
Unit - 4 □ Ways of Minimising Disaster Risk

Structure

- 4.1 Prevention and Mitigation
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4.1 Prevention and Mitigation

Prevention—Measures taken to detect, contain, and forestall events or circumstances which, if left unchecked, could result in a disaster.

Mitigation—Steps taken to contain or reduce the effects of an anticipated or already occurred disastrous event. Any action taken to minimize the extent of a disaster or potential disaster is called a mitigation measure.

Mitigation can take place before, during or after a disaster, but the term is most often used to refer to actions against potential disasters. Mitigation measures are both physical and structural, such as flood defences or strengthening buildings as well as non-structural, such as training in disaster management, regulating land-use and public education, among others.

Prevention:

Activities to provide outright avoidance of the adverse impact of hazards and related environmental, technological and biological disasters.

Depending on social and technical feasibility and cost/ benefit considerations, investing in preventive measures is justified in areas frequently affected by disaster. In the context of public awareness raising and education, prevention refers to attitude and behavior leading towards a "culture of prevention".

Activities to provide outright avoidance of the adverse impact of hazards and means

to minimize related environmental, technological and biological disasters are essential to prevent such disasters. Depending on social and technical feasibility and cost/benefit considerations, investing in preventive measures is justified in areas frequently affected by disasters.

Mitigation

Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards. Disaster prevention and mitigation denotes activities that prevent or mitigate the adverse effects of extreme natural events, above all in the medium and long term. These include on the one hand, political, legal, administrative and infrastructure measures to address the hazard situation, and, on the other, influencing the lifestyle and behaviour of the endangered population in order to reduce their disaster risk.

Measures designed to achieve these aims include:

- ❖ National and local regulation of land use: regulations for the zoning of residential and commercial districts and nature reserves. Detailed land surveys and registers are required in order to achieve this. Use of land for habitation and commercial use needs to be regulated so that lands in fragile ecological areas can be protected. The lands near or inside nature reserves are precious for wild animals and the people who depend on forest products. These areas need to be carefully used as they are important for sustaining ecological balance.
- ❖ Sustainable management and expansion of forestland: control of deforestation and slash-and-burn forest clearance, re-forestation and implementation of sustainable forest management schemes.
- ❖ Zoning natural reserves on river flood plains, planting of trees and other vegetation types on riverbanks and possible reinforcement using infrastructure such as dams, dykes and embankments. To elaborate this, it may be said, saving embankments and river spill zones from encroachment, allowing the normal flow of rivers so that it does not affect human habitation by breaching embankments.
- ❖ Adjusting infrastructure to anticipated events including relevant legal and administrative regulations: raising the heights of bridges, retrofitting buildings, drainage and irrigation systems. This is mainly mitigation strategies to minimize damages from impending disasters.
- ❖ Strengthening local prerogatives and responsibilities through decentralization and democratisation.
- ❖ Training the population and local and national institutions on the causes, impacts and means of prevention of disasters.

- ❖ Assistance to the population and local and national institutions in the adequate organisation of disaster risk management and the building up effective cooperation capabilities.
- ❖ Introduction of mechanisms and instruments for spreading risk and/or risk transfer (e.g. insurance, safety reserves).

4.2 Disaster preparedness

Preparedness

Preparation is the third main operational area. The intention is to prevent or minimize deaths or other losses and damage in the case of an extreme natural event. Prior to the event it is necessary to prepare the institutions involved (above all disaster preparedness and civil protection, the fire department, the health service, administration, police) and the endangered population as to possible situations, and take precautionary steps.

Preparedness may be defined as, "activities and measures taken in advance to ensure effective response to the impact of disaster, including the issuance of timely and effective early warnings and the temporary removal of people and property from a threatened location".

These are activities and measures taken before a hazard event to ensure effective response to the impact of hazards. It involves measures that enable governments, community and individuals to respond rapidly to disaster situations and cope with them effectively.

Preparedness includes

- ❖ making of viable emergency plans
- ❖ development of warning systems
- ❖ maintenance of inventories
- ❖ training of personnel
- ❖ search and rescue measures
- ❖ Evacuation plans for areas that may be 'at risk' for a recurring disaster.

The preparedness measures may also include:

- ❖ Establishing a legal framework and specifying government assistance for disaster preparedness.
- ❖ Establishing a deployment and coordination apparatus, task allocation and communications structure; drawing up emergency plans: clarifying the competences, resources available and tasks of the population; evacuation plans; securing contingency supplies (first aid, food, drinking water, medication).

- ❖ Building up or strengthening local and national disaster preparedness capabilities and rescue services (particularly, personnel and financial resources, logistics and communications).
- ❖ Infrastructure measures: fitting out possible emergency accommodation, securing lines of communication and evacuation routes.
- ❖ Training: conducting disaster protection exercises in evacuation, recovery, rescue, emergency medical measures, occupation and organisation of emergency accommodation. Improving abilities for rapid assessment of the requisite assistance as well as damage in the case of an emergency in order to ensure rapid and systematic delivery of needed.
- ❖ Building up appropriate decentralized early-warning systems to ensure that endangered population relevant local and national actors receive timely information.

Raising awareness

Raising awareness involves helping people and institutions to better grasp the hazard problem and current levels of vulnerability, as well as the cost and benefit connection in disaster risk management at the economic, social and political level. The awareness of decision-makers and experts in different local and national institutions (e.g. municipal administration, construction and health sector, civil protection) can be raised through a combination of training, and joint implementation of practical measures. The following aspects must be taken into account here:

- ❖ The cost-benefit analysis should be as realistic as possible in order to convince decision-makers in particular. Beneficial side-effects (e.g. gain in prestige) can also play a role.
- ❖ In order to motivate experts and decision makers and make the topic more amenable to them, disaster risk management should not be conveyed as something new, but rather as an additional development to their activities to date.
- ❖ High personnel turn over rates and strict hierarchical structures that limit consciousness raising to individual specialists are common problems. The topic should be introduced to as broad (horizontal and vertical) a section of the institutional personnel as possible in order to bring about lasting change.

Awareness in the population can also be raised through a number of measures. Information campaigns (e.g. radio or brochures) can draw short-term attention to definite dangers and needed precautions (e.g. at the beginning of the rainy period), or promote acceptance for forthcoming pre preventive activities (e.g. a law on environmental protection or a vaccination campaign). Provided it is long-term (e.g. in schools) training/education can also alter people's attitudes and behaviour. The most effective way to raise awareness,

however, is to actively involve as many people as possible in implementing measures in the different operational areas of disaster risk management.

Disaster risk management approaches that aim at mobilizing the population in this way are called participatory disaster risk management. They proceed from the precept of motivating people on a voluntary basis in order to:

- ❖ build up a sufficient pool of informed and trained personnel for an emergency,
- ❖ inculcate disaster risk management attitudes and behaviour in broad sectors of the population using the volunteers involved and
- ❖ ultimately strengthen the self-help capabilities of the endangered population.

Strengthening local disaster risk management capabilities

High priority is attached to strengthening local capabilities for two reasons:

- ❖ Disaster risk frequently varies significantly by micro-region. This is why use must be made of local knowledge, and disaster risk management tailored at the local level to local hazards and vulnerabilities, as part of the national and regional systems.
- ❖ National disaster preparedness authorities are at present still centrally organized in most developing countries and unable to provide effective help in an emergency, particularly to rural populations.

Even national early-warning systems (e.g. information on hurricanes) often reach the endangered population too late or not at all. So endangered areas must rely on their own capabilities of taking precautionary measures. A way of helping to build an effective local disaster risk management system is by stimulating community-based disaster risk management. The local system should form part of a national system and should assure the participation of all relevant social actors at the municipal level.

Early warning

The provision of timely and effective information, through identified institutions, that allow individuals at risk of a disaster, to take action to avoid or reduce their risk and prepare for effective response.

Early warning systems consist of three elements (i) forecasting and prediction of impending events, (ii) processing and dissemination of warnings to political authorities and population, and (iii) undertaking appropriate reaction to warnings.

A systematic approach to managing the "risks" associated with disasters can prevent or mitigate their impact. The process must consider the likely effects of natural hazards and the measures by which they can be minimized.

The concept of disaster risk is used to describe the likelihood of harmful consequences arising from the interaction of natural hazards and the community. Two elements are essential

in the formulation of disaster risk: the probability of occurrence of a hazard, and the vulnerability of the community to that hazard.

A closer look at the nature of hazards and the notions of vulnerability allows for a better and more comprehensive understanding of the challenges posed by disaster mitigation:

i. Nature of hazard — By seeking to understand hazards of the past, monitoring of the present, and prediction of the future, a community or public authority is poised to minimize the risk of a disaster. The NMHSs play a key role in this aspect of risk management of weather-related natural disasters; and,

ii. Notions of Vulnerability — The community vulnerability is the susceptibility and resilience of the community and environment to natural hazards. Different population segments can be exposed to greater relative risks because of their social and economic conditions. Reducing disaster vulnerability requires increasing knowledge about the likelihood, consequences, imminence and presence of natural hazards, and empowering individuals, communities and public authorities with that knowledge to lower the risk before severe weather events occur, and to respond effectively immediately afterwards.

The importance given to social and economic vulnerability as a rapidly increasing factor of risk in most of today's societies underlines the need to encourage the participation of a wide spectrum of stakeholders in hazard and risk reduction and response activities. Stakeholders are those people or organizations who may affect, be affected by, or perceive themselves to be affected by, a decision or activity. In developing a disaster risk management system, no single agency can provide a fully comprehensive solution. It is essential that agencies work together and with stakeholders to narrow knowledge gaps and to develop disaster risk management plans using a coordinated approach (WMO 2010).

Well-developed governance and institutional arrangements support the successful development and sustainability of sound early warning systems. They are the foundations upon which early warning systems are built, strengthened and maintained. Good governance is encouraged by robust legal and regulatory frameworks and supported by long-term political commitment and effective institutional arrangements. Effective governance arrangements should encourage local decision-making and participation which are supported by broader administrative and resource capabilities at the national or regional level.

Vertical and horizontal communication and coordination between early warning stakeholders is also essential.

1. Here weather-related hazards is assumed to include water-induced and climate-related hazards
2. Implicitly the poor are the most vulnerable. They are also likely to benefit the most from early warning systems since large protective infrastructure projects designed

to reduce vulnerability, often result in the dislocation of poor residents to other risk prone places (World Bank 2010, Rogers and Tsirkunov 2011).

Design of a Warning System

The detailed design of a warning system depends on the particular features of the hazard phenomenon, the vulnerability of the region, and the needs of the potentially affected communities. In general, however, the design of a warning system must provide the following basic requirements (Zillman 2003):

- ❖ A sound scientific basis of understanding of the meteorological or hydrological phenomenon concerned including the scientific basis for its predictability;
- ❖ Rapid access to global data streams in order to initialize forecast models for the short- to medium-range forecast process;

Rapid access to regional data, including locally processed remotely sensed data, in order to initialize short-range regional models and mesoscale models to provide prior and during-the-event guidance on the fine time and space scales, and also to provide monitoring of conditions during the event;

- ❖ Hardware and software to store and retrieve data, to analyze and display information, and to perform the extensive calculations required of today's numerical weather prediction (NWP) models;
- ❖ Systems to automatically detect and alert forecasters to severe weather events. These include the algorithms to detect downbursts from radar data, or expert systems, which can alert forecasters to the likelihood of severe weather events based on observational or forecast data;
- ❖ Communications to provide information to emergency management authorities and other users with lead times that allow adequate response time for emergency managers to complete preparedness action.

Effective Early Warning Systems

A warning system must empower individuals, communities and businesses to respond timely and appropriately to hazards in order to reduce the risk of death, injury, property loss and damage. Warnings must get the message across and stimulate those at risk to take action.

Increasingly precise warnings are required by disaster mitigation decision-makers. These require improvements in weather warnings (Gunasekera 2004):

- i. extending the lead time of warnings;
- ii. improving the accuracy of warnings;

- iii. greater demand for probabilistic forecasts;
- iv. better communication and dissemination of warnings;
- v. using new techniques to alert the public;
- vi. targeting of the warning services to relevant and specific users (right information to right people at right time and right place); and
- vii. warning messages are understood and the appropriate action taken in response.

Longer lead times should be considered together with the need to reduce false alarm rates and a balance should be struck between the two whereby decisions can be based on optimum lead times for warnings (Rogers and Tsirkunov 2010).

People Centered Early Warning Systems

There is general agreement on the structure of people centered early warning systems; namely, risk knowledge, monitoring and warning service, dissemination and communication, and response capability. Since the concept was introduced the capacity to provide tailored information to individuals has increased along with an ever expanding access to mobile technology. Thus it is now possible to be increasingly specific about warnings to individuals at risk, increasing the importance of the concept of people centric warning systems. It also means that individuals need to be more aware of their risks and the warning systems must increasingly support forecasts of impacts so that those at risk can fully understand the consequences and actions that need to be taken.

Risk Knowledge

Risks arise from the combination of hazards and vulnerabilities at a particular location. Identification and assessments of risk require systematic collection and analysis of data and should consider the dynamic nature of hazards and vulnerabilities that arise from processes such as urbanization, rural land-use change, environmental degradation and climate change. Risk assessments and maps help to motivate people, prioritize early warning system needs and guide preparations for disaster prevention and responses.

Monitoring and Warning Service

Warning services lie at the core of the system. There must be a sound scientific basis for predicting and forecasting hazards and reliable forecasting and warning systems that operate 24 hours a day³. Continuous monitoring of hazard parameters and precursors is essential to generate accurate warnings in a timely fashion. Warning services for different hazards should be coordinated where possible to gain the benefit of shared institutional, procedural and communication networks. This can be achieved through a multi-hazard

early warning system that coordinates and integrates the needs of different stakeholders.

In the past forecasting agencies have focused on provided warning information directly linked to the hydro-meteorological forecasts that they calculate; however, the impact of heavy precipitation, for example, will vary over a catchment area depending on many factors that contribute to the vulnerability of people. Some will have little risk others may be in life-threatening situations. It is very important to make sure that those at risk are properly informed and actions are taken to protect them. Targeting those at risk also creates a more effective response and reduces the risk of warning fatigue and false alarms.

Response Capability

It is essential that communities understand their risks; respect the warning service and know how to react. Education and preparedness programs play a key role. It is also essential that disaster management plans are in place, well-practiced and tested. The community should be well informed on options for safe behavior, available escape routes, and how best to avoid damage and loss to property.

Cross-cutting Issues:

Involvement of Local Communities

People-centered early warning systems rely on the direct participation of those most likely to be exposed to hazards. Without the involvement of local authorities and communities at risk, government and institutional interventions and responses to hazard events are likely to be inadequate. A local, 'bottom-up' approach to early warning, with the active participation of local communities, enables a multi-dimensional response to problems and needs. In this way, local communities, civic groups and traditional structures can contribute to the reduction of vulnerability and to the strengthening of local capacities.

Consideration of Gender Perspectives, Cultural Diversity and Disability

In developing early warning systems it is essential to recognize that different groups have different vulnerabilities according to culture, gender or other characteristics that influence their capacity to effectively prepare for, prevent and respond to disasters. Women and men often play different roles in society and have different access to information in disaster situations. In addition, the elderly, disabled and socio-economically disadvantaged are often more vulnerable.

Information, institutional arrangements and warning communication systems should be tailored to meet the needs of every group in every vulnerable community.

A Multi-Hazard Approach

Where possible, early warning systems should link all hazard-based systems. Economies of scale, sustainability and efficiency can be enhanced if systems and operational activities are established and maintained within a multipurpose framework that considers all hazards and end user needs. Multi-hazard early warning systems will also be activated more often than a single-hazard warning system, and therefore should provide better functionality and reliability for dangerous high intensity events, such as tsunamis, that occur infrequently. Multi-hazard systems also help the public better understand the range of risks they face and reinforce desired preparedness actions and warning response behaviors.

Housed within a National Meteorological or Hydro-meteorological Service is the ideal solution since the main elements of the system can be exercised as part of the routine forecasting and analysis functions of the service. Thus in many countries disaster risk reduction activities are the responsibility of public weather services.

Dissemination and Communication

Warnings must reach those at risk. Clear messages containing simple, useful information are critical to enable proper responses that will help safeguard lives and livelihoods. Regional, national and community level communication systems must be pre-identified and appropriate authoritative voices established. The use of multiple communication channels is necessary to ensure as many people as possible are warned, to avoid failure of any one channel, and to reinforce the warning message.

Planning in context of Disaster Preparedness:

Planning in the context of disaster preparedness is holistic. It needs to keep in view the developmental concerns, disaster policy, the disaster scenario, organisational structure, administrative arrangements and resources. A Disaster Preparedness Plan is to be formulated and executed at all levels from national to grass-root to the community level. In geographical terms, the nation, state, province, district and a village- all could have a Disaster Preparedness Plan. Individual organizations too, have such plans. An effective basis of planning and the maintenance of relevant plans gives a clear and coherent approach in dealing with disasters. Within cities, planning is generally practiced at the level of local government, either by a department of that government or by an authority separately established to execute delegated powers.

The advocacy approach is often propagated by presenting a well-publicised plan, but not one that necessarily has been formally approved. By stages, it becomes accepted as

the appropriate way ahead. The planner using an advocacy approach is all too aware that householders have their considerations as well as disaster mitigation. For example, being near to place of work, school or marketplace is of considerably greater interest to the average householder. On the other hand, when it is supported by existing planning laws and by administration of developmental control, physical planning is credible and likely to be implemented. The planning process will then have the status to lead and guide development in particular locations within the zones of concern.

The purpose of planning is to anticipate future situations and requirements, thus ensuring the application of effective and coordinated counter-measures. This is a useful definition for disaster management officials because it indicates the wide nature of requirements for counter-disaster planning. In other words, planning is not confined not merely to preparedness to respond to specific disaster events. It should cater, as far as possible, to the various phases of the disaster management cycle. Therefore, requirements for planning involve a considerable flexibility of approach.

Planning to be effective needs to take into account certain important aspects as given below:

- a. Involvement of professional planners.
- b. Clear-cut objectives.
- c. Memorandum to explain the rationale of planning.
- d. Wide consultation to make planning fruitful
- e. Monitoring
- f. Utility of planning

A Disaster Preparedness Plan made at any level:

- a. Provides for hazard identification and risk analysis
- b. Indicates basic information about resources, demography, existing organisational structure, administrative facilities at that level, be it state, district and local levels
- c. Lists preparedness and mitigation measures and response mechanisms
- d. Defines specific roles and responsibilities for various actors at various levels: and
- e. Ensures networking/coordination with the media, NGOs, international agencies and other stakeholders.

A Disaster Preparedness Plan facilitates the following:

- a. Clarifying authority, responsibility and relationships
- b. Obtaining resources
- c. Establishing the control system
- d. Directing an controlling, and
- e. Monitoring, evaluation and updation.

Key Players in Disaster Warning

The United Nations International Strategy for Disaster Reduction (UN/ISDR) identifies several key parties that play major roles in the disaster management process, especially in disaster warning (UN/ISDR, 2006).

Communities, particularly those most vulnerable, are vital to people-centred early warning systems. Their input into system design and their ability to respond ultimately determine the extent of risk associated with natural hazards. Communities should be aware of hazards and potential negative impacts to which they are exposed and be able to take specific actions to minimize the threat of loss or damage. As such, the geographic location of a community is an essential determinant in the selection of disasters on which the system should focus their community education. For example, coastal communities need to be educated and prepared for the possibility of a tsunami, while a mountain community can be educated to respond to an early warning system for landslides.

Local governments should have considerable knowledge of the hazards to which their communities are exposed. They must be actively involved in the design and maintenance of early warning systems, and understand information received to be able to advise, instruct or engage the local population in a manner that increases their safety and reduces the potential loss of resources on which the community depends.

National governments are responsible for policies and frameworks that facilitate early warning, in addition to the technical systems necessary for the preparation and issuance of timely and effective hazard warnings for their respective countries. They should ensure that warnings and related responses are directed towards the most vulnerable populations through the design of holistic disaster response and early warning frameworks that address the specific needs of the related micro- and macro-level actors. The provision of support to local communities and local governments to develop operational capabilities is an essential function to translate early warning knowledge into risk reduction practices.

Regional institutions and organizations should provide specialized knowledge and advice in support of national efforts to develop or sustain the operational capabilities of countries that share a common geographical environment. Regional organizations are crucial to linking international capabilities to the particular needs of individual countries and in facilitating effective early warning practices among adjacent countries.

International bodies should provide support for national early warning activities and foster the exchange of data and knowledge between individual countries. Support may include the provision of advisory information, technical assistance, and policy and organizational support necessary to ensure the development and operational capabilities of national authorities or agencies responsible for early warning practice.

Non-governmental organizations (NGOs) play a critical role in raising awareness among individuals and organizations involved in early warning and in the implementation of early warning systems, particularly at the community level. In addition, they play an important advocacy role to help ensure that early warning stays on the agenda of government policy makers.

The private sector has a diverse role to play in early warning, including developing early warning capabilities in their own organizations. The private sector is also essential as they are usually better equipped to implement ICT-based solutions. The private sector has a large untapped potential to help provide skilled services in the form of technical manpower, know-how, or donations of goods or services (in-kind and cash), especially for the communication, dissemination and response elements of early warning.

The media plays an important role in improving the disaster consciousness of the general population and in disseminating early warnings. The media can be the critical link between the agency providing the warning and the general public.

The scientific community has a critical role in providing specialized scientific and technical input to assist governments and communities in developing early warning systems. Their expertise is critical to analysing the risks communities face from natural hazards, supporting the design of scientific and systematic monitoring and warning services, fostering data exchange, translating scientific or technical information into comprehensible messages, and disseminating understandable warnings to those at risk.

Channels Used for Disaster Warning

The following are some of the media - both traditional and new - that can be effectively used for disaster warning purposes. Some may be more effective than the rest, depending on the nature of the disaster, the regions affected, the socio-economic status of the affected communities and their political architecture. However, it is not a question of one medium against another. All are means to a common goal of passing along disaster warnings as quickly and as accurately as possible. A

Radio and Television

Considered the most traditional electronic media used for disaster warning, radio and television have a valid use. The effectiveness of these two media is high because even in developing countries and rural environments where the tele-density is relatively low, they can be used to spread a warning quickly to a broad population. The only possible drawback of these two media is that their effectiveness is significantly reduced at night, when they are normally switched off. A study on media, perception and disaster-related behaviour in Bangladesh revealed that early, easily understandable and language-appropriate warning

dissemination through radio can reduce the potential death toll of catastrophic cyclone and tidal bore. The study, conducted by the Forum for Development, Journalism and Communication Studies, recommended that relevant authorities develop innovative warning signal systems and take necessary steps to disseminate the warning in easily understood language through radio at least two days before a cyclone hits, hence mitigating the loss of lives and property every year in Bangladesh. Mohammad Sahid Ullah, the Chittagong University professor who led the study, suggests that part of the process is increasing public confidence in broadcast media since self-evacuation and the poor quality of shelters are the major causes of death (Sahid Ullah, 2003). After the Indian Ocean tsunami of 2004, many radio manufacturers considered introducing new digital radio alert systems that react even if the set is switched off. In order to trigger this alarm, a special flag integrated into the received signal from a terrestrial transmitter or a satellite would be used and the set would automatically tune to the emergency broadcast channel. The only disadvantage of this system is that to introduce a new generation of receivers in analogue environment generally takes 5 to 10 years. With digital receivers, this would be somewhat easier (Dunnette, 2006).

Telephone (Fixed and Mobile)

Telephones can play an important role in warning communities about the impending danger of a disaster. There were many examples of how simple phone warnings saved many lives in South Asian countries during the 2004 tsunami. Perhaps the most famous was an incident that occurred in one small coastal village of Nallavadu in Pondicherry, India. A timely telephone call - warning about the impending tsunami - was said to have saved the village's entire population of 3,600 inhabitants, as well as those of three neighbouring villages. Villagers of Nallavadu were involved in the M.S. Swaminathan Research Foundation's Information Village Research Project. Vijayakumar, a former project volunteer, was working in Singapore and heard a tsunami alert issued there. He immediately phoned the research centre in Nallavadu, which issued an alert. His quick thinking, followed by swift and coordinated action, led to the evacuation of the four villages before the tsunami hit the coast (Subramanian, 2005). In some countries, mechanisms called 'telephone trees' are used to warn communities of impending dangers. An individual represents a 'node' in a telephone tree. When that individual receives a warning message (either through phone or by other means), s/he is supposed to make a pre-determined number of phone calls (usually four or five) to others in a pre-prepared list. This arrangement not only ensures the timely delivery of the warning message, but also ensures the minimum duplication of efforts. However, there are two drawbacks to using telephones for disaster warning. Telephone

penetration in many areas is still not satisfactory - particularly in rural and coastal areas most at risk. Even with the exponential increase in the number of phones that has occurred in recent years, there are still many regions in the Asia-Pacific region, where a telephone is considered a luxury. The other drawback is the congestion of phone lines that usually occurs immediately before and during a disaster, resulting in many phone calls in that vital period that cannot be completed.

Short Message Service

Short message service (SMS) is a service available on most digital mobile phones that permits the sending of short messages (also known as 'text messages', 'SMSes', 'texts' or 'txts') between mobile phones, other handheld devices and even landline telephones. During the 2005 Hurricane Katrina disaster in the US, many residents of affected coastal areas were unable to make contact with relatives and friends using traditional landline phones. However, they could communicate with each other via SMS more easily when the network was functional. This is because SMS works on a different band and can be sent or received even when phone lines are congested. SMS also has another advantage over voice calls in that one message can be sent to a group simultaneously.

Cell Broadcasting

Most of today's wireless systems support a feature called cell broadcasting. A public warning message in text can be sent to the screens of all mobile devices with such capability in any group of cells of any size, ranging from one single cell (about 8 kilometres across) to the whole country if necessary. CDMA, D-AMPS, GSM and UMTS [4] phones have this capability. There are four important points to recall about the use of cell broadcasting for emergency purposes:

- ❖ There is no additional cost to implement cell broadcasting. It is already resident in most network infrastructure and in the phones, so there is no need to build any towers, lay any cable, write any software or replace handsets.
- ❖ It is not affected by traffic load; therefore it will be of use during a disaster, when load spikes tend to crash networks, as the London bombings in 2005 showed. Also, cell broadcasting does not cause any significant load of its own, so it would not add to congestion.
- ❖ Cell broadcasting is geo-scalable, so a message can reach hundreds of millions of people across continents within a minute.
- ❖ It is geo-specific, so that government disaster managers can avoid panic and road jamming by telling each neighbourhood specifically if they should evacuate or stay put.

The only possible disadvantage to cell broadcasting is that not every user may be able to read a text message when they receive it. In many Asia-Pacific countries, a sizeable population of the phone users cannot read and understand a message sent in English. Thus, it is essential to send warning messages in local languages. However, these messages would still be inaccessible to those who cannot read, even in their own language. The Dutch Government plans to start using cell broadcasting for emergency warnings. The infrastructure is already in operation with the operators KPN, Telfort and Vodafone. It is believed to be the first multi-operator warning system in the world, based on cell broadcasting with government use (Clothier, 2005).

Satellite Radio

A satellite radio or subscription radio is a digital radio that receives signals broadcast by communications satellite, which covers a much wider geographical range than terrestrial radio signals. Satellite radio functions anywhere there is line of sight between the antenna and the satellite, given there are no major obstructions such as tunnels or buildings. Satellite radio audiences can follow a single channel regardless of location within a given range. Satellite radio can play a key role during both disaster warning and disaster recovery phases. Its key advantage is the ability to work even outside of areas not covered by normal radio channels. Satellite radios can also be of help when the transmission towers of the normal radio station are damaged in a disaster.

Internet/Email

The role Internet, email and instant messages can play in disaster warning entirely depends on their penetration within a community and usage by professionals such as first responders, coordinating bodies, etc. While these media can play a prominent role in a developed country, where nearly half of all homes and almost all offices have Internet connections, this is not the case in the developing world. In many developing countries, less than 5 percent of the population uses the Internet and even those who are users do not use it on a regular basis. In such a situation, it is difficult to expect Internet and email to play any critical role. In spite of that drawback, many disaster-related activities are already underway within the Internet community. For example, a new proposal for using the Internet to quickly warn large numbers of people of impending emergencies is currently being drafted by the Internet Engineering Task Force.

At a 1997 international conference on 'Harnessing the Internet for Disasters and Epidemics', participants raised issues affecting their ability to use the Internet for improving crisis management. Concerns included the high cost of technology, a lack of content in local languages, and governmental controls on information exchange. "The most significant obstacle

impeding widespread Internet usage was the widening gap between those with unlimited access and those, whose access to information and new technologies was restricted by economic, linguistic, cultural or administrative constraints", highlights the Pan American Health Organization's report on the conference. Without direct communication between decision makers and without a free flow of reliable information among all involved, effective contingency planning and emergency response are at risk (Putnam, 2002).

Amateur and Community Radio

For almost a century, amateur radio (also known as 'ham radio') operators have assisted their communities and countries during disasters by providing reliable communications to disaster relief organizations at a moment's notice - especially when traditional communications infrastructure breaks down. In such a situation, amateur radio operators transmit emergency messages on voice mode about the well-being of survivors and information on casualties to friends and relatives. As was evident during the Indian Ocean tsunami that destroyed electricity and communications infrastructure in the Andaman and Nicobar Islands, amateur radio operators were the critical link between the islands and the Indian mainland and helped in the coordination of rescue and relief operations.

Besides disseminating voice-based messages, some amateur radio operators can also transmit in digital modes that include technologies such as radio teletype, tele-printing over radio, packet radio transmission and the recent Phase Shift Keying, 31 Baud - a type of modulation. Amateur radio broadcasters are authorized to communicate on high frequency (HF), very high frequency (VHF), ultra high frequency (UHF) or all three bands of the radio spectrum. They require a license from the licensing authority to ensure that only competent operators use their skills. However, depending on the country, obtaining a license can be a long process.

The most effective mode to exchange messages in an email-style is pact or using Airmail as email client and Winlink2000 as network on shortwave. A very valuable advantage is that the user can address any valid email address worldwide through hf-radio and winlink. Destroyed internet infrastructure can be bridged by this technology until a gateway (more than 150 worldwide RMS) with working internet access can be reached. Messages can be disseminated using one or more of the available bands. HF waves travel long distances, while VHF and UHF waves travel very short distances as these are line-of-sight propagation. However, repeaters increase the communications range and temporary repeaters can be set up in an emergency so that messages can reach the nearest town or city (Acharya, 2005).

There are no well-known case studies where community radio has been successfully

used for disaster warning purposes. The main reason can be because this is not a widespread media channel in many countries. Even where there are community radio systems, they operate within limited areas. Nevertheless, community radio is a medium that can be very effectively used for disaster warning purposes. The effectiveness of this medium is being tested through a disaster warning system implemented by Sarvodaya, the most widespread NGO in Sri Lanka (Daily News, 2006).

Sirens

Though not necessarily an ICT-based solution, sirens can be used in tandem with other ICT media for final, localized delivery.

GIS and Remote Sensing in Disaster Management [5]

GIS can be loosely defined as a system of hardware and software used for storage, retrieval, mapping and analysis of geographic data. Spatial features are stored in a coordinate system (latitude, longitude, state, plane, etc.) that references a particular place on the earth. Descriptive attributes in tabular form are associated with spatial features. Spatial data and associated attributes in the same coordinate system can then be layered together for mapping and analysis. GIS can be used for scientific investigations, resource management and development planning.

Remote sensing is the measurement or acquisition of information about an object or phenomenon by a recording device that is not in physical or intimate contact with the object. In practice, remote sensing is the remote utilization (as from aircraft, spacecraft, satellite or ship) of any device for gathering information about the environment. Thus, an aircraft taking photographs, earth observation and weather satellites, monitoring of a foetus in the womb via ultrasound, and space probes are all examples of remote sensing. In modern usage, the term generally refers to techniques involving the use of instruments aboard aircraft and spacecraft. As disaster management work usually involves a large number of different agencies working in different areas, the need for detailed geographical information in order to make critical decisions is high. By utilizing a GIS, agencies involved in the response can share information through databases on computer-generated maps in one location. Without this capability, disaster management workers have to access a number of department managers, their unique maps and their unique data. Most disasters do not allow time to gather these resources. GIS thus provides a mechanism to centralize and visually display critical information during an emergency. There is an obvious advantage to using a map with remote sensing or GIS inputs instead of a static geographical map. A static map is mostly analogous and is not interactive. On the other hand, a vulnerability map with GIS input provides dynamic information with cause and effect relationship.

4.3 Disaster Risk Management (DRM) plan

Hazard Risk and Vulnerability Assessment (HRVA) is one of the important and integral parts for disaster risk reduction. Currently several methodologies are being used worldwide for multi hazard risk assessment, vulnerability & capacity assessment and risk analysis for development of effective strategies for disaster risk reduction. However, when we consider them for application in Indian context it is marred by several issues and challenges, which have been discussed below:

Limited agencies working in the field of HRVA, who can guide and advice development practitioners in selection, development and implementation of such methodologies suitable to the local context.

- ❖ Limited technical expertise in the form of resource agencies and individuals, who can help decision makers and government agencies in implementation.
- ❖ Lack of availability of time series and spatial database on various socio-economic, environmental and infrastructural parameters along with demographic details on public domain/ public access that dissuades action research in this field.
- ❖ Hazard mapping and development of probability matrix of various hazard events necessitates use of advanced software like GIS, remote sensing and high resolution satellite imageries, which often has high cost implications and require high level of technical expertise for its application.
- ❖ Lack of historical legacy in the form of learnings that can be drawn from application of these methodologies in context of various hazards in India.
- ❖ Limited number of research agencies working in the field of development and application of new methodologies.
- ❖ Limited work on practical application of methodologies used worldwide in various hazard situations to assess its suitability and adaptation to Indian context.

In light of the above issues it becomes a challenge for policy/ decision makers, government & relief agencies, NGOs and other development practitioners to select a suitable methodology for assessment of hazard risks, vulnerability & capacity assessment and risk analysis to develop appropriate action plan for disaster preparedness and mitigation in a given local situation and need. Thus there is a need to take stock of the existing methodologies and review them in this context. The objective of this 'Baseline Document' is to develop a common understanding and knowhow about the various methods and tools available to conduct HRVA at various levels (national, state, district and community).

What do we mean by Hazard Risk and Vulnerability Assessment (HRVA)

The objective of undertaking a HRVA is primarily to anticipate the potential problems and possible solutions to help to save lives, protect property, assets, reduce damage and facilitate a speedy recovery. It is worthwhile to mention that HRVA is a means towards becoming disaster resilient and is not an end in itself. HRVA is a critical part of the disaster risk reduction program and it has the potential to help the necessary authorities to prepare for emergencies. Use of HRVA helps the policy makers, administrators and the community to make risk based choices to address vulnerabilities, mitigate hazards, and prepare for response to and recovery from hazard events. Apart from the central government, the state governments, district authorities and even the local level governance institutions (like municipalities and village panchayats) can undertake hazard risk and vulnerability analysis based on their respective locations vis-à-vis hazards.

The State Plan

The Role of the State Disaster Management Authority (SDMA)/ State Executive Committee (SEC) and the State Departments:

Section 23 of the DM Act 2005 provides that there shall be a DM plan for every state. It outlines the broad coverage of the plan as well as the requirements of consultation in the preparation of the state plans. It also provides for annual review and updating of the state plan, and enjoins upon the state governments to make provisions for financing the activities to be carried out under the state plans. It provides for the departments of the state governments to draw up their own plans in accordance with the state plan. The state plans shall be prepared by the SEC in conformity with the guidelines to be issued on related matters by the SDMA having regard to the guidelines laid down in this regard by the NDMA, and after such consultation with local and district authorities and the people's representatives as the SEC may deem fit. The state plan prepared by SEC shall be approved by the SDMA.

Levels of Disasters

- ❖ The approach to the preparation of the state DM plan should be holistic and address all the hazards the state is vulnerable to. It should take into account past lessons and experiences, build on good existing systems at different levels. It should address the need to streamline the systems and develop operational and management procedures.
- ❖ The state plan may also adopt the generic categorisation of disasters with specific plans at the state level by various departments to handle different disasters.

- ❖ The levels of disasters have already been categorised and disseminated as L0, L1, L2 and L3, based on the ability of various authorities to deal with them. Various colour codes relating to the level of alerts have also been assimilated.
- ❖ L0 denotes normal times which are expected to be utilised for close monitoring, documentation, prevention, mitigation and preparatory activities. This is the planning stage where plans at all levels from community to the State shall be put in place. Training on search and rescue, rehearsals, evaluation and inventory updation for response activities will be carried out during this time.
- ❖ L1 specifies disasters that can be managed at the district level, however, the state and centre will remain in readiness to provide assistance if needed.
- ❖ L2 specifies disaster situations that may require assistance and active participation of the state, and the mobilisation of resources at the state level.
- ❖ L3 disaster situations arise from largescale disasters where districts and the state may not have the capacity to respond adequately and require assistance from the central government for reinstating the state and district machinery.
- ❖ Even though there cannot be watertight compartmentalisation of responsibilities between states and the centre, especially in the case of man-made disasters, the participation by the Centre will normally be at the L3 level.

Objectives

The aim of the state DM plan is to ensure that the following components of DM are addressed to facilitate planning, preparedness, operational, coordination and community participation. Flowing from the national vision and the aforementioned approach, the objectives guiding the policy formulation are:

- ❖ Promoting a culture of prevention and preparedness by ensuring that DM receives the highest priority at all levels.
- ❖ Ensuring that community is the most important stakeholder in the DM process.
- ❖ Encouraging mitigation measures based on state-of-the-art technology and environmental sustainability.
- ❖ Mainstreaming DM concerns into the developmental planning process.
- ❖ Putting in place a streamlined and institutional techno-legal framework for the creation of an enabling regulatory environment and a compliance regime.
- ❖ Developing contemporary forecasting and early warning systems backed by responsive and fail-safe communications and Information Technology (IT) support.
- ❖ Promoting a productive partnership with the media to create awareness and contributing towards capacity development.

- ❖ Ensuring efficient response and relief with a caring approach towards the needs of the vulnerable sections of the society.
- ❖ Undertaking reconstruction as an opportunity to build disaster resilient structures and habitat.
- ❖ Undertaking recovery to bring back the community to a better and safer level than the pre-disaster stage.

Need for Immediate Action

Ideally, state DM plans should be made after vulnerability assessment and risk analysis of a state have been undertaken. Guidelines issued by the NDMA will also need to be internalised in these plans. Even though this process has begun, it is likely to take some time. It is felt that the preparation of plans cannot, and should not, await the outcome the disaster risk analysis. On the basis of extant information and knowledge, a plan should be formulated by every state and updated regularly adding fresh inputs on an ongoing basis. Pending detailed micro-level vulnerability assessment and risk analysis, information as currently available about the vulnerability profile of different areas of a state, including information contained in the Vulnerability Atlas of India published by the Ministry of Urban Development may be incorporated in the plan.

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1. Implementing Disaster Risk Management Plan:

Roles and responsibilities of various agencies:

- a. Central Government, State Government, District Administration, Local Administration, TRIs and Municipal Bodies.
- b. Role of armed forces, role of police, role of para-military forces, role of fire services.
- c. Role of NSS, NCC, Scouts and Guides.
- d. Role of International Agencies, role of NGOs, role of CBOs
- e. Role of community, role of family and individuals
- f. Role of media.

The key responsibilities of DM and emergency response system departments/agencies of the state government could be envisaged as:

❖ **Planning:** Development of strategies and requirement analysis for resource utilisation. The establishment of structures, development of systems and testing and evaluation by organisations of their capacity to perform as per allotted roles.

❖ **Coordinated Execution of Plans:** Increased coordination, convergence and synergy among the departments and institutions should be promoted in order to promote sharing of resources, perspectives, information and expertise through support of training centres, academic and applied research, education and awareness generation programme, etc.

❖ **Mainstreaming DM Concerns into Development Programmes:** This deals with integration of measures for prevention of disasters and mitigation into developmental plans and projects including mitigation projects and to facilitate provision of adequate funds for DM. Plans may be shown in three broad categories, viz. short, medium and long term. The structural and non-structural measures to be taken may be brought out in each category.

Guiding Principles for the Preparation of State Plans:

Participatory Approach

The plan preparation process essentially aims at strengthening the communities, elected local bodies and state administration's response and preparedness. The plans should be prepared through a participatory approach including identification of vulnerabilities and

risks, and also be holistic, inclusive, sustainable and environment friendly. The plans should be sensitive to the special needs of vulnerable sections such as pregnant and lactating mothers, children, the elderly and physically and mentally challenged persons. The concerns of women may be specifically addressed.

Community Based DM

During any disaster, communities are always the first responders. Community participation ensures local ownership, addresses local needs, and promotes volunteerism and mutual help to prevent and minimise damage. Therefore, states should make all efforts to assist communities in understanding their vulnerabilities and the lead role that they can play in managing risks with less dependence on external entities, through robust campaigns. Also arrangements for community based disaster preparedness should form the basis for preparation of plans.

Guiding Principles-Themes Underpinning the Plans

- ❖ The vulnerability of different parts of the state to different kinds of disasters.
- ❖ The measures to be adopted for prevention and mitigation of disasters.
- ❖ The manner in which mitigation measures shall be integrated with development plans and projects.
- ❖ The capacity building and preparedness measures to be taken.
- ❖ The roles and responsibilities of each department of the government of the state in relation to the measures specified above.
- ❖ The roles and responsibilities of different Departments of the government of the state in responding to any threatening disaster situation or disaster.
- ❖ The state plan will be reviewed and updated annually. Appropriate provisions will be made by the state governments for financing the measures to be carried out under the state plan.
- ❖ Copies of the state plan will be made available to the departments of the government of the state and such department will draw up their own plans in accordance with the state plan.

NDMA has accordingly framed these guiding principles for the preparation of state DM plans.

An outline to be followed by the states for preparing the plan has also been indicated.

The Framework

The framework of the plan should highlight the paradigm shift in DM from a relief-centric approach to a regime that anticipates the importance of preparedness, prevention

and mitigation, and comprises three parts:

- ❖ General issues including broad vulnerability profile of the state. It will also comprise other thematic issues such as community based DM, medical preparedness, awareness generation, training needs analysis and development of a state Human Resources (HR) plan, knowledge management, early warning and forecasting system standards for relief, rehabilitation etc.
- ❖ Disaster specific issues and methodologies.
- ❖ Cross-cutting issues common to all situations in any disaster. It will specifically deal with implementation, monitoring and review arrangements.

Basic Features

It will be in conformity with disaster specific guidelines, which are being issued from time to time by the NDMA wherein the last chapter of each guideline will detail outlines of the plans to be made. The plan will also address cross-cutting activities in DM, the vertical and horizontal linkages requiring coordination between the union, state and local governments on the one hand and a host of government departments and agencies on the other.

Coordinating and Monitoring Mechanism

This should include a reference to the following, as part of the coordination and monitoring mechanism:

- ❖ The role of elders, senior citizens and locally respected leaders.
- ❖ The role of the NGOs, Self Help Groups and other Community Based Organisations(CBOs).
- ❖ The role of women as active participants in DM including risk reduction, mitigation, preparedness and awareness generation.
- ❖ The role of urban and rural local bodies particularly gram sabhas.

Sections of the Framework

The framework will comprise sections that deal with:

- ❖ Operational.
- ❖ Administrative.
- ❖ Financial.
- ❖ Legal Aspects.
- ❖ Process.

The plan should:

- i) Take into account the socio-cultural realities of the state, and should be equity based recognising the differential needs of all sections of the society, including marginalised groups such as the elderly, pregnant and lactating mothers, children, physically and mentally challenged persons etc. It should specifically address the concerns of women.
- ii) Be in harmony with national, district, block, village and community level plans and should incorporate implementation strategies as well as indicate specific monitoring and evaluation mechanisms. The latter should also be able to capture the qualitative outcomes.
- iii) Develop a base line and identify the total risk and also agree on the minimum acceptable level of risk. It must capture all aspects of the DM cycle from preparedness to recovery. However, the initial plan formulation need not await completion of the risk assessment exercise.
- iv) Include a reference to the components of the state Human Resource Development (HRD) plan for DM, which specific emphasis on features specifically such as:
 - ❖ Training needs analysis.
 - ❖ Involvement, besides the Administrative Training Institutes (ATIs), of other sectoral training and educational institutions in the exercise.
- v) Contemplated professional training for micro planning, which should adopt the multi-hazard approach and develop inbuilt simulation techniques for the application of the plan.
- vi) Describe the role of the Emergency Operations Centre (EOC): time bound action plans must be indicating for creating facilities for environment scanning, intelligence gathering, operations and logistics management under one roof for holistic and efficient management of disasters at the state and district level.

Arrangements must be made and procedures must be laid down for manning the EOC on 24 X 7 X 365 basis. The plan must also cover in detail the indigenised Incident Command System at the state, district and local body levels.
- vii) Incorporate Medical Preparedness and Mass Casualty Management: The following points must be reflected in the state plan:
 - ❖ Listing of all hospitals and primary health centres including private nursing homes and their capacities.
 - ❖ Emergency casualty management plans at the local, district and state level.
 - ❖ For effective management of big cities like Delhi and Mumbai, nearby medical facilities must also be built into plans.

- ❖ Availability of mobile hospitals and/or plans for acquiring the same.
- viii) Outline various life-line structures/ infrastructure (e.g., bridges, roads, school buildings, hospitals, communication network etc.) and also highlight the arrangements for the maintenance and management of these structures during disasters.
- ix) Take note of the fact that seven battalions of the National Disaster Response Force (NDRF), coexisting with the proposed National Disaster Mitigation Resource Centres (NDMRCs) have already been positioned at nine different locations to cover the entire country. These NDMRCs have been evolved to help the states in capacity development, running of mock drills and facilitating the process of central assistance to the states. State governments should take all steps to upgrade and strengthen the Civil Defence and Home Guards, in sync with the efforts being made by the GoI in this regard.
- x) In major cities (with a population exceeding 10 lakhs), municipal corporations have a large administrative system including departments like engineering, public health and revenue, and sometimes fire services. These should provide a good mechanism for coordinated response in case of any crisis/disaster. Therefore, management of major cities should be planned as a unit. In metropolitan cities it is also advisable to make the urban metropolitan government directly responsible for DM.
- xi) Include the essentials of a scientific approach in damage assessment exercise so that timely and adequate relief can be provided.
- xii) Identify emergency management problems with spatial aspects appropriate for Geographic Information System (GIS). GIS can be part of the solution to many emergency management problems. Evaluation the costs of institutionalising GIS as an emergency management tool in terms of staffing, training, data collection, hardware and software.
- xiii) Lay due emphasis on the conduct of mock exercises and drills for different disasters. These exercises are essential for role clarity of the stakeholders concerned at the district level and for synergising coordination of various emergency support functions. In case of water and climate related hazards, exercises in different vulnerable areas of the state may be planned before the onset of the rainy season. For other kinds of disasters, exercises may be planned at regular intervals as considered appropriate.
- xiv) Describe the mechanism of convergence of existing national, state, district and local resources.
- xv) Address logistic issues in preparedness, response, rehabilitation and recovery related matters.

- xvi) Incorporate modalities for inter-state coordination as worked out in consultation with the neighbouring states.
- xvii) Include details of inter-country coordination as worked out for states sharing common international boundaries in consultation with the central government and the NDMA.
- xviii) Include requirements of infrastructure, communication, training and HRD in a phased manner.

Administrative

- i) As the formulation of the XIth Five Year plan is underway, the plan must be in accordance with the development plans of the state five-year plans. The plan should also be in conformity with the state DM policy.
- ii) The systems and institutions for implementation of the plans must be clearly identified and spelt out. The plan should explicitly take note of the available NDRF, Civil Defence, Home Guards, youth and students organisations etc., The National Cadet Corps (NCC), National Service Scheme (NSS) and Nehru Yuva Kendra (NYK) networks. Specific plans for capacity building and training should also be included in a separate chapter.
- iii) Public-Private Partnerships will be factored into the DM approach and the modalities through which these will work also need to be incorporated.
- iv) Knowledge Management-the following aspects will be covered in this section:
 - ❖ Establishment and operation of Community Service Centres (CSCs). The CSCs are an essential component of realising the goal of becoming a knowledge-driven society. These centres form the core for the use of ICT for rural development and are designed to build around several other initiatives and programmes, such as self help groups, skill building, microcredit, micro-enterprises, markets, literacy and education, agriculture, health, governance and entitlements etc.
 - ❖ Measures for documenting the indigenous local practices for DM.
 - ❖ Regular updation of the resource Inventory

As disasters do not recognise man-made boundaries, inter-state, inter-district coordination issues will have to be prominently factored into the plan.
- vi) DM involves a multi-disciplinary approach of many initiatives converging at the district and local level. It is here that there is greater need for inter-disciplinary coordination and monitoring. The facilities of the DM cells in all administrative training institutes should be fully utilised and strengthened to contribute to the development of DM related skills.

- vii) Interface with Panchayati Raj Institutes/ CBOs, NGOs and the community at large and utilising their assistance should be clearly brought out.
- viii) A mechanism must be put in place to ensure that the plan is updated on a regular basis (at least once in a year) and is able to accommodate changes over time.

Financial

The plan should:

- i) Be supported with necessary budget provisions for short, medium and long term activities. The DM Act, 2005 mandates the constitution of a State Disaster Response Fund at the state level and District Disaster Response Funds at the district level. The modalities for the creation of these funds as well as guidelines for their utilisation may be included in an annexure to the plan document. If it is not possible to put in place such a fund, in the near future, a reference to the establishment of these funds should be made in the plan.
- ii) Incorporate details regarding building in DM concerns into developmental plans. Details of mitigation and capacity development measures must be spelt out.
 - iii) Be a component sub-plan of the state's annual and five-year plans, indicating upfront the allocation of each of the departments involved along the lines of the tribal area sub-plan.
- iv) Reflect the provision of adequate funds for the requirements of relief material when disaster strikes, estimated on the basis of past experience. Care should also be taken to make full provision for the requirements of forces deployed on these occasions. Availability of funds for district and local authorities from the plans should be ensured.
- v) Furnish, while referring to external aid details of the nodal arrangements for coordination.

Legal

This section will cover aspects such as:

- i) The responsibility of the SEC:
 - ❖ To coordinate and monitor the implementation of the national policy, the national plan and the state plan.
 - ❖ To provide information to the NDMA relating to various parameters of DM.
 - ❖ To earmark funds for prevention and integration of disasters in their development plans and projects.
- ii) Put in place techno-legal regimes; e.g., amending building bye-laws, bringing in flood plain zoning legislation etc.

The Process

This section will:

- i) Designate the nodal department for coordinating formulation of the state plan.
- ii) Identify the focal point in each relevant department; consisting of a core group of officers and provide for adequate training to professionalise their approach.
- iii) Involve administrative/ technical institutions for providing technical support.
- iv) Describe nodal department(s) for involvement of NGOs, CBOs, corporate sector, youth organisations, educational institutions, Panchayati Raj Institutions (PRIs), urban local bodies, media and other stakeholders-and the modalities of such partnerships.
- v) Outline the logistics management in all aspects of DM from preparedness to recovery.
- vi) Describe the consultative process with local authorities, district authorities and people's representatives.

2. Risk transfer and insurance:

Governments and business can reduce the financial impact of hazards by insuring key assets and infrastructure, establishing loans that can be executed in the after shock of an adverse event of a given magnitude and setting aside catastrophe funds.

4.3.1 Linkage between Risk Transfer and other Components of Disaster Risk Management

Disaster risk transfer ensures that funds are readily available to rectify the damage or replace the facility, should a loss occur. It does not reduce actual vulnerability. As a result, risk transfer mechanisms should always be implemented in support of, rather than as a replacement for, broad disaster risk reduction initiatives, such as improved building practices and land use planning, among others. Risk transfer and financing as the other areas of risk management build on activities of risk identification such as hazard characterization, vulnerability assessments, and risk scenarios which provide critical information to establish the feasibility and cost benefit analysis for the risk transfer instruments.

The main components of risk transfer and financing are:

- ❖ **Insurance**—Market insurance and re-insurance.
- ❖ **Risk financing**—Budget self-insurance, public asset coverage financing, catastrophe bonds, disaster assistance funds.

4.4 Insurance

Contract by which an insurance company assumes the risk of occurrence of an uncertain adverse event, committing itself to pay for losses determined in the contract in exchange for a premium. The premium must be paid by the customer in anticipation.

Insurance is an integral part of a disaster risk management strategy and risk transfer. It distributes the losses (transfers the risks) among a pool of at-risk households, businesses and/or governments and to the reinsurance markets. As primary and reinsurance markets become more international and attract capital from investors throughout the world, insurance becomes an instrument for transferring disaster economic risks over the globe.

Insurance and other insurance-related instruments are a cost-effective way of transferring and spreading the economic risks of natural disasters in developing countries. However, in developing countries, insured losses are negligible.

Facts:

Insured losses in developing countries, however, are negligible. In low income countries only about 1% of disaster losses are insured (Hoff et al., 2003).

Asia (excluding Japan) and Africa only represent 6.3% of the world insurance market.

Of all natural catastrophes in 2002, only 4.8% were insured in Asia and 1.1% in Africa (Swiss Re 2003), and only 3.8% of all damages from natural disasters between 1985-1999 were insured in Latin America and the Caribbean (Aufrett, 2003).

Catastrophic risks are becoming more insurable as developments in computer technologies provide improved methods for estimating the risks. On the other hand, insurers are pulling out of many catastrophic risk markets because of the increasing frequency of occurrence of mega-loss events which have threatened the solvency of a number of insurers and raised alarms that insurers may be over exposed in many regions and states. This has led to an increase in premiums on catastrophe insurance with a corresponding reduction in demand.

Many factors contribute to the relatively high and volatile cost of insurance, such as high exposure to hazards, limited financial reserves, high administrative costs, great reliance on reinsurance and the prevalence of under-insurance (World Bank, 2002). To increase private sector coverage, both insurers and public institutions have called for public-private partnerships, which could help to start-up insurance schemes for the previously "uninsurable."

The intention of the public-private partnership is to allow governments to subsidize private sector premiums so as to ensure a larger proportion of the "uninsurable" building stock has insurance coverage.

4.4.1 The types of insurance that will be discussed in this lesson plan are as follows

Budget Self-Insurance, Market Insurance and Reinsurance.

A) Market Insurance:

Mechanism by which losses are stabilised through pre-payment in the form of regular premium payments. In market insurance the insurer assumes the risk. Insurance makes funds available to undertake repairs or rebuild after a disaster.

Examples:

- ❖ Business interruption insurance can help companies and their employees survive the recovery and rehabilitation period.
- ❖ Hurricane, earthquake, fire insurance of a property covers the cost of the losses stated in the clauses of the policy.

B) Reinsurance

Insurance by another insurer of all or a part of a risk previously assumed by an insurance company.

A significant insurance practice is that of reinsurance, whereby risk may be divided among several insurers, reducing the exposure to loss faced by each insurer. Reinsurance is done through contracts called treaties, which specify how the premiums and losses will be shared by participating insurers. The extent of disaster insurance in the developing countries is very low in comparison with developed countries. It is purchased by businesses, hotels, and other types of enterprises. Governments, whether from internal or external sources, have difficulties to insure assets and properties. On the other hand, unless there is an express policy regarding finance protection, there is a strong limitation to maintain available funds for post-disaster recovery and reconstruction. If insurance premiums are set to reflect the risk, this will create incentives for homeowners and businesses to take disaster risk reduction measures and to relocate out of high-risk areas. In spite of the arguments mentioned previously, there are some references that show different results due to the insurance market pressure and the imperfect incentive mechanisms.

What is reinsurance?

Reinsurance occurs when multiple insurance companies share risk by purchasing insurance policies from other insurers to limit the total loss the original insurer would experience in case of disaster. By spreading risk, an individual insurance company can take on clients whose coverage would be too great of a burden for the single insurance company to handle alone. When reinsurance occurs, the premium paid by the insured is typically shared by all of the insurance companies involved.

Reinsurance can help a company by providing:

1. **Risk Transfer** — Companies can share or transfer of specific risks with other companies
2. **Arbitrage** — Additional profits can be garnered by purchasing insurance elsewhere for less than the premium the company collects from policyholders.
3. **Capital Management** — Companies can avoid having to absorb large losses by passing risk; this frees up additional capital.
4. **Solvency Margins** — The purchase of surplus relief insurance allows companies to accept new clients and avoid the need to raise additional capital.
5. **Expertise** — The expertise of another insurer can help a company obtain a proper rating and premium.

4.5 Disaster Risk Financing

Risk financing mechanisms allow losses to be paid off in the medium to long-term via some form of credit facility. Such mechanisms provide cost-effective, multi-year coverage that assists with the stabilisation of premiums and increases the availability of funds for insurance purposes. The types of risk financing instruments that are discussed in this lesson are budget self insurance, public asset coverage financing, catastrophe bonds and disaster assistance funds.

A) Budget Self-insurance

Measures taken by individual property owners to allocate a modest yearly budget for improvement, maintenance, and selected retrofit investments for their property (buildings, land, infrastructure) which help to reduce future expected losses in the event of a disaster. The owner need not incur the cost of the purchase of regular insurance. Additionally, the owner can claim a higher tax deduction for property maintenance. As a result of these, the

cost of insurance is reduced. Examples: Building a river barrier; housing retrofitting; installing impact resistant windows; installing shutter systems; installing hurricane straps on the roofs of houses.

B) Public Asset Coverage Financing

Process by which governments seek to finance the reconstruction of damaged critical public assets which are important for restoring economic growth in the aftermath of a disaster. Governments carry a large and highly dependent portfolio of infrastructure assets. Some of these are critical for restoring economic growth. However, most public assets are not covered by insurance. Funds for rebuilding damaged assets must come from annual budgets or external sources and these are typically limited. However, public budgets are under tremendous pressure in the post-disaster period.

Best Practices

- ❖ Insurance coverage for critical public assets will ensure that key infrastructure can be rebuilt or rehabilitated if damaged by an adverse event.
- ❖ Selection of assets that merit insurance coverage is based on careful prioritisation of public facilities and on comprehensive vulnerability assessments for public facilities.

C) Catastrophe Bonds

Bonds that are purchased by investors which transfers risks to the global capital market. Recently, another risk-transfer instrument, commonly called a catastrophe or cat bond, has emerged, which can be used to replace traditional reinsurance. Cat bonds make use of different formulas to trigger compensation based on losses or on a physical phenomenon such as wind speed or precipitation. These bonds are purchased by investors and thus transfer the risk to the global capital markets. Catastrophe bonds emerged as instruments primarily for insurers. Insurers cannot diversify dependent risks by writing a large number of similar policies, and therefore locally operating insurance companies diversify through reinsurance. Reinsurance companies, in turn, manage their risk by an even wider and more global diversification, but in the early 1990s large losses from U.S. catastrophes strained the capacity of the reinsurance markets and raised the price of reinsurance. The cat-bonds constitute another alternative at this level.

D) Disaster Assistance Funds

Resources assigned to respond to adverse events of important magnitude and declared

disasters. These resources should be available and be kept as liquid assets that can be accessed immediately when required. While these investments are not used, they should be generating interests.

The disaster in Japan on 11 March 2011 has made clear how vulnerable society and the economy are in the face of geophysical events, which have been receiving less attention in recent years due to the all-pervading discussion on climate change. The Tohoku quake was also possibly the first natural disaster leading to long-term energy policy changes (nuclear phase-out in Germany and Switzerland, cancellation of the introduction of nuclear power in Italy) in numerous countries far away from the affected region.

The ramifications of the event pose new challenges for the scientific community and the insurance industry regarding issues such as the complex economic interactions involved and the quality of hazard maps, earthquake models, early warning systems and disaster response organisation. With economic losses amounting to some US\$ 380bn, 2011 has been the most expensive natural disaster year to date, far surpassing the previous record (US\$ 220bn) set in 2005. At US\$ 105bn, insured losses also reached a new high. The loss figures were dominated by 2011's earthquakes - in addition to Japan, above all the devastating event in New Zealand. The year also saw disastrous floods in Australia, Thailand, France and Italy and the tornado outbreak in the USA. Weather-related risks in the USA and Canada are constantly altering as a result of anthropogenic climate change and natural climate cycles like La Niña.

The Tohoku earthquake is not only the most expensive natural disaster on record worldwide to date, it also shows that the enormous efforts undertaken in the areas of earthquake research, earthquake resistant construction methods and early warning systems, even in countries such as Japan, cannot prevent such major disasters. Although an earthquake of this magnitude had not been expected in the region, the overall risk in Japan is adequately reflected in the available models. The level of the ground motions and the resulting losses lie within the range of expectations. Model results are always associated with significant uncertainties. However, major uncertainties in loss and risk assessment are due to a lack of sufficiently high-resolution exposure information and this too has been demonstrated once again by the Japanese earthquake.

Growing-gap

The increasing severity and frequency of natural catastrophes are driving up the cost

of disaster relief and reconstruction. The gap between the actual economic loss and the insured loss is large, especially in developing and emerging markets - which are those most hurt and the least prepared - just think of the devastating earthquake in Haiti, a country which has had to rely almost entirely on humanitarian aid for its reconstruction.

Thanks to innovative solutions, the reinsurance industry can help close the gap between economic and insured losses. For example, the Caribbean Catastrophe Risk Insurance Facility paid out \$8m to the government of Haiti in the aftermath of the disaster. Measured against the loss of life and devastation on the island, the CCRIF's payout was not a major sum of money. But that's not the point, the point is that the Haitian catastrophe has highlighted the potential of parametric insurance as an innovative solution to help countries plan for and pre-finance natural disasters as part of a comprehensive disaster risk management strategy. The payout provided much needed liquidity to get the wheels of government turning again.

Available relief:

Each year features new headlines about devastating natural catastrophes in different parts of the world. The resilience of a country not only depends on the severity of the catastrophic event but also on available funding for relief, recovery and reconstruction. Currently, a large part of the economic costs are not insured. New approaches to financing disaster risks are, therefore, key to making societies more resilient, as no organisation or country can fully insulate itself against extreme events.

Governments too should play their part by building up financial reserves or using insurance solutions, they can reduce their financial burden after a disaster occurs. These measures also lower the volatility on the government budget and help improve planning certainty for the public sector. But disaster financing instruments should never be seen in isolation. Rather, they must be viewed in a country's wider risk management context, as risk mitigation and risk transfer must go hand in hand.

4.5.1 Disaster risk financing: a paradigm shift

The Asia-Pacific region is again badly hit by natural disasters. In the three months to October 2009, Typhoon Morakot devastated Taiwan and created havoc in coastal China, then two ultra-powerful typhoons battered the Philippines, a massive earthquake rocked western Sumatra in Indonesia, serious floods swept southern India, and an earthquake and tsunami struck Samoa.

All these natural disasters not only caused widespread damage and placed heavy burdens on public budgets; they also sounded again urgent alarm calls for more sustainable risk financing arrangements - before disasters strike -- to enable the affected regions to recover swiftly.

Rising impact of natural disasters

Over the last few decades, heightened natural disaster activity has impacted virtually all nations. According to Swiss Re's sigma study, "Natural catastrophes and man-made disasters in 2008", 2008 was one of the worst years for natural and man-made catastrophes creating a total economic loss of USD 269bn and claiming more than 240,000 lives with Asia suffering the most. As most of these catastrophe losses were not covered by insurance, the gap between economic and insured losses has been widening (see Figure 1).

Emerging economies are particularly vulnerable to disasters due to insufficient urban planning, high population growth and environmental degradation. In addition, risks are accumulating in regions most exposed to natural catastrophes, for example, along coastal regions. The insurance penetration, however, is typically very low.

Securing risk financing before a disaster - not afterwards

Given the huge impact of natural disasters on society and the economy, comprehensive national disaster management policies have grown in importance around the world.

These policies address disaster preparedness and relief, as well as disaster prevention and mitigation. "Ex-post" risk financing, in other words financing risk after the event has occurred (e.g. by issuing debt, raising taxes, relying on international aid) is becoming unsustainable given the magnitude of disasters and the growing risk exposure. This has led to a widening gap between available funds and post-disaster requirements. As a result, proactive risk management and mitigation strategies have become the top priorities in managing natural disasters in order to minimise losses and related funding requirements.

Understanding the overall risk landscape is important. Disasters are classified as either low risk (i.e. "high frequency/low severity") or high risk (i.e. "low frequency/high severity"). For each category of risk, specific risk management strategies and potential risk transfer/financing solutions are needed. From a government perspective, natural disasters which fall in the high risk category need to be effectively managed. Governments can either transfer risk to traditional insurers and reinsurers or issue catastrophe bonds. They may also purchase derivatives and other financial instruments in order to hedge the risk. Figure 2 provides an

overview of different loss financing mechanisms and instruments.

Re/insurance has always been a widely adopted tool for risk financing. However, insurance markets in some emerging economies are still under-developed and will take many years to grow up - hence, government push on this front is much needed.

Innovative ways of financing risk mitigation and management are now available thanks to the emergence of capital market solutions and various reinsurance arrangements. These mechanisms can be especially advantageous to emerging economies as they supplement traditional insurance which is still largely under-developed. They:

- ❖ Ensure availability of funds during recovery and rebuilding efforts.
- ❖ Protect financial budgets and reduce volatility; pre-determined premiums also allow for budget certainty, particularly in multi-year contracts.
- ❖ Have no payback obligation (in contrast to loans) and limit the pressure to divert funds from other important projects to disaster-affected areas.

Public-private partnership in risk financing

The financing and effective reduction of disaster risks requires a joint response from the private and public sectors. As complexity and costs rise, neither group can meet the challenge alone. This is particularly true for emerging economies that lack funds, yet must also deal with the increasing frequency and severity of natural disasters. Moreover, as the underlying risk exposure increases, the inflation-adjusted costs of future events could far exceed the limited government budget.

Public-private partnerships, especially those involving reinsurance and capital market solutions, can improve disaster planning and prepare stakeholders for the consequences of climate change. They can also facilitate risk awareness and joint solutions using various risk transfer mechanisms. Solutions for risk prevention, risk transfer and financing include:

- ❖ Partnerships for risk prevention: Insurers have the expertise needed to identify risk prevention measures and can offer more attractive premiums if such measures are implemented. The public sector, on the other hand, is better able to enforce and finance risk prevention measures, such as building codes, fire prevention regulations, etc.
- ❖ Partnerships for risk transfer and financing: Government can play a significant role by creating a legal framework that enables market mechanisms to function. Given the insurability challenges, the public sector can assume different roles in each

transaction. For instance, the public sector may be involved in:

- ❖ The development of risk transfer solutions that involve the collection of critical exposure data. In doing so, governments can also draw on the support and know-how of re/insurers.
- ❖ Expanding the availability of risk transfer solutions for individuals and corporations.
- ❖ Becoming the de facto insurer of last resort; it can support protection coverage on a national basis and can partner with the private sector to transfer the risk using international reinsurance or capital market solutions.

The public sector can transfer the expenses stemming from immediate relief and emergency efforts. The main benefit is improved budgeting certainty and lower debt levels after a disaster.

Overall, such partnerships play an important role in managing the increasing cost of disaster relief, and enable the public sector to fund disaster relief proactively. This can be an effective way for governments to provide relief at lower costs, without creating a significant burden on public finances.