UNIT 3 RISK REDUCTION

Structure

3.0 LEARNING OUTCOME

After reading this Unit, you should be able to:

- Understand the essentials of risk reduction;
- Analyse targets for risk reduction; and
- Discuss risk reduction with respect to specific natural hazards

3.1 INTRODUCTION

The focus in disaster management has currently shifted from disaster response to mitigation. The emphasis is on mainstreaming disaster risk reduction strategies in macro socio economic planning. Accordingly, disaster management is being approached not as a

contingent measure but as an integral aspect of developmental planning. Disaster management has not been accorded requisite priority as an issue in development planning; consequently, resource allocation has been inadequate. With the shift in emphasis, it is hoped, disaster management would be appreciated better as an integral aspect of governance. To that end, analysis of vulnerability factors contributing to 'risk' with a view to framing suitable risk reduction strategies would be required to impart requisite 'rationality' (purpose and end-orientation) to administrative decisions.

The emergence of disaster reduction as a concept that integrates development-oriented strategies and recent innovative approaches in disaster management such as vulnerability and risk reduction has presented a new perspective in planning as also opportunities to address the important areas of concern that have up till now been less considered. The concept has also been applied in policy development, usually in the context of sustainable development and long-term socio-economic development strategies.

3.2 UNDERSTANDING DISASTER RISK REDUCTION

Burton, Kates and White (1978) suggest that man can purposely adjust to the risk of environmental extremes by changing habitation or resource use, community action, restorative activity or redistribution of loss. Other adjustments are incidental but contribute to reducing loss. Hence, man may make changes, which are innocently adaptive with respect to the risk of environmental extremes.

To quote from the United Nations seminal document, 'Living with Risk: A Global Review of Disaster Reduction Initiatives', "a disaster is a function of the risk process. It results from a combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk… disaster reduction strategies include, first and foremost, vulnerability and risk assessment, as well as a number of institutional capacities and operational abilities. Essential features of disaster reduction strategy include the assessment of the vulnerability of facilities crucial to the social and economic infrastructure, the use of effective early warning systems, and the application of many different types' of scientific, technical educational and other skilled abilities."

3.2.1 Risk Reduction Framework

As per the document, the subject of disaster risk reduction in the modern era draws its relevance largely from earlier contributions and previous practices in the field of *civil defence* and later *disaster management.* The traditional focus had been on emergency preparedness and better provision of urban services during contingencies. The approach had consequently been predominantly short-term. Since disasters, of late, have threatened to disrupt development altogether and increase poverty and vulnerability of people, particularly in low-income countries, there has been a realisation of the need for protective strategies on a sustained basis to preserve the civilisation, which has been built assiduously over ages. Such paradigm shift is already discernible in Central American countries following repeated devastating disasters in the year 1998.European countries too have been forced to reassess their priorities *as p*er their 'exposure' to different hazards. In Asian countries such as China, India, Japan, Thailand, and Vietnam, more emphasis is being placed on risk identification and management of risks as part of development planning. Such emphasis is evident from the sources of finance for risk reduction, which are now 'mainstream sources' rather than emergency contingency funds. The rationale

behind such a shift is the common realisation that the risk of disasters is fundamentally linked to environmental problems and unresolved issues essential for sustainable development. Accordingly, there are two major objectives of disaster reduction policies: (1) to enable societies to be resilient to natural hazards and (2) to ensure that development efforts do not increase vulnerability to those hazards'.

Small dams disasters, for example, eliminate the risk of small floods, but could escalate the impact of a massive flood catastrophe by leading to human occupation of areas beneath. Other adjustments, for instance, warning systems etc, may lack the necessary components to be effective (Mileti, 1975). Adoption of policies to enhance adjustment and actual subsequent adjustments may not always be correlated; hence, not guaranteeing effective risk mitigation to the satisfactory extent.

An important aspect in understanding human adjustment to environmental extremes is the link or connection between adjustment activities. Isolated adjustments are less effective. Hazard adjustment linkages are best viewed in terms of how adoption of one adjustment would affect the adoption of others (White and Haas, 1975).

Sorenson (1975) has provided an inventory of possible linkages. *Firstly*, one type of adjustment may cause the adoption of a second, for example, communities with engineering works typically became dependent on federal relief programmes (in the US). *Secondly,* an independent factor may cause the adoption of one or several adjustments, for example, the National Flood Insurance Program enhances adoption of both insurance and land use controls (Hutton and Mileti, 1979; Kunreuther, 1978). Finally, other scholars propose that adjustments can interact randomly.

There is a concomitant shift in the theoretical understanding of disaster risk reduction in that the orientation is now an attempt through planned policy interventions over time to reduce risks through continuous research and development activities involving a network of agencies across social economic governmental and professional sectors instead of a specialised service limited to only security, emergency services and engineering experts.

Accordingly, the disaster risk reduction framework is composed of the following fields of action, as described in ISDR's publication in 2002; 'Living with Risk: A Global Review of Disaster Reduction Initiatives.'

- Risk awareness and assessment including hazard analysis and vulnerability and capacity analysis;
- Knowledge development including education, training, research and information;
- Public commitment and institutional frameworks, including organisational, policy, legislation and community action;
- Application of measures including environmental management, land-use and urban planning, protection of critical facilities, application of science and technology, partnership and networking, and, financial instruments;
- Early warning systems including forecasting, dissemination of warnings, preparedness measures and reaction capacities.

3.3 MAINSTREAMING 'RISK'

Risk remains insufficiently accounted for in decision-making, despite the current emphasis on perceiving disaster risk as a developmental issue and not a one of contingent measure.

As explained in the Disaster Management Training Programme (1994), the estimation of probable future losses is a matter of increasing interest to those concerned with *developmental planning* or with management of facilities or public administration in hazard prone areas. It is also pertinent for *insurance business, economic planners* and *town planners* where futuristic estimates are required. Loss estimates are also required for those involved in provision of contingent services such as civil protection, relief and emergency services, drafting building codes or regulation to minimise losses and protect life and property. Estimates could be *physical estimates* expressed in economic terms or *human losses*.

3.3.1 Rationale for Risk Articulation

As brought out by Charlotte Benson, the World Bank and the United States Geological Survey have calculated that economic losses, worldwide from natural disasters in the 1990s could be reduced by $280 billion, if $40 billion were invested in preparedness, mitigation and prevention strategies. (Benson). The damages involved are unviable in that other incidental and collateral losses involving related sectors could set off a multiplier effect calling into question the entire rationale of the investment decision. In the words of Hosseini, (2005), "development cannot be sustainable if the effects of natural and man made hazards are not taken into account in the process of development" since disaster related damage has spin off effects on related sectors, like, industries making food products and other agro based industries which would suffer the impact of a fall in farm output. Droughts adversely affect industries that supply agriculture based products such as fertilizer.

To discuss a specific project, for making a cutting road, an engineer would chose the steepest angle since that is the cheapest option. However, in case of heavy rainfall or tremor, the cutting will collapse and the road may be buried or washed away. This is basic engineering knowledge and the excuse of not having anticipated it would be unacceptable. There have been many incidents of projects wiped out by cyclones, floods or earthquakes. It is only wise to prevent such losses *if one could* (Coburn, Sspence, Pomonis, 1994).

It should also be considered, however, that the extra cost involved in accounting for such risks in investment decisions may actually be deterring since physical and socio-economic vulnerabilities to be considered in every engineering and policy decision are manifold and the costs involved are enormous. With a macro perspective, resource generation would be difficult since tax rates are already too high, as per the 'capacity to pay' argument/ approach. Besides, the question remains, how safe is safe enough? To what extent can/ does one consider safety concerns? Decisions are based on 'goal oriented risk reduction'.

Such questions, however, do not bring into question the rationality of considering risk in decision-making, especially in hazard prone areas, since losses incurred in the absence of such endeavour could be/indeed are staggering. Risk reduction is now imminent and an unquestionable requirement.

3.3.2 Cost-Benefit Analysis

A major decision-making tool, commonly used in the economic and financial evaluation of public investments, is cost-benefit analysis (CBA). For new investment projects, accounting for risk in CBA leads to more careful project selection and design to decrease potential losses when a disaster strikes. Simple explanation of cost-benefit analysis is given by Coburn, Sspence and Pomonis in the Disaster Management Training Programme, (1994)

as: all benefits of a project are computed in financial terms, assessed against costs, alternative strategies assessed by the same criterion and decisions regarding the project or alternatives, taken as per value derived, that is either positive (benefits exceed costs by a considerable margin) or negative (converse). Since benefits are derived some time in the future, decisions involve trade off between present and future benefits. Future benefits are discounted to their present value (using a *social discount* rate, which is a consistent value used in all project evaluations), which reveal the viability of a project in financial terms. Estimations consider the specific 'elements' likely to be at risk in the decision involved. As per Charlotte Benson, the economic costs of disasters can be broken down into three types:

Direct Costs, which relate to capital cost of assets (such as buildings, other physical infrastructure, raw materials, crop losses and the like,) destroyed or damaged in a disaster.

Indirect Costs, referring to the damage to the flow of goods and services, including for example, lower output from factories damaged, low sales, disruption of power supplies; etc., and

Secondary effects, referring to the short and long term impacts of a disaster on overall economic performance involving deteriorated external trade and government budget balances, increased indebtedness, reallocations in budget, etc.

The left hand side of the following table (Table 1) presents the costing criteria in analysis which in turn is dependent on the quality of risk information and the temporal dimension of planning. The right hand side displays benefits (project specific and socio economic that accrue with such measures (Vermeirin, 1990).

Cost-Benefit Analysis	
Methodological Factors • Quality of risk information • Planning horizon/lifespan *Present Value of Costs* • Cost of adhering to stricter standards • Cost of protective works • Cost associated with foregoing the use of hazardous areas	*Expected Value* Project-specific bene • Reduction i • Reduction i • Losses/dam Socio-econ • Continuity i • Contributio developmen • Improved ir

There are limitations, however, to CBA. One is the difficulty of assessing non-market values. Besides, there are ethical and other intangible issues and questions, which may not be assessed on monetary criterion. Another issue is the lack of accounting for the distribution of benefits and costs in CBA. The difficulty arises from the non-measurability of certain costs and benefits, which cannot be easily included in estimates. Also a lot of futuristic thinking and planning is involved, which is not amenable to easy quantification.

3.3.3 Goal Oriented Risk Reduction

The concept of acceptable risk was discussed in the previous Unit. The criterion of acceptable risk is used to determine appropriate levels of risk even though 'acceptable risk' itself, depends on a number of subjective and cultural/attitudinal criteria. In California, seismic building codes have been designed as per 'acceptable risk 'expressed by the community.

Buildings should be able to:

- resist minor earthquakes without damage;
- resist moderate earthquakes without significant structural damage; and
- resist major or severe earthquakes without major failure of the structural framework of the building or its equipment, and maintain life safety.

Since the concept of acceptable risk is ambiguous, a *balanced risk criterion* is adopted, which compares risks incident from other activities to arrive at resource allocation decisions between various risks. Another criterion is the *cost-effectiveness criterion*, by which every element at risk (including human life) is treated as 'capital' and costs of likely damage, computed in financial terms. Human capital loss should be avoided since it would retard economic growth. The analyses is attempted to be as objective as possible though no standard criterion has still been developed. Ultimately, acceptable risk could simply be a matter of political choice.

3.4 TARGETS FOR RISK REDUCTION

The concept of elements at risk was discussed in the second Unit. Specific identification of elements at risk is important for devising cost effective and appropriate disaster mitigation strategies. Opportunities for natural hazard mitigation can be found anywhere where population, infrastructure or economic activities are at risk from disruption/ destruction from extreme natural events. Which vulnerability reduction actions to consider, will depend on what is to be protected, on the priorities set by those affected, and, on the resources made available for their implementation. Risk information is procured from risk analysis involving hazard assessment, vulnerability assessment for proposed project considering 'elements' at risk. Mitigation measures are accordingly devised to protect identified elements at risk. Information procured is incorporated in mitigation planning and preparedness planning to meet or prevent contingencies effectively. The following are the emerging agendas in integrating risk reduction with development planning: (Hosseini, 2005)

- Appropriate governance
- Factoring risk into disaster recovery and reconstruction
- Managing the multifaceted nature of risk

As per Hossieni, bringing disaster risk reduction and development concerns closer together requires the following steps:

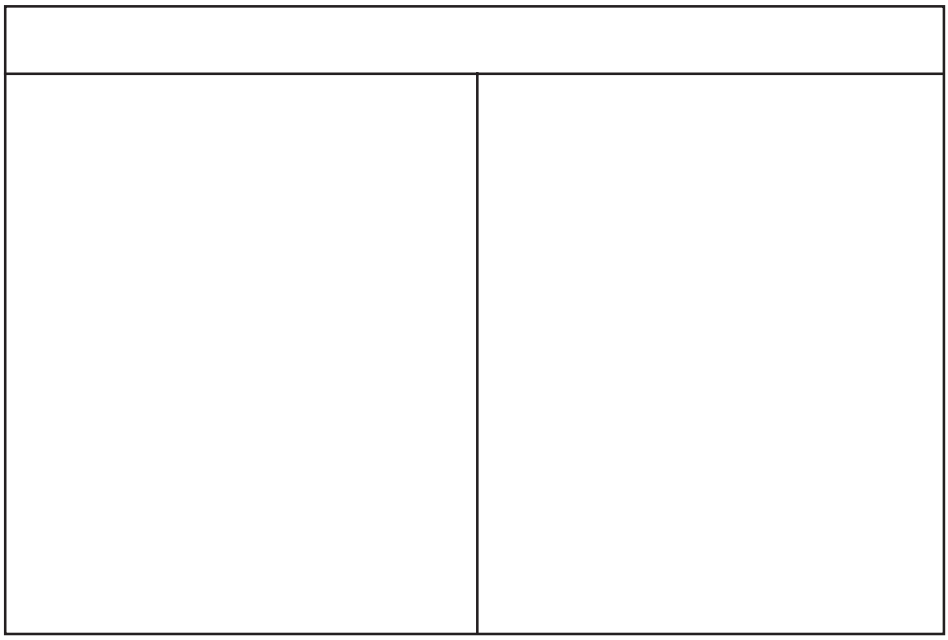
- The collection of basic data on disaster risk and the development of planning tools to track the relationship between development policy and disaster risk
- The collection and dissemination of best practice in development planning and policy that reduce disaster risk
- The galvanising of political will to reorient both the development and disaster management sectors

- Compensatory Risk management
- Addressing gaps in knowledge for disaster risk assessment.

The greatest factor(s) in mainstreaming disaster risk into development planning is political will and considerations of geographic equity or 'balanced regional development. Development policies have to be both *generic* and *disaster specific* in that vulnerable communities face multiple threats owing to socio-economic deprivations, which can be rectified through generic development strategies with the new perspective of disaster risk reduction. As per Hosseini, governance for disaster risk reduction has economic, political and administrative aspects/elements. *Economic governance* implies 'rationality' of policy in terms of resource allocation decisions and its distributional impacts. *Political governance* requires inclusiveness and comprehensiveness of policy involving all concerned stakeholders in the deliberative process, while *administrative governance* implies effective implementation through interagency coordination, community participation official accountability, periodic review and updating. Specific activities involved would be enforcement of building codes, land use planning, factoring 'environmental risk' into policy and human vulnerability monitoring and required safety standards. Gradual integration of disaster risk analysis into developmental plans is a must to affect the paradigm shift from emergency management to disaster management involving *prevention, preparedness, and mitigation* components. Concomitant attitude change is also imperative in that communities should not be looked upon as mere victims but as "resource since they possess enormous knowledge and capabilities for coping with and managing risk" (Sahni & Ariyabandu, 2003). Disquietingly though, orientation continues to be disaster relief than disaster mitigation in any significant way.

While selecting opportunities for hazard mitigation, it is essential to remember that the most effective approach to reducing the long-term impact of natural hazards is to incorporate hazard assessment and mitigation activities into the process of integrated development planning and investment project formulation and ensure implementation with assured peoples' participation (Jigyasu, 2002).

The following table illustrates activities, which can be taken at the family and community level to reduce hazard threat (Vermeirin, 1993):



Structural and Non-Structural Mitigation

Mitigation measures are classified *Structural* and *Non-Structural.* Structural mitigation measures include building and planning regulations for proper land-use management, guidelines for new constructions based on earthquake mitigation measures and various technical measures of strengthening buildings. Some other examples of structural mitigation measures include construction of dykes to provide protection against river or sea floods (Charlotte Benson). It is important to differentiate between engineered structures and non-engineered structures for better analysis of structural mitigation.

In case of floods, for example, structural interventions include the construction of dykes to provide protection against river or sea floods. In Vietnam such structures have been built and maintained for some 2000 years. Bamboo houses are built in traditional communities to brace against cyclones. In case of earthquakes, classification is attempted between engineered structures and non-engineered structures. The following table from the Caribbean Disaster Mitigation Project (Vermeirin, 1993) illustrates structural and non-structural mitigation options with planners.

Table-3

Hazard Mitigation Options		
Risk Avoidance Measures (Non-structural measures) Discourage location of settlements, infrastructure and economic activities in known hazardous areas through: • Land-use regulations, ordinances • Financial incentives or penalties • Disclosure of risk information • Public infrastructure policy • Natural resource management policy	*Risk Spreading Measures* • Property damage and revenue loss insurance • Crop diversification • Redundancy in lifeline systems	*Vu* *M* Ph en

Engineered Structures: Engineered structures are those that are planned, designed and constructed by engineers and experts in related fields. While professionals are already trained to plan, design and supervise the construction of buildings and infrastructures, they might need additional training to achieve necessary structural safety standards, incorporate mitigation practices into their design of structures to make them resistant to seismic shock, storms wind or floods. The application of sound technical principles is achieved through:

- Site planning
- Assessment of forces created by natural phenomena
- Planning and analysis of structural measures to resist such forces
- Design and proper detailing of structural component
- Construction with suitable material
- Good workmanship under adequate supervisions

Non-Engineered Structures: Such structures mainly comprise simple dwellings, mostly in rural areas, which are informally constructed, and which do not follow modern engineering norms. They are built with local materials on the basis of the local indigenous knowledge. It is held that these structures collapse quite easily during disasters, causing large-scale casualties. There is the other viewpoint, however, that recognises merit in local knowledge and advocates incorporating the same in modern engineering know-how. Charlotte Benson refers to bamboo houses found in coastal areas among tribal indigenous communities, which are braced against cyclones. There are examples of storm masonry from Gujarat India, which provide reportedly earthquake resistant structures (Jigyasu, 2002). Nothing could be said conclusively however, since researches give widely divergent views, some even suggesting that local structures are more adaptive to hazards and also more resistant. Without being precociously judgemental however, about the safety of such structures, as a policy measure, it should be ensured that informal structures are not built on hazardous sites such as steep slopes subject to landslides, floodplains subject to flash floods etc.

Though there are various definitions for an earthquake resistant construction, the following are some of the common aspects of buildings designed for earthquake mitigation as published by the International Association for Earthquake Engineering, October, 1986, revised edition of Basic Concepts of Seismic Codes: Vol 1 Part 2, 1980, and cited in Jigyasu (2002). These are as follows:

- An ordinary building should not suffer total or partial collapse
- It should not suffer such irreparable damage which would require demolishing and rebuilding
- It may sustain such damage which would be repaired quickly and the building put back to its usual functioning
- However some of the most desirable qualities are symmetry and regularity of building form, solid foundation base and reinforcement to improve ductility. Also there are basically, two types of structural framing, which can withstand gravity and seismic load viz. Bearing wall construction and framed construction. The framed construction may again consist of
- Light framing members which must have diagonal bracing such as wood frames
- Substantial rigid jointed beams and columns capable of resisting the lateral loads by themselves.

Above mentioned safety criteria depends on appropriate design and construction details for which needed expertise would have to be built through proper manpower planning implying setting up educational institutions, encouraging research, modifying syllabus etc. to prepare trained experts in disaster proofing/retrofitting of buildings.

3.5 ROLE OF SCIENCE AND TECHNOLOGY IN DISASTER RISK REDUCTION

As stated in the United Nation's Disaster Management Training Programme (1994), disaster preparedness includes all measures that ensure the readiness/ ability of a society to: (a) forecast and take precautionary measures in advance of an imminent threat (in case where) advance warnings are possible); and (b) respond to and cope with the effects of a disaster by organising and delivering timely and effective rescue, relief and other

appropriate post disaster assistance. The Red Cross has identified disaster preparedness as an effective link between emergency response, rehabilitation and development programmes (Jigyasu, 2002).

As explained in the previous Unit, the *All Hazards Perspective* is currently being emphasised in America to combat the threat of terrorism stressing on interagency collaboration and data analyses of all preceding natural and accidental mishaps. The Sub-Committee on Disaster Reduction (SDR) of the National Science and Technological Council (NSTC) in the United States has articulated six important areas that require continued energy and appropriate resources to meet the challenges of hazard risk reduction. The same may be pertinent for all countries facing the threat of terrorism, which is the single most horrifying disaster possibility in recent times.

1) Leveraging existing knowledge of natural and technological hazards to address terrorism events

2) Improve hazard information data collection and prediction capability

3) Ensure the development and widespread use of improved hazard and risk assessment models and their incorporation into decision support tools and systems.

4) Speed the transition from hazard research to hazard management application

5) Increase mitigation activities and incentives

6) Expand risk communication capabilities, especially public warning systems and techniques

Kenneth Bloem of the John Hopkins University Center for Biodefense Studies has identified a number of parallel streams where preparation for terrorist incidents can be enhanced by decades of research in traditional disaster areas:

- Wildfires and Arson
- Accidental explosions and bombs
- Floods and dam sabotage
- Chemical spills and chemical attacks
- Epidemics and biological terrorism

Mention may be made here of some other significant approaches to disaster management under discussion (Guzman):

The *comprehensive approach* to disaster management entails inclusive strategy for different yet complementing aspects of disaster management, i.e. prevention and mitigation, preparedness, response and recovery, correlated for the purpose of sustainable development strategies. The requirement is public policy based on articulated risk (s). This approach aims to augment the overall capacity of the system to react to a disaster event with readiness.

The *all-hazards approach as already explained above*, targets developing a common framework based on knowledge from all relevant fields for handling all types of disasters. The focus is harnessing science and technology for risk reduction from all man made/ natural disasters, including terrorism. The belief is that technical know-how for natural

hazard mitigation can be used to tackle technological and other man- made disasters. Common preparedness helps, in that rehabilitation, medical assistance infrastructure, manpower needed in case of emergency etc. are likely to be the same for all hazards.

The *integrated approach* places reliance on administrative coordination for joint strategising for risk reduction. It proposes that all organisations, including government, private and community organisations, are involved concertedly in risk reduction. This approach stresses on promoting multi-sectored and inter-sectored coordination to provide a total policy framework for disaster management. The modalities for such cooperation may need to be worked out to prevent overlapping, coordination problems or jurisdictional disputes between departments. Certain administrative modifications would be required, for instance, hierarchical command control structure may be unsuited for effective policy implementation. There is also need to ensure wide forms of public, private and professional participation in policy formulation and implementation. Disaster risk reduction is also an educative exercise. There is need for academic deliberation on a sustained basis wherein information and inspiration is drawn from many different sources, viz. technical, social sciences, anthropologists, etc. and correlated under an architectonic rubric of disaster mitigation policy.

The prepared community concept stresses community empowerment through state initiative. People are not passive beneficiaries but active participants in development planning and implementation processes. Peoples' capacities are recognised and channelised through the 'facilitating' role of the state. It includes analyses of the social, economic and demographic make-up of the community and its infrastructure. Through such analyses, livelihood options are studied, proposed and promulgated among aid providers and disaster management practitioners. Awareness generation and training of volunteers is attempted along with strengthening local self-governing institutions with a view to establishing participatory democracy at the grass roots.

The developmental relief approach underlines the need of undertaking disaster relief as part of long term development. The aim is to invest in aid with a view to building long-term resilience instead of stopping at short-term measures. Hence, relief has to be sustained over time and be part of a planned capacity building approach.

Besides disaster management, the other major paradigms are the vulnerability reduction approach and the risk reduction approach, which is the latest development. The vulnerability reduction approach is a comparatively new approach. The vulnerability of a community is characterised by its susceptibility to risks posed by hazards, and its resilience in the face of it. Appropriate solutions are devised using a cocktail of approaches, scientific; social is applied to address all facets of a problem. Vulnerability reduction epitomises the very concept of risk reduction in that it seeks to anticipate and prevent damage from hazards through 'developmental measures' taken over time, rather than allow disasters to happen to inspire policy in this regard. Vulnerability is physical, social, economic, cultural and attitudinal.

As per Guzman, there is need for an integrating framework encompassing all the above –stated approaches, in the form of a Total Disaster Risk Management or the TDRM approach which is based on detailed risk analysis and 'factors' the same in public policy. The question that has persisted however is how desired integration can be achieved. Following the inadequacy of any of the above approaches in achieving satisfactory disaster preparedness, the Risk Reduction Framework has been articulated by the United Nations.

Risk Reduction provides an identified 'objective', which makes targeted risk preparedness/ planning for mitigation possible. Earlier this concrete end had been lacking. Hence, all the activities mentioned above as different approaches can now be geared towards, the end objective of 'Risk Reduction.'

3.5.1 Application of Information Technology in Disaster Risk Reduction

Information technology (IT) has revolutionised communication, bringing within the ambit of connectivity, remote and far flung areas and the illiterate marginalised masses, realised true democracy and enhanced awareness of rights among people and duties among official agencies and the lay public. Knowledge is power; hence 'empowerment' is the chief contribution/result of the information communication revolution partaking in the developing world currently. Specific applications and benefits of IT are discussed thus by N. Vinod Chandra Menon (2003):

A) **Decision Support and Public Awareness**

The World Wide Web and the Internet have opened up possibilities of department specific web sites, which provide information in specialised branches of disaster management. Some of these web sites are accessible to people which disseminate valuable information for interest articulation and academic deliberation in the area. There are specialised web sites on natural hazards such as earthquakes and cyclones that provide comprehensive information regarding specific natural hazards. Such web sites also form 'knowledge bases' in that a web site on earthquakes would present all information on the hazard and ways to deal with it. These form important decision support tools (DCS) that facilitate knowledge transfer during critical times.

B) **Information Sharing**

The Information Communication Revolution has made possible the setting up of local area and wide area networks known as INTRANETS and EXTRANETS that link up institutions over distant regions and facilitate information sharing on a global basis. The integration of information technology (IT) with telecommunication interfaces has made possible facilities like video teleconferencing which provide for direct interface between aid givers and official agencies at the emergency site, rendering relief and rescue process highly efficient, besides providing for 'knowledge networking' across institutions, especially research institutions during 'peace times'.

Another significant development has been the Geographical Information System (GIS), by which detailed spatial analysis of 'at risk' area is accomplished through satellite imagery. Comprehensive information is collected about the area which is displayed graphically, on a map, highlighting critical facilities and communities at risk, available communication infrastructure etc. which guides immediate disaster response in the short run, and over the long run, facilitates risk mapping, risk assessment, dissemination of information, public awareness etc. which aid long term policy planning for disaster mitigation. The GIS has greatly facilitated response effort as strategies can be devised on the basis of scientific simulation studies and scenario analysis using information made available through remote sensing. The Indian Meteorological Department (IMD) has commissioned a satellite based communication system called Cyclone Warning Dissemination System for dissemination of cyclone warning in coastal areas.

C) **Policy Planning**

Information Technology has greatly aided planning for disaster response and preparedness. Information technology has made policy for disaster risk reduction more fact based and less judgemental /'*a priori'*. Even generally, policy making for traffic, transport, forest conservation, urban congestion etc is facilitated by spatial imagery through remote sensing.

3.6 STRATEGIES FOR RISK REDUCTION

3.6.1 Disaster Planning for Risk Reduction

Disaster planning implies securing administrative arrangements, involving unity of command, span of control, line and staff coordination, delegation, etc. precisely, principles of organisation theory to provide the administrative arrangements to prevent small scale, frequently occurring disasters, which keep disrupting growth and set back development by a number of years. Planning follows *risk identification to secure a facility/area from likely risks.* A disaster plan is the result of a wide range of preliminary activities (Lindblom, 1999). Disaster planning is conducted both at the micro (at the level of an institution, involving instituting fire protection systems, fire protection systems, electrical systems, plumbing, and protection against environmental hazards etc.) and the macro levels, the objectives of which are outlined as follows by Anil Sinha (2002):

- Forecasting, forewarning of disaster threat and providing the institutional and organisational setup and logistics, personnel, inventory, finances, etc., to achieve desired level of preparedness
- Mobilisation of resources from internal and external sources
- Taking organisational and administrative steps, including disaster action plans, regular and periodic updating of plans and projects securing institutional wherewithal to implement it, providing for a horizontal and vertical coordination through a network of official and non official agencies involved viz. government departments, civil defence military and paramilitary organisations running through the central, state and field levels
- Placing on ground, well- equipped modern forecasting and warning system and reliable fast communication system
- Generating capabilities for prompt and rapid rescue, relief and rehabilitation work on the other
- Proper planning for medical assistance and health cover would be a critical requirement
- Providing for other miscellaneous needs like stocking and distribution, food, medicines, shelter, clothing, evacuation, transportation and long term resettlement and rehabilitation of affected communities
- Securing water management practices sine provision of clean water is often problem and a necessity post disasters
- Government initiatives implying long term measures identified by the central government, instituting intensive Training programmes, building data based on documentation of disasters and lessons to be learnt there from, and, dissemination of information

- Integration of disaster management with overall development planning
- Improving public awareness
- Investment in R&D, use of modern technology, particularly information and remote sensing technologies

Interventions Needed:

- Evolve model integrated district/ institution wide disaster action plans that include all types of disasters, natural and man made, viz. land slides, accidents, earthquakes, etc., and cover all steps namely preparedness, mitigation, risk mapping, relief and rehabilitation;
- Evolve a model state plan to ensure a degree of uniformity of approaches, actions and systems and their periodic updating; and
- Training covering local industries and businesses so ensure better implementation through cooperation of the private corporate sector and the voluntary sector.

3.6.2 Disaster Risk Reduction by Information, Education, and Public Awareness

Recently much emphasis has been put on community based proactive approaches towards risk reduction. The aim is to improve the ability of vulnerable communities to cope with disasters through developing their coping capacity by building on existing practices, skills and local structures such as panchayats and community based voluntary action groups. According to a policy statement of Red Cross 2001, adopting a community-based approach is the best guarantee that disaster preparedness will be implemented and sustained. Therefore people must participate in planning and preparing for disasters. All activities and programmes should be sensitive to issues of gender and the special needs of vulnerable groups such as the disabled and backwards sections. Such projects are being undertaken successfully in the Carribbean, South and South East Asia (Jigyasu, 2002).

Considerable research is being attempted following recent examples of community resilience based on traditional social support bases such as families and local coping measures such as resilient construction technologies that minimise harm from disaster impact. Traditional buildings were found to perform well in the Armenia Earthquake in 1988, the Turkey Earthquakes in 1999 and 2000. Such buildings are often constructed of masonry and timber tubble, mud and lightweight pieces of wood. These types of constructions are found in seismically active belts that extend from Africa and Europe across Asia and also in Central America (*ibid*). Hence, the emphasis is on articulation of local risk factors and local strategies for combating the threats involved to incorporating the same, wherever found feasible, in modern science and developmental strategies.

3.6.3 Risk Reduction through Livelihood Concerns

Poor developing countries are largely primary producing economies that are mainly dependent on agriculture and related support activities for sustenance. Agriculture includes farming and also animal husbandry, pastoral activities, fishing and harvesting the forest (Bhatti, 2003). The best way to inculcate resilience in disaster prone communities is by ensuring livelihood opportunities, which help affected people cope better in the aftermath of a disaster. It has been observed that loss of livelihood causes people to migrate to

other places particularly adjoining metropolises in search of employment options which create problems of urban congestion and possibilities of conflict. To endorse the point with relevant examples, the saltpan workers in Kandla did not have any livelihood option after the Gujarat earthquake. In Kot Murad, a flood prone village in Pakistan, where farming is the main livelihood, 87% of the total households remain landless, since the system is feudal and power and resources are arrogated in the hands of the rich landowners. This social and economic vulnerable state has been compounded by annual incidents of floods. Reducing vulnerability of these communities would involve providing road and rail connectivity to market places and administrative and institutional arrangements to encourage marketing of their produce to reduce the threat to their livelihood besides structural mitigation measures such as construction of eco friendly small dams in upper catchments of rivers protective embankments along rivers and other such water harvesting measures. This would require replacement of the isolated departmental approach with an integrated flood preparedness approach based in a networking of knowledge. Attention needs to be paid to this significant dimension of disaster response and preparedness (Bhatti, 2003).

3.6.4 Stakeholders Participation in Disaster Risk Reduction

According to E. Vayunanadan (2003), all concerned parties in disaster policy and implementation should put in concerted effort towards disaster preparedness. This implies continuous/consistent participation and deliberation on the part of all concerned stakeholders with regard to new and emergent issues in town planning, administrative upgradation, employment and livelihood in urban and rural areas, mobilisation of non government effort. It is equally significant, that the 'balance of power' in such discussions is not allowed to tilt unfairly in favour of /against any stakeholder in deliberation and planning preceding policy formation, since that is likely to have adverse effect on implementation, in the sense of making it lop sided. The 'at risk' population is an equally significant stakeholder. In view of it there has to be equal 'voice' imparted to, and interest articulation for affected 'publics'. To activate such community participation, it is imperative, that right to information be championed effectively and isolated effort on the part of people organised and institutionalised through 'gram sabhas' and community action groups. Community empowerment in 'peace times' would determine its resilience in facing contingencies.

3.6.5 Risk Sharing and Transfer

Disasters divert important funds from development to disaster relief and rehabilitation. Tools need to be developed that help the poor to manage risks more effectively with alternative sources of finance such as insurance. According to Anselm Smolka (2003), beyond financing future losses, more efforts need to be made towards a more proactive strategy to reduce and prevent losses. To that end there is need for a more proactive collaboration between financial institutions, the state, and industry and insured parties to actively promote risk reduction measures. The following entities need to be considered in desired partnership:

Insured Persons

Insured persons should bear some of the responsibility through measures such as 'coinsurance' (a percentage participation in each and every case, ranging from 10-15 % and extending up to 75 % in many cases.) and/or deductibles (percentage of sum insured ranging from 10-25% as per risk levels or a flat amount, insurance payments start only after the deductibles) to maintain interest in loss reduction on the part of asset holders.

Besides, business owners should invest in emergency management and individual owners too should ensure safety and security of their property (Smolka, 2003).

Insurers

"Primary insurers are expected to provide and secure capacity by:

- charging appropriate rates
- providing appropriate underwriting guidelines
- accumulation control and portfolio management
- establishing reserves for natural perils
- limiting their liability according to their financial strength, that is reinsurance protection.

Reinsurers being the major risk bearers should ensure proper risk management, which includes:

- Balancing the risk over time and regions
- Technical support to clients in rating considerations and assessments of probable maximum losses (PMLAs)
- Controlling and limiting liabilities (setting cession/occurrence limits, budgeting, retrocession)
- The Capital Markets are a relatively new entrant in the field. Their function is to provide adequate capacity for top ranking losses. This type of Alternative Risk Transfer (ART) should be seen as a supplement rather than as competition for reinsurers. They need to take more active interest in insuring disaster losses. The state is the insurer of the last resort for very extraordinary and unserviceable losses. The state should focus on mitigation measures to protect its critical facilities, design and enforce building regulations, and overall, provide for disaster response and preparedness.
- The Private Insurance Sector has made fewer inroads into the markets in developing countries though they could significantly contribute to developing micro finance options. Even otherwise, the insurance sector has not had an active role to play in risk management, particular in developing countries because of short-term financial perspectives, as the time scale for possible positive outcome is too long. According to Smolka, insurance should undertake periodic assessments of insured stocks and make risk reduction a condition for providing insurance. The same was attempted in the United States with regard to earthquake proofing of establishments with considerable success. The state should also consider granting tax exemptions to catastrophe reserves of private insurers. Moreover, banks could set disaster reduction as a precondition for granting loans.

3.6.6 Risk Reduction through Disaster Prevention

Disaster prevention involves activities to provide outright avoidance of the adverse impacts of hazards and means to minimise environmental, technological and biological disasters. An example of prevention measure is an early warning system instituted to predict the onset of a hazard like a cyclone, storm surge or tsunami. Prevention could be better understood with reference to certain commonly occurring natural hazards:

Landslides

According to R.S Tolia, Rakesh Sharma, R.K. Pande, and J.K Pathak (2001), apart from natural causes like excessive rainfall, earthquakes, and changes in soil slope composition, in structure, hydrology or vegetation, *anthropogenic interferences* with the environment are also responsible for causing landslides. In Uttarakhand, major landslides occur because of blastings carried out for road cuttings. Other man- made factors include, construction of dams or reservoirs, housing schemes, roads, agricultural practices on steep slopes etc., implemented without proper *environmental impact assessments*. Deforestation also contributes to soil erosion. Public policy with preventive provisions is required to protect against landslide hazards such as minimising the exposure of facilities and populations to landslides. Even natural causes are not altogether beyond control, if right impetus is given to research and requisite authority and say granted to specialists. Preventive and remedial measures are studied within the purview of *environmental geomorphology.*

Cyclones

Best prevention against cyclones is provision of warning systems and second line unconventional communication infrastructure, since mainline infrastructure is the first casualty in cyclones. Such facility is known as *Amateur Radio, which* has emerged as one of the most important second line communication systems during disasters. Though the facility as yet is not as commonly applied in India as it is in Japan and other western developed nations, the Andhra Pradesh government has taken considerable initiative in this regard. The National Institute of Amateur Radio (NIAR) has established HAM radio networks along the coastal belt of Andhra Pradesh. Other measures include providing cyclone shelters at regular distances to help save lives, natural coastal shelter belts like mangroves, trees like casuarinas, eucalyptus, tamarind, neem etc. which act as natural buffers, building concrete houses to withstand strong winds and tidal waves, grains that do not shred easily in the face of strong winds, and securing cooperation of local folks like fishermen providing training and cooperation of community action groups, which is held imminent now for the success of any measure. The Andhra Pradesh government has implemented all these measures successfully (Naidu, 2001).

Droughts

Drought is a slow onset disaster. It can be controlled through timely action and proper monitoring of the drought prone area through remote sensing. Citing the report of the Central Soil and Water Conservation Research and Training Institute, Dehradun, Alka Dhameja (2001) feels that topsoil erosion and rapid deforestation is shrinking the supply of groundwater, leading to *hydrocide* or death of rivers. Soil erosion is part of a wider environmental problem of *desertification* which is explained as a “a process of environmental degradation that leads to the abandonment of irrigated fields and pasture lands because of salinisation, water-logging or other forms of soil erosion.” Dhameja recommends revival of traditional water storage and harvesting systems such as the *Kundis (saucer* shaped concrete structures used to store rainwater) of Rajasthan and the *Virdas* (shallow well s dug in low depressions or *jheels* to collect water) and the system of temple tanks, as was practiced in ancient times in South India.

Other recommended measures include, planting drought resistant seed varieties, educating farmers in drought management and powers to the district magistrate (DM) to intervene at the right time to relieve distress of farmers. It is also felt that employment generation

schemes should be formulated and run at the state level instead of being dictated and controlled by the Centre, such as the State Employment Guarantee Scheme in Maharashtra, since it would make timely intervention on the part of the District Collector possible. The said scheme has run successfully in Maharashtra.

Earthquakes

Though earthquakes cannot yet be predicted with certainty, drafting seismic codes, building regulations to ensure adoption of earthquake resistant technology, retrofitting of old structures that do not satisfactorily comply with safety regulations and regulation of informal settlements like 'jhuggis' in hazard prone areas are some of the preventive/ mitigation measures that can be attempted. Proper town planning and effective enforcement of legislation and codes for mitigation can effectively prevent loss of life from earthquakes. For administrative preparedness for quick response regular drills of paramilitary forces, simulation studies, data collection across quake-hit regions of the world with a view to diagnosing vulnerability can minimise losses during earthquakes. Manpower planning would be required to create specialist manpower to plan for and implement safe building measures.

Floods

Undesirable side effects of *dams* and *embankments* have shifted focus to non-structural mitigation measures to prevent losses from disasters. While dams result in large-scale displacement of populations and environmental degradation of surrounding areas, embankments cause siltation and water logging problems, creating fresh opportunities of floods rather than preventing their occurrence. Floodwaters carry a heavy load of sediments, which raise the riverbed overtime, making it necessary to raise the embankments to contain the waters. Rainwater is also blocked from flowing into rivers naturally because of embankments. Seepage of water underneath creates water logging in adjoining areas (Kulshreshtha, 2001). Experts now feel that total flood disaster prevention is almost impossible in case of floods since costs involved are prohibitive and information of all possible consequences difficult since engineering know how is limited. Hence the focus is now on non structural measures which aim to reduce susceptibilities such as rehabilitation safeguarding public health, better crop planning to derive maximum benefit from fertile flood zones, regulation of construction in flood prone areas as per hazard assessment and feasibility studies, disaster resistant communication infrastructure, proper drainage in urban areas for flood mitigation, provision of flood insurance, etc. (Rangachari, 2001).

In case of structural mitigation measures, the emphasis is now on inter-regional cooperation (for areas such as the Ganga –Brahmaputra- Meghna (GBM) Basin covers India, Nepal, Bhutan and Bangladesh which are low income countries and cannot afford disaster losses) in instituting early warning systems, sharing of hydro-meteorological data, especially in downstream areas regarding upstream water levels for better forecast of floods, warning, provision of drainage facilities for easy discharge of excess water from dams and reservoirs, water harvesting for dry seasons, water management through water storage in common river upstream areas, regular monitoring of dams for regulating water storage and periodic release of excess water, and statistical analysis for risk assessment and estimation of the intensity and hazard occurrence probability with respect to common hazard threats. To clarify further, as per Rangachari, the terrain of Nepal and Bhutan, as well as the upper reaches of the GBM basin in India offer excellent sites for possible storage of water. Bangladesh and the plains of India offer no such facilities. Similarly, when the rivers emerge into the terrain/plains from the hills, they spread out, spill and meander. Construction

of embankments could create political controversy. From an engineering perspective, as well, cooperation would be necessary between neighboring countries for better dam and embankment facilities and their maintenance. Each of the above mentioned natural hazards would be treated more comprehensively in subsequent Units.

3.7 INTERNATIONAL MOBILISATION FOR RISK REDUCTION

Continuing the context provided above, given the increasing concern about the impact of disasters, the UN General Assembly declared 1990-1999 as the International Decade for Natural Disaster Reduction (IDNDR). Under the theme 'Building a Culture of Prevention', work was done to advance a wider commitment to activities that could reduce the consequences of natural disasters. *The Yokohama Strategy and Plan of Action for a Safer World* (Yokohama strategy), conceived at the World Conference on Natural Disaster Reduction in Yokohama in 1994, stressed that every country had the sovereign and primary responsibility to protect its people, infrastructure and national, social or economic assets from the impact of natural disasters.

Inter-Agency Secretariat of the ISDR

The Inter-Agency Secretariat of the ISDR (UN/ISDR) is the focal point within the UN system for coordination of strategies and programs for disaster reduction and ensuring compatibility between disaster reduction activities and activities in the socio-economic and humanitarian fields.

The Secretariat also serves as an international clearinghouse for the identification, management and dissemination of information pertaining to the current state of knowledge and the range of activities underway that could contribute to the progress of disaster risk reduction efforts around the world.

The Secretariat also develops advocacy campaigns to promote wider understanding about natural hazards and disaster risk to motivate a worldwide commitment to disaster reduction. A particularly important role is to encourage both policy and advocacy studies through national committees, networks or platforms dedicated to disaster reduction, closely aligning regional initiatives.

The Secretariat plays a *facilitating* role, bringing agencies, organisations and different disciplines together on a common platform to deliberate on the *scope* of disaster risk reduction. Furthering the end the Secretariat supports the Inter-Agency Task Force on Disaster Reduction in developing universal policies/innovative strategies on disaster reduction.

The Task Force, supported by the ISDR Secretariat, formulated in 2001 a framework for action for the implementation of ISDR with four main objectives:

1) To increase public awareness to understand risk, vulnerability and disaster reduction;
2) To promote the commitment of public authorities to disaster reduction;
3) To stimulate multidisciplinary and intersect oral partnerships, including the expansion of risk reduction networks; and
4) To improve scientific knowledge about the causes of natural disasters, as well as the effects that natural hazards and related technological and environmental disasters have on societies.

In pursuing these objectives, the framework for action proposed, outlines the following areas of common concern:

- Recognition and incorporation of special vulnerability of the poor and socially marginalised groups in disaster reduction strategies;
- Environmental, social and economic vulnerability assessment with special reference to health and food security;
- Ecosystems management, with particular attention given to the implementation of Agenda 21;
- Land-use management and planning, including appropriate land use in rural, mountain and coastal areas, as well as unplanned urban areas in mega-cities and secondary cities, and
- National, regional and international legislation with respect to disaster reduction.

Regional Cooperation

A particular issue area in regional cooperation is sharing and management of common environmental units, for example over an expanse of the ocean. More regional co-operation is needed to institute risk reduction regarding shared resources.

As explained by Pardeep Sahni and Madhavi Malalgoda Ariyabandu (2003), there is need for networking of knowledge and expertise at the regional level to develop credible data base for development of policy science and risk identification for disaster mitigation policy on a regional scale. Some examples could be noted thus: The Intermediate Technology Development Group (ITDG) is an international development organisation that has been engaged in disaster risk reduction technology in Latin America, Asia and elsewhere. It is currently engaged in risk identification for the purpose of disaster risk reduction policy for the South East Asian Countries with the financial support of the Conflict and Humanitarian Affairs Department (CHAD) of U.K. The focus of research is "Livelihood Options for Disaster Risk Reduction South Asia. On the basis of empirical research in Bangladesh, India, Nepal, Pakistan and Sri Lanka, the following key issues have been highlighted.

- Risk accumulation has occurred over time because of neglect of small-scale disasters, which have increased in frequency and compounded existing hazards.
- Local level self governing institutions and community action groups should be held primarily responsible for tackling such risks. National and International effort would not be that efficacious.
- Without active participation of vulnerable communities, such programmes or policies could never be meaningful.
- The focus should be on enhancing the coping capacities of communities
- There is little evidence to suggest that risk is being incorporated into development planning.

The *Pro-Vention Consortium* was launched in February 2000. As per the account given by Pardeep Sahni and Madhavi Malalgida Ariyabandu (2003), it comprises 43 governments, international organisations, academic institutions, banks, private sector organisations and

civil society organisations. Some of the notable members are the Munich Re, University of Kyoto, Japan, University of Pennysylvania, Renaissance Reinsurers, Asian Development Bank, United Nations Development Programme (UNDP), International Federation of Red Cross and Red Crescent Societies among many more international institutes of repute.

Disasters have close linkages with Development. At times, it is development that causes disasters and there are occasions when after disasters, new development takes place. The Disaster Risk Index developed by UNDP has made an attempt to bring-forth the relationship between development and disaster risk based on scientific, methodical and systematic analysis of data. Eight Millennium Development Goals (MDG):

1) Eradicating Extreme Poverty and Hunger

2) Achieving Universal Primary Education

3) Promoting Gender Equality and Empowering Women

4) Reducing Child Morality

5) Improving Maternal Health

6) Combating HIV/AIDS, Malaria and other Diseases

7) Ensuring Environmental Sustainability

8) Developing a Global Partnership for Development;

These goals have been set up by the General Assembly of the United Nations to be achieved by the year 2015. UN/ISDR publication entitled, "Disaster Risk Management, Governance and Development" (2004) has pointed out that six out of the above stated eight Millennium Development Goals (that is, Eradicating Extreme Poverty and Hunger; Promoting Gender Equality and Empowering Women; Reducing Child Morality; Combating HIV/AIDS, Malaria and other Diseases; Ensuring Environmental Sustainability; and Developing a Global Partnership for Development) paved the way for formulating policies towards reducing disaster risks. *Eradicating Extreme Poverty and Hunger* could be achieved by reducing disaster risks through alternative livelihoods, creation of jobs, participatory approach to urban development, building social security and risk sharing and transfer, especially in cases which are not covered through insurance. Another Millennium Development Goal, that is, *Promoting Gender Equality and Empowering Women*, could have initiatives like women empowerment, more participation of women in making decisions at different levels, participation of women in setting development agenda, better employment rights to women and more accessibility to health and education, which could go a long way in reducing disaster risk to women. Likewise, *Reducing Child Mortality* could reduce disaster risks by emphasising on better childcare and by facilitating extended families to adopt and support orphanages. People become more vulnerable when affected by disasters like HIV/AIDS and Malaria, etc. Disaster risks can be reduced through better health care facilities and preventive health, designing such innovative programmes in the case of natural disasters which bring-forth quantitative rate of illness. *Ensuring Environmental Sustainability*, one of the Millennium Development Goals, impresses upon Governments, Non-Government Organisations, Civil Society Organisations, Community-based Organisations and Citizens to develop innovative mechanisms for ensuring environmental sustainability and thus helping in reducing accumulated risks. As mentioned earlier, developing *Global Partnership for Development*, the 8th Millennium Development Goal can play a substantive role in meaningfully reducing disaster risks. Different countries,

developed and developing need to cooperate and collaborate with each other for reducing, if not completely eliminating, disaster risks. It won't be out of place to mention here that the World Bank has helped in initiating certain projects, in important countries of South Asia, which not only help in achieving the Millennium Development Goals but also facilitate in reducing disaster risks ("Development, Planning and Administration", 2003). Some of these projects in Bangladesh, India, Pakistan and Sri Lanka are:

Bangladesh: Social Investment Programme Project; Rural Electrification and Renewable Energy Development Project; Financial Services for the Poorest Project; Public Procurement Reform Project; Female Secondary School Assistance Project; Legal and Judicial Capacity Building Project; Post-Literacy and Continuing Education for Human Development Project; and Poverty Alleviation and Micro-finance Project;etc.

India: Andhra Pradesh Rural Poverty Reduction Project; Uttar Pradesh State Roads Projects; Technical/Engineering Education Quality Improvement Programme Project; Andhra Pradesh Community Forest Management Project; Mumbai Urgan Transport Project; Gujarat Emergency Earthquake Reconstruction Programme Project; Banking Sector Restructuring and Privatisation Project; National Leprosy Elimination Project; etc.

Pakistan: Community Infrastructure and Services Project; Banking Sector Technical Assistance Project; NWFP On-Farm Water Management Project; Bio-diversity Conservation Project; Trade and Transportation Facilitation Project; etc.

Sri Lanka: Economic Reform Technical Assistance Project; National AIDS Prevention Project; Renewable Energy for Rural Economic Development Project; Central Bank Strengthening Project; Land Tilting and Related Services Project; Distance Learning Project; etc.

Such international mobilisation is needed for better understanding of the phenomenon related to disasters and frame suitable policy drawing upon the experience and expertise of different countries round the globe. Also, policy at individual state levels needs to be synchronised under an international umbrella for better coordination in emergency situations.

3.8 CONCLUSION

Because disasters are seen as a humanitarian concern, development professionals are rarely exposed to disaster risk reduction issues with the result that the role of risk reduction in pro poor development is largely overlooked. Disasters do not just happen; to a large extent they result from failures of development which increase vulnerability to hazard events. Hence risk reduction is an essential development concern, not a contingent measure (DFID, 2004).

Risk reduction is an ongoing effort, not piecemeal or ad hoc like disaster response, and needs sustained commitment on the part of governments for integration in development planning. A shift of emphasis has been discernable lately, in disaster mitigation strategy from disaster response to disaster risk reduction with active participation of people. There are economic imperatives behind the shift, in that prevention is a cost effective option as also more ethical as the government's primary duty is to ensure sustenance and survival of its populace. Such sustenance cannot be ensured in the wake of the looming threat of disasters. Disasters have led to terrible loss of life and property due to lack of effective planning for their prevention and mitigation. Disaster Planning is an integral aspect of developmental planning which requires preemptive policy and coordinated effort on the

part of all concerned agencies, public, private and non-government apart from active community participation for risk articulation. In the new globalised set up, integration of such efforts at the *supra- state* level that is at the level of the United Nations and international regional groupings such as the SAARC is needed for better formulation and implementation of risk reduction strategies on a regional level.

To conclude, disaster risk reduction is a primary responsibility of governments since welfare state has the responsibility to safeguard the health and property of its subjects. Government is the instrumentality of the state and hence has the legal and moral obligation to do all in its power to protect the life and property of its inhabitants.

3.9 KEY CONCEPTS

Capacity Building : Efforts aimed at developing human skills and societal infrastructure within a community or organisation to reduce the level of risk. Capacity building also includes development of institutional, financial, political and other resources, such as technology at different levels and sectors of/in the society.

Capacity : Capacity refers to physical human and social capital inherent in a community. Hence it is a combination of all the strengths and resources available within a community, society or organisation that determine its resilience in the face of a disaster catastrophe Capacity may also be described as capability.

Coping capacity : Coping capacity refers to the means available in terms of resources, technical know how and ability in terms of human health and strength to face adverse consequences of particular kind; epidemic, or flood or earthquake etc. In general, this involves managing resources, both in normal times as well as during crises or adverse conditions. Training, awareness generation, better public health and nutrition standards etc. determine coping capacity of a community.

Resilience : Resilience is explained as a resultant of inherent capacity and coping capacity with respect to particular crisis. The capacity of a system, community or society to adapt, by resisting a threat or changing in accordance with changed situations in order to survive to the best extent possible. Resilience is determined by the degree to which the social system is capable of organising itself to increase its capacity for learning from past disasters for better future protection and to improve on indigenous risk reduction measures.

Disaster Risk Management : Disaster Risk management is the systematic process of using administrative decisions, organisation, operational skills and capacities to implement policies, strategies and coping capacities of the society and

communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including *structural* and *non-structural measures* to avoid (prevention) or to limit (mitigation and preparedness) adverse impacts of hazards. (ISDR)

Disaster Risk Reduction : Disaster Risk Reduction gives the *conceptual framework of elements* considered with the possibilities to minimise vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development. (ISDR)

Emergency Management : Emergency management involves plans, structures and arrangements established to engage the normal endeavours of government, voluntary and private agencies in a speedy, comprehensive and coordinated way to respond to the whole spectrum of emergency needs. (ISDR)

Retrofitting (or upgrading) : Reinforcement of structures to become more resistant and resilient to the forces of natural hazards. Retrofitting involves consideration of changes in the mass, stiffness, damping, load path and ductility of materials, as well as radical changes such as the introduction of energy absorbing dampers and base isolation systems. Examples of retrofitting include the consideration of wind loading to strengthen and minimise the wind force, or in earthquake prone areas, the strengthening of structures. (ISDR; as per official United Nations Explanations)

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3.11 ACTIVITIES

1) What do you understand by risk reduction? Discuss Yokohama principles for disaster risk reduction

2) Discuss the role of science and technology in disaster risk reduction by quoting suitable examples.

3) Disaster planning and prevention play a role in risk reduction. Discuss.