

Annex 15 - Disaster Management for Vulnerability Reduction

Executive Summary

The tsunami that hit Maldives on 26th December once again demonstrated the vulnerability of the small island nation. Earlier the primary vulnerability resulted from the climate change factors that could cause rise in sea levels and inundate the low lands. Exposure to storms, droughts, heavy rains and high waves caused by cyclones in the South Indian Ocean were also a hazard that the country experienced several times in the past. The disaster risk scenario can be described as moderate in general when considering the hazard pattern. However if one takes into account the topography of the country and their socio-economic patterns, the vulnerability becomes obvious.

1. Vulnerability profile :

The factors that contribute to the vulnerability of country to hazards are its demographic dispersion as well as its geophysical characteristics; The 1,190 islands that make up the republic are grouped into 26 atolls that together form a chain of 820 km in length , set in an area of more than 90,000 km² of the Indian ocean. 199 of the islands are inhabited. All are very small. Only 33 inhabited islands have a land area of more than 1 km² and no fewer than 67 islands- one third of the total- have less than 500 inhabitants, while 144 islands- 70 % of the total- have less than 1,000 inhabitants.

Another factor is the very small size of islands (on average 16 hectares) and their flatness with very low elevation of 1.5 m above the sea level. 88 inhabited islands face perennial beach erosion . There is on-going damage to the ecosystems (coral reef), land loss and beach erosion due to sea level rise, changes in air and sea surface temperatures and changes in rainfall patterns. The remoteness and inaccessibility of the islands present a challenge in delivery of basic services and high diseconomies of scale. High dependence on imports even for essential items further compounds the vulnerability.

The predominant dependence of the country's economy is primarily on two sources, upon tourism and fisheries sectors. It enhances the vulnerability of economy and community from sea-related hazards. Lack of diversified economic base, because of lack of natural resources such as minerals and fresh water and other resources such as physical space and labor, limits income opportunities from industry and agriculture., Yet dependence on agriculture is high and in inhabited islands 75% of the land is used for some agriculture activity. 941 uninhabited islands are leased out through the traditional leasing system for developmental activities including agriculture The total agricultural production is estimated 35,821 tons in 2003, and shared 2.6% of Gross Domestic Product. There are other occupation categories who are mostly self employed. They are skilled labor like the carpenters, masons, electricians, skilled craftsmen who are mainly dependent on local economy and limited market demand for their livelihood .

These socio economic variables associated with individual hazards gives a more complete picture of the vulnerability of the Maldives.

2. Impact of the Tsunami

The Indian OceanTsunami of December 26th 2004 traveled at over 700 kilometers an hour reaching Maldives at 9:20 AM, which is about 3 hours after tremors were felt. Tidal waves ranging from 4 to 14 feet were reported in all parts of the country. The force of the waves caused widespread infrastructure devastation in the atolls. Flooding caused by the tsunami wiped out electricity on many islands destroying communication links with most atolls. There were 83 confirmed deaths and 25 are missing and feared dead. Over 1300 people suffered injuries. Even though less than 100 lives were lost, Maldives is one of the worst affected countries. Thirty nine islands were damaged and nearly a third of Maldives 290,000 people were affected through the loss of or damage to homes, livelihoods

and local infrastructure. The impact on national economy mostly supported by tourism, fishery and agriculture sectors is substantive. Twenty islands - about a tenth of the inhabited islands of the country - have been largely devastated and fourteen islands had to be evacuated. 188 islands had no communications for the first ten hours and four islands have no direct communication up to now. Initially 29,577 people were either displaced or homeless accounting for over 10% of the population. Currently 6,681 people are homeless on their own island and 5,801 have been (temporarily) relocated to other islands, making the total of displaced or homeless 12,482... Water supply was disrupted in about 15% of the islands and 25% had major damage to essential infrastructure such as jetties and harbors that link these islands with Male. Electric supplies in many affected islands are yet to be restored.

There has been considerable environmental damage. Based on the preliminary assessment work, the following main environmental issues arising from this current disaster have been identified:

- **Disaster waste:** vegetation, re-distributed domestic and hazardous waste, drums, large amounts of demolition waste have been spread over the impacted islands.
- **Groundwater contamination:** shallow freshwater aquifers impacted by infiltrated flood water, oil spillage from generator stores and leaks from septic tanks.
- **Coral reef damage:** potential damage caused by direct wave impact as well as secondary damage from sedimentation and excessive amounts of debris.
- **Coastal damage:** extensive beach erosion and damage to coastal protection measures
- **Beach, soil, vegetation and crop damage:** extensive washing-off of soils, stress and dieback noted in certain species from direct impacts as well as possible salt contamination

Maldives has been generally lucky in terms of natural disaster and is not affected by cyclones which often hit other areas of the Indian Ocean and as a consequence, it has focused on what it saw as its main risk – global warming and consequent rising sea-levels. Despite the moderate hazard risks in general, the vulnerability of the country is quite high due to its special characteristics. While Tsunami are infrequent events, they are extremely destructive as demonstrated by the current tsunami disaster. There may be false sense of security regarding the hazard because of the low probability of occurrence but it is pertinent to address it in order to avoid current scale of losses and damage in future.

3. Institutional Structures: A Committee on Natural Disasters existed in the country. However, subsequently it was merged in the National Commission for Protection of the Environment (NCPE). The decision could be interpreted as a reduction in the priority given to disaster management. The Ministry of Environment & Construction is recognized as the nodal department for environment related matters. However in the event of a natural disaster, the Ministry of Home Affairs takes charge. Following the tsunami, the Government of Maldives acted swiftly and set up a Ministerial Committee and Task Force. A National Disaster Management Center was established to facilitate response and coordination. The Ministry of Defense, Ministry of Finance and the Ministry of Planning and Development lead the emergency response and relief efforts in collaboration with other Departments, UN agencies and other development partners. . The Center has been the focal point for all response, relief and recovery activities. The functions of the National Disaster Management Center in the long term reconstruction and rehabilitation process is to be yet finalized.

4. Methodology

In order to analyze the existing disaster management system, the response to current Tsunami disaster and to identify the strengths, gaps and needs for developing a post disaster recovery and disaster risk management program the team mainly used three methods; i) review of relevant documents and reports ii) meetings with various departments and ministries, iii) consultations with the UNDP, UNDAC mission and selected members of the WB and ADB teams and iv) site visit.

4a. Review of reports and documents

The team consulted a number of government and UN documents and studies. Reports on sectoral damage and recovery needs were also reviewed on Health and Infrastructure damage and loss. Some important documents consulted include: Disaster Preparedness and Mitigation in the Republic of Maldives, ADB, 1993, UN's country and regional Flash Appeals, The State of the Environment 2002/2004, First National Communication of the Republic of Maldives to the United Nations Framework on Climate Change, United Nations Development Assistance Framework for Maldives, Health sector report on Tsunami Emergency Mission and Report by the Infrastructure Sector. In addition internet based review was done to analyze various governmental documents with regards to disaster risk management.

4b. Meetings and consultations

The team held meetings with the Ministry of Environment and Construction, Ministry of Atolls Development, Team on infrastructure sector assessment, Meteorology department, UNDAC, UNDP, World Bank, ADB. The team visited the National Disaster Management Center and had discussion with a range of agencies involved in disaster response.

4c. Field Visit

The team visited Kashidho Island in Kaafu atoll in order to assess the extent of damage and government's response to the tsunami disaster. Meetings with atoll chief, island chief and community members were held and damage to housing, agriculture and infrastructure sectors was observed.

5. Scope of the assessment

This assessment proposes a number of initiatives for integrating disaster risk reduction in the recovery programs. They include mainstreaming disaster risk reduction into all recovery programs, establishment of institutional and legal systems, regional cooperation for early warning system in close partnership with India and Sri Lanka, vulnerability assessment for key sectors (tourism and fisheries) and infrastructure, preparedness planning and safer area development, implementation of mitigation programs in selected islands and sectors.

6. Disaster Risk Management Strategy

Overall Comments : There are three major disaster risks to be addressed. One is climate change factors, the other is storm surge and the third is tsunami. With the overall objective remaining as sustainable development & disaster risk reduction, strategies and programs to address the specific disaster risks need to be developed. It is also important to keep in mind that normal development process aimed at social and economic improvement can significantly generate new disaster risks. The concentration of population on Male already home to 86.000 people or more than a quarter of the population, is of specific concern, All major development programs and projects need to be reviewed for their potential to reduce or aggravate vulnerability and hazard. It is in this context that the Focus Island concept and the Population consolidation strategy may have to be modified to build in better disaster prevention measures. To achieve this, a more integrated approach and collaboration between various government departments responsible for land use planning, environmental planning, and development planning is necessary. Putting in place an institutional mechanism for emergency response and disaster management is as important as decentralized planning for reducing risks through community & civil society participation. Appropriate legislation for setting standards such as building codes, defining roles and responsibilities for key actors and allocation of resources for mitigation measures would contribute significantly to mainstreaming disaster risk in development planning.

Proposed strategy for DRM strengthening and vulnerability reduction

Key strategic considerations for sustainable DRM programming in Maldives

- The definition of a DRM strategy would benefit from a good understanding of the risk. The main risk is associated with climate change and will entail sea level rise and potential for increased climate events such as flooding and storms.
- Linking disaster risk reduction with Focus Island Policy of the Government. The government's policy in this regard aims to create a regional Development program based upon the a Regional Focus Island concept. This will include the creation of regional growth poles based on investment on social and economic infrastructure on selected Islands. This strategy should include the concept of Safe Islands which covers structural mitigation and protective measures to create disaster safer living environment. In pursuing this strategy, pull incentives based upon the provision of economic opportunities, social amenities, safer housing, should be focused upon those living in high risk islands/atolls to encourage them to move to Safer Atolls. Parameters for safe islands could be developed through technical expertise from geologists based on underground stability and surface conditions. Technical experts would provide guidelines for assessments, based on a program of field observations and measurements on selected islands regarding the geological profiling, underground stability and surface conditions. These guidelines would include exclusion criteria, positive – negative criteria, definition of a “geological island safety scale/range and an evaluation matrix, which can be use in the vulnerable assessment process for future planning and development of islands. Part of these guidelines will contain recommendation to undertake future monitoring, if needed, in respect to relevant long term impacts to the island's underground stability due to the sea level change/ increased evaporation associated with global warming
- Strong linkages must be developed between the efforts on adaptation to climate change and the risk of natural hazards. Many hazards experienced by Maldives are related to sea. The projected sea level rise may result in enhancing the severity of some hazards and their impact. Thus, any efforts focused only upon natural hazard mitigation might not prove very fruitful in the absence of linkages with climate change impact reduction.
- The Maldivian economy is predominantly dependent upon tourism and fisheries sectors. Therefore, vulnerability reduction in these two sectors must be the focus of any efforts aimed at sustainable economic and social development and diversification of economy.
- Inter-atoll and Inter-island emergency response capacity building should be another key element for disaster preparedness in Maldives. The total dependence of Atolls and Islands upon the central government for disaster response can aggravate post-disaster problems, in case the central government functions were disrupted due to any simultaneously occurring incident.
- Community Empowerment will be another key principle to be considered, given the limited human, technological and economic resources of the country. Prepared and organized communities can take better actions for their safety.

The Approach and Priorities. The approach to management of disasters in the Maldives would need a preliminary vulnerability assessment of the risks and then would be developed on two levels. They are as follows :

- Strengthening the Institutional and Legal Systems (ILS) for disaster risk management
- Multi hazard disaster preparedness planning and mitigation activities including training and capacity building

The objective is to design a strategy in direct relation with the level of vulnerability, and risk frequency. Tsunami is a rare event and designing a DRM for tsunami risk is simply not cost effective. The strategy should therefore be designed on the basis of the vulnerability assessment. Thus, the proposal below is presented in a comprehensive format but should be adapted according to the results

6a. Strengthening the Institutional and Legal Systems (ILS) for disaster risk management

It would be advisable that the Task Force and the National Disaster Management Center (NDMC) continue as an institution to address disaster management program in the country. To start with, the National Disaster Management center would focus on ensuring that in the reconstruction process, risks are not rebuilt. That there is quality check on all structures being reconstructed or repaired and there is equitable and focused coverage in delivery of rehabilitation packages. It would also ensure transparency and accountability in the management and distribution of relief items and reconstruction support. It would also help in developing guiding principles for recovery and reconstruction in key sectors such as housing and restoration of all critical infrastructures which has a strong implication in vulnerability and risk profile. The task force would coordinate reconstruction and rehabilitation strategy of the other partners and donors. To support the functions of the National Disaster Management Center in the Atolls and islands, similar management arrangements with representation of all the relevant stakeholders can be made.

As the functions of reconstruction phase out, the National Disaster Management Center could look at developing a national policy for disaster management which clearly spells out roles and responsibilities of various ministries for management of disaster. The policy should provide legal instruments for enforcing land use planning, building codes and bye-laws and investment in mitigation measures. A creation of National Disaster Management Authority would be more appropriate to retain the focus on disaster management.

6b. Multi hazard disaster response and preparedness planning and mitigation activities including training and capacity building

There are several components under this thematic priority and possibly planning and implementation would likely go on for several years to reach a level of reduced vulnerability. The components that are included for multi hazard response are as follows

Establishment of an Early Warning System: the key to containing damages in the event of a disaster is to have an access to information about the probability of a hazard and the extent of damage it would create if it occurred. It is desirable for the country to participate in the regional warning systems. However, setting up a warning system only for tsunamis is not cost effective for this region. A better idea would be one multi-hazard system that includes floods, storms and droughts along with the rarer events. This would not only require technical and sophisticated warning systems but an equally established national action plan that could decide on evacuation procedures if required. While the development of a proposed Indian Ocean Tsunami Warning system would take 3-5 years, a national warning system linked with storm surge (high wave) alert should be established. An interim (based on available capacities) arrangement should be set up in the Meteorological Department linked to the warning systems of neighboring countries, particularly India and Sri Lanka. The capacities of the Meteorological Department and its linkages and working relationship with other counterpart agencies, and regional and national organizations should be enhanced. Earlier reports in 1993 note the existence of a wave monitoring program at the then Ministry of Public Works and Labor. Further research would be required to identify the current status of that program and its potential for upgrading. The participation of Meteorological Department officials in regional planning and consultation meetings will facilitate the strengthening of early warning system. The hosting of a regional meeting on EWS in Male can help in establishing contacts and working relationships with counterpart agencies. In the medium to long-term (2-5 years), a more sophisticated national system has to be set up and integrated with the proposed Indian Ocean Tsunami EWS.

Emergency Response

The enhancement of emergency response capacity for future would require preparedness planning for all hazards at national, atoll and island levels (both inhabited and resort Islands) and development of safer areas on each inhabited island. It will be based on the review of and linkages with existing sectoral contingency plans; e.g. aircraft crash/oil spill control, mass casualty management and fire services. This will require designation of a room within the Atoll or Island office that would be

equipped with failsafe communications and State of the art emergency response kits & facilities. In the event of a disaster, the Atoll /island would activate the warning systems and carry out steps for response & relief as per Standard Operating Procedures (SOP). In addition to this, the enhancement of emergency response capacity at the national level may require emergency equipments to be defined. The capacity for provision of inter-island and inter-atoll support for disaster response should also be developed, so that atolls are not totally dependent upon central government. This will include strengthening communication and transportation systems amongst the atolls, developing human resources for search and rescue, medical aid, evacuation, relief supply storage or warehousing and emergency shelters at the atoll levels

Preparedness Planning

A pilot program will be undertaken on preparedness planning in few atolls within the first 6 months. Atolls will be selected from the northern atolls, affected by the 2004 Tsunami or the 1991 High Wave and the others from the south. Preparedness plans will also be developed and implemented in at least 10 islands. These islands will be selected from at least 3 atolls, one from each type of island category; capital, primary, focus and growth pole and resort. Training for officials, fisher associations, women committees and youth groups on various aspects of disaster risk management will be an integral component. Community level volunteer Disaster Preparedness and Response Teams (DPR) will be developed to act as operational arm of the DRM Task Force to disseminate early warning, and organize first response and relief operation. The most effective responders to the current tsunami and organizers of relief efforts should become the fertile base and role models. The island DPR teams should draw on fisherman's association, youth association, sports groups, faith based organizations, and national cadet corps.

Safe Area Development

The development of "Early Warning System" must be complemented by community systems for protective action (emergency shelter, high ground) after receipt of alert warning. This is especially important in the context of the geophysical characteristics of Maldives. Due to the small size of the islands and flatness of land, people don't have many options for evacuation or fleeing upon receipt of warning. Therefore, the need for establishing emergency shelters or high grounds is critical. This will include construction of dual purpose Emergency Shelter cum Community building, or adaptation of existing buildings. It will be worthwhile to explore the potential for elevating the overall floor level of designated areas by 2-3 meters to reduce risks from sea level rise.

7. Vulnerability Assessment for Preparedness, Mitigation Planning and Risk Analysis

Conduct of a vulnerability assessment will be important from various aspects. A community based assessment through island level task forces can strengthen preparedness planning. A national process can help assess mitigation options, identify and locate new assets/infrastructure. It can also be used as input to finalize the population consolidation policy through Focus Island strategy. This Vulnerability Assessment process should be linked with vulnerability assessment of ecosystems and natural resources serving as natural protection; e.g. vulnerability assessment of coral reef with specific reference to long term implications of 1998 damage through bleaching of coral reefs.

8. Other Disaster Risk Management Programming

It is essential that a Disaster Risk Management Program is developed and implemented on a priority basis in order to develop the capacity of Maldivian government and society to reduce the future disaster risks and sustain its development gains. Key elements of such program would include: Enhancing hazard-resilience of lifelines and infrastructure; e.g. markets, hospitals, airports, water-supply and sanitation infrastructure and Jetties, storm risk assessment, preparedness and mitigation in northern atolls, and drought mitigation program including improved rainwater harvesting systems through improved run-off collection, enhanced storage and retention capacity and orientation building on hygiene and rainwater harvesting and management. This disaster risk management program must be closely synergized with the National Plans for Environmental Management (NEAP) and Climate Change Adaptation (NAPA).

9. Risk Transfer

Considering the small size of the Maldivian economy, it would be worth while for the government and private sector agencies to explore and develop mechanisms for risk transfer of any future disaster impact, particularly for the tourism industry. Normally risk transfer mechanisms include insurance and reinsurance. Maldivian government can explore the opportunities through building linkages and partnerships with the public and private sector in neighboring countries like India, Thailand and Sri Lanka.

10. Mainstreaming DRM into Development Policy, Planning and Implementation

In order to ensure sustainability in development gains the integration of disaster risk considerations into atoll and island development planning processes would be required. This would mean considering disaster risks as a factor while making decisions on consolidation of safer islands and population relocation through pull factors. The government's policy in this regard aims to create a regional development program based upon the Regional Focus Island program. This will include the creation of regional growth poles based on investment on social and economic infrastructure on selected Islands . This strategy should include the concept of Safe Islands which include structural mitigation and protective measures to create disaster safe living environment. In pursuing this strategy, pull incentives based upon the provision of economic opportunities, social amenities, safer housing, should be focused upon those living in high risk islands/atolls to encourage them to move to Safer Atolls. Such Islands and atolls can be identified on the basis of an analysis of the past disaster events and the vulnerability assessment. Mainstreaming efforts will also involve review of the status of enactment of building code and implementation of building regulations in Male, the need for development control regulations and integrated coastal zone management regulations. A review of the regional "1993 position paper on Urban and Regional Development" prepared by the office of the Maldives Physical Planning and Design will be conducted from the perspective of risk considerations.

11. Enhancing Disaster Resilience of tourism, fisheries and key infrastructure

Considering the predominant dependence of Maldivian economy and society on tourism and fisheries sectors, it is pertinent that disaster resilience of these two sectors is enhanced. Private and public sector agencies like Banyan Tree in Maldives are already promoting the concept of green and clean tourism. There is a need to link the concept of Safe Tourism into the existing Green and Clean Tourism approach. A review of the disaster resilience of key infrastructure and structural mitigation measures; e.g. the suitability, location, design standards and quality of construction of sea protection measures can guide making better choices.

12. Regional Cooperation

Maldives has been relatively isolated in the area of disaster risk management. It needs to involve in and build partnerships and linkages with other countries and regional and international agencies. This will include strengthening the existing linkages and getting new memberships in various bodies; e.g. the Regional Consultative Committee of ADPC, linkage building with Indian and Sri Lankan Meteorological Departments and other agencies, BIMSTEC, SAARC, ASEAN, Participation in and follow up on World Conference on Disaster Reduction (WCDR). Maldives has played an active role in the past at the SAARC forum through taking leadership to revise the 1992 SAARC study on disaster management, and pushing for a special session on disaster risk management at the forthcoming SAARC summit. The development and strengthening of regional cooperation is also important in order to learn lessons on recovery and DRM programming efforts in all tsunami affected countries.

E. Proposed phasing of strategy

14. Phase 1: short term (6 months; Jan - June 2005)

National Lessons Learnt Workshop on Tsunami disaster, Consultation with recovery task force on following higher standards of resiliency, Training on damage and loss assessment and recovery planning, Adaptation of DesInventar as recovery management information system and development of disaster database, Review and consultation among NDMC and MoE on NEAP/NAPA linkages

with DRM program, Policy level consultations on formation of national disaster management authority, Staffing of the NDMC, Review of the wave monitoring system of 1993, Purchase of EWS equipment for Meteorological Department, Participation of the Maldives on planning process for Indian Ocean Warning System, Pilot Preparedness Program in two atolls and 10 islands, community based vulnerability assessment in two atolls and 10 Islands, Community mobilization training for DP, Review of atoll development plans.

15. Phase 2: medium term (3 Years/July 2005 -December 2007)

Strengthening the drought rainwater harvesting infrastructure and technology, Equipment and space for the NDMC, Training of DRM authority staff, Regional meeting on EWS in Male, Participation of Meteorological officials in selected regional meetings on EWS, Review of sectoral preparedness plans and formation of national plan, Training in selected atolls and Islands, Purchase of emergency equipment etc, National Study on Vulnerability assessment for key infrastructure and on population consolidation, Risk based analysis of 1993 Urban and Regional Development paper, Identification of vulnerable atolls for MDRM, Risk assessment in tourism and fisheries sectors in 5 atolls, Consultation and planning with tourism and fisheries authorities on mainstreaming risk management, Study on disaster resiliency of key infrastructure; e.g. sea walls, Participation of government officials in RCC of ADPC.

16. Phase 3: long term (5 year/ Jan 2008- December 2009)

Community training on rainwater harvesting system management, Training of DRM authority staff, Training at national level on DP, Structural measures in pilot atolls and Islands, strengthening the rainwater harvesting infrastructure, Assessment of coral reef vulnerability in relation to the damage done by 1998 ENSO, Consultation with atoll authorities on DRM, Pilot implementation of MDRM measures in five atolls, Participation of government officials in international bodies.

G. Preliminary costs of all phases (in millions USD)

Disaster Risk Management Activities	Short-term (6 months)	Medium term 2.5 years	Long Term (3+ years)	Total 5 years
Programming	0.1	0.2	pm	0.3 million
Strengthening the institutional and legal system	0.1	0.2	pm	0.3 million
Early Warning System	0.3	0.5	0.3	1.1 million
Preparedness Planning (emergency plan and training)	0.2	1.0	0.5	1.7 million
Vulnerability assessment	-	0.5	0.2	0.7 million
Disaster Reduction in Tourism, Fisheries and key infrastructure sectors	-	1.2	0.4	1.6 million
Regional Cooperation	pm	0.1	0.1	0.2 million
TOTAL	0.7	3.7	1.5	5.9 million