RISK AND DISASTER MANAGEMENT

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Abstract

Natural Calamity is a bitter truth from which no one can escape. So many deaths, diseases, economic and social loss are few results of natural calamity. Disaster risk is on the rise all the way through the world. The economic losses and the number of people who have been affected by natural calamities have increased significantly over the past decades than the population growth, which slows down the economic growth of the affected country. The physical, social, particularly the emotional aspect and economic losses caused by these disasters are particularly more expensive for developing countries. To minimize the damages caused by disasters, various efforts have been taken by government, society, NGO's and international communities. The 26 December 2004 tsunami significantly affected the coastal regions of southern peninsular India. Govt take measure to protect the victims of tsunami.

Key terms*; risk, disaster management, tsunami.*

Information for disaster management

India has been traditionally vulnerable to natural disasters on account of
its unique geo-climatic conditions. Floods, droughts, cyclones, earthquakes and
landslides have been a recurrent phenomena The operational handling of a national risk management strategy should include a range of activities that are needed in the pre-disaster or prevention phase as well as in the **post-disaster**, or attention and reconstruction phases. For each phase a country must keep on hand the information decision makers need for executing the various stages of risk management as well as that required by the potentially affected population, and for the media.

Among **pre-disaster activities** the following have been identified as the most important for assembling the information necessary for proper risk management:

Prevention. In this stage general risk information is needed as is the identification of the most vulnerable areas and the least favourable scenarios that might arise.

Preparation. This consists of the activities and measurements taken ahead of time to assure an effective response when a disaster hits, including early alerts. It requires the existence of observation, forecasting and public alert systems, hazard measurement networks, and fluid communications mechanisms that can reach the most remote communities.

Emergency planning. This should be based on a sufficient volume of information to allow for prior and timely access to: contingency plans based on event scenarios with varying degrees of hazard; preparations and resources set aside to attend to emergencies; evacuation plans and shelters; the existence of funds budgeted for emergency attention; efficient information systems regarding the evolution of the phenomenon and its consequences. It is necessary to be ready to launch informational campaigns directed at the general public, and especially for those in high risk situations.

Mitigation. The design of **structural mitigation measures** demands vulnerability studies of strategic installations and vital lines of communication and transportation or plans for their implementation. Special attention must be paid to risk mitigation programmes involving non-engineered construction so that the necessary programmes are established for providing individual or artisan builders the technologies appropriate to their environment and experience.

Non structural mitigation measures include land use and management regulations, building codes and related enforcement measures, and zoning that takes into account risk-related hazards. Also of importance is the existence

of land use regulations and land management policies for the areas with the greatest vulnerability as well as building standards that contemplate safety precautions in anticipation of exceptional natural phenomena such as earthquakes and wind.

The main information needs of **post-disaster actions** are as follows:

Emergency response. The necessary information is described in the emergency preparation phase.

Rehabilitation. Actions aimed at repairing installations, infrastructure and assets in general demand the existence of quick evaluation systems that set priorities for the various rehabilitation tasks such as re-establishing essential public services and productive activities.

Reconstruction. When a disaster occurs, the authorities must design a reconstruction strategy with action priorities based on existing needs and available resources, and which properly take into account mitigation factors. During this phase comprehensive civil works projects must be designed, a process that demands a series of prior studies.

Risk management

Risk Management is recognised as an integral part of good management practice. It is an interactive process consisting of steps, which, when undertaken in sequence, enable continual improvement in decision making. According to the Risk Management Standard risk management is the term applied to a logical and systematic method of identifying, analysing, assessing, treating, monitoring and communicating risks associated with any activity, function or process in a way that will enable organisations to minimise losses and maximise opportunities. Risk management is as much about identifying opportunities as avoiding or mitigating losses.
The Risk Management Process involves several key steps. These steps identify, assess and analyse perceived risks, and determine treatment options for risk. Throughout the process relevant stakeholders and community groups are involved in India has been traditionally vulnerable to natural disasters on account of its unique geo-climatic conditions. Floods, droughts, cyclones, earthquakes and landslides have been a recurrent phenomena. About 60% of the landmass is prone to earthquakes of various intensities; over 40 million hectares is prone to floods; about 8% of the total area is prone to cyclones and 68% of the area is susceptible to drought. In the decade 1990-2000, an average of about 4344 people lost their lives and about 30 million people were affected by disasters every year. The loss in terms of private, community and public assets has been astronomical.information provision and decision making where appropriate.

Problems of risk information

Determining risk for purposes of managing it is a laborious and complicated task due to the manner in which risk factors are interrelated, and the complexity of the physical and social systems involved as well as the processes that lead to losses. Even after overcoming these issues, it is necessary to establish lines of communication between risk determination specialists and competent officials to assure that the risk-analysis transcends the national, regional or provincial level.

Information for risk evaluation

The principal objective of a study of hazard or threat in a place of interest is to become familiar with the phenomenon that poses it by identifying and measuring its intensity and zone of influence A detailed estimate of the hazard must deal with the local effects of topographical, subsoil or climatic conditions capable of increasing or decreasing the intensity, frequency or area of influence of the phenomena.

The evaluation of physical vulnerability can be conducted from a qualitative focus using indexes, or a quantitative one employing vulnerability functions. Social vulnerability refers to the sum of circumstances that affect population groups, limiting their ability to cope for themselves. Of the offers useful information for estimating vulnerabilities.
Risk evaluation is a process that consists of determining the nature and extension of risk in order to measure its societal consequences.

The analysis of extreme scenarios consists of determining a critical event in which extreme demands are placed on the system of risk and disaster management, estimating a country's economic loss and the system performance of risk management when such a catastrophic event occurs. Table 3of the Appendix lists the information that might be needed for making such an analysis.

Elements of disaster management

Prevention, mitigation, preparedness and relief are four elements, which add to and gain from the accomplishment of sustainable development policies. The Yokohama Strategy, originating from the international decade for natural disaster reduction in May 1994, highlights that disaster prevention, mitigation and preparedness are better than disaster-response in achieving the goals and objectives of susceptibility diminution. The Government of India has considered mitigation and prevention as fundamental components of its development strategy. The Tenth Five Year Plan emphasizes the fact that ―development cannot be sustainable without mitigation being built into the development process.‖ The need of the hour is to prepare a multi-branched approach for total disaster management comprising prevention, preparedness, response and recovery, and initiating development efforts towards risk reduction and mitigation. As per Luan, the countries in the Asia-Pacific region should establish a regional co-ordination mechanism for space-technology based disaster mitigation and strengthen co-operation, he further said that they also need to set up an all-weather and all-time comprehensive space-based disaster mitigation system and share the information. A realistic attitude to reduce the effect of disasters in the country requires a more extensive approach that comprises both pre-disaster risk reduction and post-disaster recovery. It is framed by new policies and institutional arrangements that support effective action. This kind of attitude should involve the following set of activities:

1. **Identification:** Risk analysis is to be done in order to identify the kinds of risks faced by people.
2. **Prevention and mitigation:** It is to be done in order to address the structural sources of susceptibility.
3. **Risk transfer:** Risk transfer is helpful in spreading the financial risks over time and among different factors.
4. **Emergency preparedness and response:** This will enhance a country's readiness to manage swiftly and efficiently with an urgent situation.
5. **Post disaster rehabilitation and reconstruction:** This is the final step to support successful healing and to safeguard against future disasters.

Measures taken to decrease the impact of Natural Disaster by India

Humans have managed disasters and an overview of our past experiences shows that management of disasters is not a new concept. For example, in ancient India, droughts were effectively managed through conventional water conservation methods, which are still in use in certain parts of the country - like Rajasthan. Local communities have devised indigenous safety mechanisms and drought-oriented farming methods in many parts of the country. The late 1990s and the early part of this century marked a break point in Disaster Management in India. The Orissa Super Cyclone and the Gujarat Earthquake taught the nation a tough lesson. A welcome step in this direction was setting up of a High Powered Committee on Disaster Management in 1999, which submitted its report in 2001. An important recommendation of the committee was that at least 10 percent of plan funds at the national, state and district levels be earmarked and apportioned for schemes that specifically address areas such as prevention, reduction, preparedness and mitigation of disasters. Also for the first time in the planning history of India, planners devoted a separate chapter titled *'Disaster Management: The development perspective'* in the tenth five-year plan document (Planning Commission, 2002). More recently, several institutions with a focused authorization on disaster management have come up in various parts of the country. The Ministry of Home Affairs (Disaster Management Division), National Institute for Disaster Management (New Delhi), Gujarat State Disaster Management Authority (GSDMA), Orissa State Disaster Management Authority (OSDMA), Disaster Mitigation Institute (Ahmedabad) can be seen as initiatives taken in the right direction. There has also been a determined effort on the part of the state to mainstream Disaster Mitigation initiatives in Rural Development schemes. One of its example is the coordination between the Ministry of Rural Development and the Ministry of Home Affairs, which is now the nodal ministry for coordination of relief and response and overall natural disaster management, for changing the guidelines of schemes such as Indira Awas Yojna (IAY) and Sampoorn Grameen Rojgar Yojna (SGRY) so that the houses constructed under IAY or school buildings/community buildings constructed under SGRY are earthquake/cyclone/flood resistant. World Development Report (IFRCRC, 2001) categorizes natural disasters into hydro meteorological (earthquakes, volcanic eruptions, etc) and geophysical (landslides, droughts, etc) categories. The scope of unnatural disasters broadly encompasses conflicts, civil strife, riots and industrial disasters. In the past decade (1991-2000), natural disasters have killed 66, 59,598 people, accounting for 88 percent of all deaths due to disasters. Similarly,

unnatural disasters have killed 86,923 people during the decade. Nearly two-thirds of the people killed in these disasters hail from developing countries like India, with only four percent of the casualties being reported from highly developed countries (IFRCRC, 2001). Not like Japan but then also India is considered as the world‘s most disaster prone country. Like many other countries in this region, India is beleaguered by various kinds of natural disasters every year, such as floods, drought, earthquakes, cyclones, cloud bursts and landslides. Millions of people are affected every year and the economic losses caused by natural disasters amount to a major share of the Gross National Product (GNP). Every year, huge amount of resources are mobilized for rescue, relief and rehabilitation works following natural disaster occurrences and after these efforts also, leaving behind new count to the poverty number.

In India, a closer analysis of what converts a natural event into a human and economic disaster discloses that the elementary problems of development that the country faces are the very same problems that contribute to its susceptibility to the disastrous effects of natural hazards. The principal causes of susceptibility include quick and uncontrolled urbanization, doggedness of widespread urban and rural poverty, and dreadful conditions of the environment resulting from the mismanagement of natural resources, inefficient public policies, and misguided investments in infrastructure. Development and disaster related policies have under estimated the investment in natural hazard prevention and mitigation and have largely focused on emergency response. Here people are getting help in the form of money, food, clothes, etc., but rehabilitation is still a serious issue. It takes a prolonged time. As India being a developing country faces a serious problem of unemployment and natural disaster is simply adding up number to the unemployment list. A disaster is a serious disruption of the functioning of society, causing widespread human, material or environmental losses which exceed the ability of affected society to cope on its own resources.

Principal Causes of Disasters

Natural Disasters Man-Made Disasters * Rain and wind storms * Acts of war and terrorism * Floods *Fires * Biological agents * Water (broken pipes, leaking roofs, (micro-organisms, insect or vermin infestation) blocked drains, fire extinguishing) *Earthquakes * Explosions *Volcanic eruptions *Liquid chemical spills *Building deficiencies (structure, design, environment, maintenance) * Power Failure

In case of India: The world has moved on to other preoccupations leaving the 2004 Indian Ocean Tsunami far behind. But the affected countries continue to struggle, and the recovery will still take many years. Further, heavy rain falls and their impact worsened by deforestation, led to the death of so many people, with many others forced from their homes. The massive earthquake in the Indian Ocean, off the coast of the Indonesian island Sumatra, on December 26, 2004 triggered a series of lethal tsunamis that hit the coastal regions of Indonesia, Thailand, Malaysia, Bangladesh, India, Sri Lanka, and Maldives in South/ South-east Asia and the coasts of Somalia, Kenya and Tanzania in eastern Africa. The combined death toll in this unprecedented disaster was above 2, 30,000 even by conservative estimates and over 10 lakh people in these countries were left homeless. In India, the tsunami caused devastation in the coastal areas of three southern States, Andhra Pradesh, Tamil Nadu and Kerala, and in the Union Territories of Andaman & Nicobar Islands and Pondicherry. Since the Government apparatus in India had never recognized the threat of a tsunami of such a huge magnitude, pre-disaster mitigation and preparedness measures for this disaster were almost entirely non-existent. Consequently, the devastation caused by the tsunami in the affected areas in India, especially in Andaman & Nicobar Islands, Pondicherry and the coastal districts of Tamil Nadu were enormous. In Tamil Nadu, the areas of Nagapattinam, Cuddalore, Kanyakumari, Chennai, Villupuram, Tuticorin and Tirunelveli were the worst hit. While most tsunami-affected territories have re-emerged physically, if not psychologically better, not everywhere has recovered at the same pace, including India's Tamil Nadu. "What is bad is that in the villages on the seashore there has been little clean-up. We can still find boats left five years on which had been washed up and have not been cleaned up. It's more than an eyesore," said Bhatkher Solomon, chief executive officer of the NGO Development Promotion Group. Some observers say that only about one third of the reconstruction aid that was promised after the tsunami which took place in December 2004 has actually been distributed, and a large portion of the amount has been wasted due to corruption, mismanagement and unnecessary duplication of aid efforts. As a result, hundreds of tsunami survivors continue to wait for permanent homes.

Tsunami in India

The 26 December 2004 tsunami significantly affected the coastal regions of southern peninsular India. About 8,835 human lives were lost in the tsunami in mainland India, with 86 persons reported missing. Two reconnaissance teams traveled by road to survey the damage across mainland India. Geographic and topological features affecting tsunami behavior on the
mainland were observed. The housing stock along the coast, as well as bridges and roads, suffered extensive damage. Structures were damaged by direct pressure from tsunami waves, and scouring damage was induced by the receding waves. Many of the affected structures consisted of nonengineered, poorly constructed houses belonging to the fishing community. The Great Sumatra earthquake of 26 December 2004 did not cause shaking-induced damage to the mainland of India, but the consequent Indian Ocean tsunami had a significant effect on the southern peninsular region of India. The tsunami severely affected the coastal regions of the eastern state of Tamil Nadu, the union territory of Pondicherry, and the western state of Kerala. Two reconnaissance teams undertook road trips to survey the damage across mainland India. One team traveled from the Ernakulam district in Kerala, then continued south along the west coast to the southernmost tip of mainland India Kanyakumari and up along the east coast to Tuticorin. The coastal journey was then resumed from Nagapattinam, moved northward, and concluded at Chennai. The second team traveled from Vishakhapatnam in Andhra Pradesh along
the coast down to Chennai. This paper is based on observations made during these trips.

GENERAL FEATURES OF TSUNAMI EFFECTS

The tsunami effects varied greatly across different parts of the coast according to the number of waves experienced, inundation distance and height of the waves, and density of the area as well as topological and geographical features that made some areas more vulnerable than others. The number of lives lost was also influenced by the proximity of

habitats to the coastline, exposure to previous disasters, and the local disaster management capability. These are discussed in detail in this paper. The affected areas are discussed in three parts, which are based on their geography:
Southwest coast: this comprises Kerala, which suffered significant damage that impacted
the largest number of people of any affected state but suffered relatively lower loss of life, and the Kanyakumari district of Tamil Nadu, which suffered heavy loss of life due, to a large extent, to human-created local topographical features. Southeast coast: this comprises the rich alluvial delta region of the Tamil Nadu coast and Pondicherry, which experienced maximum wave heights and recorded the maximum loss of life and damage in mainland India. East coast: this comprises Andhra Pradesh, which suffered marginal damage and loss of life. The state of Kerala experienced tsunami-related damage in three southern districts, Ernakulam, Allapuzha, and Kollam, due to the diffraction of the waves around Sri Lanka. The southernmost district of Thiruvananthpuram, however, escaped damage. This was possibly due to the wide turn of the diffracted waves at the peninsular tip, thereby missing Thiruvananthpuram. The coast of Kerala is relatively flat and practically at sea level. Throughout the coastal areas of Kerala, and especially in the affected districts, are long stretches of lakes, lagoons, and ponds connected by a network of canals called "backwaters". The backwater routes date from centuries ago and have long been used for all transportation needs, in particular for trade in coconut, rubber, rice, and spices. Today, these waterways link remote villages and islands to the mainland. Major damage in Kerala occurred in two narrow strips of land bound on the west by the Arabian Sea and on the east by a network of backwaters The northern strip comprises the island of Wypeen north of the city of Kochi in the Ernakulam district. It is about 20 km long and has a maximum width of about 3 km. Edavanakkad is a prominent fishing village in Wypeen Island that suffered maximum damage. Fifty houses were completely destroyed and 350 houses were damaged in this village, which lost 5 lives. The coast in this area had a seawall along most parts, with openings in the seawall for the passage of boats. Damage due to the tsunami was more intense in the areas that were not protected by the seawall. The other strip most affected in Kerala is a shoestring isthmus south of the city of Allapuzha about 40 km long and extending from Trikunnapuzha in the Allapuzha district to Karunagapalli in the Kollam district. In the village of Arattupuzha in the Allapuzha district, the death toll was 28.

Kanyakumari forms the southwest district of Tamil Nadu. Unlike the Kerala coast, the Tamil Nadu west coast has flat land at sea level along the north coast in some areas such as Kolachel, where the soil is rich alluvium, but in other areas and further south, the land is mountainous. It slopes steeply upward from the coastline and is rocky. This was observed at Muttom Beach and at the tip of Kanyakumari. On some beaches such as Sothavilai, there are sand dune formations. summarizes the tsunami wave characteristics in Tamil Nadu.

One of the most affected areas in the district was Kolachel and the surrounding villages, located 30 km west of Nagercoil, which is the capital of the Kanyakumari district. The land near the coast is flat and is at sea level, and no seawall was visible. Water traveled inland by more than 300 m. New streams and estuaries were carved out by incoming waves. When the waves receded, they deepened these features further by scouring. The town and neighboring villages recorded more than 500 fatalities, of which more than 50% were children. The wave height was reported to be 5 m, and the runup height was 2.6m. A large number of deaths were triggered by the humancreated topology of this town. Harbour Road, which experienced the maximum number of casualties, had a long, open, dry channel called the Ananda Victoria Marthandam AVM Canal. This canal is more than 2.5 m deep and 6 m wide, running parallel to the shore. The canal was meant to bring in fresh water but was not in use. Besides this canal, there were numerous open trenches laid parallel to each other that catered to the special needs of the coir-making industry, which is the main means of livelihood in this region besides fishing. These trenches were about deep, 15 m long, and 4 m wide. They were used to soak the coconuts and separate the husk for making coir. When the tsunami waves surged into the town, the AVM canal and these trenches became death traps. More than 300 bodies were recovered from the slush of the trenches and channel. The masonry retaining wall of the jetty at Kolachel was badly damaged.
The tsunami battered Marina Beach, of chennai and giant waves swept across the beach and the
wide Kamarjar Salai road and entered into these buildings. However, there was no significant damage to the buildings. The waves caught many morning walkers on Marina Beach unawares. Approximately 160 people died on the beach in the tsunami. The hamlet adjacent to the beach consisted of thatch shanties less than 50 m from the sea. These were ravaged in the tsunami. The fishing port of Chennai suffered significant damage, and approximately 150 fishermen were reported dead. However, the main port of Chennai, which has a seawall, was not significantly damaged. The mooring line of one of the ships, the Keshava, broke off and collided with two other ships, causing localized damage to the ships. Mooring dolphins were damaged.

CONCLUSIONSAND OBSERVATIONS

The tsunami effects varied greatly across different parts of the coast according to the number of waves experienced, the inundation distance and height of waves, and the density of the area, as well as topological and geographical features that made some areas more vulnerable than others. Besides these factors, the number of lives lost was influenced by exposure to previous disasters and the local disaster management capability. Most of the people killed were members of the fishing community and, in some cases such as Marina Beach at Chennai and Velankanni in Nagapattinam, they were visitors on the beach. The tsunami caused much damage to the housing stock along the coast and to bridges and roads. The houses were mainly nonengineered and were poorly constructed. But improving the construction methodology and the integrity of structures cannot provide the necessary assurance of tsunami resistance. If people continue to build along the shore on flat land, they will continue to be highly vulnerable in a tsunami and may expect
such damage and loss of life. Although the government has considered rigorous implementation of the CRZ _which requires structures to be a minimum distance of 500 m from the shoreline_ in the reconstruction project, it is a moot point whether this requirement will be followed. It is quite likely that fishermen will move back to the beaches in a few years. In such a case, a robust tsunami warning system along the lines of the cyclone warning system must be put in place, and tsunami shelters _which may also double as cyclone shelters must be provided in every coastal area for quick and safe egress of people and their valuables. Bridges need special attention. It may be worthwhile for the government to consider providing restraints for bridges in light of the failure of the bridge at Melamanakudi over the Pazhyar River. There is also a need to review the existing bridges and evaluate their serviceability, in light of the failure of the Arasalar Bridge.
Damage was caused at many ports due to damaged mooring dolphins. Special attention needs to be paid to the design of the moorings.