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DISASTER MANAGEMENT

Disaster management mechanism: Concepts of risk management and crisis management, Disaster management cycle, Response and Recovery, Development, Prevention, Mitigation and Preparedness, Planning for disaster management: Strategies for disaster management planning, Steps for formulating a disaster risk reduction plan, Disaster management Act and Policy in India, Organizational structure for disaster management in India, Preparation of state and district disaster management plans, Technologies for Disaster Management: Remote Sensing, GIS and GPS

Terminology

Disaster Management: Is more than just response and relief (i.e., it assumes a more proactive approach). It is a systematic process (i.e., is based on the key management principles of *planning*, *organising*, and *leading* which includes *coordinating* and *controlling*). It aims to reduce the negative impact or consequences of adverse events (i.e., disasters cannot always be prevented, but the adverse effects can be minimized.

Hazard: "Is the potential for a natural or human-caused event to occur with negative consequences". A hazard can become an emergency; when the emergency moves beyond the control of the population, it becomes a disaster.

Types Hazards

Geological Hazards: 1. Earthquake 2. Tsunami 3. Volcanic eruption 4. Landslide 5. Dam burst 6. Mine Fire
Water & Climatic Hazards: 1. Tropical Cyclone 2. Tornado and Hurricane 3. Floods 4. Drought 5. Hailstorm 6. Cloudburst 7. Landslide 8. Heat & Cold wave 9. Snow Avalanche 10.Sea erosion
Environmental Hazards: 1. Environmental pollutions 2. Deforestation 3. Desertification 4. Pest Infection
Biological: 1. Human / Animal Epidemics 2. Pest attacks 3. Food poisoning 4. Weapons of Mass Destruction
Chemical, Industrial and Nuclear Accidents: 1. Chemical disasters 2. Industrial disasters 3. Oil spills/Fires 4. Nuclear
Accident related accidents: 1. Boat / Road / Train / air crash /Rural / Urban fires 2. Forest fires 3. Building collapse 4. Electric Accidents 5. Festival related Bomb blasts /serial bomb disasters 6. Mine flooding

Emergency: "Is a situation generated by the real or imminent occurrence of an event that requires immediate attention". Paying immediate attention to an event or situation as described above is important as the event/situation can generate negative consequences and escalate into an emergency. The purpose of planning is to minimize those consequences.

Disaster: "Is a natural or human-caused event which causes intensive negative impacts on people, goods, services and/or the environment, exceeding the affected community's capability to respond".

Risk: "Is the probability that loss will occur as the result of an adverse event, given the hazard and the Risk (R) can be determined as a product of hazard (H) and vulnerability (V). i.e. R = H x V

Vulnerability: "Is the extent to which a community's structure, services or environment is likely to be damaged or disrupted by the impact of a hazard'.

A disaster is a natural or manmade event, which results in widespread human loss, loss of livelihood, property, economy and life. There are two types of disaster.

Man-made disaster: For example, industrial accidents, rail, road or air accidents, terrorist attack, war etc.
Natural disaster: Some of them are floods, tsunami, earth quakes, volcanic eruption, droughts, El-nino etc.
Disaster means a catastrophe, mishap, calamity or grave occurrence affecting any area from natural and manmade causes, or by accident or negligence, which results in substantial loss of life or human suffering or damage to, and destruction of property, or damage to, or degradation of environment and is of such a nature and magnitude as to be beyond the capacity of the community of the affected areas.

Disaster management essentially deals with management of resources and information towards a disastrous event and is measured by how efficiently, effectively and seamlessly one coordinates these resources.
The ability to effectively deal with disasters has become a challenge to modern technology. It is apparent that disaster problems cut across various disciplinary lines. One cannot effectively address disaster management difficulties by focusing on the isolated problems of a single type. Effective disaster management is influenced by the activities of a host of independent organisations at national and inter-national level.
Disasters and development are closely linked in that disasters can destroy development initiatives; but it also creates development opportunities.

DISASTER MANAGEMENT CYCLE

Disaster management can be defined as the body of policy and administrative decisions and operational activities which pertain to the various stages of a disaster at all levels. Broadly disaster management can be divided into pre-disaster and post-disaster contexts. There are three key stages of activity that are taken up within disaster management. They are:

1. Before a disaster strikes ***(pre-disaster).***

Activities taken to reduce human and property losses caused by the hazard and ensure that these losses are also minimized when the disaster strikes. Risk reduction activities are taken under this stage and they are termed as ***mitigation and preparedness activities.***

2. During a disaster ***(disaster occurrence).***

Activities taken to ensure that the needs and provisions of victims are met and suffering is minimized. Activities taken under this stage are called as ***emergency response activities***

3. After a disaster ***(post-disaster)***

Activities taken to achieve early recovery and does not expose the earlier vulnerable conditions. Activities taken under this stage are called as ***response and recovery activities***.

There are no standardized rules defining the different phases of the disaster management cycle. Different agencies use different cycles depending upon their objectives. However, while approaches vary, it is agreed that disaster management activities should be carried out in a cycle. The following steps and figures illustrates the phases of the disaster management cycle, which are described as follows

Disaster management is a cyclical process; the end of one phase is the beginning of another (Figure 1), although one phase of the cycle does not necessarily have to be completed in order for the next to take place. Often several phases are taking place concurrently. Timely decision making during each phase results in greater preparedness, better warnings, reduced vulnerability and/or the prevention of future disasters. The complete disaster management cycle includes the shaping of public policies and plans that either addresses the causes of disasters or mitigates their effects on people, property, and infrastructure. The mitigation and preparedness phases occur as improvements are made in anticipation of an event. By embracing

development, a community's ability to mitigate against and prepare for a disaster is improved. As the event unfolds, disaster managers become involved in the immediate response and long-term recovery phases.

The diagram below shows the **Disaster Management Cycle**.

Which explains the Strategies and Planning for disaster management and various steps for formulating a disaster risk reduction plan. **Disaster Management Plan (DPM)** envisages the need for providing appropriate action so as to minimize loss of life/property and for restoration of normalcy within minimum time.

Figure 1: Disaster Management Cycle

Components of Disaster Management

1.Preparedness
2.Response
3.Recovery
4.Prevention and Mitigation

Disaster prevention, mitigation and preparedness : The first important steps towards reducing disaster impact are to correctly analyse the potential risk and identify measures that can prevent, mitigate or prepare for emergencies. Information and Communication Technology can play a significant role in highlighting risk areas, vulnerabilities and potentially affected populations by producing geographically referenced analysis through, for example, a geographic information system (GIS).

DISASTER PREPAREDNESS

It involves measures to ensure that communities and services are capable of coping with the effect of disaster. Example for Disaster Preparedness

1. Community awareness andeducation
2. Proper warning system
3. Mutual aid arrangement
4. Mock drill, training practice

The goal of emergency preparedness programmes is to achieve a satisfactory level of readiness to respond to any emergency situation through programmes that strengthen the technical and managerial capacity of governments, organizations, and communities. These measures can be described as logistical readiness to deal with disasters and can be enhanced by having response mechanisms and procedures, rehearsals, developing long-term and short-term strategies, public education and building early warning

ystems. Preparedness can also take the form of ensuring that strategic reserves of food, equipment, water, medicines and other essentials are maintained in cases of national or local catastrophes. During the preparedness phase, governments, organizations, and individuals develop plans to save lives, minimize disaster damage, and enhance disaster response operations. Preparedness measures include:

- **Preparedness plans**
- **Emergency exercises/training**
- **Warning systems**
- **Emergency communications systems**
- **Evacuations plans and training**
- **Resource inventories**
- **Emergency personnel/contact lists**
- **Mutual aid agreements**
- **Public information/education**

As with mitigation efforts, preparedness actions depend on the incorporation of appropriate measures in national and regional development plans.

Disaster preparedness is defined as a **continuous and integrated process involving a wide range of activities and resources from multi-sectoral sources**.

Disaster Risk Reduction (DRR) : Natural hazards need not be natural disasters. Preventive action is possible, especially when advance knowledge of the nature and occurrence of such hazards are available to the general public. Human vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist and recover from the impact of a hazard. Factors that increase human vulnerability to disasters include rapid urbanization, population growth, and lack of knowledge about how to effectively resist the effects of disasters and poverty. Of all the factors, poverty is perhaps at the root of what makes most people vulnerable to the impact of most hazards. An understanding of human vulnerability provides us with an understanding of the significance of what physical measures should be naturally favoured in the various circumstances. Disaster Risk Reduction (DRR) forms the pillar of disaster preparedness, that is, it forms the action plan to be implemented before, during and after disasters. So, what is risk reduction? The IFRCRCS defines risk reduction as physical measures to reduce the vulnerability and exposure of infrastructure to natural hazards as well and to provide coping and adaptive infrastructure in case of a disaster event.

The Emergency Operation Plan (EOP) : At the national level, an Emergency Operation Plan (EOP) needs to be established to set out the scope of activities required for community preparedness and response. It must declare what the community can realistically do. The EOP allows the community to respond to threats and engages responders in the short-term recovery and must be flexible to be valuable in real and potential emergencies. EOPs are general and do not include the administrative plan, the mitigation strategy, the long

term recovery or the Standard Operational procedures. Those areas of disaster management are contained in separate documents.

RESPONSE AND RECOVERY

Disaster response is the sum total of actions taken by people and institutions in the face of disaster. These actions commence with the warning of an oncoming threatening event or with the event itself if it occurs without warning. The focus in the response and recovery phases of the disaster management cycle is on meeting the basic needs of the people until more permanent and sustainable solutions can be found. Developmental considerations contribute to all aspects of the disaster management cycle. One of the main goals of disaster management, and one of its strongest links with development, is the promotion of sustainable livelihoods and their protection and recovery during disasters and emergencies. Where this goal is achieved, people have a greater capacity to deal with disasters and their recovery is more rapid and long lasting. In a development oriented disaster management approach, the objectives are to reduce hazards, prevent disasters, and prepare for emergencies.

Terminology

Development:A step or stage in growth or advancement in society, economics or in politics for a better lifestyle.

Evacuation: Removal from hazardous place to another that is safe.

Humanitarian: The act of promoting the welfare of humanity, especially through the elimination of pain and suffering.

Logistics: The branch of civil defence or agency that have to do with procuring, maintaining, and transporting materiel, personnel, and facilities

Recovery: The return of buildings and infrastructure to a normal or improved state after a setback or loss.

Relief: Private or public help in the form of money, food, clothing, shelter, or medicine, provided to people who are temporarily suffering from the effects of disaster and are at the time completely helpless.

Remittance: Sending of money to pay for resources or services to help people in need after a disaster.

Reconstruction: A community or structure that has been reorganized, reformed, or restored after being impacted by a disaster or other hazard.

Rehabilitation: To restore buildings, or parts of towns, to their former condition or better.

Response: Actions taken in reaction to a disaster or similar hazards.

Security: Safety measures that provide a sense of protection against loss or harm from disaster or uncertain circumstances.

Volunteerism: The practice of using volunteer workers, especially in community service or disaster organizations and programmes.

Warning: Advice given to somebody or persons to be careful of impending danger.

DISASTER RESPONSE

It involves measures taken in anticipation of, during andimmediately after a disaster to ensure that the effects areminimized.

Example for Disaster Response

1. Implementing the disastermanagement plan
2. **S**etting up medical campsand mobilizing resources
3. Providing adequate shelterand sanitary facilities
4. Development of searchand rescue team

The aim of emergency response is to provide immediate assistance to maintain life, improve health, and to support the morale of the affected population. Such assistance may range from providing specific but limited aid, such as assisting refugees with transportation, temporary shelter, and food, to establishing semi-permanent settlement in camps and other locations. It also may involve initial repairs to damaged infrastructure. The focus in the response phase is on meeting the basic needs of the people until more permanent and sustainable solutions can be found.

Disaster Response Activities: The following are typical activities of emergency response:

1. **Warning -** Warning refers to information concerning the nature of the danger and imminent disaster threats. Warnings must be rapidly disseminated to government officials, institutions and the population at large in the areas at immediate risk so that appropriate actions may be taken, namely, either to evacuate or secure property and prevent further damage. The warning could be disseminated via radio, television, the written press, telephone system and cell phone.

2. **Evacuation and migration -** Evacuation involves the relocation of a population from zones at risk of an imminent disaster to a safer location. The primary concern is the protection of life of the community and immediate treatment of those who may be injured. Evacuation is most commonly associated with tropical storms but is also a frequent requirement with technological or industrial hazards. For evacuation to work there must be:

 A timely and accurate warning system,

 Clear identification of escape routes,

 An established policy that requires everyone to evacuate when an order is given,

 A public education programme to make the community aware of the plan.

In the case of a slow onset of a disaster, for example severe drought, the movement of people from the zone where they are at risk to a safer site is not, in fact, evacuation, but crisis-induced migration. This movement is usually not organized and coordinated by authorities but is a spontaneous response to the perception by the migrants that food and/or security can be obtained elsewhere.

3. **Search and rescue (SAR) -** Search and rescue (SAR) is the process of identifying the location of disaster victims that may be trapped or isolated and bringing them to safety and medical attention. In the aftermath of tropical storms and floods, SAR usually includes locating stranded flood victims, who may be threatened by rising water, and either bringing them to safety or providing them with food and first aid until they can be evacuated or returned to their homes. In the aftermath of earthquakes, SAR normally focuses on locating people who are trapped and/ or injured in collapsed buildings.

4. **Post-disaster assessment -** The primary objective of assessment is to provide a clear, concise picture of the post-disaster situation, to identify relief needs and to develop strategies for recovery. It determines options for humanitarian assistance, how best to utilize existing resources, or to develop requests for further assistance.

5. **Response and relief -** When a disaster has occurred response and relief have to take place immediately; there can be no delays. It is therefore important to have contingency plans in place. Relief is the provision on a humanitarian basis of material aid and emergency medical care necessary to save and preserve human lives. It also enables families to meet their basic needs for medical and health care, shelter, clothing, water, and food (including the means to prepare food). Relief supplies or services are typically provided, free of charge, in the days and weeks immediately following a sudden disaster. In the case of deteriorating slow-onset emergency situations and population displacements (refugees, internally and externally displaced people), emergency relief may be needed for extended periods.

6. **Logistics and supply -** The delivery of emergency relief will require logistical facilities and capacity. A well-organized supply service is crucial for handling the procurement or receipt, storage, and dispatch of relief supplies for distribution to disaster victims.

7. **Communication and information management -** All of the above activities are dependent on communication. There are two aspects to communications in disasters. One is the equipment that is essential for information flow, such as radios, telephones and their supporting systems of repeaters, satellites, and transmission lines. The other is information management: the protocol of knowing who communicates what information to whom, what priority is given to it, and how it is disseminated and interpreted.

8. **Survivor response and coping -** In the rush to plan and execute a relief operation it is easy to overlook the real needs and resources of the survivors. The assessment must take into account existing social coping mechanisms that negate the need to bring in outside assistance. On the other hand, disaster survivors may have new and special needs for social services to help adjust to the trauma and disruption caused by the disaster. Participation in the disaster response process by individuals to community organizations is critical to healthy recovery. Through these appropriate coping mechanisms will be mostsuccessfully developed.

9. Securit - Security is not always a priority issue after a sudden onset of disasters. It is typically handled by civil defence or police departments. However, the protection of the human rights and safety of displaced populations and refugees can be of paramount importance requiring international monitoring.

10. Emergency operations management - None of the above activities can be implemented without some degree of emergency operations management. Policies and procedures for management requirements need to be established well in advance of the disaster.

11. Rehabilitation - Rehabilitation consists of actions taken in the aftermath of a disaster to enable basic services to resume functioning, assist victims' self-help efforts to repair dwellings and community facilities, and to facilitate the revival of economic activities (including agriculture). Rehabilitation focuses on enabling the affected populations (families and local communities) to resume more-or-less normal (pre-disaster) patterns of life. It may be considered as a transitional phase between (i) immediate relief and (ii) more major, long-term reconstruction and the pursuit of ongoing development.

12. Reconstruction **-** Reconstruction is the permanent construction or replacement of severely damaged physical structures, the full restoration of all services and local infrastructure, and the revitalization of the economy (including agriculture). Reconstruction must be fully integrated into ongoing long term development plans, taking account of future disaster risks. It must also consider the possibilities of reducing those risks by the incorporation of appropriate mitigation measures. Damaged structures and services may not necessarily be restored in their previous form or locations. It may include the replacement of any temporary arrangements established as a part of the emergency response or rehabilitation. Under conditions of conflict, however, rehabilitation and reconstruction may not be feasible. For obvious reasons of safety and security, activities in rehabilitation and reconstruction may need to wait until peace allows them.

Modern and traditional responses to disasters

The responses to disasters may employ a mix of approaches from traditional to modern with these approaches moving back and forth depending on the nature of disaster in term of their scope. The scope of disasters has influenced responses in the following ways:

 Humanitarian (aid to relieve pain and suffering),

 Remittance (Cash sent to victims),

 Relief assistance (food, medication, tents),

 Networking (contacting organizations),

 Volunteerism (internal and external groups of people volunteering help or community- based approach) and

 Mutual aid agreements (pre-drawn up agreements to provide resources)

As disasters continue to occur, people affected by them sometimes need external assistance in order to survive and recover. Response can be either modern or traditional to the extent that assistance is transferred to individuals in the disaster. The assistance can either be provided in-kind,in the form of food aid, shelter materials, seeds or blankets, or it can be provided in cash, enabling people to decide for themselves what they most need, and to buy in local markets.

A striking means of response to disasters has been remittances where people residing outside the disaster area channel sums of money or goods over long distances to those affected. The terms used to describe this response are most commonly understood to refer to transfers between migrants and their places of origin. In many countries the community-based approach to emergency response has been the Community Emergency Response Team (CERT), organized in communities to work closely with the local government and the community members themselves to identify community needs and priorities for any disaster situation.

Other examples of response are:

Local Partnerships: One charitable organization, (World Vision) has a rich network of local partnerships with churches, community organizations and government agencies that come to us when families in their community suffer a disaster. Local police precincts and politicians' offices often call on World Vision to assist them after an emergency.

Gifts-in-Kind: Charitable organisations actively solicit corporate partners to donate needed new products to assist disaster survivors in their recovery and supervise the distribution of these products. Their goal is for every Storehouse to have a constant supply of emergency resources to be distributed at a moment's notice. Products will include such things as water, blankets, medical supplies, latex gloves, and kits containing enough hygiene and paper products, and other necessities to supply a family of four for up to four days.

Civil Service: World Vision as one of the charitable organisations works to be a voice in the community by serving on planning committees such as National and State Volunteer Organizations Active in Disasters (VOAD), Office of Emergency Management (OEM), FEMA, Red Cross, Salvation Army and Habitat for Humanity (H4H). These relationships allow organisations to serve as a liaison to the community and be a voice for the children and families they serve.

Specific Needs: In the aftermath of an emergency, families have many needs. Because of the large variety of donations that are received and distributed, World Vision is able to meet these special needs. New clothes, shoes, furniture, mattresses, school supplies, building materials and cleaning supplies are only a few of the unique offerings that it is able to offer.

Modern methods of disaster response

New technologies can be very useful and powerful tool in disaster response, namely:

1 **Cell phones:** cell phones as warning devices can be very useful. Short messages can be sent to recipients warning of imminent threat of tropical storms, wind storms or any severe weather likely to cause damage.

2 **Spatial information** – use of satellite imagery. The emergency management community is keenly aware of the potential of mapping technologies such as geographic information systems (GIS), remote sensing (satellite imagery), and global positioning systems (GPS) in support of emergency response operations. Increasingly, geographic technologies are being utilized for hazard mitigation as well as response efforts. These range from damage assessments mapping the event and affected areas to search and rescue,risk assessment, risk perception (Hodgson and Palm, 1992), and risk communication (Hodgson and Cutter 2001).

3 **Social media and social networking** – social media and social networking can be used as a tool to emergency response communications. Text messaging such as Twitter and the social networking system such as Face book can be used as a channel of communication in disaster response. Examples of suggested applications of social media and social networking include:

- Use blogs to rapidly publicize the need for assistance grants.
- Create geo-tagged photo groups to document damage.
- Publicize volunteers willing to share recovery-relevant expertise.
- Use map-based mashups (combinations of data in webpages) to display relevant local information.
- Immediately share "lessons learned."
- Integrate volunteer directories with social networks to simplify information sharing.
- Distribute weather information via methods that support geographic targeting.

 Encourage sharing of resource information among corporations that will most likely be involved in recovery work.

 Use the assistance application process as basis for voluntary sharing of information among affected populations.

DISASTER RECOVERY

It involves measures, which support emergency affected areas in reconstruction of the physical infrastructure and restoration of economic and emotional well being.

eg, for disaster recovery

1. Counseling programme for those who lost the near ones
2. Restoring services like roads, communication link
3. Providing financial support employment
4. Reconstructing damaged buildings

As the emergency is brought under control, the affected population is capable of undertaking a growing number of activities aimed at restoring their lives and the infrastructure that supports them. There is no distinct point at which immediate relief changes into recovery and then into longterm sustainable development. There will be many opportunities during the recovery period to enhance prevention and increase preparedness, thus reducing vulnerability. Ideally, there should be a smooth transition from recovery to on-going development. Recovery activities continue until all systems return to normal or better. Recovery measures, both short and long term, include returning vital lifesupport systems to minimum operating standards; temporary housing; public information; health and safety education; reconstruction; counselling programmes; and economic impact studies. Information resources and services include data collection related to rebuilding, and documentation of lessons learned. Additionally, there may be a need to provide food and shelter for those displaced by the disaster.

Recovery activities: are classified as short-term and long-term. During response, emergency action was taken to restore vital functions while carrying out protective measures against further damage or injury.

a) Short-term recovery is immediate and tends to overlap with response. The authorities restore interrupted utility services, clear roads, and either fix or demolish severely damaged buildings. Additionally, there may be a need to provide food and shelter for those displaced by the disaster. Although called short-term, some of these activities may last for weeks

b) Long-term recovery may involve some of the same activities, but it may continue for a number of months, sometimes years, depending on the severity and extent of the damage sustained. For example, it may include the complete redevelopment of damaged areas. The goal is for the community to return to a state that is even better than before the emergency.

The Recovery Plan: The recovery process should be understood clearly and it is important to have a general plan for recovery which should be appended to emergency operation plans. The primary purpose of the plan is to spell out the major steps for managing successful recovery. For each step you will also designate keypartners and their roles and steps to mobilize them. The plan should have at least the following seven steps:

1 Gathering basic information

2 Organizing recovery

3 Mobilizing resources for recovery

4 Administering recovery

5 Regulating recovery

6 Coordinating recovery activities

7 Evaluating recovery

For the majority of disasters, local communities are able to provide the assistance needed for recovery. However, for a major disaster, it may be necessary to obtain assistance from the government and other sources. Therefore, preparations must be made to request outside aid if a major disaster occurs. This will mean informing and convincing decision makers, especially those outside the affected area. Documenting the effects of the disaster is the best way to carry this out. Documentation involves providing evidence of what happened. Photographs of the damage provide irrefutable evidence. Take pictures of the damage, the repair work, and completed restorations. You cannot take too many pictures. There can be a good documentation if the following five simple steps are followed:

1 Take pictures of damages and repairs. More is better than too little. Private citizens may have excellent shots to supplement your own.

2 Take notes on damages and repairs. Again, more is better than too little. If there is too much to write at one time, dictate your notes into atape recorder for later transcription.

3 Clip and file newspaper reports and stories. If you can get video footage from the television stations, do that also.

4 Record all expenditures carefully and keep all receipts and invoices.

5 Make sure anyone acting on behalf of the jurisdiction does the same.

PREVENTION AND MITIGATION

It involves measures to eliminate or reduce the incidence of severity of disasters.
Example for prevention and mitigation
1.Preventing habitation in riskzones
2.Disaster resistant buildings
Mitigation refers to all actions taken before a disaster to reduce its impacts, including preparedness and long-term risk reduction measures. Mitigation activities fall broadly into two categories:

1. **Structural mitigation** – construction projects which reduce economic and social impacts

2. **Non-structural activities** – policies and practices which raise awareness of hazards or encourage developments to reduce the impact of disasters.

Four sets of tools that could be used to prevent or mitigate disasters include:

***a)* Hazard management and vulnerability reduction**

***b)* Economic diversification**

***c)* Political intervention and commitment**

***d)* Public awareness**

The first two apply exclusively to disasters caused by natural phenomena while the latter are used to mitigate any other hazards

Mitigation strategies: Two aspects of mitigation include:

***1)* Hazard identification and vulnerability analysis and**

***2)* Various mitigation strategies or measures.**

Hazard identification and vulnerability analysis:

A hazard can cause the full range of natural disasters, major man-made incidents, and resource crises that become the concern of the entire community, not just emergency management personnel. The ideal is for communities to be prepared at all times for all types of hazards. In practical terms however, this is not possible. Preparedness for one hazard or disaster may increase your risk to another. For example, structures designed to withstand hurricane force winds may incur or cause greater damage if there is an earthquake. The more logical solution would be to adapt best practices as much as possible for the most likely scenario. But what about the hazards associated with our 21st-century lifestyle such as chemical spills, ecological disasters, explosions, major transportation accidents? Mitigation involves addressing both natural and man-made hazards, different as they are in many respects. A crucial first step in mitigation is deciding which hazards have the greatest potential to affect your jurisdiction.

The most critical part of implementing a mitigation strategy is a full understanding of the nature of the threat as the hazards faced vary between locations and from hazard to hazard. Some countries are prone to floods and drought; others have histories of tropical storm damage; and others are at risk from earthquakes. Most countries are prone to at least some combination of hazards and all face the possibility of technological disasters as industrial development progresses. The effects these hazards are likely to have and their potential damage is dependent on the risks, the people, their livelihoods and the existing infrastructure. For any particular location, therefore, it is critical to know which hazards are the most likely. Furthermore, targeting mitigation efforts relies heavily on correctly assessing vulnerability.

Vulnerability assessment can also be extended to social groups or economic sectors: People who rent houses rely on a landlord to repair any damage and are more likely to be rendered homeless in the event of a disaster. Correctly identifying the groups of tenants and establishing rights of tenure and landlords' obligations to repair may reduce the number of people rendered homeless in the event of a disaster. Similarly, food growers sending their produce to market through a single mountain pass will be unable to sell their produce if the pass is blocked. Developing an alternative route to market will reduce disruption of the agricultural sector. Thus, building or constructing a number of routes is very important because in a time of disaster it will be easier for the affected group or community to employ alternatives.

Mitigation strategies or measures:

 Adjusting normal development programmes to reduce losses. For instance, varieties of crops that are more wind, flood or drought resistant can often be introduced in areas prone to floods, drought and cyclones.

 Economic diversification. In areas where the principal or sole source of the income may be threatened, attempts should be made to diversify the economy and introduce the economic activities that are less vulnerable. Diversification is extremely important where economies are dependent on a single cash crop.

 Developing disaster resistant economic activities. Some economic activities are relatively unaffected by disasters. For instance, situating warehouses in flood plains may be more appropriate than manufacturing plants in the same location. Coconut palms could be more suitable than other fruit trees in cyclone-prone coastal areas. Efforts should be made to identify and encourage the development of enterprises that are less vulnerable to the hazards.

Disaster Mitigation and Infrastructure

Investment in infrastructure for the management of hydrological hazards – such as cyclones and floods – has significantly reduced the loss of life from an annual average of 100,000 persons during the past 50 years to 41,000 persons during the past 15 years. Investment in disaster management infrastructure falls into two categories:

1 Investment in infrastructure to support sustainable socioeconomic development; and

2 Investment in infrastructure for reconstruction and recovery.

Considerations

a) Operations-To maintain operations during a disaster, ensure that a backup generator is available in case of power failure and that a battery-operated radio is at hand as well as a back-up supply of critical goods/needs – a continuous supply if at all possible.

b) Critical Information and Communication-Ensure that there is a backup copy of all critical information – namely employee data, customer list, production formulas, a list of software and hardware and logon and passwords – in an accessible yet safe place; regularly update the backup copy of all files.

c) Insurance- Ensure that all critical assets, including business interruption are insured and be aware of the content of the insurance policy.

d) Infrastructure planning- For most infrastructure projects, natural hazard mitigation should be addressed during the conceptual development of the project. The preliminary design should take into consideration the prevalent hazards and methods to avoid or to minimize the effects of the extreme natural events. These factors include:

 Situating the facility to avoid flooding, soil erosion, exposure to high winds and unstable soils, and to minimize exposure to storm surge and high waves for harbours, docking facilities and coastal buildings;

 Designing the shape of the buildings and structural systems to minimize effects of high winds and earthquake effects, tornados, and, in the case of protection works, to avoid unwanted effects such as beach erosion, accretion, or negative impact on coral reefs and wetlands;

 Construction materials that are corrosion resistant and of appropriate durability and strength.

Furthermore, targeting mitigation efforts relies heavily on correctly assessing vulnerability. Vulnerability assessment can also be extended to social groups or economic sectors: People who rent houses rely on a landlord to repair any damage and are more likely to be rendered homeless in the event of a disaster. Correctly identifying the groups of tenants and establishing rights of tenure and landlords' obligations to repair may reduce the number of people rendered homeless in the event of a disaster. Similarly, food growers sending their produce to market through a single mountain pass will be unable to sell their produce if the pass is blocked. Developing an alternative route to market will reduce disruption of the agricultural sector. Thus, building or constructing number of routes is very important because in a time of disaster it will be easier for the effected group or community to employ alternatives.

e) Mitigation Activities at Home- Homes can be destroyed by high winds. Flying debris can break windows and doors, allowing high winds and rain into your house. High winds can also cause weaker places in your home to crumble. Strengthening vulnerable areas such as roofs, exterior doors, windows, and garage doors; clearing debris from possibly affected areas; and building a safe room in your home can all contribute to personal mitigation strategies. It is also very important to encourage people to learn more about other protective measures that fall within the purview of their local building code. Additionally, in areas that are prone to strong winds, there is a need for a number of other measures to be considered such as engineering structures to withstand wind forces; including wind load requirements in building codes; planting windbreaks; planning forestry areas upwind of towns; and the provision of wind-safety buildings, for example providing strong village halls for community shelter in vulnerable settlements.

Summary:

The disaster management cycle – a continuous process – includes mitigation, preparedness, response, and recovery. Mitigation refers to those measures and policies put in place to reduce the impacts of a disaster. The process involves hazard identification, vulnerability analysis, putting in place the right infrastructure and ensuring up-to-date logistics. Proper education and public awareness are useful tools to engage community involvement. Disasters and developments are closely related. Disaster can both destroy development initiatives and create development opportunities. Development schemes can both increase and decrease vulnerability. Thus, links between disaster and development must be taken into account for sustainable socio-economic development. Effective mitigation programmes incorporate risk reduction measures in regular investment projects. Financial institutions require that foreign aid be approved on the basis of appropriate risk reduction and mitigation policies at the national, regional and local scale developments.

PR**I**NC**I**PL**ES** OF D**IS**A**STE**R MANA**GE**M**E**N**T**

1. Minimize casualties
2. Prevent further casualties
3. Rescue the victims
4. First aid
5. Evacuate
6. Medical care
7. Reconstruction

DISASTERS AND DEVELOPMENT

Disasters and development are closely linked in that disasters can both destroy development initiatives and create development opportunities and that development schemes can both increase and decrease vulnerability. Development requires institutional and structural transformations of societies to speed up economic growth reduce levels of inequality and eradicate absolute poverty. Over time, the effects of disasters can seriously degrade a country's long-term potential for sustained development and cause governments to substantially modify their economic development priorities and programs.

At the same time, disasters often provide opportunities for development. They can improve the atmosphere in favour of change and create a rationale to establish development programs such as job training, housing construction and land reform. However, poor management of the relief and rehabilitation responses may have severe negative implications for development for years to come, and may even increase vulnerability to future hazards.

Relationships between Disasters and Development

1. Disasters set back development programmes, destroying years of development initiatives. This also gives an opportunity for infrastructure improvements e.g. transport and utility systems to be rebuilt when a flood destroys them.
2. Rebuilding after a disaster provides significant opportunities to initiate development programs. A self-help housing program to rebuild housing destroyed by an earthquake teaches new skills, strengthens community pride and leadership.
3. Development programs can increase an area's susceptibility to disasters e.g. probability of technological disaster may increase in an industrialized area. Therefore, the Environment Impact Assessment is mandatory.
4. Sustainable Development programs can be designed to decrease the susceptibility to disasters and their negative consequences. Housing projects constructed under building codes designed to withstand high winds result in less destruction during the next tropical storm.

Disasters can seriously disrupt development initiatives in several ways, including:

- Loss of resources
- Interruption of (ongoing) programs
- Impact on investment climate
- Impact on the non-formal sector
- Social and Political implications

The impact of disasters on development programmes

Disasters can significantly impede the effectiveness of development resource allocation. The damage is done in many ways and the impacts can be as complex as the economy itself.

Vulnerabilities caused by development

Lack of access to education and information often has wider implications and local people may be simply unaware of the options open to them in reducing their vulnerability. Poor people, for example, have fewer assets to invest in resources which may reduce their vulnerability; they may also be unwilling to make any significant investment without clear and obvious benefits. Poor people are also less likely to be in a position to organize collectively to reduce common risks, partially because these groups are usually have a higher proportion of women, young children, elderly people, the sick and disabled. Furthermore, after a disaster, the effects of malnutrition and chronic illness put people at additional risk. Although in aggregate terms development will usually contribute to a reduction in vulnerability to natural disasters, any development activity may substantially increase particular types of vulnerability.

Illustrations of such development activities are as follows:

 Urban development often leads to an influx of low-income groups such as large-scale settlements on marginal land or in high densities with poor quality housing. Buildings may be situated on earthquake faults, in flash-flood zones, or on slopes prone to landslides.

 Marine and coastal zone development leads to concentrations of populations exposed to possible storm-surges, high winds, flash floods, and landslide risks. Tourist development can increase potential vulnerability substantially when low-lying beach areas are targets for infrastructure and capital investments. Tsunamis and tropical storms can quickly destroy these improvements as well as placing tourists and workers at substantial risk to death and injury.

 Construction of transportation lines and poorly managed forestry programmes will often lead to deforestation and increased risks of landslides.

 Water resource management projects, including dams and irrigation schemes, potentially increase risks to large populations, either by displacing natural habitats, increasing risks of severe flooding, or by increasing the risk of dam failure.

 Investment in poorly controlled hazardous industries may lead to concentrations of population around the plant; increases in air and water pollution; and exposure to hazards from both chronic and catastrophic release of toxic materials.

 Livestock development projects can lead to severe loss of vegetation cover and conditions of near-desertification around specific natural points such as wells.

 Agricultural projects promoting cash crops may reduce the production of staple foods.

Each of these examples illustrates the importance of including risk assessment as an integral part of programme planning and evaluation, and highlights the critical importance of training and education in these areas.

Development programmes can decrease vulnerability

The term mitigation is increasingly applied to measures which reduce economic losses, as well as those which reduce death and injury. The distinction between the two types of mitigation is as follows:

Structural mitigation includes measures to reduce the economic and social impact of hazardous agents and involve construction programmes, especially dams, windbreaks, terracing and hazard resistant buildings.

Non-structural mitigation is most commonly used to refer to policies and practices, including land-use policies, zoning, crop diversification, building codes, and procedures for forecasting and warning. In a broader context, non-structural mitigation can also include education, awareness, environmental understanding, community organization, and empowerment strategies. Mitigation is most effective as part of a medium- to long-term development programme which incorporates hazard-reduction measures into regular investment projects. Under these conditions risks can be assessed analytically and explicitly in the context of national planning and investment programme reviews. The cost effectiveness of specific emergency preparedness measures and hazard reduction activities can be assessed. There are opportunities to build links between government and international organizations involved in relief and recovery and to provide

opportunities for investment institutions to help governments gain access to new developments in hazard-reduction technologies. In regular investment project design and sector loans, attention can be given to early warning systems and other elements of emergency preparedness through financial or technical assistance.

There is a wide range of options for incorporating mitigation measures into regular development programmes. Each of the following examples suggests ways of protecting populations and critical economic assets against hazards and of reducing the overall impact of a disaster.

1 **Strengthening urban utility systems and industrial support infrastructures** is a common aim of development projects. This is achieved through a variety of external inputs including loans, technical assistance, and support for institutional development. "Lifeline systems" – such as water, electric power, transportation links and communications – can be made more effective as well as more selectively resistant to particular hazards.

2 **Many other opportunities exist to incorporate hazard resistant building techniques in housing and other construction programmes.** These opportunities are usually specific to the type of housing used in the region and the nature of local hazards. Such measures can substantially reduce injuries and deaths from earthquakes and tropical storms. Additionally, these programmes can protect high value economic resources, reducing the total costs of damage and improving the chances of more rapid recovery. On a wider scale, the application of building codes, associated training programmes, and more extensive use of zoning regulations in urban development reduce the risk for the local population, and the likelihood of damage to industrial facilities. Improved drainage systems and flood protection measures can further protect people and facilities in hazardous areas.

3 **Investments in improving administration and strengthening the resource-base of public institutions will have a general positive impact on the effectiveness of preparedness arrangements, emergency responses and the quality of longer-term recovery planning.** Training programmes in general, and especially those with a management or technical focus, can be expected to improve the implementation of mitigation and response measures.

4 **Agricultural and forestry programmes provide a range of opportunities for mitigation.** Reforestation programmes reduce risks of erosion, landslides and flash flooding. Changes in cropping patterns can also ameliorate erosion problems and losses due to floods and drought. The introduction of pest-resistant crops can reduce the economic and other impacts of infestations. Programmes for soil conservation, water harvesting and improving on-farm storage can mitigate the effects of drought. Each of these examples represents an opportunity for mitigation. Each also requires investment of scarce resources.

According to USAID***:***

 The operation must be directed at restoring assets or productivity in a long-term development perspective - not relief.

 The prospective economic returns should be high.

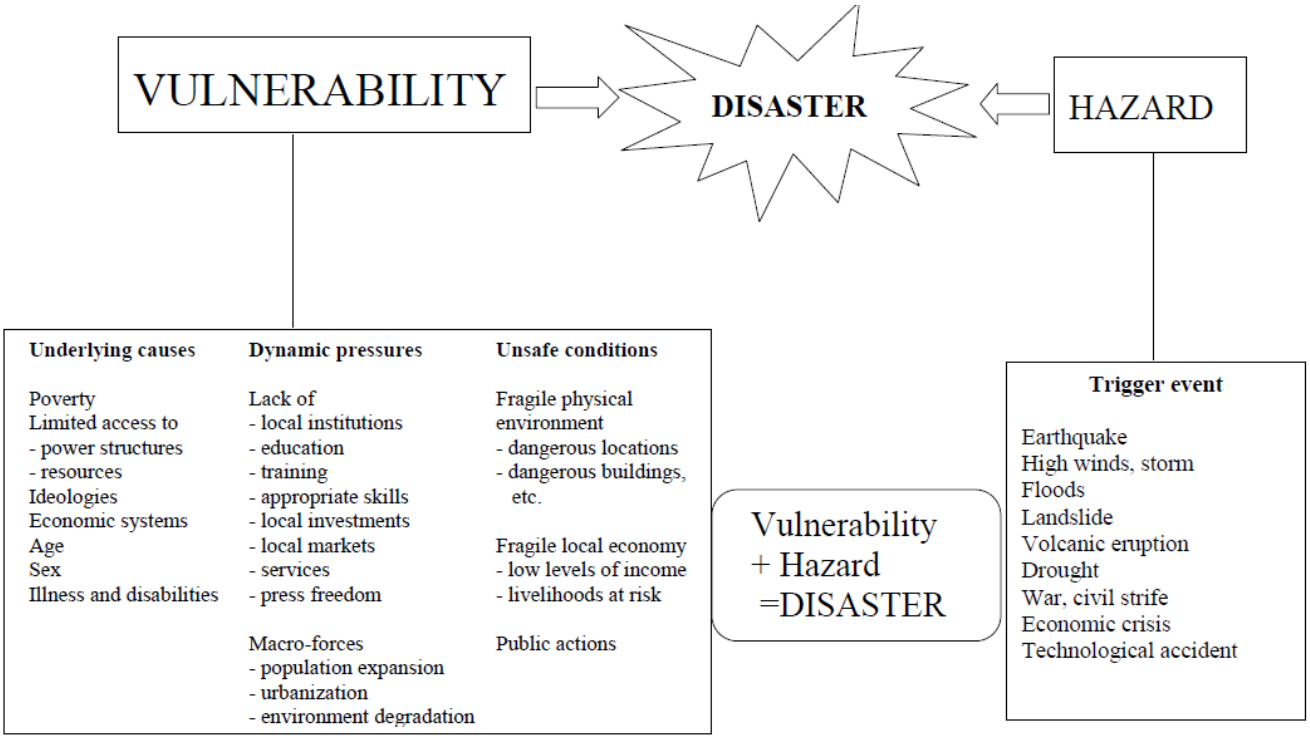
 The effects of the emergency should be significant.

 The event triggering the emergency should have a low probability of happening again soon.

 The need for an urgent response should be evident.

 Emergency lending is limited to cases where effective action can be felt in two to three years.

 There should be some prospect for future reduction in the hazard.



Hazarg is natural or human-made event that threatens to adversely affect human life, property or activity to the extent of causing a disaster. A disaster occurs when hazards and vulnerability meet.

Risk Management and Crisis Management

Risk:

The combination of the probability of an event and its negative consequences. The word “risk” has two distinctive connotations: in popular usage the emphasis is usually placed on the concept of chance or possibility, such as in “the risk of an accident”; whereas in technical settings the emphasis is usually placed on the consequences, in terms of “potential losses” for some particular cause, place and period. It can be noted that people do not necessarily share the same perceptions of the significance and underlying causes of different risks.

WHAT IS RISK?

Risk is a measure of the expected losses (deaths, injuries, property, economic activity etc) due to a hazard of a particular magnitude occurring in a given area over a specific time period.

The figure on the right illustrates essentially the four factors essentially hazards, location, exposure, and vulnerability which contribute to risk. They are:

- *Hazards* (physical effects generated in the naturally occurring event),
- *Location* of the hazards relative to the community at risk,
- *Exposure* (the value and importance of the various types of structures and lifeline systems such as water-supply, communication network, transportation network etc in the community serving the population, and
- *Vulnerability* of the exposed structures and systems to the hazards expected to affect them during their useful life.

Risk management

The systematic approach and practice of managing uncertainty to minimize potential harm and loss. Risk management comprises risk assessment and analysis, and the implementation of strategies and specific actions to control, reduce and transfer risks. It is widely practiced by organizations to minimise risk in investment decisions and to address operational risks such as those of business disruption, production failure, environmental damage, social impacts and damage from fire and natural hazards. Risk management is a core issue for sectors such as water supply, energy and agriculture whose production is directly affected by extremes of weather and climate.

Risk reduction can take place in two ways:

1. Preparedness

This protective process embraces measures which enable governments, communities and individuals to respond rapidly to disaster situations to cope with them effectively. Preparedness includes the formulation of viable emergency plans, the development of warning systems, the maintenance of inventories and the training of personnel. It may also embrace search and rescue measures as well as evacuation plans for areas that may be atrisk from a recurring disaster. Preparedness therefore encompasses those measures taken before a disaster event which are aimed at minimizing loss of life, disruption of critical services, and damage when the disaster occurs. All preparedness planning needs to be supported by appropriate legislation with clear allocation of responsibilities and budgetary provisions.

2. Mitigation

Mitigation embraces all measures taken to reduce both the effect of the hazard itself and the vulnerable conditions to it in order to reduce the scale of a future disaster. Therefore mitigation activities can be focused on the hazard itself or the elements exposed to the threat. Examples of mitigation measures which are hazard specific include modifying the occurrence of the hazard, e.g. water management in drought prone areas, avoiding the hazard by siting people away from the hazard and by strengthening structures to reduce damage when a hazard occurs. In addition to these physical measures, mitigation should also be aimed at reducing the physical, economic and social vulnerability to threats and the underlying causes for this vulnerability.

CRISIS MANAGEMENT

A sudden and unexpected event leading to major unrest amongst the individuals at the workplace is called as organization crisis. In other words, crisis is defined as any emergency situation which disturbs the employees as well as leads to instability in the organization. Crisis affects an individual, group, organization or society on the whole.

Characteristics of Crisis

- Crisis is a sequence of sudden disturbing events harming the organization.
- Crisis generally arises on a short notice.
- Crisis triggers a feeling of fear and threat amongst the individuals.

Crisis management is the process by which an organization deals with a disruptive and unexpected event that threatens to harm the organization, its stakeholders, or the general public. The study of crisis management originated with the large-scale industrial and environmental disasters in the 1980s. It is considered to be the most important process in public relations.

Three elements are common to a crisis: **(a)** a threat to the organization, **(b)** the element of surprise, and **(c)** a short decision time. "Crisis is a process of transformation where the old system can no longer be maintained." Therefore, the fourth defining quality is the need for change. If change is not needed, the event could more accurately be described as a failure or incident.

In contrast to risk management, which involves assessing potential threats and finding the best ways to avoid those threats, crisis management involves dealing with threats before, during, and after they have occurred. It is a discipline within the broader context of management consisting of skills and techniques required to identify, assess, understand, and cope with a serious situation, especially from the moment it first occurs to the point that recovery procedures start.

Crises management is a situation-based management system that includes clear roles and responsibilities and process related organisational requirements company-wide. The response shall include action in the following areas: Crisis prevention, crisis assessment, crisis handling and crisis termination. The aim of crisis management is to be well prepared for crisis, ensure a rapid and adequate response to the crisis, maintaining clear lines of reporting and communication in the event of crisis and agreeing rules for crisis termination.

The techniques of crisis management include a number of consequent steps from the understanding of the influence of the crisis on the corporation to preventing, alleviating, and overcoming the different types of crisis. Crisis management consists of different aspects including:

- Methods used to respond to both the reality and perception of crisis.
- Establishing metrics to define what scenarios constitute a crisis and should consequently trigger the necessary response mechanisms.
- Communication that occurs within the response phase of emergency-management scenarios.

Crisis-management methods of a business or an organization are called a crisis-management plan. Crisis management is occasionally referred to as incident management.

Crisis Management is the art of dealing with sudden and unexpected events which disturbs the employees, organization as well as external clients refers to Crisis Management. Or the process of handling unexpected and sudden changes in organization culture is called as crisis management.
Need for Crisis Management

- Crisis Management prepares the individuals to face unexpected developments and adverse conditions in the organization with courage and determination.
- Employees adjust well to the sudden changes in the organization.
- Employees can understand and analyze the causes of crisis and cope with it in the best possible way.
- Crisis Management helps the managers to devise strategies to come out of uncertain conditions and also decide on the future course of action.
- Crisis Management helps the managers to feel the early signs of crisis, warn the employees against the aftermaths and take necessary precautions for the same.

Essential Features of Crisis Management

- Crisis Management includes activities and processes which help the managers as well as employees to analyze and understand events which might lead to crisis and uncertainty in the organization.
- Crisis Management enables the managers and employees to respond effectively to changes in the organization culture.
- It consists of effective coordination amongst the departments to overcome emergency situations.
- Employees at the time of crisis must communicate effectively with each other and try their level best to overcome tough times. Points to keep in mind during crisis
- Don't panic or spread rumours around. Be patient.
- At the time of crisis the management should be in regular touch with the employees, external clients, stake holders as well as media.
- Avoid being too rigid. One should adapt well to changes and new situations.

Disaster management Act and Policy in India, Organizational structure for disaster management in India:

INDIAN DISASTER MANAGEMENT ACT 2005

Important Provisions

From response and relief-centric approach to a proactive, and comprehensive mindset towards DM covering all aspects from prevention, mitigation, preparedness to rehabilitation, reconstruction and recovery

Emergence of DM act 2005

- India is vulnerable to natural disasters on account of its unique geo-climatic conditions
- 60% of the landmass is prone to earthquakes
- 40 million hectares is prone to floods
- about 8% of the total area is prone to cyclones
- 68% of the area is susceptible to drought
- Impact of Orissa super cyclone (1999), Bhuj earthquake, January 2001 and Tsunami 2004, made GoI to adopt multi-disciplinary and-multi sectoral approach to disasters
- A high power committee was formed to make recommendations on preparing Disaster Management plans
- And on 23rd December 2005, GoI enacted Disaster Management Act

Important Provisions :

- **National Disaster Management Authority**
- **National Disaster Response Force**
- **National Disaster Response / Mitigation Funds**
- **National Institute of Disaster Management**
- **State Disaster Management Authority**
- **District Disaster Management Authority**
- **State / District Disaster Response / Mitigation Funds**
- **State / District / Departmental DM Plans**
- **Local Authorities – responsibilities**
- **Offences and Penalties**

National Disater Management Authority

- Prime Minister of India – Chairperson, Ex Officio
- Other 9 members nominated by the Chairperson
- The Chairperson may designate one of the Members as Vice-Chairperson–
- Member – 8 other members

Powers and functions of NDMA

- Lay down policies on disaster management; approve the National Plan; approve plans prepared by the Ministries.
- Lay down guidelines to be followed by the State Authorities/Ministries or Departments in drawing up Plans.
- Coordinate the enforcement and implementation of the policy and plan; arrange for, and oversee, the provision of funds for the purpose of mitigation measures, preparedness and response

Other provisions

- 10 National Disaster Response Force (NDRF) battalions
- National Disaster Response Fund (NDRF)
- National Disaster Mitigation Fund (NDMF)
- National Institute of Disaster Management (NIDM, New Delhi)

Preparation of state and district disaster management plans:

Kerala State Disaster Management Authority (KSDMA), As per G.O. (P) No. 154/2007/DMD dated 4th May 2007

- The Chief Minister- Chairperson; Ex Officio
- The Minister for Revenue- Vice Chairperson, Ex Officio
- The Chairperson of the State Executive Committee (Chief Secretary) shall be the CEO of the State Authority / Member, Ex-Officio
- Principal Secretary- Revenue and Home- Member, Ex-Officio
- Other Ex- Officio members nominated by The CM

State Executive Committee

- The Chief Secretary of the State- Ex-Officio Chairman;

- Four Secretaries (Revenue/Health/Home/Finance) to the Government from State departments as the State Government may think fit to be Ex-Officio Members.
- Functions (17 in number):
    - Implementing of National Plan and State Plan
    - Act as coordinating and monitoring body for management of disaster in the State.
    - Examine the vulnerability of different parts of the State to different forms of disasters
    - Lay down guidelines for preparation of disaster management plans by departments and District Authorities
    - Evaluate preparedness at all governmental or non-governmental levels
    - Coordinate response in the event of any threatening disaster situation
    - Advise the State Government regarding all financial matters in relation to disaster management and many MORE…..

SDMA powers and functions

1. Lay down State DM Policy / Approve the State DM Plan
2. Approve the DM Plans prepared by the departments / Lay down guidelines for the departments to integrate preventive and mitigating measures in their development plans and projects
3. Coordinate implementation of the State DM Plan
4. Recommend provision of funds for mitigation and preparedness
5. Review the measures being taken for mitigation, capacity building and preparedness.

State DM Plan

- **SDMP to be prepared by the State Executive Committee and approved by the State DM Authority, the DM Plan shall include:**
    - ❑ The vulnerability of different parts of the State to different forms of disaster.
    - ❑ The measures to be adopted for the prevention and mitigation of disasters.
    - ❑ The manner in which the mitigation measures shall be integrated with the development plans and projects.
    - ❑ The capacity building and preparedness measures to be taken.
    - ❑ The roles and responsibilities of different Departments of the Government of the State in responding to threatening disaster situation or disasters.

Department DM plan

- **Every department of the State Government shall prepare a Disaster Management Plan which shall lay down the following:**
    - ▪ Integration of strategies for the prevention of disasters or the mitigation of its effects or both with the development plans and programmes by the department
    - ▪ The roles and responsibilities of the department of the State in the event of any disaster and emergency support function it is required to perform

District DM authority

Chapter IV of DM ACT, 2005

- District Collector – Chairperson, Ex-officio

- Additional District Magistrate - Chief Executive Officer of the District Authority
- The elected representative of the local authority- Co- Chairperson, Ex-Officio
- The SP- Member, Ex-Officio
- The DMO- Member, Ex-Officio
- Three other district level officers; to be appointed by the State Government

DDMA powers and functions

1. To prepare, review and update district DM plan
2. To coordinate and monitor the implementation of DM plan at district level.
3. Identify areas vulnerable to disasters
4. Ensure measures for prevention and mitigation
5. To lay down guidelines for and ensure departmental DM plans
6. To lay down guidelines for integration of DM related measures in departmental development plans and projects
7. To organize and coordinate specialized training programmes
8. To facilitate community training and awareness
9. To set up, maintain, review and upgrade early warning systems
10. To lay down guidelines for, give direction and coordinate response to any disaster at the district level

DDMA Plan

- **District Plan shall include:**
    1. Areas in the district vulnerable to different forms of disasters;
    2. Measures to be taken, for prevention and mitigation of disaster, by the Departments of the state at the district level
    3. Capacity-building and preparedness measures required to be taken by the Departments at the district level
    4. Response plans and procedures, in the event of a disaster

Technologies for Disaster Management: (Remote Sensing, GIS and GPS)

Geographic Information Systems (GIS) and Disaster Management

Geographic Information Systems are information systems capable of integrating, storing, editing, analyzing, sharing, and displaying geographically-referenced information. In a more generic sense, GIS is a tool that allows users to create interactive queries (user created searches), analyze the spatial information, edit data, maps, and present the results of all these operations.

GIS Application can be useful in the following activities:

1 **To create hazard inventory maps:** At this level GIS can be used for the pre-feasibility study of developmental projects, at all inter-municipal or district level.

2 **Locate critical facilities:** The GIS system is quite useful in providing information on the physical location of shelters, drains and other physical facilities. The use of GIS for disaster management is intended for planners in the early phase of regional development projects or large engineering projects. It is used to investigate where hazards can be a constraint on the development of rural, urban or infrastructural projects.

3 **Create and manage associated database:** The use of GIS at this level is intended for planners to formulate projects at feasibility levels, but it is also used to generate hazard and risk maps for existing settlements and cities, and in the planning of disaster preparedness and disaster relief activities.

4 **Vulnerability assessment:** GIS can provide useful information to boost disaster awareness with government and the public, so that (on a national level) decisions can be taken to establish or expand disaster management organisations. At such a general level, the objective is to give an inventory of disasters and simultaneously identify "high-risk" or vulnerable areas within the country.

GIS and the Disaster Management Cycle

Planning

The most critical stage of disaster management is the realization that there is a need for planning based on the risk that is present. The extent to which lives and properties will be spared the adverse effects of a disaster is dependent on the level of planning that takes place and the extent to which technology has been incorporated in planning efforts. GIS is useful in helping with forward planning. It provides the framework for planners and disaster managers to view spatial data by way of computer based maps.

Mitigation

The use of GIS in disaster management can help with structural and nonstructural mitigation. GIS allows you to spatially represent areas at risk and the level of risk associated with a particular hazard, which can be a guide in decision making. It will facilitate the implementation of necessary mechanisms to lessen the impact of a potential emergency. With GIS, disaster managers are in a better position to determine the level of mitigative structures that should be in place given the vulnerability of an area or population.

Preparedness

As a tool, GIS can help with the identification and location of resources and "at risk" areas. It establishes a link between partners and critical agencies, which allow disaster managers to know where relevant partner agencies are stationed. In the context of disaster management, GIS maps can provide information on the human resources present in an Emergency Operation Centre as well as on the ground personnel such as security, health providers and other key responders. This is particularly useful since the technology can help with strategic placement of emergency personnel where it matters most. GIS helps to answer the question of who is to be based where and at what phase during the emergency. It can help to determine whether or not road infrastructure and communications networks are capable of handling the effects of disaster and, if necessary, guide in the placement of resources.

Response

GIS technology can provide the user with accurate information on the exact location of an emergency situation. This would prove useful as less time is spent trying to determine where the trouble areas are. Ideally, GIStechnology can help to provide quick response to an affected area once issues (such as routes to the area) are known. In the case of a chlorine explosion for example, GIS can indicate the unsafe area as well as point rescue workers to resources that are closest to the affected areas. GIS can be used as a floor guide for emergency response to point out evacuation routes, assembly points and other evacuation matters.

Recovery

Mapping and geo-spatial data will provide a comprehensive display on the level of damage or disruption that was sustained as a result of the emergency. GIS can provide a synopsis of what has been damaged, where, and the number of persons or institutions that were affected. This kind of information is quite useful to the recovery process.

GIS and Emergency Shelters

GIS technology can be used by shelter operators to capture specific personal details of persons being housed at the shelter. It would also facilitate the process of stock demands and distribution. The technology would capture information on the general makeup of the shelter, that is,the number of children, adults, disabled or any other special occupants.

GIS and Distribution of Relief

"Food drops" in affected areas after a disaster is always likely to take place. The process can be helped with the use of GIS, as maps can be generated which identify the specific areas where clusters of victims are located and the unique needs of persons within these clusters.

GIS and Data Gathering

 Special populations

With GIS, disaster managers are placed in a position where they have diagrammatic presentations of the specific location of disabled or elderly persons (for example) that reside within a community. This will make organized assistance on their behalf more efficient and time saving.

 Most vulnerable areas

Maps can be produced to highlight more "high risk" areas that are particularly prone to disasters. This kind of information helps with planning (before the occurrence of the disaster) and also facilitates the coordination of efforts during and after the event.

Advantages of GIS

GIS as an innovative and interactive technology tool has more advantages than there are challenges.

1 GIS has the ability to represent spatial information over a wide geographic area. GIS accommodates 3-dimensional graphics which will provide a more detailed viewed of its contents.

2 GIS technology facilitates the integration of different geo-spatial information; which can include models, maps and other graphic forms.

3 GIS effectively analyzes, collects, manages and distributes up-to-date information.

4 GIS is versatile and easy to use – this requires little training to get individuals involved in the process.

5 Attribute table which forms a database- Given that information from GIS can be easily tabulated, it provides a comprehensive pictorial overview of what is happening in the country. For example, GIS can show the exact location of shelters across the country, or the sites where search and rescue operations have taken place.

Challenges of using GIS in Disaster Management

1 Major impacts on life of people, economy and environment. In the context of emergency management, GIS can impact people's lives in a significant way as it reveals sometimes personal and people-specific information.

2 Crucial decisions- Based on the information obtained from GIS mapping, it may require taking critical (sometimes hard) decisions in the best interest of the affected area.

3 GIS being a technological tool can be complex and a bit difficult to grasp initially.

4 Large amounts of information (input) is usually required to get useful output from the system.

5 Time is critical during an Emergency- The decision-making process may be stalled during an emergency due to:

 the large volume of information required by the GIS system; and

 the vast amount of time require to analyze the information before a decision is finally made.

Who can use GIS?

GIS can be used in any area of disaster management. Among the professionals within the disaster management discipline who would find GIS useful are: Emergency Planners Meteorologists Geologists Telecommunications personnel Security personnel Health practitioners

Global Positioning System (GPS) and Disaster Management

The term global positioning system (GPS) is used to refer to the Global Navigation Satellite System (GNSS) developed by the United States Department of Defence. The proper name is The Navigation System with Timing And Ranging Global Positioning System (NAVSTAR GPS) however the acronym GPS is typically used. Though initially intended solely for US military purposes the GPS system was extended for civilian use in the 1980's. Popular applications include automobile and marine navigation, tracking, farming and research. GPS is a grouping of 24 well-spaced satellites that orbit the earth and make it possible for people with ground receivers to pin-point their exact geographic location with great accuracy. GPS equipment is widely used across the globe and is sufficiently "low-cost" so that anyone can own a GPS receiver.

Application of GPS to Disaster Management

GPS is particularly useful during disasters because it operates in any weather, anywhere and at all times. While it functions simply to give the location of the receiver, the level of precision of GPS makes it quite useful in disaster management. In many instances GPS data is integrated with GIS to overlay real-time activity during emergency. GPS find its greatest utility during the response and recovery phases; however it can also be utilized during preparedness and mitigation phases. An important application of GPS in EDM is tracking of emergency vehicles or supplies. In this application the GPS receiver attached to the vehicle and the location is overlaid onto a map. Other applications include the monitoring the height of waves. GPS units are fixed to buoys and the height of the units are can be determined to within centimetres any significant change in wave height or velocity can trigger an alarm for a tsunami or sea surge. Volcanoes can also be

monitored using GPS. By measuring the deformation of the ground, inferences about volcanic activity can be made.

Remote Sensing and Disaster Management

Remote sensing is the use of electromagnetic (EM) wave radiation to acquire information about an object or phenomenon, by a recording device that is not in physical or intimate contact with the object. In other words, Remote Sensing is the acquisition of information about an object by a recording device that is NOT in physical or intimate contact with the object. As you read this material you are actually engaging in remote sensing; we do this so naturally that we seldom realize it. We could take this a step further - we use telescopes to view distant planets. We are definitely sensing objects remotely. In both cases the sensor is our eyes and the EM wave is light. If the term EM waves seems new to you it shouldn't. Everyday light, radio waves and microwaves and x-rays are examples of EM waves. EM waves transport energy and information from one place to another. They are used in cellular networks, microwave ovens, portable radios, x-ray machines and satellites systems. Remote sensing in the context of disaster management usually refers to the technology that includes man-made sensors that are attached to aircrafts, or satellites. Instead of viewing a far away planet from earth, the sensing equipment is usually high above looking down at our 'distant' planet - earth. Distant in this context can mean just a few hundred feet overhead or miles above the earth's surface *(see Figure 2)*. and it is "completely" dark? We can no longer sense with our eyes. However, if we were to look through a pair of night vision goggles we would be able to see.

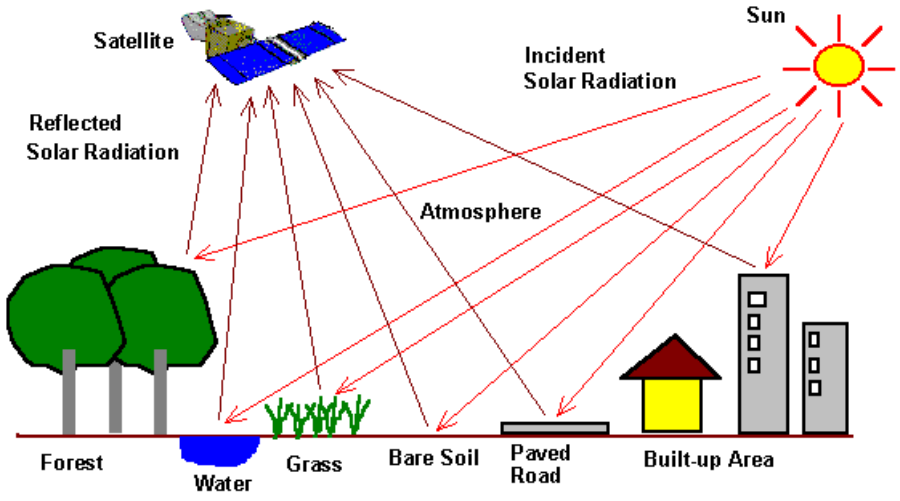


Figure 2: Diagram showing how Remote Sensing is operated and utilized

Wavelength classification in Remote Sensing

Remote Sensing is classified by three wavelength regions:

i Visible and Reflective Infrared Remote Sensing.

ii Thermal Infrared Remote Sensing.

iii Microwave Remote Sensing.

Visible and Reflective Infrared Remote Sensing

Visible and reflective infrared remote sensing uses 'everyday' light and infrared lasers, with wavelength ranging from approximately 0.4 to .0.8 micrometers. Usually 'regular' cameras or video recorders are

attached to airplanes to provide aerial photos. This is the most common and inexpensive form of remote sensing. Visible remote sensing allows us to make before and after comparisons in the event of a disaster.

Thermal Infrared Remote Sensing

Night goggles are a made from a type of infrared sensor. Infrared sensors allow us to image temperature differences, such as thermal pollution in rivers which we cannot see with our naked eyes or to gauge the temperature differences near volcanoes. Infrared sensors exploit the fact that all objects emit a type of EM radiation called "blackbody radiation" at a wavelength proportional to their surface temperature. These sensors allow us to see a particular part of the electromagnetic spectrum that we would not be able to see with our naked eyes. The term electromagnetic spectrum refers to the range of EM waves with different wavelengths. In terms of wavelength, EM waves range from Gamma Rays to radio waves.

Microwave Remote Sensing

Another type of remote sensing uses microwave radiation. An important property of microwaves is that they are seldom affected by atmospheric conditions. Another useful property of microwave radiation is that it can often image beneath or through objects (just like an X-ray – another type of EM wave that we use in everyday lives). Microwaves can also image differences in the earth's surface due to the absorption level of water or chemicals.

Passive versus Active Remote Sensing

Remote sensing can also be categorized into two broad categories: passive or active. Passive remote sensing makes use of sensors that detect the reflected or emitted EM radiation from natural sources (usually sunlight). Active remote sensing makes use of sensors that detect reflected responses from objects that are irradiated from artificially-generated energy sources, such as radars *(see Figure 3 below).*

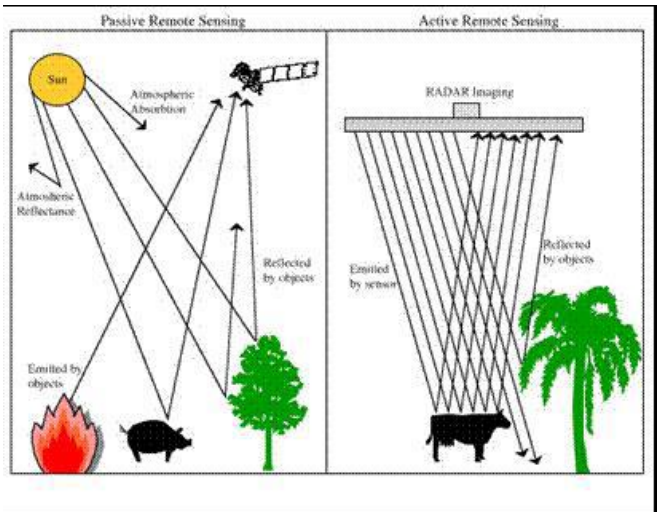


Figure 3: Comparison of Active and Passive Remote Sensing

Remote Sensing Satellites

Many satellites are fitted with several sensors that can measure over two or three of the wavelength regions. An example of such a satellite is the LandSat 7 satellite, which is a part of the US Government's NASA LandSat Program

Remote Sensing in Disaster Management

The data gathered from remote sensing can be used in a variety of ways to accomplish several objectives. It is usually combined with information from other data sources, and with information from on-the ground observations to get a full picture of water, land or ground activities. Remote sensing data is often integrated with GIS. There exist a wide variety of commercial and free software that allow users to view data collected from the many observing satellites referenced above. As new technologies emerge, and with the increased incidents of natural and man-made disasters, it is necessary to employ as many of these technological advancements as possible to mitigate against the effects of disasters.

Remote Sensing and Flooding

Flooding is one of the most frequently occurring hazards. With flooding comes the risk of damage or disruption to normal living including communication, transportation, the environment and infrastructure. Given the magnitude of disruption that can take place, it may be difficult for disaster managers to gain access to remote areas or areas that have been cut off as a result of the disaster. Remote sensing as a technological tool would greatly assist this process as it would allow users of the technology the opportunity to view what is taking place in an affected area, without jeopardizing the safety of the user, since they will not actually be at the site. It is always going to be difficult, if not impossible, for planners to identify all the areas likely to experience flooding in any location. The use of technology however, in determining flood potential could highlight features of the geography that could make the community susceptible to the hazard. Types of flooding such as flash flooding, which usually take place in a relatively short time, with little or no warning could prove potentially dangerous for disaster managers if they attempt to physically go into an area that has been experiencing continuous rainfall. While the task of providing assistance to victims is critical and time dependent, a physical presence in the affected area could increase the persons at risk. Using remote technology however, would allow response workers to stay away from danger zones while at the same time gather pertinent information to facilitate timely response, rescue and relief efforts. Floodplain mapping is a useful indication of flood possibilities in an area and remote sensing can aid the process of identifying flood plains. The technology would generate satellite imagery of the area in question, which would allow for proper planning and timely rescue efforts should the need arise. The detailed photography produced from remote sensing provides accurate information and can restrict efforts to the affected area. Other characteristics that could be identified about a geographic region using remote sensing include land-use classification, historical data, soil coverage, and soil moisture.

Remote sensing and Hurricanes

Hurricane forecasting over the last century has improved dramatically, with experts being able to estimate the likely number of storms for a given year, intensity and possible levels of destruction. Today, this process is made even easier with the use of remote sensing technology. Trackers are able, even while the storm is in progress, to go to the core of the system in search of information. This tool, at any stage of the hurricane threat is useful in mitigating against the deadly effects that could take place. Remote sensing can allow planners to ascertain data about the features of watersheds to include drainage and density. Once obtained, this is useful information as it provides information on the capacity of the watershed to deal with the volume of water-flow that could result from rains associated with the storm.

High resolution technology, a feature of remote sensing, is useful in providing spatial data on hurricanes. Because the scales of geographic areas in remote sensing can be manipulated, users will be in a position to

zoom in on specific areas for study. Storm surges and coastal flooding, which often accompany hurricanes can be better mapped using remote sensing and provide information on the level of flooding that has been experienced.

Remote sensing and Earthquakes

Development in any area with high seismic risk is always going to be problematic. Given the high volume of fault lines that extend across the breadth of geographic areas, it is inevitable that there are going to be human settlements in these areas. Considering also that there is no early warning system in place for earthquakes, emphasis must be placed on hazard mitigation to reduce the likely impact from earthquakes on lives or properties. Extensive use of remote sensing (and especially the use of satellite imaging) is critical to the planning process for earthquake preparedness. This technology will help in identifying the structural and non-structural earthquake hazards that are present and employ the most appropriate tool for minimizing these risks. LandSat imagery is one tool that is effective for this purpose given availability and cost. After an earthquake has taken place, visibility with the naked eye, as well as access to worst affected areas may be restricted. When this happens, it becomes difficult for emergency personnel to gain access to survivors in a short period of time. Using remote sensing technology, however, would significantly improve the timeliness and quality of aid that can be provided. Activities, such as search and rescue, are best affected after major earthquakes using remote sensing. Since there will be considerable amount of debris from collapsed structures, it would be advantageous to employ the service of remote sensing for deep searching.

Remote Sensing and Volcanic Eruptions

On-the-spot seismic monitoring of volcanoes is the most effective way to monitor volcanic activity. However, it may not be practical or safe to be on-site at all times. In light of this, remote sensing is crucial to the monitoring process. Remote sensing technology can allow disaster managers to observe volcanic activities on a continuous basis without being physically on site especially at times when it would be dangerous.

Remote sensing and Landslides

Landslides usually occur with other hazards, such as flooding, hurricanes and earthquakes, but can also happen independently. Once major portions of land shift out of place, access to and general visibility of the affected area is usually severely restricted. Remotely sensed images under these conditions are useful tools in assisting planners. It presents a picture of what has taken place, and aids in the decision making process regarding the future of the affected area. Where assessment of an area is limited due to debris and mudflow from a landslide, remote sensing could penetrate dense areas to provide critical information.

Advantages of Remote Sensing

 Saves time

 Users of the technology do not have to be in direct contact with danger zones.

 Shows image of very large areas of land or space.

 Detect features at wavelengths not visible to the human eye.

 Data can be regularly and routinely acquired and archived.

 The most cost-effective dataset for monitoring change over large areas.

 Can assist with damage assessment monitoring.

 The imagery obtained, using remote sensing, can be useful for forward planning and reconstruction of an affected area.

 Helps to prevent the recurrence of the same disaster in the future.

Challenges faced using Remote Sensing

 It can be costly to build and operate a remote sensing system

 Small size activities cannot be delineated on remote sensing imagery or through aerial photography

 Data can be difficult to interpret and may require expert skills.

 Resolution is often coarse.