institutions.

In strategic collaborative planning the information base becomes extremely important precisely because of the wide range of interests involved. Although it is difficult for individuals and institutions to change their positions, and even more difficult for them to change their values, if they can agree on the validity of an information base, it is far more likely that deals can be struck using the strategic collaborative approach. The information base includes driving forces (internal and external) and scenarios (illustrating the range of possible futures affecting the issue area).

Defining the internal environment for SWOT (strengths–weaknesses–opportunities–threats) analysis is difficult because a wide range of institutions may offer resources of significant importance in tackling the issue at hand – in fact complex issues usually require coordinated action by a networked set of institutions. (Of course, many of the failures and shortcomings in improving complex systems of disaster-risk management in Asia and elsewhere can be attributed to the failure of a coordinated strategic response by key agencies and actors.) Thus the internal environment analysis (SWOT) needs to begin with an inventory of resources at hand (across a number of institutions) that could assist in addressing the issue.



Then, the strengths and weaknesses of these potential institutional resources need to be analysed. Because a wide range of institutions will need to be included, the analysis of internal strengths and weaknesses will obviously be in less depth than in the case of the conventional strategic planning model, which focuses on one institution.

Figure 6. Strategic collaborative planning model

Developing scenarios to provide context for strategic collaborative planning in the field of disaster management is difficult.[10] Because the future is less well known than the past and present (the information

[10] For a discussion of scenario preparation in the field of water resources, see APEC Centre for Technology

base for driving forces) and different interest groups will perceive and want to portray the future differently, developing scenarios will be challenging. Professional facilitators or mediation experts may need to be involved to facilitate agreement in potentially controversial areas such as scenario construction.

Once a strategy has been agreed upon, unlike the case of the conventional planning model in which the institution involved usually already has a legal (constitutional) mandate, the strategy will need to be legitimized. Often this requires legislation or a political mandate. However, if diverse groups have worked out difficult compromises and agreed on a strategy, this can be, relatively, the easy part. In effect, the strategic collaborative process will have done the 'dirty work' for the politicians, a situation that they often like.

Because the strategic collaborative approach involves a wide range of stakeholders and interest groups, the sustainability of feedback and monitoring becomes an issue, especially if the collaborative organization is outside the public sector. (In cases where an umbrella agency exists with responsibility for overall DPM, it is often the best agency to guide collaborative strategic planning process.) Often the collaborators become less active once they put in place a strategy – or especially if they fail to do so. However, the latter is not always the case; frequently the collaborative group does stay together. In cases where the collaboration was organized outside the public sector, the collaborators may even set up office, hire staff, etc, paid for by contributions from collaborators, some foundation or NGO or the public sector. If the collaborative group does disintegrate or becomes less effective, it is especially incumbent on the official umbrella agency (if one exists) to monitor the performance of the overall strategy, because it will involve more than one institution.

2. Implementing strategic collaborative planning

As noted, this process is often kicked off by pressing issues or the existence of a change-oriented vision in which disaster-risk management plays a key role in socio-economic development. The hard part is to bring the key interest groups together – e.g., watershed planning, technical agencies, farmers, livestock herders, community groups, local governments, etc in the case of flood management of a large river basin – to catalyze the process. Normally, a government agency (such as an umbrella planning agency for disaster management, the environment ministry or the national developmental planning agency), an NGO or an interest group – e.g. a leading environmental research group – will need to champion the process. In the international case, an international body would normally trigger the strategic collaborative planning process, such as the Mekong River Commission which had recently initiated and successfully launched the Mekong Flood Mitigation and Management Programme in November 2002.

Once the process has been constituted, it will need funds, although volunteers can contribute if there is sufficient motivation. Funding is primarily needed for the hard analysis, i.e. identifying and assessing the driving forces, and for undertaking SWOT and scenario analysis. To do the technical work, a technical working group needs to be formed. However, a wider but of still manageable size stakeholder group needs to exist to interact regularly with the technical working group. Key interest groups need to be represented as part of the stakeholder group, but its membership should preferably be limited to about 20 persons. It is virtually impossible to make progress in a collaborative process if large numbers of people are involved, because compromises cannot usually be negotiated in public (your constituency will accuse you of "backing down"). Large groups usually produce "watered down", "lowest common denominator" and politically non-offensive outcomes. The victims are the consumers of the service, i.e. disaster-affected and vulnerable people. However, large-scale meetings are useful during issues identification and when subjecting findings from technical analysis processes to public scrutiny, i.e. drivers, SWOT and scenario analysis interim outputs. Representatives of different groups involved in strategy formulation based on small-group dynamics have an obligation to constantly interact with their constituency during the entire process and bring feedback from their constituency to the small groups (technical working group and stakeholder group). (Effective dynamics for such processes are readily understood, an outcome of a century of negotiations, e.g. labour–management negotiations.)[11]

Foresight, *Water Supply and Management in the APEC Region*, Bangkok: APEC Centre for Technology Foresight, 1998. (In particular, see section on "The future for water supply and management: scenario-based futures").

[11] Delli Priscoli, J., "Participation, River Basin Organizations and Flood Management", Background paper

Once an overall strategy has been agreed upon, it is important that the collaborative group act as a unified front. Unity will dramatically increase the chances of the strategy being legitimized by the relevant level of government and being implemented, especially, as is often the case, if it involves a large number of networked institutions.

It is ideal if the collaborative group can sustain itself. The fruits of strategic planning are in the implementation, i.e. in management, not in formulating a strategy. By remaining active, the collaborative group can monitor the strategy and provide feedback. If such monitoring is formally undertaken by an official body, and a civil society collaborative group is involved, the latter can work with the official monitoring agency, either by supporting its activities, or by playing a watchdog or second-opinion role.

3. Guidelines to undertake strategic collaborative planning

The detailed guidelines to follow the steps indicated in figure 1 can be found in an earlier publication of ESCAP on the integration of community-based disaster risk management (ESCAP, 2004). Among the key steps, it is important to highlight the role of the formulation of a shared vision to ensure synergy of efforts as indicated in the following section.

Vision

A vision is a statement that describes a desired future state. It is oriented to a given time period, usually about twenty years. A vision for flood-prone watershed planning might be built around a theme of achievement of sustainable water use and prosperity in all of a country's watersheds by 2025. The problem with visions is that they often tend to be utopian rather than realistic, and are often so vague as to be of little value in guiding the collaborative strategic planning process. However, if well done, a vision can be useful in orienting stakeholders (looking and pulling in one direction) in developing a strategy, particularly at the stage of mission formulation.

How can realistic and useful visions be formulated? In terms of disaster-risk management, the vision needs to key off the national development vision (even better, be developed as a component of the national development vision) – to a considerable and increasing extent effective disaster management is a key factor supporting (and sometimes constraining) national development. A DPM vision formulated in isolation from an overall national vision that incorporates social, economic and environmental dimensions reflecting national developmental aspirations is likely to be of little value. Many Asian countries such as Japan, Malaysia, Republic of Korea and Thailand have developed long-term visions that can be used to orient the disaster-risk management vision.

Box . Action plan on flood defence for the Rhine (1998–2020)

Vision To protect people and goods against flooding while integrating ecological improvement of the Rhine and its floodplains

Development of strategies

- Strategic approaches to flood control and management: NEW PERCEPTION, which involves also spatial planning and land use
- Integration of flood control and management into national development process: *PRINCIPLES*
- Establishment of a priority action plan: *ACTION TARGETS*

Principles

- **Integration of related sectoral measures:** (i) water management, (ii) spatial planning and urban development, (iii) nature protection, and (iv) agriculture and forestry
- **Integration of preventive measures:** (i) water is part of the whole, (ii) store water, (iii) let the river expand, (iv) beware of the danger, and (v) integrated and concerted action
- Targets
- **Reduce damage risks:** no increase until 2000, reduction up to ten per cent by 2005 and up to 25 per cent by 2020
- **Increase of awareness of floods:** risk maps for 50 per cent of the floodplains and areas at flood risk by 2000 and 100 per cent by 2005

prepared for UNESCAP, Bangkok, 2001.

- **Improve flood forecasting system:** prolong forecasting period by 50 per cent by 2000 and by 100 per cent by 2005

Source: *New Developments in Flood Control Along The River Rhine*, Jan Leentvaar, in "Regional Cooperation on Flood Control and Management in the Twenty-first Century in Asia and the Pacific", ESCAP, 1999.

In formulating the disaster-risk management vision, key stakeholders need to be convened. Priority (parameter defining) data needs to be circulated to all involved stakeholders, e.g. information on past damage, current and forecast levels of risk by subregion, future economic structure, international water agreements in place and expected to be ratified, etc. The danger is that in trying to have all stakeholders on one's side, the vision will be too general to be useful, thus expecting 100-per cent consensus is likely to be unrealistic.

The vision that is produced should be short (less than four paragraphs), clear and oriented towards a specific time frame. Sometimes quality graphics can make a vision clearer. Once formulated, the vision should be widely disseminated.

IV. INSTITUTIONALIZATION OF COMMUNITY-BASED DISASTER RISK MANAGEMENT (CBDRM)

One of the most important concepts of disaster mitigation is to delegate authority and empower people in decision making. In this context, community-based disaster risk management (CBDRM) was conceived and designed. In order to ensure effective integration of CBDRM into the socio-economic development process, it is essential to achieve necessary changes in perception of disaster risk management, to prepare for conflict prevention and resolution at community level, and to strengthen the legal and institutional framework to support necessary measures for CBDRM.

1. Change in perception of disaster management

In order to improve disaster management, many new initiatives have recently been introduced to improve the current management practices so as to better handle increasingly complex socio-economic development process, particularly those related to enhancing public awareness and participation of stakeholders in disaster-risk management. New initiatives instrumental to the participation of stakeholders are mostly evolved from the changing perception and practices in disaster-risk management.

One of the most important changes is related to early warning, when the Declaration of the 1998 Potsdam Early Warning Conference stated that "early warning represents a cornerstone of disaster reduction and should, therefore, become a key element of future disaster reduction strategies for the 21st century". The objective of early warning is to empower individuals and communities threatened by natural or similar hazards to act in a timely and appropriate manner so as to reduce the possibility of personal injury, loss of life and damage to property or to nearby fragile environments. Risk assessment provides the basis for an effective warning system at any level of responsibility. It identifies potential threats from flood-related hazards and establishes the degree of local exposure or vulnerability to hazardous conditions. This knowledge is essential for policy decisions which translate warning information into effective preventive action. Effective early warning depends upon multi-sectoral and interdisciplinary collaboration among all concerned actors.

Several groups must contribute to this empowerment. Each has a set of essential overlapping functions for which it should be responsible. Members of vulnerable populations should be aware of the flood-related hazards and the related effects to which they are exposed and be able to take specific action which will minimize their personal threat of loss or damage. Local communities should have sufficient familiarity with hazards to which they are exposed, and understand the advisory information received, to be able to advise, instruct or engage the population in a manner which increases their safety or reduces the possible loss of resources on which the community depends. Governments should exercise their sovereign responsibility to prepare and issue hazard warnings for their national territory in a timely and effective manner, and to ensure that warnings and related protective guidance are directed to those populations determined to be most vulnerable to the hazard risk. The provision of support to local communities to use information and develop operational capabilities is an essential function to translate early-warning knowledge into risk reduction practices.

As most of natural disasters in the region are water related, especially floods. It is of interest to

discuss latest changes in perception of flood management. The changes are driven by the rapid expansion of urban areas during the past two decades, which have resulted in rapid growth in many population centres and settlements along coastal and low-lying areas that are prone to flooding, with increasing flood impact. The frequency and severity of flooding have, as a consequence, increased at both basin and local levels, particularly in those urban areas. Significant flood losses have frequently been experienced in many major urban centres in the region, such as Bangkok, Dhaka, Hanoi, Jakarta, Kuala Lumpur, Manila and Phnom Penh. These flood losses are expected to increase with the continuing urban expansion and escalation of land and property values. In many of these urban centres, flooding may be caused mainly by storm waters.

Local water-related hazards, such as flooding caused by storm water, offer opportunities for small-scale measures to be adopted and for local communities to play an active role in flood management. It is commonly accepted that proper drainage of storm water and protection against flood losses are fundamental requirements for the sustained development and growth of modern cities. In many cases, especially for storm-water management, non-structural measures are required for an optimal solution to the urban flooding/drainage problem. For the successful implementation of these measures, it is necessary to ensure that all stakeholders fully understand the causes of urban flooding and recognize the financial and environmental implications on the basis of sustainable economic development and sound environmental management.

With regard to storm-water management, master plans and strategies have been established for many of the main cities in the region, based on an integrated and participatory approach to flood management. This approach involves all the relevant parties, i.e. the central and local governments and the private sector. In most cases, it is no longer practical or acceptable to regard floods, especially those resulting from storm water, as natural hazards to be tackled only by the central government. The roles of the local governments and the private sector are becoming more important in the financing of flood control measures and in resolving conflicts resulting from urban development causing increased vulnerability to flooding.

2. Conflict prevention and resolution

For most of the developing countries in the region, where participation of communities and stakeholders is still very weak, the *initiation phase* plays an instrumental role in changing the static prevailing conditions into launching the collaborative process, especially the trust building step. Effective initiation phase may be triggered in various ways, such as government efforts in public education, government or independent organization initiatives, and public protests resulting from worsening conflicts and leading to negotiation and collaboration. While the initiatives would provide ample opportunities to promote community-based projects, the response to public protests tends to provide little time for adequate analysis of the situation to move on to an effective participation of all stakeholders to ensure sustainability of the integration process. Prior analysis of conflicts or disputes in disaster management leading to public protests would provide better information for a proper design of participation of all stakeholders for effective integration of disaster management into the development process. Detailed analysis of conflicts or potential conflicts would form a firm basis to ensure effective participation of all stakeholders and timely establishment of mechanisms for conflict resolution or prevention. In this context, it is important to take note of recent important developments related to these aspects.

Box . The five basic sources of conflict

1. Relationship conflict

This is conflict rooted in poor communication, misperceptions, dueling egos, personality differences, and stereotypes. This kind of conflict produces strong emotions and often must be addressed before people are able to resolve other forms of conflict. Sometimes this kind of conflict is resolved by increased communication or by getting to know each other better. But in polarized situations, increased communication may actually reinforce misperceptions and stereotypes. In such situations, the intervention of a third party is often needed to create an appropriate climate for better communication.

2. Data conflict

This conflict results from a lack of important information, or contradictory information, or misinformation. It may also involve different views as to which information is important or relevant, different interpretations of the data, or different assessment procedures. In a conflict situation, conflicts over data are sometimes hidden because people may break off communication. They do not even know that they are arguing from a different set of facts. These conflicts are often resolved quickly once communication is reestablished and there is an open exchange of perceptions and

information. In other situations the information needed may not exist, or the procedures used by the parties to collect or assess information are not compatible. In such cases, resolution may require that the parties agree on a strategy to get the information they need to resolve the issue.

3. Values conflict

Values conflicts occur when people disagree about what is good or bad, right or wrong, just or unjust. While people can live with quite different values systems, value disputes occur when people attempt to force one set of values on others or lay claims to exclusive value systems which do not allow for divergent beliefs. Resolution of value disputes sometimes occurs, at least over time, as people educate one another about the basis for their beliefs. Beliefs about environmental values, for example, have changed considerably over the past two decades, at least in part due to this education process. Value conflicts can also be resolved when people build upon their many shared values rather than concentrate on their differences. Or they may be resolved when the situation is structured so that it is not necessary to resolve the differences.

4. Structural conflict

Structural conflict means that the situation is set up in such a way that conflict is built in. The "structure" that causes the conflict may be the way in which roles and relationships have been defined, or unreasonable time constraints, unequal power or authority, unequal control of resources, or geographical or physical constraints. For example, disputes over contracts often occur when organizations define the relationship as a competitive situation in which each side tries to get the best of the deal. If everybody does the best possible job of trying to 'protect' his or her organization, it may create a situation where all the organizations suffer, yet individuals continue to be rewarded for their efforts to protect them. Structural conflicts can be resolved by redefining roles or responsibilities, realigning rewards and punishments, or adjusting the distribution of power or control over resources.

5. Interest conflict

Interest-based conflicts occur over substantive issues (money, physical resources, time), procedural issues (the way the dispute is to be resolved) or psychological issues (perceptions of trust, fairness, desire for participation. respect). For an interest-based dispute to be resolved, all parties must have a significant number of their interests addressed and met by the proposed resolution in each of these three areas. Often it is necessary to address data conflict or relationship conflict before addressing interest conflict. If there are conflicts over interests, the dispute will not be addressed to people's satisfaction until their interests have been addressed.

Source: *Overview of Alternative Dispute Resolution (ADR)* by James L. Creighton, Trudie Wetherall, Jerome Delli Priscoli, and Donna Ayres.

3. Strengthening the legal and institutional framework for CBDRM

The most important foundation for the framework of CBDRM is laws and public policies. Strengthening the legal and institutional framework is therefore expected to facilitate the integration of CBDRM into the socio-economic development process. Although it is recognized that individuals, groups or institutions may create success stories in enhancing public awareness and participation in CBDRM, there would be no assurance that these success stories would be further disseminated and replicated or even sustained. Therefore, it would be much more effective if the institutional and legal framework could provide freedom and incentives for people to participate in disaster-risk management, including CBDRM.

Since the legal and institutional framework for disaster-risk management depends very much on the political, social and economic conditions of the countries, effective and successful strengthening of such a framework is an extremely difficult process, in which commitment of top level of decision making and widespread participation of the public are essential. In this subchapter, attempts are made to provide information related to the principles and possible models for strengthening the legal and institutional framework for effective CBDRM. It includes three main sections: (1) principles of institutional and legal framework, (2) model for the process of strengthening the legal framework and (3) model for the process of strengthening the institutional framework.

The following three key elements of the institutional and legal framework must be addressed to ensure effectiveness in public participation: the right to information, the right to participate and accountability.

Strengthening the legal framework for participatory planning and management for effective integration of CBDRM into the socio-economic development process can be viewed from two perspectives: (1) to implement the existing basic law on public participation or (2) to strengthen the existing legal framework of natural resource management and disaster management for better public participation.

The two perspectives of the legal framework for public participation reflect the complexity of political and cultural conditions in the region. While these two perspectives may offer different legal

frameworks for participatory planning and management, the socio-economic conditions of developing countries show the following common needs in capacity-building to strengthen the legal framework: fiscal decentralization and access to resources.

PART II: INTEGRATION OF WATER-RELATED DISASTER PREPAREDNESS AND MITIGATION

V. ISSUES AND CHALLENGES IN DISASTER RISK MANAGEMENT FOR SOCIO-ECONOMIC DEVELOPMENT

This chapter is based mainly on the findings and recommendations of the Ad hoc Expert Group Meeting on the Integration of Water-related Disaster Preparedness and Mitigation into Socio-economic Development Plans, held in Bangkok on 23-24 November 2006. After taking note of the four prevailing patterns of development for economic growth and social improvement, the participants recommended to focus on the following, among priority issues for an effective integration of water-related disaster management into socio-economic development process:

- Needs to bridge the gap between experts and policy makers/ politicians
- As disaster risk management is an attractive subject in the normal circumstances, it is important to identify approaches to capture the interest of politicians?
- Mechanisms must be discussed for bridging the gap between academics and politicians
- In order to capture interest and concerns of politicians and top-level decision makers, it is necessary to focus first on socio-economic benefits of disaster risk management.
- Results of disaster risk management should not be presented technically but in a language that policy makers can use.

In addition, the participants also proposed to look into the following issues:

- How to make these issues high profile – we are aware of the issues, but how to raise awareness of others
- Enhance regional cooperation
- To learn more on how to resolve disasters especially flood related problems
- Learn from experiences on flash flood and typhoons
- Water related disasters drain the economies – how to incorporate response into national policies
- Specific solutions and policies especially for developing countries
- Lack a culture of maintenance in building infrastructure
- Apply lessons to country's policies
- Learn experience of other countries
- Early warning projects
- How to manage water especially flooding and how to incorporate into 10 year plan
- Flood protection
- Infra design
- International cooperation
- Response and recovery from loss of life, economic loss and to better help people after disaster occurs

Against the above priority issues and issues of interest, the participants discussed those issues and challenges in disaster risk management that they considered of importance for the socio-economic development process of the four development patterns as elaborated in the following sessions.

1. Issues and challenges in disaster risk management of regional development

As most of the growth centres are also major urban areas, rapid socio-economic development will lead to higher vulnerability to disasters. Among the rapidly increasing impact is the economic impacts of

floods and storm waters, as currently experienced in major cities of the region such Bangkok, Hanoi, Jakarta, Manila. As can be seen from the principal causes of river flooding in Indonesia, water-related disasters tend to aggravate with the development process as part of human interventions, such as man-made obstructions to flow or poor maintenance or incorrect procedures in operating flood control facilities.

Principal causes of river flooding in Indonesia

High rainfall in watershed
Inadequate drainage of the floodplain or delta areas
Backwater from a main river into a tributary
Gradation of the river bed
Inadequate existing flow capacity and free board
Increased run-off in deforested areas
Mud flows and landslides
Volcanic debris flow resulting from volcanic eruption
Man-made obstructions to flow (bridges, weirs etc.)
Backwater from high tide into river
Poor maintenance
Incorrect procedures in operating the manual for flood control facilities

Source: Satriyo Ronoprawiro, "Flood control works in Indonesia", country paper prepared for the ESCAP Workshop on Regional Cooperation in Flood Control and Management for Improvement of the Urban Environment in Asia and the Pacific, Bangkok, October 1998.

In the above context, challenges in disaster risk management of regional development can be viewed from the following perspectives: disaster risk management as pre-conditions for economic growth poles; disaster risk management as key criteria for continuing progress of development; disaster risk management as an important aspect of social equity in development; and disaster risk management to cope with climate change.

a. Disaster risk management as pre-conditions for economic growth poles

As experienced in many cases, most of the growth centres are part of major urban areas located in disaster prone areas, such those along coastal belts or flood plains. These areas usually have many comparative and strategic advantages for economic development to other nearby areas. The disaster threats, usually from water-related hazards, are viewed as manageable. As the competition for investment, especially from the private sector both domestic and international sources, is becoming more intense, investors must be assured of the capacity to manage the potential disasters. For this reason, disaster risk management would thus become the pre-conditions for a successful development of economic growth centres.

Flood control in Japan

Immediately after the end of the Second World War, flood control was conceived as an important activity for the reconstruction and rehabilitation of the economy of Japan. Flood control was necessary to increase food production and also for economic development. The rehabilitation and prevention of natural disasters (especially by flood) was accepted as one of the five priority objectives of the Five-year Economic Rehabilitation Plan, drafted in 1948.[a/] The importance of flood control was highlighted by the allocation of funds for this purpose. "Looking into the government investment in public works, we find that still further stress was put on flood control and disaster rehabilitation. Their share occupied nearly two thirds of the total." [a/] Subsequently, flood control and disaster rehabilitation continued to account for a major share of funds for public infrastructure investment in Japan; the actual allocation continued to increase, although the share of flood control in the total investment was reduced in comparison with that for industrial development. As a part of the national development strategy, flood control could then be seen as providing support to the industrialization programme (especially for the Pacific Coastal Belt) and thus formed an integral part of the development process.

a Masahiko Honjo, "Trends in development planning in Japan", in *Growth Pole Strategy and Regional Development*

Policy: Asian Experiences and Alternative Approaches, Fu-chen Lo and Kamal Salih, eds.(Oxford, Pergamon Press, 1978).

b. Disaster risk management as key criteria for continuing progress of development

The most important challenges faced in the development of growth centres include effective enforcement of land-use planning and management, environmental conservation and appropriate investment by all sectors. One of the most common issues in those growth centres, which are also the major urban centres, is the worsening of the traffic compounded by floods, such as currently experienced in many major cities in the region, such as Hanoi, Jakarta, Manila and New Delhi. Successful disaster risk management in these cities is expected to establish conducive environment for further economic growth. For this purpose, mobilization of resources from the public and private sectors as well as contribution from people will be necessary to overcome these problems.

SMART Tunnel of Kuala Lumpur

The Stormwater Management and Road Tunnel (SMART) project was initiated primarily to mitigate the recurring floods in the city of Kuala Lumpur, the financial, business and commercial hub of Malaysia. Studies had indicated that the critical stretch of Sungai Klang between Sg Klang /Sg Ampang confluence and Sg Gombak/ Sg Klang confluence to be flood prone areas and the fact that the river is further constrained by the Jalan Tun Perak Bridge (near Masjid Jamek) which is low, has resulted in the surrounding areas to experience flash floods. The SMART system will be able to divert large volumes of flood water from entering this critical stretch via a holding pond, bypass tunnel and storage reservoir. This will reduce the flood water level at the Jalan Tun Perak Bridge, preventing spillover.

However, at the design stage of SMART, the dual purpose concept was born from the ingenuity of the project proponents and the motorway tunnel was integrated into the system to relieve traffic congestion at the main Southern Gateway to the city centre. The SMART project is implemented under the close supervision of the Government, namely the Drainage and Irrigation Department of Malaysia and the Malaysia Highway Authority.

Source: Salmah Zakaria, 2006, Presentation at the Expert Group Meeting of UNESCAP, November 2006

c. Disaster risk management as an important aspect of social equity in development planning

Experiences in many developing countries showed that urban development with only focus on economic and physical purposes without giving adequate attention to social dimension and human development such as poverty eradication and environmental conservation, will lead to social and political problems. In those circumstances, urban poverty and disaster vulnerability will increase with development. In order to ensure sustainable development of growth centres, not only disaster risk management but also poverty eradication measures must be integrated into the socio-economic development process.

Urban Poverty and Disaster Risk Management

The Urban Disasters and Reconstruction dialogue debated the establishment of a permanent link between emergency relief and the transitional phase of development, including disaster risk reduction. The discussion underscored the importance of disaster risk reduction as a foundation for sustainable development of urban settlements. It was emphasized that disaster risk reduction policies should be integrated into all poverty reduction and development policies, be cross-sectoral, thus complementing the overall concept of sustainable relief. In particular, disaster risk reduction needs to be included in the local government agenda, using participatory processes as a key vehicle for implementation. Disaster risk reduction is a joint responsibility, which should be facilitated by solid political commitment and sound institutional support.

There was further debate on disaster risk reduction in an urban context. Urban settlements represent concentrations of production, economies and social development, at the same time generating risks and encompassing vulnerabilities not only for its residents, settlements and assets but often also for regional, if not global, economies. With the ever shrinking global village, contingent risk from crisis in human settlements affects neighbouring towns, regions, states, and, in some cases, the rest of the planet. The discussions focused on the importance of multi-sectoral and multi-level capacity-building for reducing risk, including that of decision-makers.

Other points of emphasis included the importance of understanding the root causes of disasters, identifying the gaps in strategy implementation, respect for accumulated cultural wisdom and community intelligence, and consideration of environmental aspects as key elements in implementing disaster risk reduction as part of sustainable relief. Active participation of civil society was highlighted as crucial to sustainable disaster mitigation, as well as recovery from a crisis. Joint efforts of the communities, private sector, financial institutions and academia would strengthen the voices of the civil society towards more inclusive and comprehensive disaster management strategies.

Source: Report of the Second Session of the World Urban Forum, Barcelona, Spain, 13-17 September 2004, UN-Habitat, 1 November 2004

d. Disaster risk management for future cities: coping with climate change

Many major cities in the region are well protected from river floodings through a system of dikes, such as those cities along the Yellow River in China or in the Red River Delta of Viet Nam. Similarly, the rapid growth of urban areas requires a proper system of drainage against storm waters resulted from heavy rainfalls, for which well-established engineering designs are adopted. With the emerging situation under the impact of climate change, these design standards in several cases are no long appropriate. One of such examples is the pending revision of flood frequency design standards for drainage systems for many major cities in the region. Disaster risk management for growth centres must therefore address possible impacts of climate change.

Coping with Extreme Events in the Red River Delta

Changing hydrologic conditions caused by upstream development in the Red River Basin of Viet Nam and by changing global and regional climate patterns , extreme flood events are expected to occur in the future with increasing frequency and with higher intensity. Constraints in costs and lands make it prohibitive to increase the height of the existing dyke system in the Red River Delta. These constraints call for new non-structural methods to reduce the severity and magnitude of floods, using the special physical conditions of the River Basin. One such method is the use of karst caves in limestone areas to cope with extreme flood events by storing excess flood waters and gradually releasing the waters into ground water aquifers in a controlled and calculated manner. This paper examines the proposed new flood control measures to use groundwater flood retention of the extensive pervious karstic limestone formation in the study area. In order to support this new concept of fighting against extreme floods, known as 'flood karst method', hydraulic modeling is extensively used to study different flood scenarios to identify possible options for decision-making. These options are derived from the studies on how best to combine the use storage of existing and potential surface water storage and underground retention facilities to cope with excess storm waters of extreme flood events. Finally, on the basis of the simulation of possible contributions by the facilities available, namely the Hoa Binh Reservoir, the Karst caves, the flood diversion works and proposed emergency spillways, a set of operation procedures was recommended for adoption to minimize impacts of extreme flood events.

Source: Dang Quang Tinh, "Coping with Extreme Flood Events in Using Karst Caves in Limestone Areas in the Red River Basin of Viet Nam"

2. Issues and challenges in disaster risk management of sectoral development

Sectoral development patterns are usually adopted to reflect the importance of selected sectors in the context of national development. For example, the second National Economic Development Plan (NEDP) of Thailand (1967-1971) moved from the mainly public resources allocation for project development in the First NEDP (1961-1966) to sectoral development planning to cover strategies for each sector such as agriculture, manufacturing, education and health[12]. One of the most important challenges in such approach is the coordination of policies and strategies among key sectors and also with respect to the overall development process of the countries. Experiences from developing countries showed that integration of disaster risk management at the inception of the development process, such as demonstrated for agricultural development of India, could lead to better strategies for effective integration of disaster risk management into the development process.

Box Incidence of flooding on agriculture in India

The economy and development of the people of the Ganges–Brahmaputra–Meghna Basin are dependent on agriculture. On average, the crop loss accounts for about 76 percent of the total damage caused by floods. The first flood generally occurs in June and damages standing crops – rice and jute. The flood from July to September is most devastating and damages the major *kharif* crops and jeopardizes the economy of the people. It is difficult to protect the standing crops during flood periods and farmers will have to live with floods for years to come. Cropping patterns in flood-affected areas must be changed to ensure the stability of crop production. Some of the important measures to be taken are: (a) Reserve stock of seeds is required immediately when the crops are damaged in early flood; (b) Reserve stock of fodder; (c) Flood warning system; and (d) Mixed cropping.

There is a wide scope to grow crops including rice during the flood-free period of the year, which is more productive because of better response to fertilizer and more sunshine hours. Therefore, the best way to ensure production in flood-prone areas is to grow crops in the flood-free period. This requires:

(i) restructuring of cropping pattern based on the agro-climatic conditions of flood prone areas;

(i) feasibility of raising crops; and

[12] Porametee Vimolsiri, "Integration of Poverty Alleviation and Social Sector Development into the Planning Process of Thailand", prepared for ESCAP, Bangkok, 2002

(ii) improvement of the irrigation system.

Crops such as wheat, rape, mustard, potatoes, lentil, summer mung, boro rice and almost all vegetables including fodder crops are usually grown in flood-free periods. Some adjustments in sowing period are required to grow black gram, green gram (mung) and for double cropping of rice and maize before and after the flood. Instead of growing rice from July to November/December, it would be necessary to grow rice from the end of September to December/January. In changing the cropping pattern, participation of the farmers is necessary.

Source: Ghany, M., *Flood control study in the Ganga-Brahmaputra-Meghna River basin*, 2001

3. Issues and challenges in disaster risk management for integrated rural development

Integrated rural development tends to cover large areas, such as recommended in the rural centre planning concept of ESCAP[13]. Under these circumstances, it is important to address disaster risk management under the impact of both large-scale hazards (affecting many areas) as well as localized natural disasters (which could affect the functionalities of the network of development centres). The following recommendations were recorded at the Session on "Disaster prevention functions in rural areas and disaster resistant sustainable livelihoods" at the World Conference on Disaster Reduction, Kobe, Japan in January 2005 aim at building disaster-resistant national land and communities in the countries of the Asian monsoon region [14]:

- It is important that the multifunctionality of agriculture, forestry and fisheries, rural communities and forests are evaluated appropriately, and that conservation measures by means of the sustainable development of agriculture, forestry and fisheries are devised for these functions. Concerning new land use needs accompanying economic growth, in particular, we need to consider land use plans in rural areas, including measures to conserve these functions.
- To sustain experiences and technologies for coexisting with nature in agriculture, forestry and fisheries, as well as "mutual aid" schemes manifested by rural communities in the event of a disaster, and to encourage positive participation in disaster prevention activities by people involved in agriculture, forestry and fisheries, it is important that we improve the economic and living environments of rural areas, and devise measures enabling sustainable agriculture, forestry and fisheries to be practiced.
- Disaster resistant communities and infrastructure can only be reached through sustainable development and vice versa. The common element which sites between the two is livelihoods, which needs to be supported by a strong asset base; natural, physical, social, financial. Livelihood asset base of the poor is a reflection of the systems of governance. The weaker the asset base of the people, they are more vulnerable to hazards. Enabling governance structures are a pre-requisite for creating conditions for asset enhancement. The current decentralized governance structures in most South Asian countries offer and entry point in this direction.
- Disaster Resistant Sustainable Livelihoods framework takes a holistic view towards addressing the issues of disaster risk and poverty. It has the potential to meet the challenges of the present by applying within the current governance, institutional and policy frameworks in the sub continent, and to meet the challenges of the future. Re- building of the damages resulting from recent tsunami, which is right now high priority in Asia, is an opportunity to apply a long-term vision towards disaster risk and poverty reduction. DRSL in this sense is extremely relevant and timely.

The Session called on the national governments and international donors, international development organizations to apply the Disaster Resistant Sustainable Livelihoods framework in the policy decisions, development planning and in investment decisions.

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[13] Guidelines for Rural Centre Planning (RCP): Rural Industrialization – Organizational Framework for RCP, United Nations ESCAP, Bangkok, 1990

[14] Session Report, "Disaster prevention functions in rural areas and disaster resistant sustainable livelihoods", World Conference on Disaster Reduction, Kobe, January 2005

4. Issues and challenges in disaster risk management of basin development

To a greater or lesser extent, all countries in the ESCAP region are vulnerable to water-related natural disasters. Such disasters may be caused by cyclones, floods, land instability and drought. Burgeoning population growth, along with intensified agricultural development and the accelerating expansion of urban centres, contribute to a steady increase in the magnitude of actual and potential disaster losses. An ever-increasing proportion of national populations live in areas which are susceptible to water-related disasters. These additional numbers of people put escalating demands on limited natural resources, leading to over-exploitation of resources and increasing degradation of the natural environment.

A frequent consequence of poor land use, aggravated by the occurrence of such water-based natural disaster events as tropical cyclones and floods, is soil erosion. On upland watersheds, such developmental land-use practices as deforestation, cultivation and the destruction of native vegetation can lead to accelerated soil erosion. Steeply-sloping forested land, when cleared of the protective cover of vegetation, is highly susceptible to soil erosion and landslip. In areas where the soil structure is fragile, the extent of soil erosion can be so serious that the potential agricultural productivity is irreversibly impaired. The adverse effects of land degradation are both insidious and cumulative. Not only can urban and rural populations be directly affected, but these effects can also impact on overall national prosperity and welfare. Even in areas subject to more gradual and less obvious erosion, there will be an inevitable and progressive reduction in soil fertility and productivity unless the land is developed and managed within its capability.

In recent years there has been an increasing recognition of the need for new approaches to the management of land and water resources, aimed at the control of degradation, the long-term, sustainable utilization of natural resources and the maintenance of the quality of the natural environment. Efforts to understand the interaction between natural hazards and the environment, the choices societies may make to increase or reduce the risk of disasters, and the community's ability to predict, control and limit the impacts of disaster events, are all part of rational environmental management.

Box. Flood control and management in the major deltas of Viet Nam

Viet Nam has two major deltaic areas forming the two most important agricultural regions of the country: the Red and Mekong deltas. Floods are annual events in these areas. In the Red River basin, floods are known to be among the most violent types of river floods. Dykes were therefore built in the early periods of Vietnamese history and as early as in the third century BC. It was recorded that a major dyke 8,500 m long and 6 m high was built in the ninth century to protect Hanoi capital. Since then, the dyke system has continued to be strengthened in response to frequent flood events. It was also recorded that from the tenth to the nineteenth centuries, the dyke system was breached in 188 years. From the beginning of the twentieth century, the Red River dykes continued to be strengthened for better flood control, for example, the level of protection of Hanoi was raised from 10 m at the end of the nineteenth century to about 12 m in 1944. Following a major dyke breaching in 1945, major efforts have been made continuously over the past five decades to strengthen the dykes. In all, 255 million m^3 of earth embankment and 4.2 million m^3 of rock revetment have been made to raise the level of protection from 12 to 14 m. As well as dyke improvement, the completion of the Hoa Binh reservoir on the Da River, a tributary of the Red River, in 1990, was expected to reduce from 14.14 m to below 13.50 m the historical flood level experienced in 1971. With the rapid urban expansion in the Red River Delta, efforts are being made to ensure that there is no reduction in the flood-carrying capacity of the major channel, particularly by illegal settlements.

In the Mekong Delta, floods are, in contrast, much more gradual but prolonged: floods may last for nearly three months. This long period of flooding severely affects the economic productivity of about 2.6 million ha annually and the social well-being of the local inhabitants. Flood control and management has been a major focus of planning carried out within the framework of the Mekong cooperation programme initiated by ESCAP in 1957. Since the late 1980s, there has been a major shift in flood control planning. The new development planning philosophy adopted by the Vietnamese water resources planners promotes co-habitation with the floods by controlling only the early floods and improving drainage after the annual flood peaks. The new flood damage mitigation has resulted in extension of the cultivating period to enable the cultivation of two paddy crops of high-yield varieties and consequently increased the annual paddy production of the delta significantly. As a result, rice production in the flood-affected area of the Mekong Delta has increased more than threefold over the past 25 years, from about 2.4 million tons in 1976 to nearly 7.5 million tons at present. The focus of flood control and management in the Mekong Delta is being shifted towards improving the social conditions and safety of the communities following a major flood disaster in 1994.

Sources: Phan Khanh and others, *Dykes in Viet Nam - A Provisional History* (Hanoi, Agricultural Publishers, 1995); and Viet Nam country report, February 1999.

The periodical occurrence of water-based natural disasters cannot be avoided. It is far more rewarding and effective to direct government and community effort towards the mitigation of damage than

towards disaster response, relief and recovery. For such measures to be fully effective, an integrated, river-basin wide approach is needed. Such an integrated river basin management involves the adoption of a coherent management system for land, water and vegetation which can ameliorate the adverse impacts of natural disasters and help to achieve the sustainable use of the natural resources within a watershed. This approach recognizes that such factors as urban and agricultural development, the loss of wetlands, land drainage schemes, forest clearance and other activities carried out in the watershed, even though well away from river channels, can increase the volume and rate of run-off and worsen flood conditions. Accordingly, integrated river basin management involves the coordinated use and management of land, water, vegetation and other bio-physical resources within the entire river basin with the object of ensuring minimal land degradation and erosion and causing minimal impact to water yield and quality and other features of the environment.

VI. WATER-RELATED DISASTERS PREPAREDNESS AND MITIGATION

1. Experiences of selected countries

a. Experiences of China

The experiences of ***China***[15] showed a major shift adopted starting in 2003, when the Ministry of Water Resources declared that the flood and drought disaster mitigation in China ***w***ould shift "from flood control to flood management" and "from simplex drought-fighting to comprehensive drought management". New measures taken in response to this policy shift include the Flood Management Strategy Study Project which aimed ***t***o develop a strategy for integrated flood management appropriate to the flooding characteristics encountered in China and pressures produced by the very rapid rate of development. It also aimed to identify:

- Current good flood management practices in the country, through case study investigation in six selected provinces;
- Advanced flood management practice internationally;
- Strategic Framework and Action plan to advance integrated flood management in the country

Through the above study, an effort was made to adopt a new concept for flood management in China, as summarized below:

- Floods present not only a hazard, but also opportunities and benefits for natural resource and the environment.
- There are complicated relationships, interactions and transformations among them.
- Flood management is to strive for the most favorable possibility through effective improving and operating all related flood prevention and mitigation systems under a series of uncertainties.
- It should be stressed that the measures to minimize the flood damages may not always bring the best impacts in political, social, economic and ecological aspects.
- It is the essential of the flood risk management to modulate the interests concerned with flood risks existing objectively among communities and between man and nature by means of legal, executive, economic, technical, educational and engineering measures comprehensively.

The main outputs of the Flood Management Strategy Study included the following:

Fundamental Concept of Flood Management

Strategic Framework

- Objectives: Long term and intermediate
- The general strategy and strategic tasks

[15] Quozhi Du, Flood Risk Management and Socio-Economic Development Planning in China, Presentation at the Ad hoc Expert Group Meeting, 23-24 November 2006, ESCAP, Bangkok, 2006

- The major strategic measures
- The operation mode and promoting mechanism

Action Plan

- Perfecting legislation system and policies
- Enhancing institutional organization for flood management
- Pushing integrated flood management planning
- Forming a viable and effective flood management mechanism

The Chinese experiences in the implementation of the policy shift pointed out the following lessons:

- It is a gradual process to shift from flood control to flood management, implying the adjustment and improvement of conceptual frameworks, administration systems and operating mechanisms.
- We should select a flood management approach based on the risk of flooding in relation to the Chinese conditions.
- Flood management is not a denial of flood control structural measures, but stresses a more rational layout and operation of flood control systems.
- In the next two decades, it will still be the golden phase for large-scale construction of infrastructure.
- Wise planning, designing, constructing and operating of flood control systems, will not only meet the demands of flood damage reduction, but also play an important role in dealing with water shortages and water environment degradation.
- Flood Emergency Management is an important component of the flood management.To enhance the emergency response capacities is an urgent task.
- Dams are a very effective structural measure because they can store large flood volumes, modifying flood routing and significantly reducing peak flows, and then increasing available water resources for drought mitigation.
- Dams and reservoirs play important roles that cannot be substituted by other measures in the integrated flood and water management system, and that the key issue is how to hold moderation.
- The role of dams in view of the whole basin involving not only hydrometeorological and engineering factors but also socio-economic and eco-systemic factors. In the meantime, the dams and reservoirs should be planned and operated more carefully to avoid a vicious circle in interaction among regions and between man and nature.
- The operation of dam is not to eliminate floods. Managed flood releases form reservoirs through a rational operation of dams will be an effective measure to promote a harmonious relationship among regions concerned in a river basin as well as between human and nature.

b. Experiences of Indonesia

Experiences of *Indonesia*[16] pointed out the efforts made by Government of Indonesia to seek and promote a more promising approach that would focus on flood management, considering the fact that floods cannot be prevented totally. It aims to adopt the concept of "living with the floods", with focus first on non-physical plans to limit the damages, and secondly, direct physical investments to feasible locations. Preventive measures comprise risk assessment, and subsequent preparation or updating spatial plans and raising public awareness about flood risks for new development and required preventions. In this philosophy, it promotes, as the most important component of the approach, the resilience of community to live in harmony with flood such as community service and empowerment of the society. The flood preparedness and mitigation programme consists of provision of early flood warning system and flood

[16] Bambang Warsito, *Action Report Toward Flood Disasters Reduction - Indonesian Case*, Presentation at the Ad hoc Expert Group Meeting, 23-24 November 2006, ESCAP, Bangkok, 2006

hazard mapping and risks guides, flood resistant building code, raising awareness, campaign, capacity building, education and training, etc. The priority targeted areas include JABODETABEK (Jakarta,Bogor, Depok, Tangerang dan Bekasi), Bandung, Semarang, Surabaya, Makassar, Denpasar,Padang, Medan, and Lampung and other cities that have flood prone areas.

Specific measures would include the following:

- Land use (spatial) planning
- Integrated Water Resources Management
- Provision of adequate urban infrastructure
- Provision lows priced housing to resettle poor people obstructing discharge of flood waters
- Community service and empowerment of society comprising early flood warning systems and hazard mapping and risks assessment as well as raising awareness.

These would also involve the following stages of development:

- In the prevention stage, efforts are mainly focused on prevention measures such thatdamages and victims are kept at minimum level during disaster.
- In the emergency stage, efforts are focused on search and rescue measures and evacuation as well as emergency supports such as temporary shelters, food supplies and medical service for disaster victims.
- In the rehabilitation stage, efforts are directed to rehabilitate any damages on physical and non-physical matters caused by floods as well as community empowerment and to recover the strength of victims.
- In the reconstruction stage, efforts are directed to reconstruct public infrastructures and facilities such the community live are recovered.

The Indonesian experience also pointed out the following important legal framework for integrated flood management measures, as stipulated in Law 7/2004 related to river basin management.

- The principle “one river, one plan, one coordinated management” may imply “many managers”, but these should coordinate the activities.
- The law also envisages river territories (Wilayah Sungai, WS), areas with hydrologic boundaries, comprising a distinct combination of watersheds of several rivers.
- General arrangements are formulated in the law, for more specific aspects the government will issue new government regulations (PP)

The Ministry for Public Works (PU) coordinates development and management of assets in the build up area through :

- Spatial Planning
- Roads
- Urban and Rural Development
- Water Resources
- Technical Research and Development
- Human Resources Development and Guidance of Construction and Investment

The experiences also pointed out the need for policy support and good governance to involve the following important issues that must be part of flood management projects, which are identified in the recent policy and institutional reforms in Indonesia:

- Decentralization
- Integrated water resources management (“one river, one basin”)
- Basin coordination institutions

- Empowerment of local communities (water users associations) in decision-making
- Capacity building of government organisations
- Equal distribution of costs and benefits between the various stakeholders

c. Experiences of Malaysia

The experience of ***Malaysia***[17], especially those related to the Klang River Basin and the development of Kuala Lumpur, provided a wide spectrum of measures from preventive to curative. It was pointed out that preventive measures are essential for continued economic and social development and supported by improvement in governance, which would include policy development in terms of guidelines, planning and research and development. For curative measures, it was pointed out that these structural measures are very costly and should be carried out as a final alternatives.

The experience of development of guidelines was presented with the preparation of the "**Urban Drainage Stormwater Management Manual**" that had been adopted by the Government for application and enforcement.

The evolution of flood management in Malaysia was also linked to the implementation of the recommendation of the World Summit on Sustainable Development in Johannesburg in 2002 when the country was formulating its integrated water resources management plan (IWRM) in 2005. As part of these efforts, application of strategic planning and management was made for the development of an IWRM plan for the Langat River Basin. This exercise pointed out the following experiences:

- A holistic Integrated River Basin Management (IRBM) approach that involves sensitizing land-focused agencies to water-related concerns.
- A National Water Policy for water conservation, focusing on protecting catchtment areas and reservoirs, and issues of inter-basin transfers.
- New emphasis on preventative and precautionary measures; keeping development levels within the carrying capacities of river basins; and moving from the development of new water resources to the conservation of existing ones.
- The federal-level National Water Resources Council to review the effectiveness of all aspects of the water sector and include state-level participation.
- A new Urban Drainage Master Plan to control excess water at the source.
- National Spatial Planning, which aims to ensure equitable geographic distribution of development projects and takes into account river basin characteristics such as water supply and drainage and discharge capacities.
- Decision Support Systems are being created with various basins being grouped together for planning purposes.

The overall experiences on the development of an IWRM plan for the country pointed out to the following lessons:

- The will power to enforce guidelines and legislation by certain quarters is still wanting
- Public participation in IWRM has started & should be further encouraged and promoted
- Research efforts to build up knowledge in IWRM should be enhanced.
- An integrated and comprehensive water resources management legislation should be enacted
- An enabling environment should be created encourage and promote public participation in a proactive, constructive and effective manner
- The formal and informal processes of capacity building in IWRM be further strengthened.

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[17] Salmah Zakaria, *Water-related Disasters in Malaysia; Langat River Basin;* and *Storm-water Management And Road Transport Tunnel (SMART Tunnel),* Presentations at the Ad hoc Expert Group Meeting, 23-24 November 2006, ESCAP, Bangkok, 2006

d. Experiences of Pakistan

The experience in ***Pakistan***[18] pointed out that among the key major policies on flood disaster management is the Flood Disaster Management Policy in Pakistan, which aimed in achieving the following main objectives:

- Reduction of floods and flood damages through technically sound and economically viable strategy;
- Protection of cities, vital infrastructural installations, prioritized economic areas and other areas in that order;
- Exploring more effective use of existing flood control facilities;
- Improvements in Watershed and River Management Practices;
- Improvement in Flood Forecasting & Advance Warning System;
- Minimize adverse effects on natural ecosystem and environment;
- Community participation approach for effective flood preparedness, fighting and rehabilitation;
- Flood adaptability

Major Structural Measures for Flood Disaster Management included the following:

- Construction of Embankments
- Construction of Spurs/Battery Of Spurs
- Construction of Dikes/Gabion Walls/Flood Walls
- Construction of Dispersion/Diversion Structures
- Channelization of Flood Waters
- Construction of Delay Action Dams
- Construction of Bypass Structures

Major Non-Structural Measures for Flood Disaster Management included the following sets of activities, especially for the improvement of flood forecasting and warning systems:

The improvement of flood forecasting systems would be carried out through the following activities:

- Effective Data Collection and Dissemination System
- Real Time Rain-Fall and River Flow Data Collection
- Weather Radar Prediction
- Modern System of Transmission of Flood Forecasts.

Improvement of early flood warning systems is expected to include the following:

- Based on effective Flood Forecasts, early Flood Warning is issued
- Reliable interaction between all related Flood Control and Relief Agencies.
- In-time warning and evacuation arrangements by Provincial Relief Departments, District Administrations & Pakistan Army.

Flood Disaster Risk Management Agencies included various Departments/Agencies at both the federal and provincial levels as follows.

1. Federal Flood Commission (FFC)

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[18] Riaz Ahmad Khan, *Experience in the Integration of Water-related Disaster Risk Management into Socio-economic Development Plans in Pakistan*, Presentation at the Ad hoc Expert Group Meeting, 23-24 November 2006, ESCAP, Bangkok, 2006

2. Flood Forecasting Division (FFD) of Meteorological Department
3. Pakistan Army Engineering Corps
4. Provincial Irrigation and Power Departments
5. Water and Power Development Authority of Pakistan (WAPDA)
6. Emergency Relief Cell, Cabinet Division, Islamabad
7. Provincial Flood Relief Departments
8. Pakistan Commissioner For Indus Waters (PCIW)
9. Police Information Department
10. Pakistan Forest Department
11. Pakistan Railways
12. Information Department
13. Provincial Communication Departments
14. District Administrations

The current practices for the integration of water-related disaster risk management is reflected in the implementation of flood risk management polices through the National Flood Protection Plans under the following integrated approach:

- Review of flood Damages to public sector infrastructure and review of plans for restoration and reconstruction works;
- Measures for improvements in Flood Forecasting and Warning System;
- Standardization of designs and specifications for Flood Protection Works;
- Evaluation and monitoring relating to progress of implementation of the National Flood Protection Plan;
- Preparation of a research program for Flood Control and Protection.

Major policy measures adopted by the Government for better flood management in water resources areas include the following:

- Immediate construction of at-least 5 large multipurpose storage dams upto 2016;
- Augmentation of existing storages and judicious regulation for flood mitigation ;
- Further supplementation through Small & Medium dams;
- Further improvement of water conveyance infrastructure;
- Improvement in drainage & reclamation system;
- Effective flood control through improved flood forecasting & warning system, promotion of flood retardation through construction of multiple storages and flood embankments and adequate maintenance of existing infrastructure.

e. Experiences of the Philippines

The experiences of a recent Summit in the Central Luzon of the Philippines[19] identified 3 major areas of intervention in terms of initiating policy reforms and the implementation of plans, programs, and projects as follows;

- Water and Soil Resources Management
- Risk and Vulnerability Management and
- Institutional Arrangement and Water Pricing

The Summit also proposed the Strategies to include the following:

- Inclusion of massive watershed rehab and management in the list of investment and funding priorities

[19] Resito V. David, *Case Study of Central Luzon July 2005: Water Resources Management Summit*, Presentation at the Ad hoc Expert Group Meeting, 23-24 November 2006, ESCAP, Bangkok, 2006

- Revisit current flood control strategies to include alternative approaches (encouraging infiltration and gradual release of surface water)
- Recovery of river regimes
- Full adoption of the integrated water resources management (IWRM) concept
- The National Water Resources Board (NWRB) to function as the apex organization
- Integration of baseline data
- Terminate unsustainable flood control projects

f. Experiences of Republic of Korea

The experiences of flood management in ***Republic of Korea***[20] included changes in water policy at the national level involving the following

- National Water Resources Plan
- Long-term Plan for Dam Construction
- Waterworks Management Plan

The above policy changes also included related changes in flood disaster prevention policies in the following aspects:

- Comprehensive River Basin Basis Control Plan
- Systematic Expansion of Investment on River Improvement Project
- Planning for reinforcement of Flood Control Capacities of existing Dams

Ultimately, it was expected to involve the following policy measures for reduction of natural disaster risks:

- The governance reform in building global disaster risk reduction capacity and in mainstreaming disaster risk management
- Legislation can set standards and boundaries for reduction of natural disaster
- The key challenge in building governance structures for human development and risk reduction is to establish the policy with equity

g. Experiences of Thailand

The experiences of ***Thailand***[21] highlighted the following features of the national water policy.

- Accelerate promulgation of Water Act as the framework for national water management
- Create water management organizations both at national and river basin levels with supportive legislation
- Emphasize suitable and equitable water allocation for all water use sectors
- Formulate clear directions for raw water provision and water sources development
- Provide and develop raw water sources for agriculture purpose
- Develop and include water related topics at all levels of educational curriculum
- Promote and support participation of the public, non-government and government organizations
- Accelerate preparation of plans for flood and drought protections
- Provide sufficient and sustainable financial support for action programs in line with the national policy

Urgent measures for expecting high tide during flood in the Chao Phraya Delta included the following.

- Decreasing flow in the north of Chao Phraya Dam by diverting water into the field in right and left bank and controlling flow through dam.
- Decreasing flow in the south of Chao Phraya Dam by diverting water into the field in right and left bank about 224,000 ha

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[20] Kim Sang Ug, *The socio-economic development process and water-related disaster risk management in Korea***,** Presentation at the Ad hoc Expert Group Meeting, 23-24 November 2006, ESCAP, Bangkok, 2006

[21] Kanapoj Wandee, *Information of Recent Floods – Country Report of Thailand***,** Presentation at the Ad hoc Expert Group Meeting, 23-24 November 2006, ESCAP, Bangkok, 2006

- Pumping and draining water in lower part of Chao Phraya Basin into Nakornnayok River, Bangpakong River , Tha Chin River, Mahachai Canal and sea
- Draining water through Klong Latpho regulating gate during low tide
- During the high tide period, the flow from Pasak dam will be decreased
- BMA will not pump water into Chao Phraya River during a high tide period.

Remedy measures after flooding would include the following.

- Rehabilitation of water sources for consumption and shallow wells
- Prevention of polluted water in prolong flooding areas
- Damage evaluation and compensations
- Recovery agriculture land
- Rehabilitation of houses and infrastructures
- Sanitation, garbage, cleaning and disease control
- Remedy health and mental health

The national strategies for the mid and long-term development would include the following.

- protection and rehabilitation of forest
- conservation and remedy: forest, water resources, water ways and wetlands
- water retarding by using retarding basin, dam
- land used utilization
- flood forecasting and risk insurance
- urban protection
- administration of 25 major river basins

2. Large-scale structural or engineering measures

(a) Major water storage reservoirs

Major water storage reservoirs were the most commonly adopted measures for flood control and drought management in the region prior to the 1980s. The construction of major reservoirs for multi-purpose use can lead to better regulation of the flow regime and therefore minimize the flooding potential. An example of active storage reservoirs reaching 61 per cent of the annual run-off was achieved for the western river basins in Thailand. However, the large areas of land required to store the flood flows of major rivers are generally no longer available, especially where they involve the flooding of valuable agricultural lands. Many sites that are geologically and topographically suitable may require very considerable and expensive land acquisition and the displacement of large populations. The cost of large reservoirs can generally only be justified where they protect heavily developed urban areas and are the only practical means for reducing flood damage significantly. In recent years, most of the water storage reservoirs are adopted for small and moderate-sized streams.

(b) Dykes and floodwalls

The principal purpose of dykes and floodwalls is to confine flood waters to the stream channel and a selected portion of the floodplain. These barriers protect only the land area immediately behind them, and are effective only against flood depths up to the chosen level for which they were designed. Many long and high dykes have been constructed in the region, such as in China, India and Viet Nam. In China, there was over 246,000 km of dykes, in India, about 16,000 km and in Viet Nam about 8,000 km. Dykes and floodwalls may create a false sense of security about the degree of protection provided. Floods exceeding the design levels can cause disastrous loss of life and property. Dykes and floodwalls may increase flooding in other areas and are therefore mostly designed to form part of a comprehensive programme. In the region, dykes are mostly used for protection in rural areas and floodwalls in urban areas. The requirements for the design and construction of dykes and floodwalls are governed by the degree of hazard to life and property within the protected area and by site conditions. In many areas in the region, the 100-year return period flood is generally accepted for protection of residential development. For agricultural areas, the most common level of protection against flooding is the 10-year return period.

(c) Retarding basins and flood storage areas

Flood storage and retardation are used to reduce the flood peak at downstream locations and confine flooding to areas within the flood control system. This flood mitigation measure is being increasingly adopted in the region to mitigate urban flooding as well as flash flooding and riverine flooding. It is widely employed in several countries in the region, such as in Australia, Bangladesh, Indonesia, Japan, Malaysia, Thailand and Viet Nam. Retarding basins can also play a role in the improvement of water quality by the removal of floating debris and the collection of sediment. Low land along the river and natural depressions on the floodplain can be utilized for the off-river storage of flood waters. The efficiency of operation of such storage can usually be improved by providing it with suitable intake structures for controlled filling and outlet structures to permit controlled releases when downstream conditions allow.

(d) Bypass floodways

Bypass floodways or flood diversion structures serve two functions in flood mitigation: to provide an additional outlet for water from upstream and to create large, shallow reservoirs to store a portion of the flood water and decrease the flow in the main channel. Flood diversion may result in the shift of the main river channel, such as the Tone River in Japan. Flood diversion can utilize a major flood channel, such as the Hai River system in China, where the total flood design capacity has recently been increased nearly 10 times, to about 25,000 m^3/s. A similar experience in Viet Nam showed that the Day Channel in the Red River basin carried only 60 per cent of the flood diversion capacity of 5,000 m^3/s when a bypass floodway was installed. Flood diversions are being increasingly and commonly accepted in the region to protect major cities or urban areas. Such diversions are being planned for Bangkok and Jakarta. However, opportunities for the construction of flood diversions are limited by the topography of the area and the availability of low-value land which can be used for the floodway.

(e) River training works

River training works are aimed at modifying the hydraulic conditions of the watercourse or the floodplain, and/or flood channels constructed within the floodplain. These works enable flood waters to be passed at a lower level than would occur naturally. In many cases, these measures are adopted to mitigate the cumulative impact of upstream developments, such as large-scale deforestation, urbanization and reclamation of wetlands. Several systematic programmes of river training works have been implemented in several countries, such as in Australia, Japan, Malaysia and Thailand. In several other countries, river bank protection works have been implemented to minimize the impact of changes in meandering river channels, such as in Bangladesh, China, Lao People's Democratic Republic, Thailand and Viet Nam. River training works adopted in the region include channel modification measures and various channel structures, such as groynes, revetments and sediment control structures.

(f) Drainage evacuation systems

Drainage evacuation systems are mostly used in urban areas to dispose of water produced by storm run-off from within the protected area behind dykes or floodwalls. These systems include gravity drainage through pipes fitted with gates during periods of low river flow; temporary accumulation of drainage flow in storage areas; and pumping of interior drainage water during periods when the gravity drainage outflow is restricted by backwater. These measures are common in areas subject to flash floods, such as in Japan and Malaysia. These measures are also used for the protection of major urban areas in Bangladesh, India, Indonesia and the Lao People's Democratic Republic. In other countries, a combination of these means was adopted to minimize operation costs, particularly for areas under the influence of tidal fluctuation, such as in the Chao Phraya Delta in Thailand and the Mekong Delta in Viet Nam.

3. Land management measures

Land management has been adopted as a complementary measure to the major engineering measures for flood mitigation and control. Land management measures may include a variety of structural and non-structural approaches. The structural approaches comprise a number of small and relatively low-cost mechanical devices to reduce run-off rates or volume, to control or retard overland flow or to give protection against erosive or scouring forces. The non-structural measures comprise a variety of farming, cropping and cultivation techniques the purposes of which are to maintain a protective vegetative cover,

increase infiltration and impede overland flow. For the most effective results, a number of these measures are generally used. The application of these structural and non-structural measures is necessary to achieve integrated watershed management for optimal management results. Land management is a necessity, particularly for highly urbanized watersheds such as those in many areas of Australia, Japan, India, Indonesia and Malaysia.

On cultivated lands, special cropping methods and tillage practices can be employed to minimize the time periods during which the ground must be unprotected during land preparation, seed planting or after harvesting. These techniques are aimed at reducing the total area of ground exposed to erosive rainfall at any time. In addition, farming practices or small-scale structural measures can be employed to improve infiltration, retard run-off and reduce the erosive energy of overland flow. Strip cropping and alley cropping, where alternating strips of different crop types and different stages of the cropping cycle are planted, are effective methods of erosion control which act not only to maintain effective crop cover but also to retard overland flow and reduce the erosive energy of run-off. The application of techniques of this kind is usually termed “conservation farming”.

A wide variety of terrace-like structures are employed for erosion control under a range of topographic and farming conditions. In general terms, terraces may be constructed for several purposes, which can include run-off diversion, run-off detention, the slowing of overland flow velocity, the reduction of erosive slope length, improved infiltration and soil moisture retention, slope stabilization or the retention of ponded water for irrigation, particularly for rice production. On gently sloping agricultural or grazing lands, low channel-type terraces can be so constructed that crops or pastures can be planted on them and they cause little loss of productive land. On steeper country, terraces have to be more substantial structures and they may take significant areas of land out of production. On steep land, bench terraces become very substantial and expensive structures which alter the appearance of the landscape completely and serve not so much for erosion or moisture control but principally to permit farming and cultivation to be undertaken on land where agriculture would otherwise be quite impossible.

4. Land-use control measures

Land-use control has been widely adopted in response to increasing population pressure. Uncontrolled land use has led to significant changes to watershed ecosystems and land degradation. These changes usually have adverse effects on the natural hydrological cycle and lead to an increase in the intensity of floods. The application of the land management measures mentioned above can result in improvement or conservation of the hydraulic conditions of the watersheds for flood mitigation. However, these measures need to be supported by the imposition of land-use controls, designed to manage degradation and minimize exposure to the risk of disasters. To achieve this objective, legislative controls which empower the relevant government authorities to direct land-use planning policies and practices related to watershed management are being widely adopted and implemented in several countries in the region, particularly in those with rapidly urbanizing catchments, such as Australia, Japan and Malaysia. Through these controls, the authorities should strive to ensure that an effective and comprehensive legal and administrative system is adopted which addresses the problems of land degradation, environmental protection, and the maintenance of ecosystems. This system should be consistent with the principles of sustainable resource development. Such a system requires an integrated approach to the management and protection of natural resources, including land, water, vegetation and human activity, undertaken on the basis of the total watershed. This approach recognizes that changes to the natural environment in the upper watershed will influence conditions in the downstream areas.

Legislation should establish national standards for watershed management which relate to the use, development and protection of land in a way which will minimize the risk to populations and avoid the degradation of natural resources during the occurrence of water-related natural disasters. Activities within a watershed should be controlled and protected through a comprehensive watershed management plan which places restrictions on those activities that can increase the risk of damage.

VII. MAINSTREAMING DISASTER PREPAREDNESS AND MITIGATION INTO SOCIO-ECONOMIC DEVELOPMENT PROCESS

1. Common tools for integration

Mainstreaming disaster preparedness and mitigation into socio-economic development process is itself an integration process. Tools for such an effective integration process can be classified into the following three major groups:

(i) Tools for process design,

(ii) Tools for information collection, and

(iii) Tools for implementation

In the following sections, brief discussion will be made on possible tools that are considered to be applicable to the different development patterns discussed earlier in Chapter V.

a. Tools for process design

As indicated in Chapter V as well as in the Introduction, the current rapidly growing socio-economic development process of the region is driven by four development patterns. These development patterns are fundamentally different on the basis of their immediate and medium-term goals, although in the long run, they tend to converge to the same principles for sustainable development. These differences tend to reflect the conceptual approaches adopted to ensure achievement of the immediate and medium-term goals. For these purposes, various tools could be used for the process design, as follows.

(i) Master planning tools,

(ii) Resources allocation planning tools, and

(iii) Strategic planning tools

Master planning tools are most commonly used to provide the framework for integration for most of the development patterns, especially for the growth centres, sectoral development and integrated rural development. However, the concept of master planning has also evolved significantly during the last three decades in order to better reflect the rapid change of socio-economic development and most importantly the effects of globalization.

Framework for the National Physical Plan of Malaysia

Optimizing the Use of Land

As a physical plan, it is incumbent on the NPP to re-examine the sectoral distribution of land use to ensure the optimal use of land. Agriculture is not expected to be expanding in acreage but in productivity. The greatest demand for land will be in urban expansion but the quantum of land required is relatively small compared to the potential land available for urban development. However, local planning will be required to adjust to the location of the available land. To assist local planning land is categorized according to their agricultural importance to the country, agricultural productivity and environment sensitivity, and ranked. The objective of the ranking system is to enable the determination of land for immediate conversion to other uses or for long-term conservation.

Safeguarding the Environment

With the absence of a need to make large areas of forest land available for agriculture or for urban use, there is an opportunity to articulate the proposals of the various national councils that have expressed concern regarding the natural environment, such as the Forestry Council, the Coastal Zone Council and the Environmental Council. In response, the NPP proposes the delineation of a forest Central Spine which will be linked to other conservation areas.

Future water supply needs will also be safeguarded by conserving potential river and underground sources of water.

Planning Appropriate Infrastructure

In national transportation the NPP proposes the long-term commitment to a fast-train system and in local transportation a commitment to favour public transport.

Infrastructure shall be examined as appropriate to the particular areas and their expectations of development.

Source: *National Physical Plan, 2005*, Federal Department of Town and Country Planning, Malaysia, http://www.npptownplan.gov.my/index.php

Resources allocation tools are mostly adopted for river basin development and to a certain extent

for integrated rural development planning. Resource allocation techniques derive mainly from the master planning techniques, in which the limitation of available resources requires special arrangements to ensure appropriate allocation among uses or users. Since most of the resource allocation techniques are based on the zero-sum principle, these techniques have recently improved to incorporate the win-win concept in planning.

It must be noted that tools for the above planning process could be used to integrate disaster risk management into the corresponding development process. However, in view of the priority concern of the development planning process, it is increasingly accepted that the strategic planning tools, such as discussed in Chapter III, are necessary to effectively involve key stakeholders and to create win-win collaboration.

b. Tools for information collection

For the integration of disaster risk management into the development process, two key groups of tools for information collection are required: information on risk, and information on socio-economic impacts of disasters. Since there is a rich literature on risk assessment, this section will devote to briefly discuss tools to collect information on socio-economic impacts of disasters.

Assessment of socio-economic impacts of natural disaster in the region has recently taken a new direction, when major regional efforts were made to assess the impacts of the 2004 Tsunami. The methodology developed by the Economic Commission for Latin America and the Caribbean (ECLAC) was widely accepted by all major financing institutions and most countries in the region. The ECLAC methodology adopted a more systematic classification of impacts and a comprehensive system of assessment to facilitate linkage between assessment efforts to the development process.

ESCAP applied the ECLAC methodology to seven countries in the region during the period from 2004 to 2005 and subsequently developed a tool to facilitate the application as well as the training of personnel. This tool is known as ESCAP Disaster Impact Calculator (DIC), which is currently used to support efforts in various countries to develop a system for rapid disbursement of funds for disaster management. More details of the ESCAP-DIC are given in Annex 1.

c. Tools for implementation

Many tools have been developed to support the implementation of disaster risk management. However, the most important tool to support the implementation of the integration of disaster preparedness and mitigation into the socio-economic development process is tools for the institutionalization of community-based disaster risk management. Please refer to Chapter IV for more information on experiences of institutionalization of CBDRM.

Apart from CBDRM, integrating the following elements of work below into development plans should be considered.

Insurance and Risk Transfer Alternatives: Private sector (insurance companies) should participate in exploring how this can be done. Insurance against disaster increases public confidence and induce investment.

Education: Education sector should be encouraged to integrate DPM into school curriculum primarily to increase awareness and promote disaster prevention culture in the long term. For large cities, local universities should be encouraged to develop DPM degree courses as a component in city Human Resources Development.

Legal framework: Within the scope of city authority, emergency provision clauses should be included in laws, bylaws and codes to facilitate DPM by granting public endorsed authority (EOC and involved agencies) and effective duration to EOC.

Budget Allocation: City annual budget should allocate fund for items 1.3 to 1.6 and 2 above. For private sector, funding, donation and voluntary uses of private properties for the benefits of DPM should be tax deductible.

Mass Media: As a stakeholder and key actor before, during and after crisis, the role of mass media should be encouraged.

Twinning Basins, Cities and Communities: National and international twinning on experiences of disaster risk management should be encouraged, including twinning between neighboring planning areas sharing similar crisis.

2. Experiences of mainstreaming

Disaster risk management planning forms the most important step in disaster prevention or mitigation. An effective planning programme can lead to successful prevention of annual disasters. The importance of disaster risk management in the national development context depends on the extent of annual disaster impact and the prevailing socio-economic conditions, on the one hand, and the costs of disaster risk management measures, on the other. Experience in the region on disaster risk management planning for socio-economic development can be classified into three major groups: flood control as an integral part of the national development process, as a social component, and as an important part of sustainable development.

a. Disaster risk management as an integral part of the national economic development process

Floodplains have been the most populated areas for centuries and water-related disaster management has long been a part of mankind's history. In several cases, the history of water-related disaster management started many centuries ago, as on the Yellow River in China and the Red River in Viet Nam. In both cases, water-related disaster management forms a foundation for socio-economic development. A review of recent experience of water-related disaster management, such as flood management, in the region has revealed a number of successful applications in several countries, including Australia (the upper Parramatta River catchment), Indonesia (Brantas and Citarum river basins), Japan (Tone-Edo River system), Malaysia (Klang River basin), Republic of Korea (Keum River basin) and Thailand (Chao Phraya River basin).

Box . Two contrasting approaches on the integration of flood control into the development process

Flood control in Japan

Immediately after the end of the Second World War, flood control was conceived as an important activity for the reconstruction and rehabilitation of the economy of Japan. Flood control was necessary to increase food production and also for economic development. The rehabilitation and prevention of natural disasters (especially by flood) was accepted as one of the five priority objectives of the Five-year Economic Rehabilitation Plan, drafted in 1948.[a/] The importance of flood control was highlighted by the allocation of funds for this purpose. "Looking into the government investment in public works, we find that still further stress was put on flood control and disaster rehabilitation. Their share occupied nearly two thirds of the total." [a/] Subsequently, flood control and disaster rehabilitation continued to account for a major share of funds for public infrastructure investment in Japan; the actual allocation continued to increase, although the share of flood control in the total investment was reduced in comparison with that for industrial development. As a part of the national development strategy, flood control could then be seen as providing support to the industrialization programme (especially for the Pacific Coastal Belt) and thus formed an integral part of the development process.

Flood control in the Republic of Korea

Investment for the flood control programme in the Republic of Korea was not concentrated during the initial years of development after the conflict, as the top priority was given to industrialization. According to a statistic provided in a recent study by the Asian Development Bank (ADB),[b/] the frequency of flood disasters in the Republic of Korea was higher than that in Japan during the period 1964-1986 (although the severity of flood disasters was less than that in Japan.) The systematic integration of flood control activities into the national development strategy was first made for the Programme for Village Environmental Improvement for the rural development component (Saemaul Undong) in 1970.[c/] Subsequent to the achievement of a high economic growth rate during the 1970s, the flood control programme was fully integrated into the development process from the Fourth Five-year Plan (1977-1981) onwards, when extensive development of the four major river basins was included as one of the six strategies of development.[d/] The experience in the Republic of Korea showed that community participation in the flood control programme should be considered as an important factor for integrating it into the national socio-economic development programme.

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a Masahiko Honjo, Trends in development planning in Japan , in *Growth Pole Strategy and Regional Development Policy: Asian Experiences and Alternative Approaches,* Fu-chen Lo and Kamal Salih, eds.(Oxford, Pergamon Press, 1978).

b Asian Development Bank, Disaster Mitigation in Asia and the Pacific (Manila,1991).

c William Boyer and Byong Man Ahn, *Rural Development in South Korea: A Sociopolitical Analysis* (Newark, University of Delaware Press, 1991).

d An-jae Kim, Industrialization and growth-pole development in Korea: a case study of Ulsan Industrial Complex , in *Growth Pole Strategy and Regional Development Policy*...

The recent experience has pointed to the fact that water-related disaster management planning need to be developed as an integral part of the economic development programme. Within such a programme, a realistic implementation programme of water-related disaster management measures has to be established taking into account two possible aspects of the development process. First of all, national targets for natural disaster reduction need to be established in the context of the overall goals of the national development process and subsequently translated into criteria for national spatial planning. Second, community participation has to be conceived as a key factor for success. Owing to the increasing complexity of the economic development process, it is often not at all clear how these two aspects were adopted for water-related disaster management planning. The relevant past successful experience of flood control planning in Japan and the Republic of Korea is presented in box I.5 to indicate how it was integrated into the management process.

b. Water-related disaster management as a social component

Disaster reduction is considered a social component of national development in several developing countries, where the costs of water-related disaster management measures are too high as compared with annual government budgets or allocations for public sector investment. Prioritization of disaster reduction activities is a difficult task in the context of the national socio-economic development process.

Box . Floods and water-related disaster management in Bangladesh

The population of Bangladesh stands at about 118 million with a density of 798 persons/km^2. The annual population growth rate is 1.8 per cent. The Bangladesh economy is still traditional in nature and represents an under-developed economy. The total gross domestic product (GDP) in 1995 was US$ 20.4 billion. About one fifth to one third of the country is flooded annually by overflowing rivers to varying degrees during the monsoon. Loss as a percentage of annual GDP value was 5.09 in 1988. The storm surge flooding of coastal areas caused by the 1991 tropical cyclone in the Bay of Bengal resulted in the death of 140,000 people and a total loss to the economy of about US$ 1.4 billion. The structural flood control measures for protection against river flooding are provided mainly by earthen embankments. Drainage facilities are provided to mitigate rainfall flooding. Non-structural measures include flood forecasting and warning, flood preparedness and flood proofing. Shelters are constructed to provide refuge to the vulnerable population during cyclonic storm-surge flooding. Flood control and drainage facilities have so far been provided to 60 per cent of the flood-prone area. Nevertheless, flood losses continue to be experienced and are mainly caused by the following factors: river bank erosion, public cuts, poor design, poor construction, poor materials, and poor operation and maintenance. Public cuts could become more serious in future as population pressure grows on land lying outside major embankments and especially if confinement of such rivers by embankments, along both their banks increases river flood levels. Lessons from recent flood control projects have shown that projects are successful when they are not seriously affected by river bank erosion and other hydraulic and morphologic processes and community participation is active.

The flood problem in Bangladesh is a complex social economic issue. The policy of the Government has thus evolved gradually over the past 30 years from a narrow focus on flood control to a wider context of flood and water management towards the overall national objectives. The Water and Flood Management Strategy approved by the Government in 1995 reflected this evolution. The Strategy provides a framework for incorporating cross-sectoral issues, environmental concerns and public opinion.

Sources: Institute of Flood Control and Drainage Research, Bangladesh University of Engineering and Technology, Flood loss reduction in Bangladesh , paper prepared for the ESCAP South Asia Subregional Expert Group Meeting on Integrating Environmental Considerations into Economic Decision-making Processes, Colombo, November 1997; and Hugh Branmer and Hamidur Rahman Khan, Bangladesh country study , in Asian Development Bank, *Disaster Mitigation in Asia and the Pacific* (Manila, 1991).

A case in point is the complex water-related disaster management in Bangladesh. In 1995, the Water and Flood Management Strategy of Bangladesh was drawn up with the assistance of the donor community to identify feasible structural and non-structural measures for mitigating flood disasters and to provide an overall framework to prioritize disaster reduction activities for national development.

The experience of water-related disaster management in Bangladesh demonstrates that firm commitment on the part of the Government, the active participation of the affected communities and assistance from the

donor community are required to ensure that priority measures are properly undertaken to meet the priority social needs. For this purpose, a well-established water-related disaster management strategy has to be formulated to enable the country to be better prepared for more severe situations that may be caused by higher floods and by the more vulnerable social conditions resulting from high population growth.

c. Flood control towards sustainable development

In several countries, activities on water-related disaster reduction were conceived as an important part of an environmental management strategy for sustainable development when they account for a major share of resources allocated to the national water resources management programme. Examples of such strategies include the conceptual approach to water-related disaster management initiated by His Majesty the King of Thailand for the Chao Phraya River basin in Thailand; the amendment of the River Law of Japan in 1997 to incorporate environmental dimensions in the flood control programmes; and the Klang River Basin Environmental Improvement and Flood Mitigation Project in Malaysia in 1998. In all these examples, clear strategic approaches are first developed to ensure that the respective action programmes are well established and the participation of all stakeholders is guided towards the adopted vision.

3. Remarks

Integration is easier when the public is in the right mood. Timing is therefore important. For example, stakeholder participation activities should synchronize with water-related events such as floods and droughts, schooling and religious schedules. International headline news and international days can help creating suitable environment for integration. Coordination with multilateral agencies such as ESCAP and mass media can be win-win.

Tools and tactics to coax the public include risk oriented social and stakeholder analysis. Influential groups such as school children and religious groups should be explored. Local politicians might see the values of integration and use it as their campaign platform. Incentives for NGOs and commercial private sector resulting from integration should be identified.

Box . Evolution of the flood control framework in Japan: the River Law

The river administration system in Japan has been revised several times since the enactment of the so-called "Old River Law" in 1896. Under the "New River Law" enacted in 1964, the institutional framework for flood control and water use was improved systematically by, for example, introducing an integrated river system management system. The River Law of 1964, therefore, has played an important role in forming river administration today. However, as the economic and social conditions have changed in the subsequent years, the conditions surrounding the river administration system have also changed dramatically. Today, projects are expected not only to perform flood control and water-use functions but also to provide an attractive waterside space and habitat for diverse plants and animals. There is also a growing demand for creative efforts to make effective use of rivers as an important component of the regional climate, landscape and culture. In addition, in keeping pace with the improvement in socio-economic status and lifestyles, the social impact of drought has become much more serious than before, and there is a pressing need for measures to ensure smooth coordination of water use during periods of drought. In view of these changes, in December 1996, the River Council made recommendations on the reform of the river administration system for meeting the change of social and economic needs. In response to these recommendations, the Ministry of Construction drafted a River Law amendment bill and submitted it to the 140th session of the Diet in 1997. The bill was adopted on 28 May during that session, and proclaimed on 5 June 1997. The 1997 Amendment of the River Law became effective in December 1997 to provide a framework for comprehensive river management in the new century: flood control, water use and environmental conservation.

Source: Infrastructure Development Institute of Japan, *Rivers in Japan 98* (1998).

VIII. CONCLUSIONS.

In the above chapters, efforts were made to describe the prevailing development patterns of the region and to present the importance of integrating water-related disaster risk management into these development patterns in order to ensure a sustainable development process. The chapters also provided relevant experiences as well as good practices for reference in actual application.

In preparing this publication, the authors are also aware of the different perspectives of country

development planning. In these perspectives, socio-economic development is viewed as a recurring and overlapping process of: planning, implementation, monitoring and evaluation. Out of these, planning is the most effective phase for intervention (integration of DPM) as it is usually done by relatively small and focus groups of stakeholders in a relatively short and clearly defined time period. As such, development plans are considered to be the most appropriate **vehicles for integration** with DPM. For a country, there are four possible levels of development plans. Each of these is discussed separately in the following subsections.

Sector Development Plans

Sectors selected for integration are **industry** and **tourism**. As disaster is area specific, criterion for sector selection is the sectors' connection with target areas of planning. For example, agriculture, industry, tourism, urban and rural sectors are area specific while services, banking and finance are not. Agricultural areas are sparsely populated, and hence they are not considered as disaster affected areas but rather as useful areas for DPM. For example, rice paddy areas are used as flood retention areas when needed. For this reason, agricultural sector is not selected. Urban and rural sectors are selected and considered in sections 7.1.3 and 7.1.4.

Basin Development Plans

Basin development plans have their own standing in that they combine IWRM with land use and other resources utilization plans. The plans can have subordinate plans such as sub basin plans, down to community plans. With respect to integration, basin's subordinate plans and lower overlap with urban and rural development plans and hence will be addressed in sections 7.1.3 and 7.1.4.

City, Town and Land Use Plans

'City plans, Town plans and Land Use plans' is used here to describe development plans and their subordinate plans. In many situations, city plan or town plan is the same thing, and land use plan is their subset. In some countries, development plan exist at village (community) level.

Community Development Plans

Community or village development plans are subordinate plans of all above development plans. In sector development plan, community development plans are classified under rural sector. DPM at this level has received a lot of attention under the title "Community-Based Disaster Risk Management" or CBDPM.

With the above remarks, it is hoped that readers would be able to incorporate the different perspectives of development to ensure sustain the prevailing high economic growth rates of the region.

REFERENCES

(TO BE ADDED)

ANNEX 1

NOTE ON THE USE OF ESCAP DISASTER IMPACT CALCULATOR TO ASSESS SOCIO-ECONOMIC IMPACTS OF NATURAL DISASTERS

1. Current Practices on Disaster Impact Assessment in the Region

Asia and the Pacific is the most disaster-prone region of the world. It accounts for 91 per cent of the total number of deaths by natural disasters in the world and 49 per cent of the total economic damage. Except for major natural disasters, when major international assistance is provided, assessment of socio-economic impacts of natural disasters in most of developing countries in the region was mostly concentrated to relief and emergency measures.

The following is a brief description of conventional disaster impact assessment used in the region:

- Authorities gather data and estimate the damages of disasters in terms of people affected, infrastructure and productive assets destroyed. On the people affected, the number of deaths, missing, injured and displaced are the usual indicators used. The data gathered and included in the reports only compose direct costs. In addition, needs of the victims and relief assistance extended are likewise reported.

- Infrastructure damages like buildings, roads, bridges, houses etc. are quoted as the value of the asset lost or the cost of replacement or repair. The same is true for equipment and other productive assets like machineries, communications and power lines, irrigation canals, etc.

- Damages from the private businesses are not usually assessed. There is no systematic assessment on the production losses of factories, number of labourers displaced, delays in deliveries, etc.

- The long-term effects on the economy of disaster damages are not appropriately included lik e the cost of stoppage of operations of certain vital firms; the income lost by the transport sector; the foregone income of factories, groceries, stores, tourist facilities, etc.

With the implementation of the pilot case studies in seven countries and the assessment of the socio-economic impacts of the 2004 Tsunami, many countries in the region indicated their interest in improving assessment of impacts of natural disasters on a routine basis.

2. Background on the ECLAC Methodology

The United Nations Economic Commission for Latin America and the Caribbean (ECLAC) started to develop a methodology to assess the socio-economic and environmental impact of natural or man-made disasters since 1970s. The ECLAC methodology has evolved through the past two and half decades with an objective to improve the linkage between impact assessment and decision making on disaster recovery, reconstruction and prevention. The purpose of developing this methodology was therefore to make a realistic and comprehensive assessment of the damages and losses caused by a disaster. Such realistic and comprehensive picture of disaster impacts is essential to identify immediate recovery measures and long-term reconstruction needs and to prioritise activities on the basis of economic and financial implications of the disaster and resource availability. The ECLAC methodology could be used to assess impact of any disaster and the importance of this methodology became obvious after the Asian tsunami of December 2004, when the methodology was adopted by the international team, consisting of the World Bank, ADB, JBIC and the United Nations, to assist the tsunami-affected countries in assess socio-economic impacts of the tsunami.

3. Brief description of the ECLAC Methodology

In order to facilitate the linkage between results of assessment to decision-making on emergency measures, disaster recovery, reconstruction and prevention, the methodology introduces three types of

impacts: direct (stock), indirect (flow) and overall macro-economic impacts. In addition, the methodology also aims to assess total impacts of natural disasters by examining four sectors of the economy to ensure comprehensiveness of assessment: social sector (housing, health, education, culture and sports), economic sector (agriculture, industry and services), infrastructure (transport and communications, energy, water and sewerage) and macro-economic sector.

a. Direct and Indirect Impacts based on ECLAC Methodology

The Economic Commission for Latin America and the Caribbean (ECLAC) developed a methodology that classifies and identifies direct and indirect damages and how they result in secondary impacts. The following are the major and salient features and classifications according to the ECLAC handbook.

I. PRIMARY CONSIDERATION	
Damages to agriculture, cattle raising and fishing	
Direct damages	Indirect damages
• Repair or reconstruction costs of agriculture, cattle farming and fishing infrastructure, including tertiary level roads • Damages or destruction of fishing fleet • Damages or destruction of fish farming ponds and shrimp factories • Agriculture production ready to be harvested • Stocked agricultural produce and grains • Losses in animal stock	• Reduced yields in future crops • Not planting of future crops • Reduced fishing • Loss of employment • Differential impact on women
II. OTHER CONSIDERATIONS	
Damages in water and sanitation	
Direct damages	Indirect damages
• Repairs or reconstruction costs in water collection works • Repairs or reconstruction costs of water processing plants • Repairs or reconstruction costs of distribution pipes • Repair costs of leakages in water distribution network • Repair costs of sanitary sewage network • Rehabilitation cost of served water treatment plants	• Increased costs of water supply by trucks • Digging and equipment of emergency wells • Fall of income due to decreased billing of supplying enterprises • Increase of reproductive work of rural women
Damages to housing and human settlements	
Direct damages	Indirect damages
• Repair of damaged housing • Reconstruction destroyed housing • Household furnishings and appliances replacement • Repair or reconstruction of public buildings and facilities	• Temporary housing supply • Relocation of housing in safe areas • Cost of migration to families
Damages in transport and communications	
Direct damages	Indirect damages
• Repairs or reconstruction costs of roads and bridges • Replacement cost of automotive stock • Repair or reconstruction coast of railway tracks • Rehabilitation costs of ports and airports	• Increased transport costs due to the use of longer alternate routes and/or roads in poor condition • Relocation costs for telecommunication towers • Income losses due to air transport reduction or cancellation • Income reduction in waterways and canals due to

	reduced water level in the face of drought
Commerce, industry and services	
Direct damages • Repair or reconstruction costs of infrastructure • Repair or replacement cost of equipment and machinery • Losses in finished production (stocks and inventories	Indirect damages • Reduced production • Temporary employment losses • Differential impact on women
Damages to tourism	
Direct damages • Repair or reconstruction costs of tourism infrastructure • Repair or replacement cost of furniture and tourism equipment • Damages to beaches and other tourist attractions	Indirect damages • Temporary fall in hotel occupancy and income of enterprises • Negative effect in linked activities • Cancelled future reservations and cost of promotion campaigns • Unemployment • Differential impact on women
Damages to the education and culture sectors	
Direct damages • Repair or reconstruction costs of schooling facilities • Furnishings and educational material's replacement • Rehabilitation of historical and cultural heritage	Indirect damages • Delay in school year • Rent of temporary facilities • Repairs to schooling centres used as shelters for displaced population during disaster • Reduced income from damaged culture and historical centres (museums, etc.)
Damages to the health sector	
Direct damages • Repairs or reconstruction of health infrastructure: hospitals, health clinics, etc. • Replacement of equipment, furnishings and lost medicines and stocks	Indirect damages • Increased expenditure to provide medical attention • Preventive campaign costs in the face of potential epidemics or infective diseases • Relocation costs for moving health centres to safer grounds
Damages to the environment	
Direct damages (estimated indirectly) • Repair costs of natural resources to their previous state: reforestation, land stabilization, protection against slippage, etc. • Cost of alternative water sources • Beach cleanup and replenishing	Indirect damages • Loss of environmental services • Cleanup from spills of toxic materials
Damages should likewise be assessed according to their impacts on women	
• Double burden on women • Effect on gender and relationships	

4. Development of the ESCAP Disaster Impacts Calculator

Disasters have become more frequent around the world, especially in Asia, and have led for widespread loss of human life, large-scale damages to economic and social infrastructure and to the environment. For most of developing countries in Asia, which face the increasing socio-economic impact of disasters, the application of the ECLAC methodology is expected to provide better information for more

effective policy and decision-making against the limited resources available and conflicting priorities. This was one of the main objectives that UNESCAP in cooperation with UNDP and ECLAC carried out a pilot project on application of the ECLAC methodology in seven countries in Asia. The outcomes of the pilot projects showed that indirect impacts were much higher than usually estimated (20 to 100 %) and total estimated economic impacts of disasters were found mostly doubled. For the Philippine case study, the total impacts of the Typhoon Unding, Violeta, Winnie and Yoyong were found to be almost three times larger than the direct impacts.

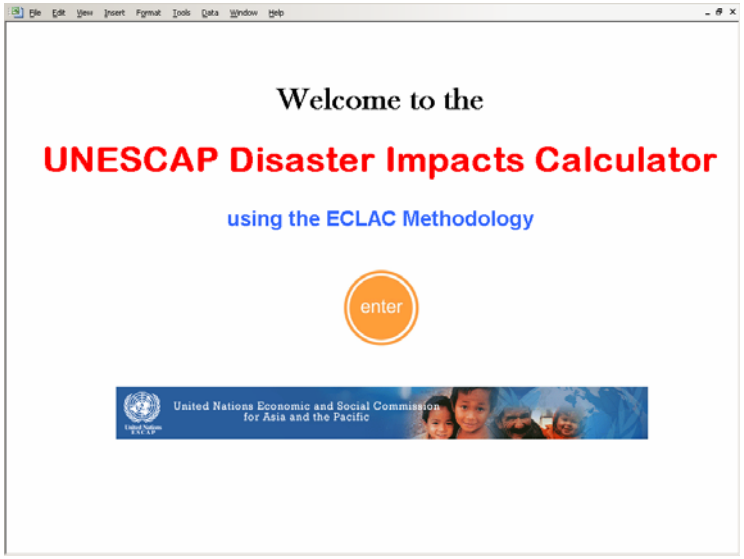
In view of the importance of the findings and experience of systematic and comprehensive application of the ECLAC methodology in all the case studies and especially for the case study in the Philippines, UNESCAP decided to proceed further in this project by consolidating all the experiences into a standard template, which is now called UNESCAP Disaster Impacts Calculator.

The Calculator was developed with the technical support of an expert team provided by the National Economic and Development Authority (NEDA) of the Philippines, led by Mr. Emmanuel C. Torrente and Mr. Victor J. Bawagan and included in the distributed CD-ROM. The CD-ROM is expected to provide an easy reference on the ECLAC methodology, detailed assessment of the case study in the Philippines and the template for calculation of direct and indirect impacts of disasters.

Below are some screenshots the Calculator contained in the CD-ROM.

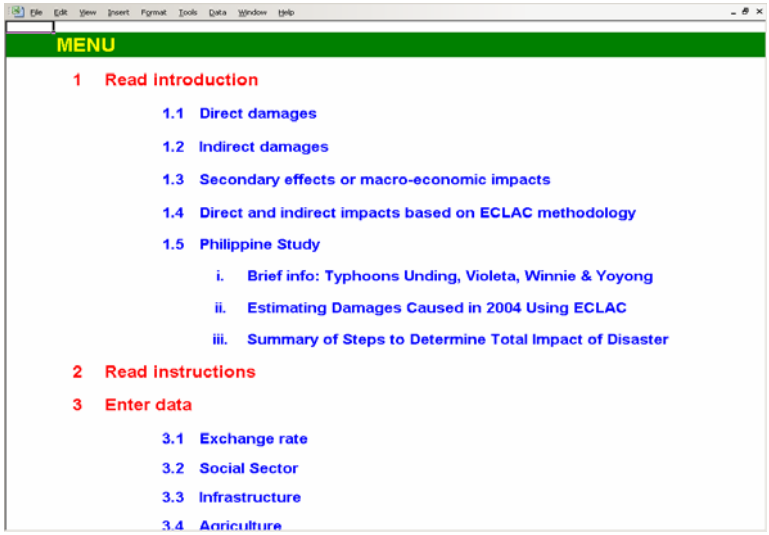
a. Opening screen

The UNESCAP Disaster Impacts Calculator is an easy-to-use tool that helps practitioners assess the impact of calamities and disaster by providing a user-friendly interface for data entry and information output while leaving formulas in the background and out of the way. Easy navigation is made through mouse clicks and cursor movements.



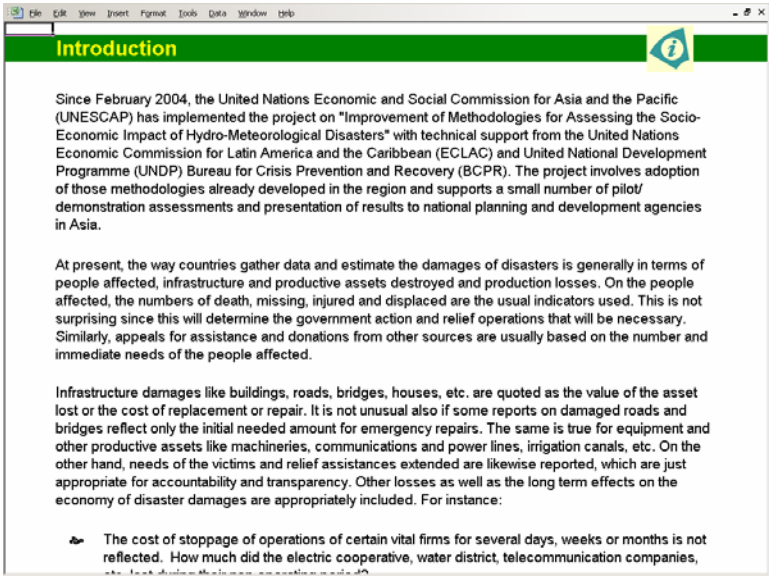
b. Menu screen

By clicking on the enter icon in the opening screen, the user is brought into a menu that hosts the elements of the calculator. Again, simply by clicking at the menu items the user is forwarded into any of the four major pages of the calculator namely the introduction page, the instruction page, data entry page, and the output page.



c. Introduction

The introduction page gives the user a background of UNESCAP's efforts on gathering methodologies used in assessing the socio-economic impacts of hydro-meteorological disasters in the Asia-Pacific region and its work on improving these methodologies. A background of the ECLAC disaster impact assessment methodology derived mainly from the handbook is also made available as well as the principles behind the methodology.



Introduction

Since February 2004, the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) has implemented the project on "Improvement of Methodologies for Assessing the Socio-Economic Impact of Hydro-Meteorological Disasters" with technical support from the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) and United National Development Programme (UNDP) Bureau for Crisis Prevention and Recovery (BCPR). The project involves adoption of those methodologies already developed in the region and supports a small number of pilot/ demonstration assessments and presentation of results to national planning and development agencies in Asia.

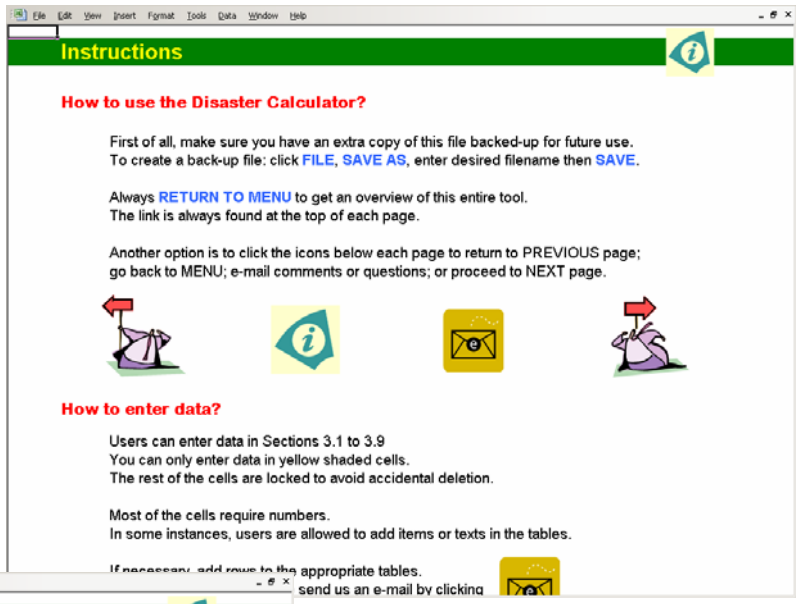
At present, the way countries gather data and estimate the damages of disasters is generally in terms of people affected, infrastructure and productive assets destroyed and production losses. On the people affected, the numbers of death, missing, injured and displaced are the usual indicators used. This is not surprising since this will determine the government action and relief operations that will be necessary. Similarly, appeals for assistance and donations from other sources are usually based on the number and immediate needs of the people affected.

Infrastructure damages like buildings, roads, bridges, houses, etc. are quoted as the value of the asset lost or the cost of replacement or repair. It is not unusual also if some reports on damaged roads and bridges reflect only the initial needed amount for emergency repairs. The same is true for equipment and other productive assets like machineries, communications and power lines, irrigation canals, etc. On the other hand, needs of the victims and relief assistances extended are likewise reported, which are just appropriate for accountability and transparency. Other losses as well as the long term effects on the economy of disaster damages are appropriately included. For instance:

- The cost of stoppage of operations of certain vital firms for several days, weeks or months is not reflected. How much did the electric cooperative, water district, telecommunication companies,

In addition, the Philippine case study is presented as an example to provide the user with a guide on how the ECLAC methodology was applied.

d. Instructions



Instructions

How to use the Disaster Calculator?

First of all, make sure you have an extra copy of this file backed-up for future use.
To create a back-up file: click FILE, SAVE AS, enter desired filename then SAVE.

Always RETURN TO MENU to get an overview of this entire tool.
The link is always found at the top of each page.

Another option is to click the icons below each page to return to PREVIOUS page; go back to MENU; e-mail comments or questions; or proceed to NEXT page.

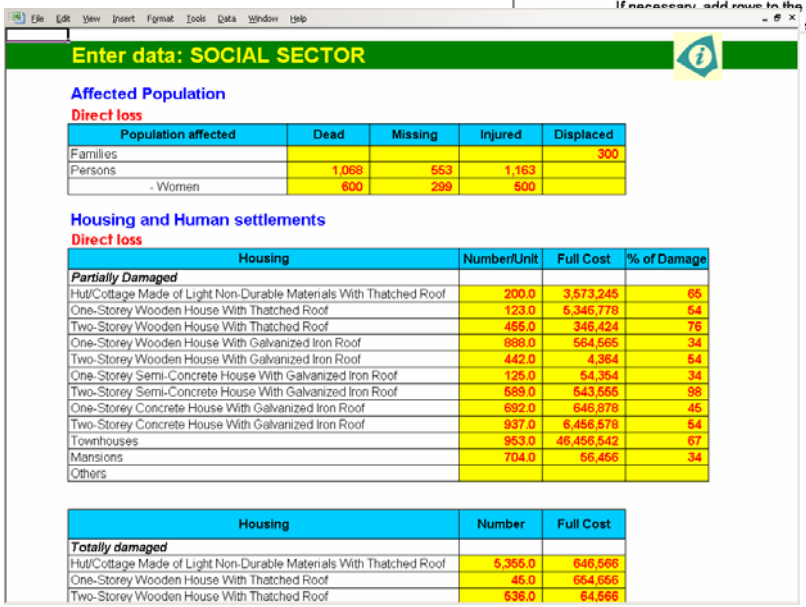
How to enter data?

Users can enter data in Sections 3.1 to 3.9
You can only enter data in yellow shaded cells.
The rest of the cells are locked to avoid accidental deletion.

Most of the cells require numbers.
In some instances, users are allowed to add items or texts in the tables.

appropriate tables.
send us an e-mail by clicking

To further help the user, a simple instruction guide is provided on how to use and navigate the Calculator.



Enter data: SOCIAL SECTOR

Affected Population

Direct loss

Population affected	Dead	Missing	Injured	Displaced
Families				300
Persons	1,068	553	1,163	
- Women	600	299	500	

Housing and Human settlements

Direct loss

Housing	Number/Unit	Full Cost	% of Damage
Partially Damaged			
Hut/Cottage Made of Light Non-Durable Materials With Thatched Roof	200.0	3,573,245	65
One-Storey Wooden House With Thatched Roof	123.0	5,346,778	54
Two-Storey Wooden House With Thatched Roof	455.0	346,424	76
One-Storey Wooden House With Galvanized Iron Roof	888.0	564,565	34
Two-Storey Wooden House With Galvanized Iron Roof	442.0	4,364	54
One-Storey Semi-Concrete House With Galvanized Iron Roof	125.0	54,354	34
Two-Storey Semi-Concrete House With Galvanized Iron Roof	589.0	543,565	98
One-Storey Concrete House With Galvanized Iron Roof	692.0	646,878	45
Two-Storey Concrete House With Galvanized Iron Roof	937.0	6,456,578	54
Townhouses	953.0	46,456,542	67
Mansions	704.0	56,456	34
Others			

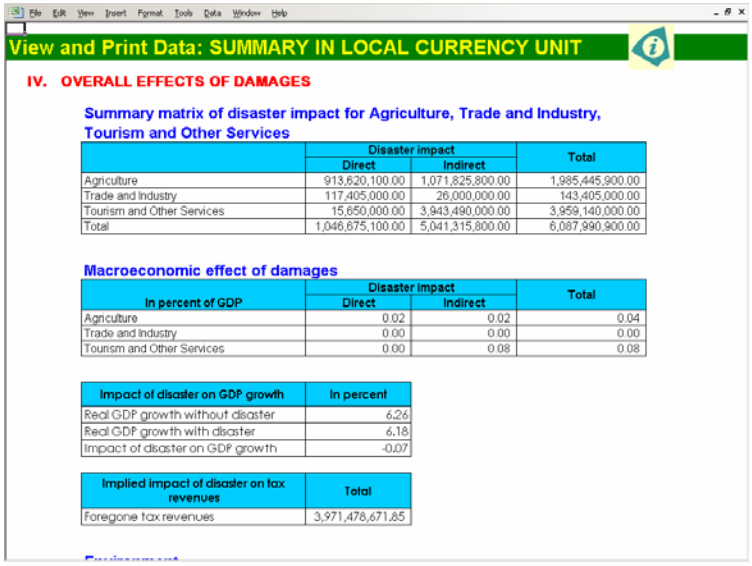
Housing	Number	Full Cost
Totally damaged		
Hut/Cottage Made of Light Non-Durable Materials With Thatched Roof	5,355.0	646,566
One-Storey Wooden House With Thatched Roof	45.0	654,666
Two-Storey Wooden House With Thatched Roof	536.0	64,566

e. Data Entry

The Data Entry pages are where the user's hands get dirty. This is the most important part of the Calculator where the practitioner puts in the disaster damage data gathered form the field one by one. It is most useful to remember adage "Garbage in, garbage out" at this point. This would only mean that the output our Calculator churns out is only as good as the information entered into it.

f. Output screen

The last part of the Calculator is the output page. Outputs are presented by sector as outlined in the ECLAC handbook and in summary form for easy viewing. Furthermore, the output may be viewed by local currency of in US dollar terms for international comparison.



View and Print Data: SUMMARY IN LOCAL CURRENCY UNIT

IV. OVERALL EFFECTS OF DAMAGES

Summary matrix of disaster impact for Agriculture, Trade and Industry, Tourism and Other Services

	Disaster impact		Total
	Direct	Indirect	
Agriculture	913,620,100.00	1,071,825,800.00	1,985,445,900.00
Trade and Industry	117,405,000.00	26,000,000.00	143,405,000.00
Tourism and Other Services	15,650,000.00	3,943,490,000.00	3,959,140,000.00
Total	1,046,675,100.00	5,041,315,800.00	6,087,990,900.00

Macroeconomic effect of damages

In percent of GDP	Disaster impact		Total
	Direct	Indirect	
Agriculture	0.02	0.02	0.04
Trade and Industry	0.00	0.00	0.00
Tourism and Other Services	0.00	0.08	0.08

Impact of disaster on GDP growth	In percent
Real GDP growth without disaster	6.26
Real GDP growth with disaster	6.18
Impact of disaster on GDP growth	-0.07

Implied impact of disaster on tax revenues	Total
Foregone tax revenues	3,971,478,671.85

5. The Background Case Study for the ESCAP Disaster Impact Calculator in the Philippines

In 2004, UNESCAP introduced the methodology published by the ECLAC. The Government of the Philippines tried to use the methodology using existing data on the damages of past typhoons that passed by Quezon- Unding, Violeta, Winnie and Yoyong (UVWY).

a. General approach of application

The application was made using two approaches.

- First, using the ECLAC methodology, disaster damages and their impacts were expressed as the total sum of direct and indirect costs. Indirect damages, as part of indirect losses, cover foregone economic flows and opportunity costs, among others.
- Second, disaster damages were measured as a percentage of the total income or output of the affected local or national economy. This was expressed as percentages of gross national domestic product (GDP), gross regional domestic product (GRDP) or sectoral damages expressed as fractions of the income or potential income of various economic sectors like agriculture, industry or services. The estimated aggregate losses were expressed or quantified as the difference between the target growth of a particular sector and the actual growth achieved.

Economic Losses = Target GDP (or GRDP) – Actual GDP (or GRDP)

The application also examined possible indicators of the disasters on the population, particularly the poor on a per capita or per family basis, as damage incurred per person or family nationwide or on the affected area/s.

$$\text{Damage per capita} = \frac{\text{Total assessed damages}}{\text{Total population in the affected area}}$$

b. Application of the ECLAC Methodology

(1) Direct damages based on reports submitted to the OCD

The template adopted for the ESCAP-DIC includes data for areas and population affected; casualties, total direct damages including houses damaged, and costs of damage to assets or properties.

(2) Indirect losses

The indirect losses of the template adopted for the ESCAP-DIC will cover all the key sectors identified by the ECLAC methodology, including agriculture, industry, infrastructure,

services sector as well as macro-economic impacts. For the agricultural sector, the estimation of losses proposed in the ESCAP-DIC will be based on the comprehensive methodology developed by the Department of Agriculture of the Philippines to assess damages to crops, livestock and fishery incurred by farmers and fishermen during disasters. For rice and corn, information such as type and variety, growth stage, hectares of area planted, wind speed, amount of rainfall, among others is gathered to determine the degree/amount of salvageable or recoverable amount. The methodology also incorporates some assumptions on average crop productivity and input costs. This set of information is then used to compute the volume and value of production loss as a result of the disaster. However, since this information is not available for other crops. This study makes several assumptions and adjustments to make the information presented herein compatible with the ECLAC methodology.

(3) Macroeconomic impact

- From the estimated indirect damages, the corresponding loss in the Gross Domestic Product was computed using GVA ratios derived from the latest Input-Output Accounts.
- For the example available in the ESCAP-DIC, it was found that the aggregate damage brought about by Typhoons Unding, Violeta, Winnie, and Yoyong shaved off 0.24 percentage points off the growth of the Philippine economy in 2004. On this basis, it was concluded that the real GDP growth could have been 6.26 percent instead of only 6.03 percent in 2004, had the series of typhoons not occurred or had they not passed the Philippines.

(4) Total damages

- The ESCAP-DIC provides facilities for summing up direct damages and indirect losses (including lost revenues) in both local currency and US dollars.

Table A1-1. Damages

	Amount (in Pesos)	Amount (in US Dollars)
Direct damages	11,317,738,746	**201,958,505**
Indirect losses	27,959,328,024	**489,918,046**
Total damages	**39,277,066,770**	**700,876,551**
- % of GDP	0.80	

- In terms of sector as identified by ECLAC, the following is the summary of the total damages:

Table A.1-2. Summary of the total damages

	Direct	Indirect	Total	% of Total
Social	**5,602,736,000**		**5,602,736,000**	**14.26**
- Housing	5,067,990,000		5,067,990,000	12.90
- School facilities	461,846,000		461,846,000	1.18
- Health facilities	72,900,000		72,900,000	0.19
Infrastructure	**2,023,172,746**		2,023,172,746	5.15
- Bridges, roads, etc	1,687,526,278		**1,687,526,278**	**4.30**
- Transmission facilities	34,300,000		34,300,000	0.09
- Electric facilities	221,468		221,468	0.00
- Water facilities	300,000,000		300,000,000	0.76
- Transportation	1,125,000		1,125,000	0.00
Economic sectors	**3,691,830,000**	**26,739,836,705**	**30,431,666,705**	**77.48**
- Agriculture	3,691,830,000	3,052,503,787	6,744,333,787	17.17
- Rice		252,813,591	252,813,591	0.64
- Corn		402,896,863	402,896,863	1.03

- Other crops		496,793,332	496,793,332	1.26
- Emergency expenditure		1,900,000,000	1,900,000,000	4.84
- Manufacturing		19,255,344,000	19,255,344,000	49.02
- Utilities		3,603,441,694	3,603,441,694	9.17
- Electricity		2,098,011,111	2,098,011,111	5.34
- Water		1,505,430,581	1,505,430,581	3.83
- Transpo., Communication		1,208,648,773	1,208,648,773	3.08
- Transportation		163,332,800	163,332,800	0.42
- Land		107,500,000	107,500,000	0.27
- Sea		14,182,800	14,182,800	0.04
- Air		41,650,000	41,650,000	0.11
- Communication		1,045,315,973	1,045,315,973	2.66
- Private Services		(206,145,902)	(206,145,902)	-0.52
- Government Services		(133,955,648)	(133,955,648)	-0.34
(Loss in Tax Revenues)		1,219,491,319	1,219,491,319	3.10
TOTAL	**11,317,738,746**	**27,959,328,024**	**39,277,066,770**	**100.00**

- The templates used in the case study followed the ECLAC principles outlined here:

(1) Direct damages are assessed using cost of repair or replacement, as the case may be, of the tangible assets.
(2) Indirect losses are estimated using the principle of opportunity losses that the economy incurred due to the disruption of economic activities. These are in terms of the cost of inputs used for crops that were not harvested; foregone revenues due to non-operating days of firms; or non-availability of services due to the destruction of vital infrastructure, among others.
(3) Indirect losses can be expressed as gross value-added (GVA) per sector and multiplied by their respective gross-value added ratio to yield the nominal amount of losses in each sector.
(4) Resulting losses expressed in nominal GVA are convertible into constant prices and can be then expressed in terms of percentage point lost in the gross domestic product (GDP).
(5) The potential tax revenue lost per percentage point reduction in GDP can be calculated from the percentage point/s reduction from the GDP.
(6) The total damages and losses to the economy are the sum of the direct and indirect losses.

6. Towards Operationalizing the UNESCAP Disaster Impact Calculator (DIC)

Among the efforts to promote the adoption of the UNESCAP Disaster Impact Calculator for routine assessment, UNESCAP proposed to integrate the operationalization of the Calculator into routine assessment for decision-making. The basis of operationalization was to aim at improving the knowledge of total impacts of disasters from the time of decision-making on the provision of relief (to attempt to achieve 60% of the total impacts, few days after the occurrence of the disaster) or at the time of decision-making on emergency repairs (to aim at achieving 70% of the total impacts, one week after the occurrence of the disaster) and at the time of decision-making on recovery and rehabilitation.

This proposal was made on the basis of the findings of the seven case studies, such as shown on Table A1-2. From this table, one could recognize that good assessment of four areas (housing, agriculture, manufacturing and utilities) of the two sectors: social and economic, one could achieve more than 80 per cent of the total impacts. This proposal was examined for possible application in the Philippines, where seven regions that are frequently affected by typhoons and other natural disasters. In order to operationalize the Calculator, it was agreed that establishment of the base line for priority areas of selected sectors would be made prior to occurrence of disasters. The base line information would be as extracted from the Calculator for preparation in cooperation with various local and national authorities. In addition, it was agreed that in order to improve accuracy of assessment, compilation of impacts of previous disasters would be made for verification.