Government of Pakistan
Cabinet Division

National Plan:

Strengthening National Capacities for Multi Hazard Early Warning and Response System

Phase: I

Prepared by

Dr. Qamar-uz-Zaman Chaudhry
Director General
Pakistan Meteorological Department

Under the guidance of

Mr. Ejaz Rahim
Secretary, Cabinet Division

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Phase-I of National Plan :

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Executive Summary

The world community was appalled by the unprecedented losses of life and property caused by the history's ever deadliest tsunami event of 26th December 2004 which played havoc in coastal areas of eleven countries on the periphery of the North Indian Ocean and later by the 8th October, 2005 devastating earthquake in Pakistan. Luckily, during tsunami disaster Pakistan's entire coastline was saved because of being in the shadow of the Indian Peninsular landmass which bore major brunt of the forces directed northwestward. If an effective tsunami early warning system had been in place in the Indian Ocean region, thousands of lives would have been saved. The same stark lesson can be drawn from other disasters that have killed tens of thousands of people in the past few years. Effective early warning systems not only save lives but also help protect livelihoods national development gains.

After December 2004 tragic Tsunami Disaster, UN appointed President Clinton as UN's special envoy for Tsunami Recovery. On March 27, 2006 he participated in a roundtable meeting on "Indian Ocean Tsunami Warning and Response Systems" convened by UNESCO/IOC and the UN's International Strategy for Disaster Reduction (ISDR) secretariat in Bonn, Germany. In that meeting, a number of agencies have formed a consortium to assist requesting governments in developing national plans. On April 16, 2006 President Clinton wrote a letter to Prime Minister of Pakistan endorsing new initiative to promote disaster reduction in the Indian Ocean region and encouraged the active support. ISDR has identified following seven core objective areas for which consortium can provide funding for developing National Capacities:-

- *National tsunami centre established and operating as the authoritative source for tsunami advice and warnings. [Lead partner: UNESCO/IOC]*
- *Strengthening of operational 24/7 national warnings services through the National Meteorological Services as part of multi-hazard approach to national warning systems. [Lead partner: WMO]*
- *Warning response plan for coastal regions prepared and disseminated and a national (coastal) response and evacuation exercise undertaken. [Lead partner: UN-OCHA]*
- *Awareness-raising and education campaign undertaken on tsunami risks and the warning system in coastal regions. [Lead partner: IFRC]*
- *Assessment of Environmental Flashpoints at sub-national level for use in preparedness and spatial planning and disaster risk reduction. [Lead partner: UNEP]*
- *Organizations responsible for disaster risk reduction and disaster management established to lead, monitor and coordinate the plan. [Lead partner: UNDP]*
- *Intermediate and long-term plan developed for the complete and sustainable tsunami warning and response system with full costing. [Lead partner: World Bank]*

Like other South Asian countries, Pakistan continues to suffer from a plethora of natural hazards and disasters like floods, earthquakes, landslides, cyclones that threaten to affect the lives and livelihood of its citizens. To be effective, early warning systems must be people-centered and must integrate four elements; (i) a knowledge of the risks faced; (ii) a technical monitoring and warning service; (iii) the dissemination of meaningful warnings to those at risk; and (iv) public awareness and preparedness to act. Failure in any one of these elements can mean failure of the whole early warning system.

According to UN Global Survey of Early Warning Systems-2006, considerable progress has been made in developing the knowledge and technical tools required to assess risks and to generate and communicate predictions and warnings, particularly as a result of growing scientific understanding and the use of modern information and communication technologies. Early warning system technologies are now available for almost all types of hazards and are in operation at least in some parts of the world.

However, the experiences of the Indian Ocean tsunami, the hurricanes in the Gulf of Mexico, and many other recent events such as heat waves, droughts, famine, wildfires, floods and mudflows, point to significant inadequacies in existing early warning systems. In many cases, especially in developing countries like Pakistan, warning systems lack the basic capacities of equipment, skills, and resources. Among both developed and developing nations, the weakest element is the warning dissemination and preparedness to act. Warnings may fail due to inadequate political commitment, weak coordination among the various actors, and lacks of public awareness and public participation in development and operation of early warning systems.

The establishment of proposed Multi Hazard Early Warning and Response System in Pakistan will serve as a country-based early warning and response system. Such a system is needed not only for the protection of citizens and national assets but also provides the building blocks of the global early warnings system. The recommendation addresses the need for a national plan based on a survey of capabilities, a warning dissemination strategy, community-based approaches, and public education and exercises. The recommendation highlights gaps and opportunities that deserve immediate concerted action, including tropical cyclones, floods, tsunamis and drought for the optimal protection of the lives, property and the national assets of the country.

After October 8, 2005, earthquake tragedy, it was deemed pertinent that an effective disaster management system should exist in the country. The Prime Minister of Pakistan considered the proposals of Cabinet Division on the subject.

i. Approved establishment of National Disaster Management System through the procedure outlined in Article 144 of the constitution.
ii. Approved, in principle, the setting up of the Disaster Management Commission (NDMC) headed by the Prime Minister of Pakistan and which include the Provincial Chief Ministers besides other Ministers.
iii. Approved the setting up of National Disaster Management Authority (NDMA) which shall be a highly professional body with key specialized disciplines, with focused approach and lean structure.

The cost of first phase of National Plan for Establishment of Multi Hazard Early Warning and Response System is estimated about US$ 32 million. It includes nine essential components dealing with all major disasters generally experienced in Pakistan. The essential components of the proposed system alongwith the executing organizations are given below:

Project Title	Executing Organization	Cost US $ (million)
• Establishment of Tsunami Early Warning System in Pakistan	Pakistan Meteorological Department	11.2
• Establishment of Earthquake Prediction Study Centre	National Centre for Physics, Islamabad	0.35
• Tide Gauge Network for monitoring of sea level variations along Pakistan coast	National Institute of Oceanography	2.0
• Up-gradation of Warning Capabilities of National Meteorological Service in Pakistan	Pakistan Meteorological Department	6.5
• Establishment of Tropical Cyclone Warning Centre	Pakistan Meteorological Department	1.7
• Flood Forecasting Center for NWFP	Pakistan Meteorological Department	6.5
• Drought Monitoring and Warning System	Pakistan Meteorological Department	0.2
• Establishment of Specialized Control Centre at National Disaster Management Authority (NDMA)	Cabinet Division / NDMA	2.3
• Setting up of Federal Urban Search & Rescue Teams	Civil Defence of Pakistan	7.5
	Total	***US $ 38.25***

They will be linked with the focal point at National Disaster Management Authority (NDMA) administered by the Cabinet Division through a reliable communication system. NDMA would establish direct communication links to reach the stakeholders. NDMA will have a round the clock operational fully automated control room for collecting information of emergencies of all sorts in the country. It is responsible to coordinate with the Provincial Crisis Management Cells (PCMCs) and other specialized agencies to gather relevant information. It will mobilize the local emergency response services and provide them additional equipment and manpower in case of emergency situations and disasters.

This document which contains the first phase of the National Plan for the Strengthening National Capacities for Multi Hazard Early warning and response System has been prepared for seeking funding from the donors consortium formed on the initiative of President Clinton.

1. Introduction:

Like other South Asian countries, Pakistan continues to suffer from a plethora of natural hazards that threaten to affect the lives and livelihood of its citizens – natural disasters include floods, earthquakes, landslides, cyclones, and drought. These hazards pose serious threat to the economic and social development of the country. The human impact of natural disasters in Pakistan can be judged by the fact that 6,037 people were killed and 8,989,631 affected in the period between 1993-2002 (*World Disasters Report 2003,* Geneva, International Federation of Red Cross and Red Crescent Societies), while more than 85000 people were killed and more than 4 million people were affected due to the recent major earthquake that occurred on 8th October, 2005 in the north of Pakistan.

There are various national and provincial institutions working independently to address the issues related to different disasters. However, the country lacks an effective unified multi-hazard disaster warning system to help reduce the loss of life and livelihoods resulting from natural hazards. President Clinton's initiative and formation of a consortium to help the developing countries establishing the Tsunami early warning system is highly appreciated.

1.1- Geography:

Pakistan is situated in South Asian region between longitudes 61º & 76º E and latitudes 24º & 37º N covering a total land area of 796,095 sq km. The country possesses quite complicated and attractive physiographical features that include the northern high mountain ranges (the Himalayas, the Karakorum and the Hindukush) and snow-covered peaks, the western bordering highlands, the Salt range and Potohar Plateau, the Indus plains and the Balochistan Plateau. The country shares its borders with Iran to the west, India in the Southeast, Afghanistan in the north-west, and China in the north. The Arabian Sea lies to its south. Pakistan is a land of great topographic and climatic contrasts.

Low rainfall and extreme variations in temperature characterize the climate in Pakistan. About 60 per cent of the total land area is classified as arid, which receives less than 200 mm annual rainfall. The southern slopes of the Himalayas and the sub mountainous tract receive higher rainfall from 760 to 1270 mm. Some areas adjoining Kashmir receive more than 2000 mm precipitation per annum. The temperatures can be as low as -27° Celsius in the north (at Skardu) in winter and as high as 52° Celsius in the southern parts during summer.

1.2- Seismicity / Earthquakes:

Pakistan lies in a seismic belt and therefore suffers from frequent earthquakes of small magnitudes and big earthquakes occasionally. Mountain ranges of Suleiman, Hindu Kush and Korakuram are significantly vulnerable. The devastation generally immense because of the poor quality of buildings. There was a major earthquake in Quetta, Balochistan, in 1935 when the entire city was destroyed. From 1974 to 1990, approximately 5669 people were killed due to earthquakes in the Northern Areas (NA), North Western Frontier Province (NWFP) and Balochistan. The most recent and the deadliest earthquake occurred on 8th October, 2005 in northern parts of Pakistan measuring 7.6 on the Richter scale. The focal depth of the earthquake was just 10 kilometers and its epicenter was in the north of Muzaffarabad (Azad Kashmir) about

90 kilometers north of Islamabad. The earthquake occurred at 08:50:30 PST. Its intensity was estimated to be similar to the 1935 Quetta earthquake, the 2001 Gujarat Earthquake and 1906 San Francisco earthquake. The most affected areas were of Kashmir, eastern NWFP and northern Punjab. The Pakistan government's official death toll was 87350. Most of the affected people lived in mountainous regions with access impeded by landslides that blocked the roads, leaving an estimated 3.3 million homeless in Pakistan. The UN reported that more than 4 million people were directly affected, prior to the commencement of winter rain and snowfall in the region. It is estimated that damages incurred are well over US$ 5 billion.

1.3 Tsunami:

Pakistan also has a history of tsunami, due to a great earthquake of magnitude 8.3 which occurred offshore Makran Coast south of Pasni during the early hours on 28th November, 1945 producing 12–15 meter high sea waves that killed at least 4,000 people in Pasni and adjoining areas. The tsunami hit as far as Mumbai in India. Karachi, about 450 kms from the epicenter, experienced 6 feet high sea waves which affected the harbors facilities. Fortunately, the time at which the sea wave occurred was different from the time of high tide at Karachi on that day. Accordingly, the occurrence of a future tsunami event from this source region cannot be ruled out. It was, therefore, deemed necessary for Pakistan to develop a Tsunami Early Warning System.

The world community was appalled by the unprecedented losses of life and property caused by the history's ever deadliest tsunami event of 26th December 2004 which played havoc in coastal areas of eleven countries on the periphery of the North Indian Ocean. Luckily, Pakistan's entire coastline was saved because of being in the shadow of the Indian Peninsular landmass which bore major brunt of the forces directed northwestward. Apprehensions of what would happen, should such an event recur, caused great concern in the international community, necessitating the establishment of an "Integrated Tsunami Early Warning and Response System" at the national, regional and global levels.

Government of Pakistan also responded promptly to this issue of great humanitarian concern and the Prime Minister directed Federal Minister of Science & Technology (S&T) to submit a detailed feasibility report in this regard. On the recommendation of the Ministry of Science & Technology, Prime Minister entrusted Pakistan Meteorological Department as the focal agency to set up such a system in Pakistan. Subsequently, the Planning Commission of Pakistan agreed to the need for immediate up-gradation and expansion of Pakistan Meteorological Department's existing seismic network, so as to serve as a basic component for tsunami early warning system. The Planning Commission later approved the project "Up-gradation of Seismic Network of Pakistan" Phase-I of the Tsunami Early Warning System and work is in progress on this project. Tsunami Early Warning Centre would be established in the port city of Karachi in Phase-II.

1.4 Tropical Cyclones:

Although not a frequent phenomenon, cyclones can cause large-scale damage to the coastal areas of Sindh and Balochistan. The cyclone of 1999 in Thatta and Badin districts wiped out 73 settlements, and resulted in 168 lives lost, nearly 0.6 million people affected and killing of

11,000 cattle. It destroyed 1,800 small and big boats and partially damaged 642 boats, causing a loss of Rs 380 million. The losses to infrastructure were estimated at Rs750 million.

The period 1971-2001 records 14 cyclones. Coastal belt of Pakistan (especially coastal areas of Sindh) is highly vulnerable to tropical cyclones and associated storm surges. The changing climate is behaving vigorously resulting into increase in frequency, intensity and changes in tracks of storms. Although the frequency of invasion of Tropical cyclones is low along Pakistani coast, yet they cause considerable damage in the area. Such unprecedented damage to lives, property and infrastructure leaves adverse impact on the socio-economic development of the region. Coastal belt is mostly low-lying, therefore storm surges extends several kilometers inland damaging standing crops and converting the agriculture land into gully lands for long time. In addition to landfall of tropical cyclones and storm surges, strong winds create havoc destroying human settlements, electric and communication installation, fall trees and damage the seasonal crops. After its departure, it leaves the area water logged where cultivation can not be possible for about months due to the soil characteristics.

1.5 Drought:

Pakistan has a long latitudinal extent and the rainfall variability during different seasons is considerably high. The climate of the country in lower southern half is arid and hyper-arid. Some regions of the country in each season remain drastically dry and are always vulnerable to drought. If subsequent seasons fail to generate significant precipitation, the drought conditions emerge in these areas gaining severity in the absence of rainfall. In this way Drought has become an intermittent phenomenon in the country. All the provinces of Pakistan have a history of facing major droughts in the past. In recent years drought is reported to have brought extensive damages to Balochistan, Sindh and Southern Punjab where average annual rainfall is as low as 200-250 mm. Severe drought episodes in 2000 and 2002 affected livelihoods, resulted in human deaths, pushed tens of thousands people to migrate, and killed large number of cattle. This drought led to 120 deaths and affected 2,200,000 people. The main arid rangelands are Thar, Cholistan, Dera Ghazi Khan, Tharparkar, Kohistan, and western Balochistan. Except Balochistan, all of these areas are within the range of monsoon rainfall, which, however, is erratic and scattered. Hence, 2 to 3 years in every 10 years in these areas are drought years.

Drought differs from other natural disasters (e.g. floods, earthquakes, tropical cyclones, tornados etc.) in the sense that the effects of drought often accumulate slowly over a considerable period of time and may linger on for years even after the termination of the event. Because of this, drought is often referred to as a “Creeping Phenomenon”. Drought impacts are less obvious and are spread over large geographical areas than are the damages that result from other natural hazards. Consequently drought affects more people than any other environmental hazard.

Unfortunately, no organization dealing with the drought issues existed in Pakistan and the responses to drought for the distressed economic and social sectors, whenever such situation arose, were taken on emergency and on ad hoc basis. Such reactions to crisis often resulted in the implementation of hastily prepared assessment and response procedure that lead to ineffective, poorly coordinated and untimely responses. It is thus inevitable and need of the time that a monitoring and early warning system, which could be one of the major element of “Drought Mitigation” be developed on scientific grounds.

Addressing this important issue Government of Pakistan has established a National Centre for Drought / Environment Monitoring and Early Warning System in Pakistan. The major tasks to be accomplished by the centre would be:

- To serve as a hub for the collection, consolidation and analysis of drought related relevant data from all the possible sources in the country.
- To prepare and issue the weekly drought monitors and moisture stresses in different regions of the country particularly in drought vulnerable areas. These drought monitors would be abased on the following parameters:-

  i. ***Standardized Precipitation Index (S.P.I.).***
  This will be worked out using the rainfall data collected from the network stations and the Gamma distribution in statistics.
  ii. ***Palmer Drought Index (P.D.I.).***
  iii. Normalized Difference of vegetation Index (NDVI) obtained from satellite data.
    - Water availability in Dams / reservoirs.
    - River and stream flow data.
    - Soil moisture data wherever available.
    - Evapo-transpiration data computed from different weather parameters.
    - Seasonal snowfall data in our catchment areas.
    - Underground water situation.

This centre will also be responsible for extending the raingauges network in the country. The existing network of about 100 stations would be extended to 500 stations or even more. Some agencies using rainfall data would be involved to operate the stations on voluntary basis.

The Drought Monitoring Centre would be responsible for advising the Government on drought related matters including drought declaration.

Establishment of Operational Centres:

One operational centre will be established in each province. The main responsibilities of these centres would be:

- To collect data from the network stations in its region.
- To co-ordinate with the voluntary agencies operating the network and help them in running the stations smoothly.
- To store and process the data and transmit it to the National Centres in the desired format.

A research unit will be established under the National Centre. It will carry out research in drought related issues such as the climatological conditions leading to the occurrence of droughts and would develop statistical models for improving drought forecasts etc.

1.6 Floods:

Pakistan is one of the five South Asian countries with the highest annual average number of people physically exposed to floods, which occur normally due to tropical monsoon depressions systems that originate from Bay of Bengal during the monsoon from July to September. The depressions originating in Bay of Bengal passing over lower Central India and Rajputana, enter Pakistan and continue towards North into Kashmir. The mountain ranges in the extreme north of Pakistan provide a perennial source of inflow into the rivers. Floods particularly hit Punjab and Sindh while hill torrents tend to affect the hilly areas of NWFP, Balochistan and the northern federally administered areas. Flood events of 1950, 1992 and 1998 caused many deaths and huge losses to the national economy. According to official sources, floods in Pakistan during the decade 1991 to 2001 caused an estimated damage of over Pak Rs 78,000 million to property.

Major Flood Events in Pakistan

Year	Lives Lost	Villages Affected
1950	2910	10000
1955	679	6945
1956	160	11609
1973	474	9719
1975	126	8628
1976	425	9150
1978	393	9199
1988	508	1000
1992	1008	13208
1995	591	6852
1998	47	161
2001	201	0.4 million*
2003	230	1.266 million*

* Number of persons affected

National Flood Forecasting Division (NFFD) was established at Lahore under PMD in 1978 with the collaboration of UNDP. The mandate of NFFD includes collection of hydrological and meteorological data, its analysis, and preparation of Flood Forecasts & issuance of warnings. The operations of this centre are backed by the following components.

a) Rainfall and Discharge Measurement System:

This system is operating under the administrative control of WAPDA. For this purpose, Rim stations have been set up by WAPDA in catchment areas of the Indus river at "Kachura" which measures the snow melting and inflow through the station. The instruments are also installed at Bishma, Ogi, Phulra, Tarbela and Daggar which read the flow rate and take into account the rain element. All these informations are collected by WAPDA and passed on to the NFFD Lahore through its 36 telemetry centers. The second type of discharge data of canals is collected by the Irrigation Departments through their own network; utilizing police department facilities, data is passed on to NFFD Lahore.

b) Quantitative Precipitation Measurement (QPM) Radars

Continuing along the path of modernization and with the encouragement from the Government, four 5cm wavelength Weather Surveillance Radars have been installed at Karachi, Dera Ismail Khan, Rahim Yar Khan and Islamabad with the assistance of Government of Japan. Two precipitation measuring radars of wavelength 10 cm and 5 cm have been installed at Lahore and Sialkot respectively with the financial assistance of Asian Development Bank. These radars have been integrated by a network and have the capability to monitor the weather systems and their characteristics up to a radius of 400 kms. A Doppler radar having 10 cm wavelength is under installation at Mangla also.

c) Computer Centre

After the data have been received from the concerned quarters, it is fed into the computers which are installed at NFFB Lahore. The data is processed after every six (6) hours and based on the analysis, flood forecast is produced daily for the concerned agencies.

2. Disaster Management Policy at National Level

Disaster management policy in Pakistan exhibits following features:

- Disaster management in Pakistan basically revolves around flood disasters with a primary focus on rescue and relief. After each disaster episode the government incurs considerable expenditure directed at rescue, relief and rehabilitation.

- Applied disaster management policy sometimes carries strategic biases that are aimed at protecting locations and infrastructure of greater economic, political and strategic significance at the cost of areas and communities with lesser influence and importance.

- Within disaster management bodies in Pakistan, there is a dearth of knowledge and information about hazard identification, risk assessment & management, and linkages between livelihoods and disaster preparedness. Disaster management policy responses are not generally influenced by methods and tools for cost-effective and sustainable interventions.

- There are no long-term, inclusive and coherent institutional arrangements to address disaster issues with a long-term vision. For instance, the Emergency Relief Cell is mandated to deal only with post-disaster scenarios.

- Disasters are viewed in isolation from the processes of mainstream development and poverty alleviation planning. Some of the large-scale development projects are bringing new forms of disaster and adding to the vulnerability of at-risk communities. The Left Bank Outfall Drainage (LBOD) project and link canals are significant examples in Pakistan.

- Disaster Management, development planning and environmental management institutions operate in isolation and integrated planning between these sectors is almost lacking.

- Absence of a central authority for integrated disaster management and lack of coordination within and between disaster related organizations is responsible for effective and efficient disaster management in the country.

- State-level disaster preparedness and mitigation measures are heavily tilted towards structural aspects and undermine non-structural elements such as the knowledge and capacities of local people, and the related livelihood protection issues.

- Disaster and relief departments and organizations largely remain under-resourced, untrained, and not given required importance within administrative hierarchy. A dedicated fund for disaster management at the federal level has never been a part of the overall development planning. The officials of two important organizations engaged in disaster management e.g. Emergency Relief Cell and Federal Flood Commission are not provided with adequate training. A great deal of uncertainty prevails among government employees about their stay in any disaster related organization / department, which contributes towards working with less interest and efficiency.

- Given the frequent incidence of floods during monsoon season the government has taken adequate measures for flood control and management down to district level. The Pakistan Army plays a significant role in flood management by providing search and rescue services and emergency relief in affected areas. Flood Commission commences flood fighting plans every year in April and monitors the discharge of water at strategically important barrages and dams, and maintains a regular interaction with all provincial governments in pre, during and post flood situations. The district, provincial and federal governments prepare flood fighting plans annually and ensure timely dissemination of early warning through indigenous and modern modes of communication.

3. National Strategy for Disaster Management

In 1950, Pakistan witnessed first but severe flood disaster that claimed 2910 lives and affected more than 10,000 villages. Since then, floods, drought, cyclones, earthquakes and landslides have been striking with regular intervals but none of the successive governments could ever devise a comprehensive strategy for disaster management.

The need for a flood control programme in the then East Pakistan (Bangladesh) was realized only in the late 60s that subsequently led to the incorporation of the programme in the Fourth Five-Year Plan (1970-75) but efforts in this direction remained insignificant. Three years later, the Emergency Relief Cell prepared a draft National Disaster Plan in 1974, which intended to deal with various components of disaster management. The Plan was to establish procedures, organizational set-up, fix primary responsibilities and support functions of implementing

agencies and standard procedures for the monitoring of disaster operations. However, it has never been finalized and implemented.

At the federal level, the Emergency Relief Cell (ERC) in the Cabinet Division serves as the focal point during emergencies. At the provincial level, the ERC coordinates with provincial relief departments / relief commissioners who are responsible for effective distribution of relief items in respective provinces. The Cell is also responsible for dealing with institutional donors and receives grants / donations / funds for distribution through the Prime Minister's Disaster Relief Fund.

4. Organizations with Overall Disaster Related Responsibilities

The Federal Flood Commission (FFC), Emergency Relief Cell (ERC) and Pakistan Meteorological Department are the key agencies for disaster management in Pakistan. However, in case of a disaster, almost all federal and provincial ministries, departments and divisions start dealing with the situation offhandedly. A brief description of responsibilities of such organizations is given below:

4.1 Emergency Relief Cell (ERC):

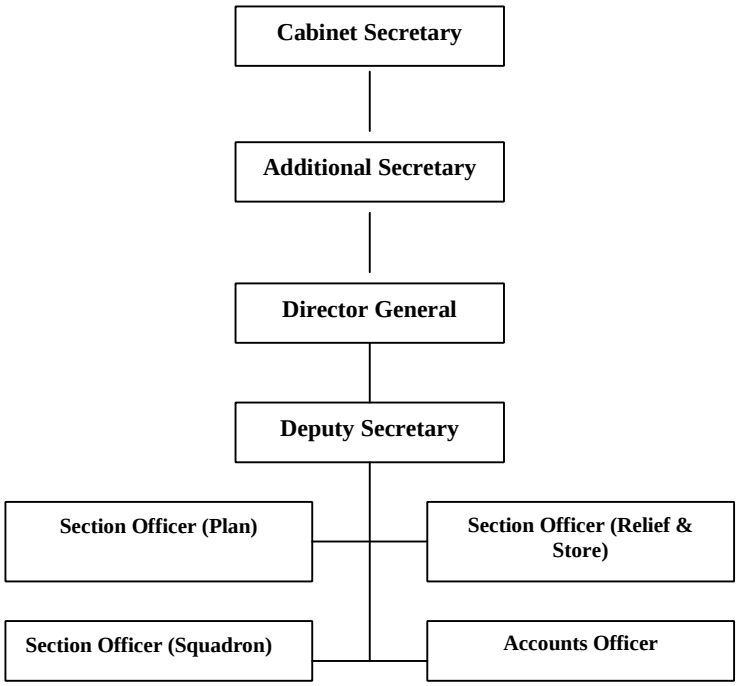
Responsibilities of the ERC in connection with disaster relief are:

a. To provide in cash as well as in kind to supplement the resources of the provincial governments in the event of major disasters
b. To coordinate the activities of the federal Division, Provincial Governments, as well as governmental, semi governmental, international and national aid-giving agencies, in the conduct of operations for relief of disasters
c. To maintain contact with international aid-giving agencies/ voluntary organizations and donor countries for disaster relief measures
d. To administer Relief Funds, being maintained at the Federal Level
e. To stockpile certain items of basic necessity and establish central inventory of resources
f. To provide assistance to the calamity stricken friendly countries

The ERC operates an Emergency Control Room, which coordinates the situation during calamities by liaising with relevant agencies such as the Federal Flood Commission, Meteorological Department, and Provincial Governments.

The ERC maintains a warehouse in the capital, Islamabad, stocking essential non-perishable relief item such as medicines, blankets, clothing and tents. In addition, there is a Relief Goods Dispatch Organization (GDO) located in Karachi. This is responsible for receiving and dispatching all relief goods from foreign and local agencies in the event of a disaster. The ERC also maintains an Aviation Squadron with a fleet of 4 helicopters, whose task is to assist rescue operations and enable officials to visit the affected areas.

Organizational Set-up of Cabinet Division (Emergency Relief Cell)



4.2 Pakistan Meteorological Department (PMD):

Pakistan Meteorological Department is both a scientific and a service department, and functions under the Ministry of Defence. It is responsible for providing meteorological service throughout Pakistan. Apart from Meteorology, the department is also concerned with Agrometeorology, Hydrology, Astronomy and Astrophysics, Seismology, Geomagnetism, Atmospheric Electricity and studies of the Ionosphere and Cosmic Rays.

The major functions of PMD are to provide information on meteorological and geophysical matters with the objective of disaster mitigation due to weather and geophysical phenomena, agriculture development based on climatic potential of the country, prediction and modification of weather forecast.

The department has established:

1. A network of observing stations to generate meteorological, geophysical and phonological data.
2. A telecommunication system for speedy dissemination of data
3. Meteorological offices to analyze data for issuing forecasts and warnings for aviation, agriculture, shipping, sports, irrigation etc.
4. Climatological and data processing units for scrutinizing, comparing and publishing data for appraisal of long term weather trends and earthquakes.

5. Research & Development Division to carry out research activities regarding analysis of extreme events observed in the past and their future trend, climate change, weather modification, land-ocean-atmosphere interaction, seasonal weather prediction and etc.

The department has introduced a modern flood forecasting system, earthquake and nuclear explosion detection system, radar, satellite, computer technology, flight safety consultancy services in seismic design of dams, buildings and other development and disaster relief schemes.

4.3 Federal Flood Commission (FFC):

The Federal Flood Commission was created in 1977. Till the end of 1976, the Provincial Irrigation Departments (PIDs) were responsible for the planning and execution of flood protection works. But after the massive floods of 1973 & 1976 and huge losses to human lives, land and property, the federal government deemed it necessary to have a federal agency in place for flood protection and preventive measures across the country.

Responsibilities of the FFC:

a. Preparation of flood protection plans for the country
b. Approval of flood control / protection schemes prepared by provincial governments and concerned federal agencies
c. Recommendation regarding principles of regulation of reservoirs for flood control
d. Review of damage to flood protection works and review of plans for restoration and reconstruction works
e. Measures for improvement of flood forecasting and warning system
f. Preparation of a research programme for flood control and protection
g. Standardization of designs and specifications for flood protection works
h. Evaluation and monitoring of progress of implementation of the National Flood Protection Plan
i. Monitor the provincial government's implementation of the national Flood Protection Plan. The federal government provides the resources for meeting the capital cost of the project (s)

4.3 National Crisis Management Cell (NCMC):

The National Crisis Management Cell, under the Ministry of Interior, has a round the clock operational control room for collecting information of emergencies of all sorts in the country. It coordinates with the Provincial Crisis management Cells (PCMCs) and other security agencies to gather relevant information. It is also responsible for coordinating plans for emergency response services in case of emergency situations / disasters.

4.5 Civil Defence:

The Civil Defence Department was established through an ordinance in 1951. It is now governed through 1952 Civil Defence Act. Before 1993, it was mandated to "take measures not amounting to actual combat, for affording defence against any form of hostile attack by a foreign power or for depriving any form of hostile attack by a foreign power of its effect, wholly or in

part, whether such measures are taken before, during or after the time of the attack". But then it was assigned with an additional task during peace times to take remedial measures against natural or man-made disasters. Specifically, the Civil Defence is to:

a. Assist local administration / Army in rescue, evacuation and relief measures
b. supplement anti-flood equipment of Army
c. Provide personnel for anti flood training in rescue and relief work
d. Save lives by rapid extrication of persons trapped beneath debris or in building damaged by a natural or man made disasters
e. Render first aid to rescue persons and transport them to nearest hospitals for further treatment.
f. Ensure evacuation of damaged buildings/structures including demolition of damaged structures to avoid further loss of life and properties.
g. Assist in restoration of essential traffic so as to carry out rescue work without any hindrance or obstruction.
h. Assist in debris clearance and restoration of essential services to the affected buildings.
i. Search or defuse unexploded bombs in the affected areas.
j. Provide quick and effective research and rescue coverage, protection and operation in case of any disaster.
k. Recruit / induct operational staff for Search & Rescue teams with required specialized skills of search and rescue.
l. Build public confidence by introduction of more effective measures for their protection and ensure adoption of requisite preventive measures by the community.
m. Enhance the capabilities of the existing Search & Rescue teams of Pakistan.

4.6 Provincial Relief Departments

a. Provide adequate resource support to area Administration through co-ordination with Provincial Government Departments / Agencies
b. Provision of necessary funds to the area administration for relief work
c. Oversee the working of area administration for relief work
d. Obtain field reports of losses and apprise the Provincial Government / Federal Government
e. Assess and evaluate losses and suggest to the Federal / Provincial Governments for providing relief to the affected persons

4.7 Provincial Irrigation Departments

a. Complete repairs of the flood protection works in the pre-flood season
b. Provide funds to the Army for replenishment of stores
c. Review the plan for regulation of water supply
d. Position requisite machinery and material at safe localities near vulnerable points for emergency repairs
e. Inspection of breaching sections and carrying out final survey

4.8 Provincial Health Departments

a. Establish a system of high readiness and list of personnel to be mobilized when alert of danger warning is received or impact of disaster reported
b. Establish an Emergency Cell (Medical) to ensure better coordination in disaster situations
c. Set-up medical camps and organize Medical Mobile Teams (MMTs) to be sent to the scene of disaster with a minimum of delay
d. Ensure communication links between hospitals and the scene of disaster
e. Activate emergency field medical units

4.9 Provincial Agriculture & Livestock Departments

a. To assist in saving crops, agriculture land and livestock in disaster situation
b. To make available inputs like seed plant, fertilizers and agriculture equipment to the victims of disaster on credit basis
c. To survey and investigate extent of damages to the crops and livestock

4.10 Provincial Food Departments

a. To ensure adequate availability of food stocks in disaster situation
b. To organize ration depots at location required by the local authorities

4.11 Communication & Works

a. To supervise, direct and control protection of roads and structures
b. To coordinate survey investigation of the extent of damage to roads and structures
c. To organize emergency repairs for restoration of public transport routes

4.12 Planning & Development Departments

a. To assist in obtaining of information and data for pre-disaster survey and planning to serve as a basis for prevention measures and for relief operations
b. To assist in evaluation of losses and damages

4.13 Army

a. Survey and inspect flood protection works
b. Assess resources for relief, rescue and evacuation work
c. Position personnel, material and equipment at planned pre-determined location
d. Review and revise flood protection and relief operation plans
e. Train civil / military power boats operators
f. Review the logistics of ration, POL, arms and ammunition, medical cover, tentage, communications and allied measures for movement of troops in aid of civil powers
g. Set-up flood emergency cells at each corps headquarters

4.14 Police Department

a. Operate through Police Telecommunication the wireless and tele-printer network for flood information and messages to all concerned departments and agencies
b. Ensure law and order during flood emergency
c. Provide assistance in flood warning, rescue, relief and evacuation operations

4.15 Dams Safety Council

a. To carry out periodic inspections of dams and advise WAPDA and provincial governments regarding repairs and maintenance of dams and reservoirs
b. To review the plans of new dams to ensure adequate safety of structures
c. To review the plans and specifications for enlargement, modifications, major repairs, revival or abandoning of dams / reservoirs
d. To supply technical data and maintain general liaison with World Bank and UN Organizations
e. To keep a close liaison with International Commission on Large Dams based at Paris, France

5. Disaster Management in Regional Bodies

5.1 South Asian Association for Regional Cooperation (SAARC):

The South Asian Association for Regional Cooperation (SAARC) was established on December 8, 1985. Member countries include Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The objectives of the Association as defined in the Charter are:

a. To promote the welfare of the peoples of South Asia and to improve their quality of life;
b. To accelerate economic growth, social progress and cultural development in the region and to provide all individuals the opportunity to live in dignity and to realize their full potential;
c. To promote and strengthen collective self-reliance among the countries of South Asia;
d. To contribute to mutual trust, understand and appreciation of one another's problem;
e. To promote active collaboration and mutual assistance in the economic, social, cultural, technical and scientific fields;
f. To strengthen cooperation with other developing countries;
g. To strengthen cooperation among themselves in international forums on matters of common interest; and
h. To cooperate with international and regional organizations with similar aims and purposes.

In its summits from 1985 to January 2004, the SAARC recognized the devastating affects and consequences of natural disasters and degradation of environment in member countries and called for strategies and policies to be implemented for sustainable development and poverty alleviation. However, there is no significant development on the issue of disaster management at regional level except for the preservation of environment. In 1992, a Technical Committee on

Environment was formed to coordinate regional cooperation in Environment and related areas. The relevant outcomes of the Association are as following:

5.1.1 The SAARC Regional Study on the Causes and Consequences of Natural Disasters and the Protection and Preservation of the Environment:

During the Third SAARC Summit (Kathmandu, 1987), a study was commissioned for the Protection and Preservation of the Environment and the Causes and Consequences of Natural Disasters. Accordingly, a Group of Experts with members from all the SAARC Countries was constituted to prepare the Study, which was completed in 1991. Its main recommendations were endorsed by the Heads of State of Governments at their Sixth Summit (Colombo, 1991). The recommendations outlined in the study are categorized as follows:

1. Measures to protect and manage the environment;
2. Measures and programs for strengthening disaster management capabilities; and
3. Implementation mechanisms for the measures outlined in the study.

5.1.2 The SAARC Regional Study on Greenhouse Effect and its Impact on the Region:

The Fourth Summit (Islamabad, 1988) stressed to enhance regional cooperation with a view to strengthening disaster management capabilities. It was urged that a Study on Greenhouse Effect and its Impact on the Region should be completed in the shortest period to provide a basis for an action plan for meaningful cooperation among Member States.

The Study had the following components:

i. Regional measures in sharing experiences, scientific capabilities and information on climate change; and

ii. Global collaboration in Monitoring Climatology, Sea Level Rise, Natural Disaster, Technology Transfer and Finance etc.

5.1.3 SAARC Plan of Action on Environment:

The Third Meeting of Environment Ministers (Malé, 1997) adopted the SAARC Plan of Action on Environment. The Action Plan is based on the recommendations of the two Studies outlined above. The Plan seeks to evaluate the status of SAARC cooperation in the field of environment, identifies the concerns of Member States at regional and global levels, and sets out parameters and modalities for enhanced cooperation.

5.1.4 The Colombo Declaration for a Common Environment Program:

The Fourth Environment Ministers Meeting adopted the Common Environment Program (Colombo, 1998). The Program recalled various major international instruments and declarations on environment and noted the importance of enhanced cooperation in sharing information in the region to promote effective management of the environment for the benefit of all the Member Countries. The Common Environment Program while calling for early implementation of the SAARC Plan of Action on Environment recommended, inter-alia, compilation of a regional

directory of scientific and technological institutions in the field of environment and state-of-the-art report on eco-friendly technologies.

5.2 Regional Co-operation for Disaster Risk Mitigation within the SAARC Framework

Pakistan is considering to propose the following activities to be undertaken at the SAARC Platform:

- Setting up a separate Committee on Disaster Management.
- Developing a South Asian Regional Program on Disaster Management.
- Initiating a common training program for disaster managers of the region.

The proposal outlines the following initiatives for consideration of the SAARC member states for achieving the objective of regional cooperation for disaster risk reduction:

1- Regional collaboration on enhancing Early Warning Systems
2- Standard Operating Procedures for mutual assistance in times of disasters of catastrophic proportions
3- South Asian Disaster Resource Inventory
4- Regional Action Plan for Disasters

5.3 Regional Cooperation in Flood Disaster Mitigation in the Hindu Kush – Himalayan (HKH)

Particular concern about regional cooperation on hydrological activities was voiced during the 2nd Steering Committee Meeting of the hydrological research network HKH-FRIEND (Flow Regime From International Experimental Network Data, part of UNESCO's International Hydrological Programme) held in April 2000 in Kathmandu.

In response, ICIMOD in collaboration with regional partners and the World Meteorological Organization (WMO) have now started on a long-term project whose final aim is to establish an operational flood information system for the HKH region. As a first step, ICIMOD and the WMO, supported by the US Department of State (Regional Environmental Office of South Asia), US Office for Foreign Disaster Assistance, and Danish International Development Assistance (DANIDA), organized a high level consultative meeting on 'Developing a Framework for Flood Forecasting and Information Exchange in the Hindu Kush Himalayan Region' in Kathmandu in May 2001. Participants from Bangladesh, Bhutan, China, India, Nepal, and Pakistan, agreed on an initial Action Plan for Regional Co-operation for Flood Information Exchange.

The objective of the Project is to promote regional cooperation in sharing of hydro-meteorological information which would lead to the reduction in flood vulnerability by providing timely and reliable warning to save people's lives and property. This will improve the economic condition of the population in this region and help in poverty alleviation.

Principal Partners

The regional country partners are:

- Bangladesh
- Bhutan
- China
- India
- Nepal
- Pakistan

The Ministries of Water Resources, Departments of Hydrology and Meteorology and Flood Forecasting units of partner countries will be the lead agencies for this project.

- Some universities of these countries involved in this sector will also be actively involved.

- The principal implementing partner is the World Meteorological Organization (WMO).

Other key partners include

- The U.S. Department of State of Regional Environmental Office of South Asia
- U.S. Office of Foreign Disaster Assistance
- DANIDA
- UNESCO

Other international agencies

- U.S. National Oceanic and Atmospheric Administration (NOAA)
- the U.S. Geological Survey (USGS)
- World Bank
- Asian Development Bank (ADB)
- Centre for Ecology and Hydrology (CEH), UK
- European members of HKH-FRIEND
- Japan Meteorological Agency (JMA)
- German national committee for the International Hydrological Program (UNESCO)
- Operational Hydrological Program (WMO)
- Asian Disaster Preparedness Centre (Thailand)
- Japan International Cooperation Agency (JICA)
- Mekong River Commission (MRC)
- National Hydrological Services (NHS)
- National Meteorological Services (NMS)
- The HKH-FRIEND secretariat, located at ICIMOD, will also be actively involved in the implementation of the project.

5.4 Establishment of National Disaster Management System in Pakistan: Recent Development

The Prime Minister has approved the establishment of a National Disaster Management System in Pakistan on 1st February, 2006 in the wake of earthquake of October, 2005.

The Prime Minister considered the proposals of Cabinet Division for establishment of a National Disaster Management System (NDMS) in Pakistan and took the following decisions.

1. Approved establishment of National Disaster Management System through the procedure outlined in Article 144 of the constitution. Cabinet Division in consultation with Law, Justice & Human Rights Division should take up the case with the provinces to get the Resolutions of the Provincial Assemblies with in one month, authorizing the Federal Government for a federal law on the proposed NDMS
2. Approved, in principle, the setting up of the Disaster Management Commission (NDMC) with the following composition:

Prime Minister	Chairman
Leaders of Opposition in the Senate & NA	Member
Ministers for Defence & Communications	Member
Ministers for Finance & Interior	Member
Governor NWFP (for FATA)	Member
Chief Minister of Provinces	Member
Prime Minister AJ&K	Member
Chief Executive, Northern Areas	Member
Chairman, JCSC	Member
Representative (s) of Civil Society	Member

3. approved the setting up of National Disaster Management Authority (NDMA) which shall be a highly professional body with key specialized disciplines, with focused approach and lean structure, duly empowered trough a statutory framework to plan and monitor disaster management liaise and coordinate with all stakeholders both at international and national levels including Armed Forces.
4. The Authority shall also undertake training and capacity building and also develop Core competencies at the federal level and capacity in the provinces to tackle all kind of disasters. For this purpose, the creation of National Disaster Management Centre was also approved in principle. To make a quick beginning, Civil Defence Academy Lahore under the Ministry of Interior shall be considered to be upgraded and made a Centre of Excellence, under the Authority pending normal establishment of the full-fledged institute for Disaster Management.
5. Other modalities, including those for development of Rapid Response Units, will be finalized by the Authority.

In pursuance of the above decisions all the Chief Secretaries of the four provinces have been asked on 13th February, 2006 to get Resolution passed from the respective Provincial Assemblies in terms of Article 144 of the constitution. A Summary dated 16th February, 2006 has also been submitted to the Prime Minister for nomination of representative(s) of the civil society in NDMC.

Importance of Multi Hazard Early Warning System

6.1 Establishment of Early Warning System

Achieving the Millennium Development Goals and building a safer world in the 21st century is only possible when the world more effectively reduces damage from disasters triggered by natural events. This is no easy task: while the number of deaths from disasters is declining, its frequency (number of occurrences) and effects (economic losses and number people affected) are worsening, mainly due to increasing frequency and severity of many hydrometeorological disasters, partly as a result of global climate change.

Asia is the most afflicted region in the world, particularly by flood-related disasters that caused estimated $70 billion damages over the last decade. Most of the disasters that occurred and the highest percentage of totally affected people in the world in last 5-years took place in Asia. Other major hazards in Asia include cyclones and tornado, earthquake and drought.

Global trends indicate that the exposure of people to disaster risks is increasing due to the growing importance of vulnerability factors. In developing countries, the major causes of increased vulnerabilities to natural disasters are: poverty, worsening environmental soundness of the natural resource base, population growth and displacement, urban growth, conflicts, weak institutional capacities, and climate variability and change.

These emerging trends require that development practice is re-oriented towards focusing on the vulnerability of a society to natural disaster rather than on its total wealth. This new focus explicitly recognizes the links between early warning, disaster risk reduction and sustainable development.

6.2 Early warning, disaster risk reduction

Early warning has the potential to contribute significantly to reducing current and future disaster losses as an important non-structural component of risk reduction. It is a proactive political process in which networks of various institutions undertake systematic information collection and analysis together in a collective effort to generate information to help prevent likely disaster events from occurring or to reduce their outcomes. Risk assessment is the starting point and context for identifying risks by determining situations in which conditions for a particular type of disaster exist while early warnings are the interpretations and projections that the outbreak of disaster in a high-risk situation is likely and imminent. Warning helps provide the knowledge to identify impending risks, determine their levels and potential impacts, both in terms of people and locations, and guide actions to avoid, reduce or mitigate the effects of those risks when they occur.

Early warning plays such a strong role in improving human security because it is one of the most effective measures for reducing negative impacts of threats and risks triggered by natural disastrous events. Early warning and other mitigation interventions are a cost effective way of disaster risk reduction

Early warning, as a branch of risk information, serves several purposes and provides many developmental benefits, including the following:

- it is a disaster protection mechanism;

- it introduces and supports services at the local level that directly enhance development;
- it promotes increased development and application of scientific knowledge, including improved science and technology information dissemination.
- it advances community participation for its own sake;
- it promotes public-private partnerships;
- it creates the potential for increased utilization of indigenous knowledge and values;
- effective early warning promotes improved environmental management and sustainable livelihoods that are harmonious with the environment through helping increase the security of vulnerable populations and endangered environments.

6.3 Hazard-specific advances and trends

6.3.1 Flood

Most flood forecasting is still based on traditional methods and indicative variables: worldwide, flood forecasts and predictions based on forecasted rainfall and run-off models are in general not yet good enough for warning purposes. The major trend is towards improvement of predictability of forecasts through research and development of new hazard modelling, and, of effectiveness of warnings. A number of approaches are being adopted, including worldwide efforts to operationalize combined models through coupling of meteorological with hydrological models, but developed countries (and others such as China) are making better progress in combining rainfall forecast with numerical run-off models to generate operational and effective flood warming.

An ongoing trend that is gathering momentum and is expected to make significant improvement in flood forecasting, is the movement towards incorporation of satellite rainfall estimates and the use of infrared and radar information in combination with existing systems to improve rainfall prediction. Radar alternatives are also being assessed in the USA for use in deriving real-time non-contact measurements of changing river profiles, such as river depth, velocity and discharge to improve flood forecasting. The technological foundation for developing new generation flood early warning systems include: rainfall radar, stable and low-cost observation systems for rainfall and other climate variables, satellite communication, mobile telephony, broadband and other communication systems, broadcasting and information dissemination systems (e.g. satellite and internet broadcasting), and computers and software that allow use of geographical information systems (GIS) and other emerging applications.

Regarding effectiveness of warnings, an approach that is likely to become a future trend in enhancing the utility of flood warnings is reawakening public awareness and preparedness for flood, including early warning, through strategies based on the social marketing approach. However, in several developing countries, the concern is more fundamental: how to develop the basic infrastructure for flood forecasting.

6.3.2 Drought

Early warning systems for drought and desertification are more complex than those of other hydro-meteorological hazards and are, consequently, relatively less developed globally. No fully operational drought early warning systems exist in the world. Even in the developed

countries, progress in developing drought monitoring capabilities as part of comprehensive drought mitigation programmes has been slow.

6.3.3 Geological hazards

There has been progress in developing probabilistic and time dependent seismic hazard assessment for most of the active regions of the world but detailed hazard maps and warning systems do not exist for many regions. Globally, there exists no reliable system for forecasting earthquakes for period longer than a few seconds (the longest being 60 seconds for Mexico city) as real time prediction of the location, magnitude and time of occurrence of earthquakes has yet to be attained. Similarly, progress has been extensive in monitoring changes in seismic activity but the exact onset of a dangerous volcano eruption cannot be accurately predicted. Some prototype earthquake and volcano warning systems have been installed for a few locations but earthquake and volcano forecasting has not yet been achieved worldwide.
To overcome the problem, basic research on earthquakes has received increased attention, particularly in developed countries. In Europe, a high priority has been the continuation of the promising approach of integrating GPS and radar use in seismological monitoring to improve deterministic earthquake prediction in addition to efforts to predict technical, social, economic and ecological vulnerability to seismic events. But it is not expected that even space technology could help in improving earthquake prediction any time soon.

Consequently, countries are shifting to the approach of emphasizing mitigation. Due to the little success in predicting the place, time and size of specific earthquakes worldwide, the approach to earthquake hazard warning has shifted to determining seismic risk.

Nonetheless, fundamental research in earthquakes and mitigating interventions, including developing adequate preparedness to respond effectively to warnings in earthquake prone areas, must continue to be a key part of future research agenda on mitigating earthquake risks. In particular, substantial efforts need to be devoted to undertaking microzoning for major urban areas in earthquake prone regions.

6.3.4 Climate

A significant trend has been increasing and sustained worldwide efforts to better understand and predict climate change and variability causes, including sea surface temperature anomalies such as El Nino–Southern Oscillation (ENSO) and North Atlantic Oscillation (NAO). Efforts have centered on modelling climate processes, detecting climate change, monitoring climatic variability, developing climate applications and services, and, assessing effects of climate. Countries are developing early warning systems as part of integrated adaptation strategies based on the recognition that climate change is uncertain and procedures are presently generally unavailable to accurately predict these uncertain hazards.

6.3.5 Tsunami

As a result of improvements in predicting capability, tsunamis can now be detected at least 60 minutes before they strike, regional and national warning systems have been established in several prone countries in the Pacific area for local level warnings to complement those from

the International Tsunami Information Centre, and, preparation of tsunami maps for prone locations is progressing. Most tsunami warning systems still lack accuracy but efforts are underway to reduce false alarms.

6.4 Thematic advances and trends

It is generally recognized that much progress has been made in boosting the scientific basis and technological aspects of warning systems, particularly in the area of application of the information and communication technologies, but progress has been slower in integrating forecasting in effective risk management, even in developed countries.

6.4.1 Vulnerability to disasters is increasing

Disaster losses, unmitigated, will continue to rise due to increasing vulnerability arising from population growth, urbanization, poverty and inequality, environmental degradation, climate change and variability, lack of mitigation and institutional weaknesses. Hence, perhaps the most basic trend in risk management and early warning is the move from a focus on hazards to emphasis on vulnerability and socio-economic factors. This is part of the gradual but discernible movement towards expanding the scope of formal early warning systems in relation to broader issues of risk assessment and management. This emerging pattern is most advanced for the seemingly intractable problems of earthquake and drought prediction and forecasting.

6.4.2 Lead times are increasing

In terms of warning systems output, a major trend is that technology is changing the definition and measurement of real time for various hazards. The timescale in which the onset of hazard events can be predicted to allow response to the event ranges from several months for climatic variations such as El Nino, days for tropical cyclone, days to hours for volcanoes, hours to twenty minutes for tsunamis and seconds to about one minute in the case of Mexico city for earthquakes.

6.4.3 Use of seasonal forecasting is expanding

The development of better short time forecasts and warnings presents very difficult obstacles, particularly for some quick-onset climatic and geological hazards, such as flash flood and earthquakes. But, while pursuing that objective, it is also important to develop medium term seasonal forecasts as they help increase preparedness against natural hazards. Since the majority of natural disasters are due to weather and climate factors, developments in the methodology, approach and process of seasonal and long-term predicting and forecasting of these hazards are substantial pointers to the overall direction of natural disaster forecasting and warning.

6.4.4 Application of information communication technologies is expanding…

The past decade has witnessed an explosion in the types, extent and depth of application of communication and information technologies to early warning, albeit mainly directed at improving the technical identification, monitoring, modeling and forecasting of threats. Advances in the application of modern information and communication technologies in warning dissemination continue unabated, particularly in developed countries. For example, operators are

testing new methods of warning transmission including short message text on mobile phones in Europe and pagers and satellite radio systems in the USA. Future warning systems will be more active, allow people to see the hazard themselves through technologies such as the new mobile phones with cameras that send pictures by e-mail, and aim at warning only those at risk through the use of central technologies such as remote sensing, geographic localization, GIS and pervasive computing and communications.

Progress in enhancing warning and response through application of technology has, in contrast, been relatively slow, particularly at the local level in developed countries and at the national and community levels in developing countries.

6.4.5 …but is creating some communication and response problems

A general observation at the pre-EWC II consultations was that the use of the new information and communication technologies, particularly the internet, in the dissemination of warning messages, while useful in expanding the coverage and reducing time lags in warning dissemination, is creating problems of untargeted messages inducing wrong responses due to misinterpretation.

This problem is also related to the type of hazard under consideration. For example, while the internet has been a useful communication tool for hurricane warning dissemination in Latin America, the Caribbean and North America, its use in disseminating warnings on El Nino has been fraught with problems of engendering wrong responses that have causes unnecessary losses (Villagran et al. 2003). The internet should complement and augment traditional mechanisms for disseminating predictions by functioning as a clearinghouse of information exchange, repository of information, and a medium for self expression and community communication.

6.4.6 Focus on institutionalizing early warning is growing

Partly to address these concerns, there is growing focus on institutional development activities under the major international drought and food security warning systems such as FEWSNET. Also, countries are making efforts to develop the institutional environment of early warning, as part of designing legal and administrative frameworks for emergency management. This is key to ensuring that warnings are authoritative and trusted and accepted by stakeholders. The focus on issues of institutionalization in developing warning systems is important because it is how people respond to warning that determines its effectiveness. The process of interfacing technology systems and people is probably the weakest link in the early warning chain. For example, during the flood on the Elbe River in August 2002, different forecasts and warnings were given by different sources while local administrators failed to inform downstream neighbours of impending floods (Morgenschweiss et al., 1998).

6.4.7 Emphasis is shifting from focus on details of warning messages

A noticeable trend was that most of the discussion on improving disaster early warning has focused on micro-issues, such as improving the effectiveness of warning messages, due to the concentration on engineering aspects of early warning (Handmer 2001). However, efforts have began to rectify the situation of excessive focus on the details of warning message design, dissemination and response, without adequate attention to necessary processes for achieving the

multi-organizational change, cooperation and multi-stakeholder interaction needed to engender total warning and to make warning messages more effective.

6.4.8 Public expectations regarding warning services are rising

The concern with the performance of early warning is derived from rising expectations of people regarding public safety and security during disasters. Contributory factors to this trend fo rising expectations include: increased exposure to disaster threats, conception of warnings as a human security and development right, expanded stakeholder involvement, reduced public tolerance for errors, climate change, and rising demands from insurers.

6.4.9 Regionalism is promoting integration of early warning in sustainable development

Early warning has become a window for introducing and expanding the practice of disaster risk management, writ large, and for promoting regional cooperation. A common and significant recurring theme in contemporary discussion of early warning in all regions is the widespread understanding and recognition that early warning is but an aspect of disaster management and cannot be treated in isolation from the other components of disaster risk reduction. Consequently, early warning is gradually being integrated into the development process through various efforts to mainstream disaster risk reduction in sustainable development, most of which have occurred within the context of regional cooperation.

6.5 Early warning development and integration in sustainable development: obstacles

There has been considerable progress in developing the prediction and warning generation component of early warning, but equally considerable weaknesses remain in making those warning messages effective in enabling people and institutions to take protective action to reduce the impact of disasters. Thus, the single most important weakness of existing early warning systems is the growing improvements in the technical identification, detection and modelling of hazard threats built upon relatively unchanging capability and procedures for warning and response management: a case of modern forecasting using unchanged warning procedures and systems. Consequently, the communication from forecast agencies to warning organizations to vulnerable communities represents the weakest links in warning systems. In particular, few systems incorporate feedback loops for end-users to assess the effectiveness of forecasts and warnings.

Common constraints

The following obstacles are common to early warning systems worldwide, but are more critical in hampering the development and effectiveness of early warning systems in developing countries, particularly Africa:

(i) weak national focus on warning, often due to inadequate national commitment to continuously supporting the development and maintenance of early warning systems
(ii) persistence of disaster response outlook among the disaster management community

(iii) inadequate user orientation of early warning systems partly due to dominance of scientific, technological and engineering perspectives in early warning and the weak role of social, political, economic and cultural considerations

(iv) lack of clear definitions and harmonization of risk concepts, and terms and procedures for presenting risk and warning information

(v) the institutionalization of early warning systems is hampered by the lack of clarity of responsibilities in the warning systems, including determining a clear chain of command for early warning functions, particularly that of issuing warnings. Often, information and messages come from various sources, thereby creating confusion as to the authenticity, effectiveness and trustworthiness of each message as well as the proper response. Unclear administrative responsibilities also result in inadequate integration and coordination of different early warning systems for the same hazard and of key institutions and actors involved in early warning and disaster prevention and mitigation. This has delayed effective response and weakened the impacts of early warning and other risk management activities

(vi) inadequate decentralization of early warning practice; most warning systems are agency-centred and top-down and lack adequate partnerships with community involvement

(vii) inadequate land use planning as risks are not always considered above other criteria; non-compliance with appropriate land use controls and standards undermine the effectiveness of warning advice and response plans

(viii) weak trans-boundary and international cooperation constraints the development of effective warning systems for several trans-boundary hazards.

6.6 Integrating early warning into public policy: lessons and pointers

6.6.1 Warning is a component of risk management

To be effective, it is important to recognize that early warning and early warning systems must be part of comprehensive disaster risk reduction and management systems that ensure consistent and national or region-wide development of all components of risk management. However, this recognition implies that it is equally essential to consider that even the perfect early warning can only achieve so much: other safety and risk management interventions are needed to ensure effective risk mitigation. This is because the success of early warning is determined largely by the extent to which other components, such as compliance with land use planning standards, building codes and regulations, are effective in developing effective disaster risk response capabilities.

6.6.2 Effective early warning systems depends on some essential elements

The review of lessons from experience in early warning systems in general shows the following essential elements in developing a successful system:

(a) adequate institutional capacity, including financial and human resource endowment, to provide effective warning services

(b) accuracy of forecasts, based on adequate hazard and risk assessment

(c) effective communication of warnings to at risk individuals, groups, businesses and locations

(d) good planning for implementation of the system, including preparedness planning

(e) effective participation, coordination and partnerships across sectors, locations, disciplines, institutions and boundaries, stressing local networks, capabilities and consensus
(f) high level of awareness of risks and warning advice, including through public education and training
(g) effective data, information, knowledge, skills and experience exchange
(h) mechanisms for review of outcomes and outputs, including sustainability, of the system
(i) strong and long-term political commitment to continuous development of warning services, using integrated and consistent government policies and programmes.

Some of these factors, and others, are elaborated below.

6.6.3 Effective warning requires sound basic infrastructure in Pakistan

Development of effective early warning systems requires the establishment of the requisite infrastructure and capabilities for detecting, modeling and predicting natural hazards. These must be based on the principle of optimizing benefits of the new technologies while utilizing the appropriate mix of technologies within a framework informed by traditional systems of hazard warning.

6.6.4 …but not necessarily a lot of money or technology

A common conclusion from the regional and hemispheric consultations was that the availability of financial resources for sustained support for early warning work, particularly maintaining and strengthening observation and monitoring networks for hydrometeorological hazards, is reducing globally. Addressing this requires innovative financing mechanisms but, although early warning systems involve physical and electronic facilities, they do not necessarily require a lot of money or technology, as exemplified by the experience of decentralized low-tech warning systems in Central America, Cuba and Bangladesh. The basic ingredients are organization and information backed by political commitment (Association of Caribbean States 2003). Deficiencies in these retard progress in early warning development and become obstacles in integrating early warning in sustainable development.

6.6.5 Early warning systems need to be well managed

For effectiveness, early warning systems need a clear chain of command that assures that only one official warning is given to each affected community and that stakeholders know the official source of the warning to avoid confusion and panic. Early warning systems, like other management systems, require sustained management input to endure. In the absence of strong professional management, early warning systems lose their capability to provide useful warning information for disaster reduction.

6.6.6 The coverage of warnings must be broad

Warnings are most effective when targeted at only the people at risk, however, warnings must be issued to all at-risk groups or locations within the target area. Early warning activities must equally cover all parts of a national jurisdiction or targeted areas and not favour or be

under-represented in some parts of a country. The warning message must be the same for all in target areas, but the medium of transmission must be targeted at specific groups. However, messages must be passed through as wide a variety of warning devices as possible to reach all in the target group. Also, warning messages must be crafted in such a way as to be understood by all concerned.

6.6.7 Good preparedness is essential for effective warning

It is not sufficient to ensure that appropriate and timely warning reaches target groups; it is also essential that the local population knows how to react and what to do in emergencies. This depends on the extent to which warning services are decentralized and participatory. Realigning warning systems to addressing community needs implies that warning authorities have to engage communities to know those needs, recognize people's personal contacts, assess risks and manage public expectations of the warning system.

6.6.8 Participation, partnerships and community involvement are crucial

Early warning decision making is an integrative process that requires interaction between information sources, safe actions and choices, and, societal impact. Extreme events are inherently contextual and relational, hence the importance of placing the needs and circumstances of at risk populations at the centre of warning system objective, design and implementation. This involves engaging the target groups and communities in warning development so as to institutionalize emergency
response structures at the community level. Active participation of vulnerable communities, full co-operation of civil society, partnerships among various interest groups, including the informal and private sectors, and education and training at all levels are necessary for the effectiveness, good governance and sustainability of early warning systems.

6.6.9 Warnings must be integrated in user decision making

The effectiveness of predictions and warning of complex and extreme events, such as natural disasters, are enhanced if they are part of the decision making process of intended target groups and other stakeholder interests. This is facilitated by: (a) generating predictions with the needs of the end user in mind at all stages of the process, (b) all stakeholders understanding clearly articulated uncertainties associated with predictions, and (c) system implementers recognizing that predictions and prior experience shape response and subsequent behaviour of individuals and institutions to risk warnings.

6.6.10 Effective warning communication is a critical condition for effective warning

Most warning systems fail at the interface between early warning and other risk management activities, particularly those that involve local decision making and management. Apart from the internet, there are very few examples of successful application of modern technologies in local warning and response on a large scale, particularly for flood warning, even in developed countries (Handmer 2002). Excessive emphasis on technology in early warning at the expense of attention to the human interface in the system negates efforts aimed at ensuring cost and outcome effective warning systems.

For early warning to empower communities threatened by impending disasters, it must be provided in good time, be precise and prompt and should convey reliable and actionable information. Early warning communication is more than simply the dissemination of facts: effective early warning requires that the target population not only receives advance warning of hazards and vulnerability changes but also that they understand the content of the message, accept it, believe it and know how to use to guide their response actions. The latter is catalyzed by on-going public education and awareness-strengthening processes on potential risks and the role of early warning advice in disaster risk reduction.

The context of warning information from regional and global sources, including the internet, within national and local circumstances ensures that the responses generated are effective through minimization of misinterpretation of that information. Warning information from international and regional systems needs to be interpreted within local contexts and utilized in conjunction with national level information to be effective and to prevent misinterpretation, misuse and negative impacts. With the proliferation of information systems on the internet, the transmission of false or misunderstood information to the public domain occurs; it is easy to make forecasts but difficult to retract or modify false ones. Hence, there is the need for skills to adapt global or regional information to local circumstances.

6.6.11 Pre-event education makes warning response effective

The preparedness component of the early warning of impending disaster needs to be clear, ready and known to end-users. Public knowledge of early warning systems, including response mechanisms, through information, education and communication initiatives enhances the success of warning messages. Responses to warnings are most appropriate and effective when the public has received prior education and sensitization about the hazard and people have worked out a response plan in advance of the warning. To facilitate this, the probabilistic nature of warning messages have to be made clear and target populations have to be educated on how to interpret probabilistic warnings (National Science and Technology Council 2000). The object is to minimize wrong warnings and to reduce the uncertainty in decision-making.

6.6.12 Warning systems must be based on continuous learning

Successful early warning involves continuous learning. The practice, accuracy and effectiveness of warning as a risk reduction tool would be greatly enhanced by documenting, analyzing and creating a knowledge base that compiles experiences on warning during past disasters, and, through effective networking by connecting people to ideas and linking people to people to access development information.

6.6.13 Regionalism is essential for developing warning systems

Regionalism is crucial for the development and sustainability of early warning systems for a number of reasons. First, the development of integrated early warning systems for structural vulnerabilities and livelihood risks depends on coordination at the international level. Second, assessing hydrometeorological hazards is best done over large geographic areas. Third, the approach has proved effective in promoting the development of early warning systems in several parts of the world.

6.6.14 Multi-purpose monitoring is required for vulnerability warning

Broadening the traditional scope of early warning to not only save lives but also improve livelihoods, requires multi-purpose monitoring which can be used both to warn of crises and as an annual planning tool: data and information from the system can be used in 'normal' periods for development work and also ’expanded' when disaster crises occur. This is a key to integrating early warning in sustainable development.

6.6.15 The scope of warning systems needs to cover other hazards

The contribution of early warning systems, as a class of preparedness measures, to disaster risk reduction and prevention will be enhanced if they possess the capacity to respond to emerging hazards. Hence, it is essential to develop early warning systems for other dominant hazards, in addition to those for food security and hydrometeorological that currently dominate the early warning landscape.

6.6.16 Drought and desertification monitoring is a long-term process

Drought and desertification are believed to be a creeping phenomenon which grows in all dimensions in the absence or shortfall of precipitation in a particular region over an extended period of time. The devastation attached to such phenomenon is perhaps the severest one among all the natural disasters.

The evolution of a well organized and effective capacity for the development of early warning systems in drought and desertification monitoring is a long-term affair. For example, in the case of AGRHYMET in West Africa, it has taken three decades for the programme to mature enough to begin to develop early warning systems for these hazards.

Strengthening National Capacities for Multi Hazard Early Warning and Response System in Pakistan (Phase-I)

7. Essential Components of the Proposed System

Project Title	Executing Organization	Cost US $ (million)
• Establishment of Tsunami Early Warning System in Pakistan	Pakistan Meteorological Department	11.2
• Establishment of Earthquake Prediction Study Centre	National Centre for Physics, Islamabad	0.35
• Tide Gauge Network for monitoring of sea level variations along Pakistan coast	National Institute of Oceanography	2.0
• Up-gradation of Warning Capabilities of National Meteorological Service in Pakistan	Pakistan Meteorological Department	6.5
• Establishment of Tropical Cyclone Warning Centre	Pakistan Meteorological Department	1.7
• Flood Forecasting Center for NWFP	Pakistan Meteorological Department	6.5
• Drought Monitoring and Warning System	Pakistan Meteorological Department	0.2
• Establishment of Specialized Control Centre at National Disaster Management Authority (NDMA)	Cabinet Division / NDMA	2.3
• Setting up of Federal Urban Search & Rescue Teams	Civil Defence of Pakistan	7.5
	Total	***US $ 38.25***

8. Strengthening National Capacities for Multi Hazard Early Warning and Response System in Pakistan: Phase-I

While satisfactory progress is being made to build the regional infrastructure for the Indian Ocean Tsunami Warning System (IOTWS), but without an effective national infrastructure, tsunami and other disaster warnings are unlikely to reach people at risk. Or in cases where warnings do reach, communities and local authorities at the receiving end are unlikely to be sufficiently prepared to take the necessary actions to save lives. There is an urgent need to accelerate national efforts and better synchronize them with regional developments to bring a truly 'end-to-end' system into operation.

Roundtable on Indian Ocean Tsunami Warning and Response System, Bonn, Germany, March 27, 2006, convened in the presence of President William J. Clinton, United Nations Special Envoy for Tsunami Recovery, announced the formation of a consortium for helping the Indian Ocean Countries to establish warning and response system.

This consortium of ISDR system partners have joined forces to offer an immediate package of advisory support to governments in the Indian Ocean region which have fallen furthest behind in developing this national capacity. The consortium partners include UNESCO's Intergovernmental Oceanographic Commission (IOC), World Meteorological Organization (WMO), UN Office for Coordination of Humanitarian Affairs (OCHA), the World Bank (WB), the UN Development Programme (UNDP), the UN Environment Programme (UNEP), the International Federation of Red Cross and Red Crescent Societies (IFRC) and the ISDR secretariat. The Consortium is coordinated by the ISDR secretariat through its Platform for the Promotion of Early Warning in close cooperation with UNESCO/IOC. Operational leadership will be provided by ISDR system partners at the country level.

Support will cover capacities in policy design and planning, institutional and operational infrastructure for national tsunami early warning, and response systems, within the context of regional and multi-hazard warning systems. A framework covering seven core components of a national system is proposed. Under Phase I, the consortium aims to assist up to 10 requesting governments over the next four months, in order to include these national plans in the deliberations of the next IOTWS Intergovernmental Coordination Group meeting in August 2006. Under Phase II, the consortium will continue to offer fast-track assistance for the implementation of these plans for a further 12 months, i.e. upto August 2007. Phase-II may require a concerted fund-raising effort depending on demand.

8.1 The accelerated one-year plan – seven targeted objectives

The proposed first phase of the initiative is the preparation of an accelerated one-year plan of action, to address the needs of requesting governments with respect to the seven targeted objectives outlined below.

The seven targeted objectives focus on key capacities that are essential to the achievement of effective people centred tsunami early warning systems.

The seven targeted objectives

The following objectives identified by ISDR provide a simple framework for achieving action on essential elements of an effective tsunami warning and response system:

- *National tsunami centre established and operating as the authoritative source for tsunami advice and warnings. [Lead partner: UNESCO/IOC]*
- *Strengthening of operational 24/7 national warnings services through the National Meteorological Services as part of multi-hazard approach to national warning systems. [Lead partner: WMO]*
- *Warning response plan for coastal regions prepared and disseminated and a national (coastal) response and evacuation exercise undertaken. [Lead partner: UN-OCHA]*
- *Awareness-raising and education campaign undertaken on tsunami risks and the warning system in coastal regions. [Lead partner: IFRC]*
- *Assessment of Environmental Flashpoints at sub-national level for use in preparedness and spatial planning and disaster risk reduction. [Lead partner: UNEP]*
- *Organizations responsible for disaster risk reduction and disaster management established to lead, monitor and coordinate the plan. [Lead partner: UNDP]*
- *Intermediate and long-term plan developed for the complete and sustainable tsunami warning and response system with full costing. [Lead partner: World Bank]*

8.2 The support package

Each consortium partner will provide assistance on one of the targeted objectives, and will assist countries to illustrate and plan for that specific capacity in preparing the country plan, as follows: UNESCO-IOC for Objective 1, WMO for Objective 2, OCHA for Objective 3, IFRC for Objective 4, UNEP for Objective 5, UNDP for objective 6, and the World Bank for Objective 7. The capacities that may be offered are set out in the one-page support statements prepared by each consortium member that are annexed to this document. Under Phase II, the consortium partners will also endeavour to assist in the implementation of these plans, as their existing programmes and resources allow, and to assist in fundraising efforts to support the implementation stage.

The support is offered principally for the preparation of country plans over the next four months, i.e. by 31 July 2006. In support of this process and the accelerated one-year plan to strengthen national capacities, the UN Special Envoy for Tsunami Recovery, President William J. Clinton, will assist partners to mobilize national political support where required, through the ICG and bilateral communication with Heads of States. The Special Envoy will also support fundraising and mobilization of resources to implement country plans, where necessary.

8.3 Target Objective 1: National Tsunami Centre Established and Operating as the Authoritative Source for Tsunami Advice and Warnings.

Support agency: Intergovernmental Oceanographic Commission (IOC) of UNESCO

8.3.1 Short description of the capacity:

The national tsunami centre is a technical facility that is staffed by a small cadre of well-trained tsunami experts and technicians and operates on a 24 hour a day, 7 days a week basis, supported by a network of seismic and oceanic observing systems and by highly reliable data analysis and communications systems. The centre acts as the national focal point for regional and international interactions.

8.3.2 Main tasks required:

Building a Tsunami Warning and Mitigation System means the establishment of a comprehensive Tsunami Warning System (TWS) infrastructure and people based knowledge level that is designed to save lives and reduce property damage from the approach of a tsunami. In order to build such a system there is a number of requirements:

- The TWS infrastructure uses technology to disseminate tsunami warnings. This technology needs to be adopted by all stakeholders in the system.
- Emergency management officials must translate the warnings into public evacuation actions.
- A team of experts by area of expertise and stakeholders needs to be established and funded within government to form “Tsunami Warning and Mitigation Committees.”
- Ideally, such committees can be established at all levels of government including the national, provincial, and local jurisdictions.
- Strategic country planning and resource commitment can take place at the national and provincial levels.
- Formulation and implementation of community specific strategies is best conducted at the local levels.

8.3.3 Project title: **Establishment of Tsunami Early Warning System**

Abstract:

The world community was appalled by the unprecedented losses of life and property caused by the history's ever deadliest Tsunami event of 26 December 2004 which played havoc in costal areas of Indonesia, Thailand, Andaman Islands, Sri Lanka Bangladesh, southern Indian coasts and even coasts of eastern Africa. Luckily Pakistan entire coast line was saved because of being in the shadow of Indian peninsular land mass which bore major brunt of the forces directed northwestward but this was the wake up call for Pakistan also. Form the data record of Arabian Sea, there was five earthquakes with magnitude greater than and equal to 6.0 Richter scale since 1905. The ever big earthquake Magnitude 8.3 was occurred on 27 November 1945 which created Tsunami and height of this Tsunami at the coast of Makran was about 40 feet. Four thousand people at the coasts of Pasni were reported dead. Again on 5 August 1947, another big earthquake with magnitude 7.3 Richter scale was recorded in Arabian sea.

Project type –

Submitting organization(s): Pakistan Meteorological Department

Endorsement by authority: Government of Pakistan

Background information:

In December 2004, one of the strongest earthquakes ever recorded and the resulting tsunami wave caused one of the most devastating natural disasters ever recorded in the Indian Ocean region. The disaster revealed key infrastructural deficiencies in the affected regions, which led, in the absence of an early warning disaster management system, to destruction of an exceptionally large scale.

Recently on January 26, 2001, Bhoje earthquake with magnitude 7.9 was occurred at Indian Gujarat coast. Active fault line exists in Arabian Sea just 90 to 95 km away form the Makran coast, which is further links with the continental plate boundary. Maximum seismic activities are found in front of Pasni and Gawadar, and mostly strong and catastrophic earthquake this area took place in the upper crust. In the presence of tectonic setting and seismicity record of Arabian Sea Pakistan Meteorological Department has prepared a big project named "Up-gradation and Strengthening of Seismic Network" of PMD. In phase I this project is consisted of one national seismic monitoring

network of 15 broad bands (very sensitive) sensors with one central recording station at Karachi some seismic stations would be established at the coast line of Sindh and Balochistan and other at rest of the country. This network would be linked to central station through satellite. This network would be capable of detecting any earthquake activity in Arabian Sea which can generate Tsunami so this network will be utilized as early warning system for tsunami in Arabian Sea.

The potential for the generation of Tsunami in Arabian Sea exist. To issue the early warning of Tsunami the detection and mechanism of earthquake in very short time would be important so that optimum measurements could be taken by authority before the arrival of sea waves.

For the confirmation, as all earthquakes does not generate Tsunami, four sea based Deep Ocean Buoys with Bottom Pressure Recorders are proposed to be installed at different places along coast line. Beside this, Pakistan Meteorological Department is also establishing two local seismic networks for southern and northern Pakistan. Each network would be consisted of 20-25 seismic stations (other than national network). Southern network may also will be capable of detecting micro seismic activates of the faults this information's will be further utilized for the modeling of Tsunami waves travel times in Arabian Sea.

The PMD must guarantee sustainability, i.e. maintenance and readiness of local warning systems, and should conduct continuous awareness-raising measures among the population in collaboration with relevant organizations. During a crisis they must implement evacuation measures, securing public safety and organizing local aid activities. They are additionally responsible for requesting external support and assistance. Therefore, field exercises for local rescue forces as well as the local population will be regularly conducted in order to ensure readiness in the event of a disaster.

The technical implementation of the Tsunami Early Warning System will be guaranteed by the set-up of secure, fully backed-up communication structures via satellite communications (V-Sat) on top of a standard land-based infrastructure, plus the set-up, adaptation or extension of area-wide communication structures between the Regional Centres and the Main centre.

Estimated

Cost of the Equipments:

- Cost of 15 remote site VSAT and seismic equipments = 600,000 US$
- Cost of 14 power systems = 112,000 US$
- Cost of central recoding stations = 110,000 US$
- Cost of 4 tide gauges = 333,320 US$
- Approximate cost of four buoys and bottom pressure recorder linked through satellite = 10 million US$

Total = 11.16 million US$ (Approx)

Primary contact:

Director General , Pakistan Meteorological Centre, Islamabad-Pakistan. *+92 51 9250367*
dgmetpak@hotmail.com

Objectives / Expected impact:

In order to limit the effects of disasters in the future – such as the Tsunami disaster which occurred around the Indian Ocean in December last year - all four requirements described by UN/ISDR must be fulfilled: • Risk Knowledge (Collection and preparation of information about probable and/or possible risks in the region) • Warning Services (Technical observation of those parameters, which indicate the initial features of the disaster and, if necessary, publication of warnings) • Response Capability (Development of alarm plans as well as public information campaigns, awareness-raising, training and learning in cooperation with the local administration and population to ensure the appropriate reactions in emergency situations) • Dissemination (Installation and maintenance of systems, which are able to warn the threatened population reliably and sustainably in the case of a disaster.)

(see UN/ISDR Platform for the Promotion of Early Warning (PPEW))

The Federal Government of Pakistan initiated the implementation of the first phase, the “Seismic Network” for an early warning system. Nevertheless, this system will remain totally ineffective if the population of the endangered regions cannot be informed in a reliable way and –following corresponding information and training- act adequately.

PMD offer a comprehensive solution for response capability and dissemination, i.e. setting-up and operation of a disaster communication and management infrastructure in Pakistan, which will reduce the effects of possible future disasters and leads to sustainable awareness and sensitization with the

	affected population.
Geographic coverage:	**Coastal Areas of Pakistan and Middle East**
Geographic details:	–
Project duration:	24 months
Requested funds:	11.16 million US$
Additional Funding Information:	The Federal Government of Pakistan initiated the implementation of the first phase, the “Seismic Network” for an early warning system.

8.3.4	**Project title:**	**Establishment of Earthquake Prediction Study Group Under National Centre For Physics Islamabad**
	Abstract:	In order to reduce the risk of an earthquake and mitigate its effects, particularly those which are associated with major disastrous earthquakes, it is necessary to predict as to where and when in future, a large earthquake may occur. Earthquake prediction at the present time, is far form an exact science and forecasts have not been very accurate. At present predictions are given in statistical terms. A statistical approach is primarily used for long term earthquake prediction. For example when a prediction is made that "there is a 90% probability of that an earthquake to occur in the next 50 years, it does not mean that this earthquake cannot happen tomorrow or it may not be delayed by 50 years. In previous years, 29 major earthquakes were tested for prediction, 8 of them were followed by strong earthquake, 6 were predicted and 2 were missed. On the whole 5 errors out of 29 predictions. Similarly 9 alarms were declared in which 6 were correct and 3 false. Many groups of seismologists and mathematicians from Russia, Italy and California have developed algorithm for prediction of earthquake. A group of mathematicians from Italy and Russia visited Pakistan on the invitation of Prime Minister of Pakistan in March 2006. On the basis of their algorithm, they have predicted another big earthquake of magnitude greater than or equal to 6.7 in Northern Pakistan before the middle of April 2007.
	Project type	---
	Submitting organization(s):	National Centre for Physics, Islamabad
	Endorsement by authority:	Government of Pakistan
	Background information:	The earthquake of 8th October 2005 was the most devastating and tragic one that ever struck Pakistan since its creation. The Government is conscious of its responsibility and immediately rose up to the occasion and geared up all possible resources to meet these challenges. The Government is also conscious of the need to strengthen the knowledge base of geology, geological faults and seismology in earthquake prone areas in the country. For more geological investigation and updating the knowledge of faults, strengthening of monitoring, it would require extensive work.

Primary contact:	Director General, NCP, Islamabad
Objectives / Expected impact:	Several earthquake monitoring stations have been established in the country. However, no effort has been made for developing indigenous capability for earthquake prediction. Earthquake prediction is a difficult task and it is almost impossible to predict earthquake accurately the time of occurrence, the location and magnitude of earthquakes. Extensive research work is going on in some institutions abroad. A number of precursors to predict earthquake have been developed. In parallel to the field work, theoretical studies can be undertaken to correlate these precursors. Mathematicians, Physicists and Statisticians can make theoretical models and develop algorithms for earthquake prediction. Pioneering work in developing the model has been done by International Institute of Earthquake Predication Theory And Mathematical Geophysics, Moscow, Russia. This work has been done under the guidance of its founder Prof. Vladimir Keilis Borok who recently visited Pakistan with his co-scientists on Prime Minister invitation. They claimed that earthquake can be predicted with probability factor of about 70%. The approach of this theoretical calculation is easy to undertake as it is based entirely on analysis of geological and seismic data. As per the decision of the Prime Minister, we may start developing the capability for earthquake prediction in an autonomous manner, but under the umbrella of National Center for Physics (NCP) Islamabad and in collaboration with reputable institutes abroad. The cooperation will be expanded in future with other centers engaged in similar studies. Initially there is a need to send our scientists for training abroad. About 20 fresh Post-graduates (M. Phil, M.Sc) in math, physics, statistics geology and seismology would be recruited and send abroad for training in groups.
Geographic coverage:	**Pakistan**
Project duration:	2-years
Requested funds (Phase-I):	US$ 0.35 million
Regular Funding per annum	US$ 0.15 million

8.3.5 Project title: **Tide Gauge Network for Monitoring of Sea Level Variations along Pakistan Coast**

Abstract:

Pakistan has a coast line of about 990 km and the Exclusive Economic Zone (EEZ) of about 240,000 km^2. It roughly divided into two main sections on the basis of its physiographical characteristics viz. the Sindh coast and the Balochistan coast. Due to flat topography, the Indus Deltaic creek system (Sindh Coast) is very much vulnerable to sea level variation. This area is also prone to storms/cyclones, which cause a great deal of inundation in the low-lying areas. With that cyclone, the seawater, as huge storms surges intrudes into the land far away from the coast and inundates hectors of land with saline water. Currently, the agricultural land present view of ponds fill with saline water. The global SLR is also playing an important role in the recent abnormal coastal flooding. Most of the Balochistan coast lies in the subduction zone and have long history of tectonic activities and Tsunamis in the region. Therefore Balochistan coast line also needs continuous monitoring of sea level variations along the coast.

The objective of this project is to set up a sea level monitoring system. At least six (6) tide gauge stations may be established along the Pakistan coast. The extend of vulnerability of the area as well representation of both Sindh and Balochistan coast lines are the main consideration for selection of the tidal observatories sites. The proposed system would be linked with system of regional and International networks.

Project type –

Submitting organization(s): National Institute of Oceanography , Pakistan

Endorsement by authority: Cabinet Division of Pakistan

Background information:

The UNEP in its regional seas program in 1989 has included Pakistan in a group of countries which are vulnerable to impact of rising sea level. A rise in the sea level caused by climate change would directly threaten low-lying coastal areas. The long-term trend of mean sea level for Karachi harbor shows increasing trend about 1.1 mm per year. The higher base provided by SLR for storm surges and tides would be particularly important of the Indus delta, where the beach slope is only 0.1 degree.

Sindh coastal zone is more vulnerable to sea level rise than Balochistan coast, as uplifting of coast about 1-2 mm per year due to subduction of Indian ocean plate is characteristic

	of Balochistan coast. With in the Indus deltaic creek system, the area nearby Karachi is most vulnerable to coastal erosion and accretion than the other deltaic region mainly due to human activity together with natural phenomenon such as wave action, strong tidal current and rise in sea level
Primary contact:	Director General, National Institute of Oceanography, St-47, Block-1, Clifton, Karachi, Pakistan. Tel.# 92-021-9251172-78,fax # 92-021-9251179 Email: niopk@cubexs.net.pk
Objectives / Expected impact:	1. Continuous monitoring of tidal level at the selected tide gauge stations along the Pakistan coast. 2. Recent tsunami destructions in south Asia compel Pakistan to monitor tidal continuous variation along Pakistan coast includes the Tsunami Warning Centre, a proposal suggested by NIO. 3. Study of sea level variation through historical tidal data and its relationship with changes with sea surface temperature, localized tectonic activities and global phenomenon such as ENSO events. 4. Study of seasonal variation in sea level and its relationship with meteorological and oceanographic parameters. 5. Focus on the changes in the extreme water levels (ie HHW's and LLW's) and try to relate these changes to climatic trends (seasonal, annual, decadal) including ENSO, as well as local tectonics (land subsidence or uplift) and to even more local effects such as harbor dredging. 6. The studies relating to vulnerability and the impact of sea level rise on the coastal zone will help the other concerned departments to investigate on the appropriate adaptation options. 7. Based on the assessed vulnerability and available adaptation options of the study, the planer may undertake appropriate measures against the sufferings of the people and their economy.
Geographic coverage:	**Pakistan**
Geographic details:	
Project duration:	36 months
Requested funds:	USD 2 million
Additional Funding Information:	
Final grade:	

8.4 Target Objective 2: Strengthening of operational 24/7 national warnings services through the National Meteorological Services as part of multi-hazard approach to national warning systems.

Support agency: World Meteorological Organization (WMO)

8.4.1 Short description of the capacity:

Every country requires a basic operational capability for 24/7 warning services to be able to monitor hazards, develop and disseminate forecasts and warnings within a multi-hazard approach, in support of preventive, preparedness and emergency response measures. In certain countries, this capability is attached to the National Meteorological and Hydrological Services (NMHS), which require for this purpose effective observing networks, trained professional staff, access to state of the art computers, data archiving and management equipment, efficient telecommunication equipment and access to networks, ability to develop and disseminate specific forecasts, warnings and data products to government authorities and other stake holders in support of various stages of disaster risk management from prevention to preparedness to emergency response and recovery.

Warning services should be available for all hazards posing risk to the country and span various time-scales. Hazards connected with very short warning lead-time are for example tsunami, flash floods, and tornadoes, hazards with longer warning lead-times of 24 hours to several days are for example tropical cyclones and storm surges, and droughts have a warning lead-time of months). However, organizational capacities of the NMHSs vary significantly from country to country in serving their mandate for development and/or issuance of warnings. In many countries in this region, there is an urgent need for upgrading and strengthening the technical and operational capacities of NMHSs to meet the minimum requirements as operational 24/7 warning services. Furthermore, the role and responsibilities of NMHSs as agencies responsible for providing warning within a multi-hazard approach and their interaction with other key agencies involved in disaster risk reductions must be clearly identifiable and be an integral part of national disaster plans of the countries.

8.4.2 Main tasks required:

- Establish a national disaster plan in which the role and responsibilities of the NMHS and their interactions with other agencies involved in different aspect of disaster risk management planning and response are identified for tsunami and hydro-meteorological hazards posing risk to the country.
- Ensure through legislation, the NMHSs mandates are clear. Identify minimum requirements for operational 24/7 NMHSs to be able to effectively serve their mandate in support of preventive, preparedness and emergency response measures.
- Determine gaps and needs for strengthening of NMHSs capacities with respect to observation networks, computers and data management systems, telecommunication equipment and access to networks, technical training and capacity building, joint training and educational programmes with media, National Disaster Management Agencies

(NDMAs), Red Cross and Red Crescent Societies for providing useful and understandable warnings, professional staff needs to operate the forecasting and warning services, needs for manuals, protocols, operating plans, etc.

- Establish working links with other agencies, authorities and user communities (government officers, police, disaster managers, media, etc) as determined the official mandate.

Strengthening of linkages with regional tsunami alert providers, national tsunami centre (if different from the NMHSs), and WMO's Regional Specialized Meteorological Centres to benefit from forecasts, alerts and other information that can be critical for development of national forecasts and warnings.

8.4.3	**Project title:**	**Establishment of Tropical Cyclone Warning Centre**
	Abstract:	Tropical Cyclones and storm surges are the deadliest among all natural disasters for coastal dwellers as they are at times very intense. Tens of thousands are still losing their lives in this technologically developed world due to lack of communication and necessary infrastructure for early warnings and effective response system. Existence of a reliable prediction, warning, evacuation and post-disaster response system can avert the losses of lives and property up to a large extent. It foresees the setting-up of technically self-sufficient flexible communications systems for the transmission of information during emergencies. This would be complemented by structures inter-linking national / regional disaster management centres and local response teams focusing on awareness raising and teaching appropriate response behaviour. This will be achieved through technology transfer to provide state-of-the-art numerical predictions of tropical cyclones landfall and hydrological models to predict floods; and training of decision-makers, emergency manager, non-government officials, and education programs for the public.
	Project type	–
	Submitting organization(s):	Pakistan Meteorological Department
	Endorsement by authority:	World Meteorological Organization
	Background information:	Tropical Cyclones and associated surges are believed to be the deadliest among natural disasters for coastal population due to their frequency and intensity. April-May and October-November are known as tropical storms season for Arabian Sea. An effective warning system requires accurate meteorological forecasts of the tropical cyclone landfall position/timing, the wind distribution (from which the storm surge can be calculated) and the precipitation (from which the flooding can be predicted). This project has three components: (1) A transfer of advanced technology, experience, and training that will enhance the forecast and warning aspect of an effective warning system; (2) An internal infrastructure enhancement that will enable these warnings to be communicated effectively, and the education and training of emergency managers and non-governmental officials to ensure that the public responds in an appropriate way to the threat; and (3) A monitoring and re-assessment component that will assess not only the success of this

	project, but will also contribute to sustaining an effective early warning system.
Primary contact:	Director General , Pakistan Meteorological Centre, Islamabad-Pakistan. *+92 51 9250367* dgmetpak@hotmail.com
Objectives / Expected impact:	The objectives of establishment of the Tropical Cyclone Early Warning Centre are to minimize the effects of disasters from tropical cyclone in the future. These objectives can be achieved if all four requirements described by UN/ISDR must be fulfilled: • Risk Knowledge (Collection and preparation of information about probable and/or possible risks in the region) • Warning Services (Technical observation of those parameters, which indicate the initial features of the disaster and, if necessary, publication of warnings) • Response Capability (Development of alarm plans as well as public information campaigns, awareness-raising, training and learning in cooperation with the local administration and population to ensure the appropriate reactions in emergency situations) • Dissemination (Installation and maintenance of systems, which are able to warn the threatened population reliably and sustainably in the case of a disaster.)
Geographic coverage:	**Coastal Areas of Pakistan and Middle East**
Geographic details:	–
Project duration:	24 months
Requested funds:	USD1.7 Million
Additional Funding Information:	The Federal Government of Pakistan.
Final grade:	

8.4.4 Project title: **Flood Forecasting System for North West Frontier Province (N.W.F.P.)** (Weather Radar & other Facilities)

Abstract:

The purpose of the flood forecasting and warning centre at Peshawar is to provide as much advance notice as possible of an impending flood especially in NWFP. Over time, the demands for flood forecasts have changed from a simple indication of the likelihood of flooding to an accurate prediction of magnitude and timing for warning local authorities and the affected population of the expected levels and extent of flood inundation. The development of flood forecasting and warning system is an essential element in regional and national flood alert strategies, and is a high priority in Pakistan.

The project is a part of the overall measures being adopted by the Government to further improve flood forecasting. The project envisages Flood Forecasting & Warning System at Peshawar and installation of 10-CM Doppler Weather Radar at Cherat near Peshawar.

(a) **Flood Forecasting Center**

In order to forecast the potential for flooding in N.W.F.P., PMD, will monitor snow cover, rainfall amounts, stream flows, temperature and river ice conditions. Data collected will be analyzed to determine runoff potential, predict water levels, ice break-ups and ice jams. Information needed for flood forecasting includes stream stage level (the height of water level in the stream above an arbitrary datum) and the amount and distribution of precipitation. Stream stage will be measured at stream-gauging stations, where automated equipment will be used to continuously monitor and record water levels. Precipitation gauges distributed throughout the drainage basin will be used to measure and record the amount of precipitation that will fall during a given storm. This information together with the Quantitative precipitation Measurement (Q.P.M) Doppler Radar proposed at Peshawar (Cherat) will allow the amount and distribution of precipitation to be accurately estimated. From this estimate, stream discharge at a given location will be predicted and converted to an estimate of stream flow. The higher reliability of forecasts and additional lead time would result in improved Dam water management, flood fighting and evacuations from areas likely to be affected by floods. This would reduce the huge flood damages to the irrigation network infrastructure, road infrastructure and sufferings of the people.

(b) Procurement of Doppler Weather Radar at Peshawar (Cherat):

This project is a part of the overall measures being adopted by the Government to further improve flood forecasting and minimize damages due to floods. At the moment PMD have Networking of four Radars at Karachi, R.Y.Khan, D.I.Khan and Islamabad. The Radar installed at Islamabad (with the elevation angle of 1.3 degree) will cover only the plan surrounding areas and not covered the hilly areas of Northern part of the country. After completion of these projects, activities of PMD on observation and surveillance of heavy rain will highly be improved and weather forecasting and flood warning will be more accurate in N.W.F.P. Because 10-CM radar at Peshawar (Cherat) will be able to intensively observe western side rainfall. As a result of this project, PMD will be able to provide real time weather and flood forecasting to the public, aviation, agriculture and other sectors. This would reduce the huge flood damages to the irrigation network, road infrastructure and inundation in populated areas in N.W.F.P.

Project type –

Submitting organization(s): Pakistan Meteorological Department

Endorsement by authority: World Meteorological Organization

Background information: During summer season, melting snow from the catchment areas of the rivers approaching in the N.W.F.P. causes flood damages on the lower areas of the country. The flood in 2005 caused the worst damages including death of some peoples and destruction of many houses.
After the installation of this new project, the flood prediction and warning to the population would be possible before the flood effect the area which would sufficient for implementation of the evacuation plan.

The flood discharge of the rivers in N.W.F.P. would be possible through the proposed project, so as to issue early flood information / warnings to enable the residents to make evacuation measures accordingly. The provision of flood forecasting related equipment would improve capability of PMD and related organizations in better managing the flood forecasting and warning issues through coordinated efforts

Primary contact: Director General , Pakistan Meteorological Centre, Islamabad-Pakistan. *+92 51 9250367*
dgmetpak@hotmail.com

Objectives / Expected impact: The project aims at providing early and accurate forecasting and warning system. Upon completion of the Project, it would contribute to reduction of flood damages, especially

prevention of loss of human lives in the country.

It is most imperative to provide accurate and timely meteorological information to the government and public sectors, so as to achieve the overall measures being adopted by the Government of Pakistan. In view of the above PMD has planned to upgrade its observation and forecasting capabilities, for which meteorological products are indispensable. From a long term point of view, it is also necessary to improve meteorological services in the N.W.F.P. as well as in the country. Therefore, it is strongly recommended that country wide activity programme be promoted through the achievement of these project objectives. It hardly needs any elaboration to mention that accurate and timely flood forecasts are essential with sufficient lead time for successful disasters management towards lessening the loss of life and property.

PMD is striving hard towards developing and expanding its physical facilities and basic operational capabilities to raise its level of competence to produce effective forecasts and warnings in support of promotion of sustainable economic and social development of the country through agricultural production increase in Pakistan.

Upon completion of the Project, the following benefits are expected:

1. The flood forecasting and warning system installed through the Project would provide earlier and more accurate information on flood forecasting and warning and reduce the flood damages in low lying areas; loss of human lives in particular.
2. Through improvement and expansion of the existing rainfall and water level gauging stations as components of the Project, the more extensive and accurate hydrological data could be collected and used as the relevant future plans / studies / infrastructure development.

Geographic coverage: **Pakistan**

Geographic details: –

Project duration: 24 months

Requested funds:

(a)	Flood Forecasting Centre for NWFP	US$ 2.8 Million
(b)	Procurement and Installation of 10-CM Quantitative Precipitation Measurement Doppler Weather Radar at Peshawar (Cherat)	US$ 3.7 Million
	Grand Total (a+b)	**= US$ 6.5 Million**

Additional Funding Information: The Federal Government of Pakistan

Final grade:

8.4.5 Project title: **Up-gradation of Warning Capabilities of National Meteorological Service in Pakistan**

Abstract:

WMO Expert Mission visited Pakistan immediately after the devastating earthquake of October 8, 2005 to assess the current capabilities of the Pakistan Meteorological Department and proposed enhancement of its meteorological, hydrological and seismological services to meet the future challenges. It includes the strengthening of meteorological and seismological observation network, installation of modern radars, Satellite stations, efficient data processing and communication system and human resources development.

Project type –

Submitting organization(s): Pakistan Meteorological Department

Endorsement by authority: World Meteorological Organization

Background information:

The Meteorological Department is both a scientific and a service department, and functions under the Ministry of Defence. It is responsible for providing meteorological service throughout Pakistan. Apart from Meteorology, the department is also concerned with Agro-meteorology, Hydrology, Astronomy and Astrophysics, Seismology, Geomagnetism, Atmospheric Electricity and studies of the Ionosphere and Cosmic Rays.

The major functions of the Met Department are to provide information on meteorological and geophysical matters with the objective of disaster mitigation due to weather and geophysical phenomena, agriculture development based on climatic potential of the country, prediction and modification of weather forecast.
The department has established:

i. A network of observing stations to generate meteorological, geophysical and phonological data.
ii. A telecommunication system for speedy dissemination of data
iii. Meteorological offices to analyze data for issuing forecasts and warnings for aviation, agriculture, shipping, sports, irrigation etc.
iv. Climatological and data processing units for scrutinizing, comparing and publishing data for appraisal of long term weather trends and earthquakes.

	The department has introduced a modern flood forecasting system, earthquake and nuclear explosion detection system, radar, satellite, computer technology, flight safety consultancy services in seismic design of dams, buildings and other development and disaster relief schemes.
Primary contact:	Director General, Pakistan Meteorological Centre, Islamabad-Pakistan. *+92 51 9250367* dgmetpak@hotmail.com
Objectives / Expected impact:	Main objective of this project is to improve the quality of prediction, timely warnings and their dissemination.
Geographic coverage:	**Coastal Areas of Pakistan and Middle East**
Geographic details:	–
Project duration:	12 months
Requested funds:	USD 6.5 Million
Additional Funding Information:	The Federal Government of Pakistan
Final grade:	

8.4.6	**Project title:**	**Drought Monitoring and Warning System** (Consultancy Services only)
	Abstract:	Pakistan has recently established a Drought Monitoring and Warning Center with an extensive network of rain gauges and Automatic Weather Stations (AWSs) in the country. The existing network of about 100 stations would be extended to 500 stations or even more. Some agencies using rainfall data would be involved to operate the stations on voluntary basis. The Drought Monitoring Centre would be responsible for advising the Government on drought related matters including drought declaration and mitigation measures likely to be taken by the stakeholders. Being a new set-up and the manpower with lack of experience, expertise are required from developed countries having an established drought warning system. Engagement of experts would not only help in operating the system efficiently but also train the technical manpower engaged in data collection, processing and warning.
	Project type	–
	Submitting organization(s):	Pakistan Meteorological Department
	Endorsement by authority:	World Meteorological Organization
	Background information:	Pakistan has a long latitudinal extent and the rainfall variability during different seasons is considerably high. The climate of the country in lower southern half is arid and hyper-arid. Some regions of the country in each season, remain drastically dry and are always vulnerable to drought. If subsequent seasons fail to generate significant precipitation, the drought conditions emerge in these areas gaining severity in the absence of rainfall. All the provinces of Pakistan have a history of facing major droughts in the past. Drought differs from other natural disasters (e.g. floods, earthquakes, tropical cyclones, tornados etc.) in the sense that the effects of drought often accumulate slowly over a considerable period of time and may linger on for years even after the termination of the event. Because of this, drought is often referred to as a "Creeping Phenomenon". Drought impacts are less obvious and are spread over large geographical areas than are the damages that result from other natural hazards. Consequently drought affects more people than any other environmental hazard. Unfortunately, no organization dealing with the drought issues existed in Pakistan and the responses to drought for

the distressed economic and social sectors, whenever such situation arose, were taken on emergency and on ad hoc basis. Such reactions to crisis often resulted in the implementation of hastily prepared assessment and response procedure that lead to ineffective, poorly coordinated and untimely responses. It is thus inevitable and need of the time that a monitoring and early warning system, which could be one of the major element of "Drought Mitigation" be developed on scientific grounds.

Addressing this important issue Government of Pakistan has Established a National Centre for Drought / Environment Monitoring and Early Warning System in Pakistan.

This centre will also be responsible for extending the rain gauges network in the country. The existing network of about 100 stations would be extended to 500 stations or even more. Some agencies using rainfall data would be involved to operate the stations on voluntary basis.
The Drought Monitoring Centre would be responsible for advising the Government on drought related matters including drought declaration.

Establishment of Operational Centres

- One operational centre will be established in each province. The main responsibilities of these centres would be to:-
- Collect data from the network stations in its region.
- Co-ordinate with the voluntary agencies operating the network and help them in running the stations smoothly.
- Store and process the data and transmit it to the National Centres in the desired format.
- A research unit will be established under the National Centre. It will carry out research in drought related issues such as the climatological conditions leading to the occurrence of droughts and would develop statistical models for improving drought forecasts etc.

Primary contact: Director General , Pakistan Meteorological Centre, Islamabad-Pakistan. *+92 51 9250367* dgmetpak@hotmail.com

Objectives / Expected impact: The main objective of this project is to develop near real-time drought monitoring system. The indices used will include a deviation from the normalized difference vegetation index (NDVI) from its long-term mean and a vegetation condition index (VCI). Expected Outcomes • Establish a real time drought monitoring system based on

	NDVI and other indices • Producing the maps of the well known remote sensing indices such as NDVI and VI • Producing normal climatological maps of NDVI and VI • Fill in the gaps in drought monitoring for the region, resulting from measurement related problems of precipitation and other meteorological parameters
Geographic coverage:	**Pakistan and adjoining Countries**
Geographic details:	–
Project duration:	24 months
Requested funds:	USD 0.2 Million
Additional Funding Information:	The Federal Government of Pakistan
Final grade:	

8.5 Target Objective 3: Warning response plan for coastal regions prepared and disseminated and a national (coastal) response and evacuation exercise undertaken.

Support agency: UN Office for the Coordination of Humanitarian Affairs (OCHA)

Short description of the capacity:

Based on technical information available (e.g. tsunami hazard maps, highly vulnerable areas) and operation of tsunami alert systems, warning response plans for selected coastal regions will be prepared and disseminated. A highly participatory approach involving community leaders at the local level will be utilized. Once the plan is adopted, an evacuation drill will be conducted. This activity will include public education and awareness programmes.

Project for this objective would be developed in Phase-II of the National Plan.

8.6 Target Objective 4: Awareness-raising and education campaign undertaken on tsunami risks and the warning system in coastal regions.

Support agency: International Federation for Red Cross and Red Crescent Societies

8.6.1 Short description of the capacity:

National Red Cross and Red Crescent Societies are present in 183 countries. In each of the countries in the Indian Ocean region, National Societies – as auxiliary to the public authorities – are active in disaster management. In terms of the structure, National Societies have their headquarters in the capital and the branches at provincial, city or district levels. All levels are supported by a network of staff and volunteers.

Apart from the National Societies, the International Federation of Red Cross and Red Crescent Societies' country offices and regional delegations have extensive experience in disaster preparedness and risk reduction which includes early warning. Through sharing knowledge and experience and working with National Societies, they have the mission to strengthen the institutional capacity and organization for disaster management, for instance its work in cyclone early warning in Bangladesh and flood related early warning in Cambodia.

They are also part of regional bodies and networks helping to ensure a more coordinated approach in disaster management. With its permanent observer status at the United Nations, the International Federation of Red Cross Red Crescent Societies also works with the United Nations, international organizations, Inter-governmental and non-governmental international organizations in moving forward policy and practice in early warning.

Within the Indian Ocean region a number of national Red Cross and Red Crescent Societies, with their programmes in disaster preparedness, have supported and run activities in awareness raising and education for more than 10 years.

8.6.2 Main tasks required:

At schools

- Integrate early warning and disaster management education into the education system.
- Increase knowledge of risks and identify vulnerable areas.
- Develop disaster response plans for safer schools.
- Promote the development of an Early Warning Day to be held at schools that brings together all actors of the community and those involved in early warning and disaster management.
- Produce educational materials, i.e. board games, to reach out to children.

At community level

- To increase awareness of early warning issues and share cost effective good practices at community level, a National Early Warning Fair will be established to support building networks and to exchange information between the various actors.
- Raise awareness of risks and actions to take through National Societies' settings and other community based organizations, such as Youth Red Cross / Red Crescent and Mother's Club.
- Multiply vulnerability and capacity assessment in a participatory process with communities and develop a plan of action as a result of it, linking this with local authority plans.
- Enhance training and coordination between the Red Cross and Red Crescent branches, local government authorities, NGOs, community leaders to increase awareness on risks in particular in most vulnerable areas.
- Communities will be trained in disaster preparedness and evacuation related activities to reduce their vulnerability to hazards.
- Train Community Disaster Response Teams. Well informed communities save more lives as they are trained in early warning, know about the risks, understand the danger signals and respond to disasters.

With the media

- Provide training of journalists at national and rural radio level to ensure understanding of early warning and disaster management issues in support of dissemination of alert.
- Promote the development of early warning information dissemination by including early warning messages in street theatres and popular radio/ TV programmes to attract attention, e.g. radio soap opera.

Project for this objective would be developed in Phase-II of the National Plan.

8.7 Target Objective 5: Assessment of Environmental Flashpoints at sub-national level for use in preparedness and spatial planning and disaster risk reduction

Support agency: United Nations Environment Programme (UNEP)

8.7.1 Short description of the capacity:

Sub-national assessments of environmental flashpoints, developed in cooperation with national and international partners, would draw attention to critical environmental concerns that affect risk and vulnerability to coastal hazards. Assessments would be fully integrated with preparedness planning for the Indian Ocean Warning System and for use in identifying strategic interventions through existing national mechanisms for spatial planning, early warning and disaster risk reduction.

8.7.2 Main tasks required:

Assessments of environmental flashpoints would be developed based on an instrument designed by UNEP and cooperating technical experts and would include identification of critical parameters, data and information needs. The instrument will be adapted to national needs based on consultations with national authorities and technical experts which would include those national partners expected to use the analyses for decision making purposes. The assessment will be carried out by trained national partners with technical support from UNEP. A final review of the assessment will include development of an action plan and guidelines for integrating the assessment findings in national and sub-national planning processes.

Project for this objective would be developed in Phase-II of the National Plan.

8.8 Target Objective 6: Organizations responsible for disaster risk reduction and disaster management established to lead, monitor and coordinate the plan.

Support agency: United Nations Development Programme (UNDP)

8.8.1 Short description of the capacity:

The multi-faceted nature of effective early warning systems requires that plans to develop and implement them are undertaken with input from multiple stakeholders. The primary responsibility and leadership of a multi-stakeholder process for designing and implementing early warning system plans under the current initiative is expected to rest with national governments. The role of international agencies is to support national governments and the other stakeholders in the planning process.

The basic capacity needed for ensuring that organizations responsible for disaster risk reduction and disaster management are established to lead, monitor and coordinate the plan therefore has two dimensions: 1) that governments identify and convene or involve the

appropriate mix of stakeholders needed to design effective early warning systems, and 2) coordination of support for the planning process by international agencies.

8.8.2 Main tasks required:

Design of early warning system plans under the current initiative involves work by two interfacing sets of institutional structures:

1) Each country desiring to participate can so indicate and identify the organizations responsible for disaster risk reduction and disaster management that have been, or will be, established to lead, monitor and coordinate development of early warning system plans.

2) Upon being notified of a country's desire to participate in the initiative, UNDP will facilitate coordination among international partners involved in the current plan as requested, through the institutional mechanisms described above.

The substantive dimensions of the plans in each country will be elaborated through the resulting collaborative process. It will also be important to compare plans across countries in order to share knowledge being generated by the planning process.

8.8.3 Project title: **Establishment of Specialized Control Centre at National Disaster Management Authority** (NDMA)

Abstract:

In the wake of devastation caused due to the catastrophic earthquake of October 08, 2005 in northern Pakistan and Kashmir, the government agreed in principle for all needed resources to mitigate natural disasters.

The Prime Minister stressed for the establishment of an effective disaster management system in the country. Accordingly, Establishment Division put forward a proposal for the establishment of National Management System. The Prime Minister approved setting up of a National Disaster Management Authority (NDMA) in the country.

Since NDMA will be responsible for disaster management, a Specialized Control Room needs to be setup in NDMA that would serve as a hub for receiving Early Warnings from specialized national agencies and subsequently would issue necessary instructions to agencies involved in mitigation activities.

NDMA would require to acquire a reliable and multi-layer communication linkage with all stakeholders to work effectively during disasters as well.

Project type –

Submitting organization(s): Cabinet Division of Pakistan

Endorsement by authority:

Background information:

In the wake of October 8, 2005 catastrophic event, The Prime Minister was briefed on the Establishment of National Disaster Management System in Pakistan. While having a cross country comparison of Disaster Management Systems, it was pointed out that almost every country in the region like Sri Lanka, Bangladesh, China, Japan, Iran had National Bodies for disaster management, whereas critical inadequacies were pointed out in Pakistan's Disaster Management System. It was highlighted that contrary to international practices we had developed fragmentary approach to disaster management and there are no national / provincial / district or departmental disaster management plans besides the absence of SOPs at all levels. In particular there was absence of trained and integrated search and rescue system. As a way forward following main proposals were made for the setting up of National Disaster

Management System:-

1. A National Disaster Management Commission alongwith a duly empowered authority may be created.
2. Authority so created should be highly professional body with key specialized disciplines, focus approach and lean structure.
3. The authority should make decisions and arrangements for capacity building in disaster mitigation.

Primary contact: Chairman, NDMA

Objectives / Expected impact: The objective of establishing specialized state-of-the-art control room of NDMA would to coordinate with all stakeholders involved in the Disaster Management, starting from the agencies involved in Early Warning to the agencies required to act and mitigate the impact of a natural disaster. The control room would be equipped with the best possible reliable communication system besides other necessary equipments.

Government of Pakistan would provide the other administrative expenditures required for the setting up of National Disaster Management Authority (NDMA).

Geographic coverage: **Pakistan**
Geographic details: –
Project duration: 12 months
Requested funds: USD 2.3 Million
Additional Funding Information: The Federal Government of Pakistan
Final grade:

8.8.4 Project title: **Setting up of Federal Urban Search & Rescue Teams**

Abstract: Millions of people around the globe have died helplessly in the recent past as a result of major disasters like tsunami, earthquakes, floods, cyclones and land slides etc. The global geological changes are causing major disasters at quick intervals causing colossal damages especially in the developing countries. Although these natural disasters cannot be stopped, the damages due to such disasters can be minimized by awareness, preparedness, mitigation and implementation of schemes through technically qualified and experienced hands as the life safety is the prime responsibility of the state and there is no compromise on the safety of life". It is a matter of fact that there was no national trained and well equipped Search & Rescue team to combat the crisis situation being faced with the collapse of many buildings during the recent earth quake disaster. The Prime Minister of Pakistan, therefore, issued a directive to formulate two core Search & Rescue teams at federal level to combat such situations in future with latest equipment and trained personnel.

Project type –

Submitting organization(s): Civil Defence

Endorsement by authority: Cabinet Division of Pakistan

Background information: In all developed countries, Government Search & Rescue teams, many private agencies and volunteer institutions come forward to provide Search & Rescue in major disasters either independently or in coordination with Government / Semi government departments of the affected countries. However, in Pakistan Search & Rescue teams are not available. The city fire and rescue service Karachi is the only Search & Rescue team available for providing affective Search & Rescue operations with limited equipment.

In case of any major disaster, people may require Search & Rescue from debris of collapsed buildings, marooned by floods, trapped in accidented vehicles, fire related emergencies and other such disasters. Unfortunately, not all first responders are adequately trained or equipped to successfully mitigate and provide Search & Rescue services to the endangered masses in an affective and appropriate manner.

The growth of population, nature of construction, establishment of heavy industries, use of highly inflammable materials, chemicals and hazardous liquids, solids and gases have made Search & Rescue tasks in major disasters more tedious and

indeed challenging. The project would result in considerable savings in the event of a major disaster and assist in protecting the huge investments of the multinational companies in Pakistan.

Primary contact: Director General, Civil Defence, Islamabad-Pakistan. *+92 51 9250367*

Objectives / Expected impact:

The objective of this project is to formulate two core Search & Rescue teams to react in case of any Disaster/Crisis situation with modern technology and skill to carry out following tasks.

i). Save lives by rapid extrication of persons trapped beneath debris or in building damaged by a natural or man made disasters.

ii). Render first aid to rescue persons and transport them to nearest hospitals for further treatment.

iii). Ensure evacuation of damaged buildings/structures including demolition of damaged structures to avoid further loss of life and properties.

iv). Assist in restoration of essential traffic so as to carry out rescue work without any hindrance or obstruction.

v). Assist in debris clearance and restoration of essential services to the affected buildings.

vi). Search or defuse unexploded bombs in the affected areas.

vii). To provide quick and effective research and rescue coverage, protection and operation in case of any disaster.

viii). To recruit/induct operational staff for Search & Rescue teams with required specialized skills of search and rescue.

ix). To build public confidence by introduction of more effective measures for their protection and ensure adoption of requisite preventive measures by the community.

x). To enhance the capabilities of the existing Search & Rescue teams of Pakistan.

Cost Breakdown of Different Sections of Search & Rescue Teams.

A. Mobile Rescue Section

Cost of Equipment	US$ 0.22 Million/Section
Cost of Rescue Vehicle:	US$ 0.05 Million/Vehicle
Total Cost of One Mobile Rescue Section:	US$ 0.27 Million
Mobile Rescue Section Required:	Two Sections
Total Cost of Equipment + Vehicles	≈ US$ 0.55 Million

B. Mobile Medical Section:

Cost of Equipment	US$ 0.15 Million/Section
Cost of Medical Vehicle:	US$ 0.05 Million/Vehicle
Total Cost of One Medical Section:	US$ 0.2 Million
Mobile Medical Section Required:	Two Sections
Total cost of Equipment + Vehicles:	US$ 0.4 Million

C. Mobile Technical Section

Cost of Equipment	US$ 0.15 Million/Section
Cost of Technical Vehicle:	US$ 0.05 Million/Vehicle
Total Cost for One Mobile Technical Section:	US$ 0.2 Million
Mobile Technical Section Required:	Two Sections
Total cost of Equipment + Vehicles:	US$ 0.4 Million

D. Mobile Communication Section:

Cost of Equipment	US$ 1.5 Million/Section
Cost of Communication Vehicle:	US$ 0.05 Million/Vehicle
Total Cost of One Mobile Communication Section:	US$ 1.5 Million
Mobile Communication Section Required:	Two Sections
Total Cost of Equipment + Vehicles:	US$ 3.0 Million

E. Mobile Logistic Section:

Cost of Equipment as per list attached Annexure-A	US$ 1.5 Million/Section
Cost of Logistic Vehicle:	US$ 0.05 Million/Vehicle
Total Cost for One Mobile Logistic Section:	US$ 1.5 Million
Mobile Logistic Section Required:	Two Sections
Total Cost of Equipment + Vehicles:	US$ 3.0 Million

F. Mobile Planning Section:

Cost of Equipment	US$ 0.025 Million/Section
Cost of Planning Vehicle:	US$ 0.05 Million/Vehicle
Total Cost for One Mobile Planning Section:	US$ 0.075 Million
Mobile Planning Section Required:	Two Sections
Total Cost of Equipment + Jeeps	US$ 0.15 Million

Grand Total: **US$ 7.5 Million.**

List of Requisite equipment for search & Rescue Teams.

- Human sound detectors
- Destructive structure Detectors
- Rescue Hydraulic Devices
- Rescue Tripod
- Inflammable (explosive) Gas Dector
- Electroscope
- Rosen Bauer Generator 40 KV
- Portable floodlight with 90 watt and 30 watt
- Head Searchlight 12-24 volt, complete with charging unit
- Fireman/Rescue Suits
- Chemical protective suit (HAZMAT Suit)
- Automatic Fire Escape
- Rescue rope 40 meter tensile strength 25000 Kgs
- Rescue bell made of polyester 70mm wide and 1300m long
- Pillars 8 inch size
- Steel saw adjustable form 8 to 12 inches + Saw Blade
- Neoprene plug + Wood plug
- Lockable pliers 10 inches size
- Hacksaw
- Pick head file axe
- Belt cutter V shape blade
- Set of flat screw drivers
- Set of Philips head screw drivers
- Universal rescue tool
- Multipurpose rescue tool
- Crash Axe 6 lbs size
- Pick head axe 6 lbs size
- Cable Cutter 24 inches size
- Bolt Cutter 14 inches size
- Live wire Cutter
- Door Opener
- Crow bar
- Sledge Hammer 8 lbs size
- Pike pole
- Portable Resuscitator
- Escape Hood with bag pack
- Collapsible stretcher
- Inflatable splints-complete set
- Neck splints made of polyethylene plastic
- First Response kit of 24 pieces of equipment with bag
- Flame resistant blanket welled with non flammable liquid
- Complete (60 pieces) of Bandages for burn injured
- Heat resistant blanket coated with Aluminize

- Rescue Boat
- Portable Pump with 4” suction Intel and pressure outlet each 2 ½ 1300 LPM at 10 bar with suitable capacity Engine
- Fire extinguisher dry power
- Fire extinguisher CO2
- Hydraulic power unit (Lukas Brand)
- Hand pump
- Hydraulic cutter (Lukas Brand)
- Hydraulic Spreader (Lukas Brand)
- Hydraulic Rescue Cylinder (Lukas Brand)
- Hose reel for hydraulic able (Lukas Brand)
- Lifting jack 10 ton
- High pressure rescue air pillow with equipment
- Air pillow 35x35 cms size lifting capacity 9000Kg
- Air pillow 30x50 cms size lifting capacity 12000 Kg
- Air pillow 50x60 cms size lifting capacity 24000 Kgs
- Dual controller with dead-man control valve
- Pressure reducer using with pressure 00/300 bar
- Air line 5m length with joint
- Air Cylinder 6L 300 bar
- Low pressure rescue air pillow with equipment
    - ☐ Air Cylinder pillow 90 cms dia
    - ☐ Dual controller with dead-man demand valve
    - ☐ Pressure reducer using with pressure 200/300 bar
    - ☐ Airline 5 m length with joint
    - ☐ Air cylinder 6L 300 bar
- Set of sealing bags for leaking
    - ☐ Air pillow 60x30 cms size c/m 4 steel rings
    - ☐ Air pump pedal type with safe valve
    - ☐ Air line 10m length c/w joint
    - ☐ Polyester belt 5 cms width 2m length, tensile strength 4000 Kgs c/w tension adjuster
    - ☐ Polyester belt 5cms width 2m length tensile strength 4000 Kgs c/w tension adjuster
    - ☐ Leak sealing plate 60x30x3 cm
    - ☐ Leak sealing plate 100x30x3 cm
    - ☐ Acid resistant pillow case

- Multipurpose power tool driven with 2 cycle, air cooled petrol engine
  - ☐ Drill rod + Moil point + Wedge + Chisel + Asphalt Chisel + Tamper + Spade
- Multipurpose saw for cutting concrete steel bolts and pipes etc
  - ☐ Blades for metal & concrete cutting
  - ☐ Turbo ventilator capacity 34000 cubic meter per hour powered by 5.5
- HP, 4 stroke petrol engine
  - ☐ Portable winch powered by 4 stroke petrol engine pulling capacity 1600 Kgs c/w equipment
  - ☐ Wire rope 10 mms dia. 30 m length 8-leg anchor with hook sling
  - ☐ Breathing apparatus: automatic positive pressure type c/w mask demand valve pressure reducer, carbon composite back supporter, air cylinder 6L bar, safety goggle
  - ☐ Traffic cone
  - ☐ Red or Orange flags 20m length
  - ☐ Multipurpose fire ladder 45 feet
  - ☐ Hook ladder + Glass Pinch
  - ☐ Confined Space Nut Cutter
  - ☐ Baby Grinder + Baby Cutter
  - ☐ Foot Blower with 100 feet air pipe
  - ☐ Tripod with Carder/Harness
  - ☐ Helmets with protective torches
  - ☐ Hands Gloves Leather
  - ☐ Plastic bags (large size)
  - ☐ Air Fresher
  - ☐ Disaster Flame Cutting Unit
  - ☐ Acetylene cutting unit
  - ☐ Full face mask with multipurpose cartridge.
  - ☐ Metal Tow Rod & Chain Break down facility
  - ☐ Ram Jacks (complete set)
  - ☐ Mega Phone/ Public Address System
  - ☐ Binocular
  - ☐ Lighting Tower

Geographic coverage: **Pakistan**
Geographic details: –
Project duration: 12 months
Requested funds: USD 7.5 Million
Additional Funding Information: The Federal Government of Pakistan
Final grade:

8.9 Target Objective 7: Intermediate and long-term plan developed for an end-to-end system with components' cost to develop and operate a sustainable tsunami warning and response system.

Support agency: The World Bank (WB)

8.9.1 Short description of the capacity:

National Plan for Tsunami Warning and Response System outlines the objectives and strategies for a sustainable tsunami warning and response system. The Plan, following a multi-hazard approach, integrates policy and management issues and includes all requirements of an end-to-end system including instrumentation requirements, communication infrastructure, emergency preparedness and response, contingency planning, risk assessments, and preparedness, awareness and education, and training and capacity building programs. The Plan provides for benchmarking of the status of early warning and response systems, intermediate and long term goals, implementation strategies, financial arrangements and indicators to measure the progress in the implementation of the plan.

8.9.2 Main tasks required:

Based on its expertise in design and implementation of large community-driven development programs and critical infrastructure projects including strengthening of hydro meteorological services in client countries, development of intermediate and long-term plan for tsunami warning and response systems will require the following steps:

- Undertake detailed scientific assessment of existing tsunami warning and response system and identify the gaps in policy, legal and organization framework;
- Requirements for improvements in seismic and sea-level instrumentation and network development, data transmission and archiving, data reduction and analysis methodologies for monitoring, detection, and evaluation for tsunamigenic potential;
- Identify needs for training, software and hardware for surge modelling to develop inundation maps;
- Undertake vulnerability and risk mapping for tsunami hazard prone areas;
- Technology transfer and capacity building for operating the system;
- Assessment of disaster management system and critical infrastructure;
- Developing tsunami response plans including establishment of command, control and coordination, incident management teams, standard operating procedures;
- Developing tsunami warning protocols and warning dissemination mechanism from national to local levels;
- Develop an intermediate and long term plan to develop and operate a robust tsunami warning and response system;
- Develop financing strategy for funding the plan and its implementation;

Project for this objective would also be developed in Phase-II of the National Plan.

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