Challenges and issues for implementation of multi-hazard Early Warning Systems for integrated risk reduction in developing and least developed countries

Natural disasters are not uniformly distributed around the globe. A study conducted by the Earth Institute at Columbia University revealed that there are disaster hotspots (see http://www.earth.columbia.edu/news/2004/story10-29-04.html) whose distribution is well correlated with developing and least developed countries, particularly with respect to the occurrence of hydrometeorological disasters such as droughts, tropical cyclones and floods.

Despite many international initiatives on disaster risk management and advances in scientific knowledge and applications, the social and economic impacts of these disasters in developing and least developed countries are growing, due to the fact that their economies are unable to absorb the shocks caused by disasters, inabilities of these countries to effectively implement multi-hazard early warning systems for integrated risk reduction, but also due to increasing vulnerability of exposed populations aggravated by poverty, environmental degradation, population growth and displacement, urban growth, conflict and weak institutional capacities. A good example was the flood of the year 2000 in Mozambique that caused damage estimated at US $ 450,000,000.00, which lead to a reduction from 10% to 2% in annual GDP growth.

Despite this sobering realization, actions can be taken to considerably reduce the loss of life and socio-economic damage caused by natural hazards through developing and implementing multi-hazard early warning systems as integral part of disaster risk management activities that require the contribution and coordination of a wide range of actors, each with a set of functions and responsibilities for which they should be responsible and accountable for. Multi-hazard early warning systems as part of integrated risk reduction strategies would support not only safety of life but also help protect livelihoods and hard-won national development gains.

To be effective early warning systems must be people centered and must integrate the following four inter-related elements underpinned by effective governance and institutional arrangements, involvement of all stakeholders including local communities, consideration of people's interests, needs and values in a multi-hazard approach: (a) risk knowledge; (b) technical monitoring and warning services; (c) communication and dissemination of warnings and; (d) community response. As recognized by many, failure in one of the elements can result in failure of the whole early warning system.

In developing and least developed countries there remain many challenges on legislative, policy, financial, organizational, technical, operational, training and capacity building aspects to be addressed with a view to ensure that early warning systems are implemented as an integral part of disasters risk reduction strategies within a multi-hazard framework.

Challenges and issues

Risk identification and knowledge

Risk assessment is a recent practice in disaster risk reduction which is carried out mostly on *ad hoc* basis in many developing and least developed countries. Risk assessments have predominantly been concerned with hazards for which there are relatively good data bases and expertise (e.g. frequency and severity of hydrometeorological events).

Often national capabilities for generating knowledge on risks are determined by countries' capabilities in science, technology, availability and sustainability of observation networks and research, which are generally limited in developing and least developed countries. Major challenges in this respect are:

- Data gaps, characterized by poor availability and inconsistencies in the historical records as a result of eroding observation networks;
- Ability to access, share and effectively use available data to generate risk information and knowledge;
- Methodologies for systematic and standardized risk assessment;

- Research to further the knowledge of natural hazards and their changing patterns;
- Training, capacity building and technological transfer for risk assessment, vulnerability assessment and hazard mapping;
- Involvements of those at risk in the identification of risks and their continuous update;
- Definition of roles and responsibilities of different actors in risk assessments.

Integration of risk information and early warnings in emergency preparedness, planning and response

Emergency preparedness, planning and response is recognized as one of the weakest links of the elements of an effective early warning system.

Hazard information has been, in most cases, the guiding element for preparedness, planning, and response activities. The challenge is to mainstream risk assessment results and early warnings in preparedness, planning and response. For this to be realized the following are major challenges:

- Availability of risk assessments for all locations;
- Integration of risk information into early warning messages;
- Priority accorded to integrated risk reduction as part of development processes;
- Political commitment to effectively address disaster risk reduction, through the adoption of appropriate legal, institutional and policy frameworks;
- Planning and coordination.

Technical and operational capabilities for observing, detecting, monitoring, forecasting and warnings of hazards

Observation networks that form the basis of early warning systems are eroding in most developing and least developed countries. Moreover, these countries are not able to take advantage and apply the new systems and tools currently available due to limited human, technical and financial capabilities.

Most countries have hazard monitoring and forecasting systems for the dominant hazards that affect them, but in many cases the warning systems do not cover all hazards and all parts of the national territory. Capacities for monitoring and prediction of hazards vary considerably from one hazard to another and from one country to another. Major challenges include:

- Coverage and sustainability of observation networks;
- Availability of technical capabilities in a sustainable fashion (resources, expertise, operational capabilities);
- Availability of systems for hazards such as flash floods, severe storms;
- Improvement of accuracy and lead times for severe and high impact weather e.g. storms and flash floods;
- Ability to access, share and use effectively data, information and products from various sources;
- Use of advanced methods and techniques such as NWP and ensemble forecasting techniques;
- Use of satellite data;
- Training, capacity building and technological transfer;
- Methodologies, standards and protocols;
- Issue of site specific, objective and user driven warnings;
- Multi-disciplinary and multi-agency coordination and collaboration at all levels;
- Sharing of expertise between neighboring countries;
- Capabilities of regional centres for supporting technical and institutional capacities at national level.

Communication and dissemination mechanisms

Communication and dissemination is recognized as another weak link among the elements of an effective early warning system. Communication and dissemination of information and warnings must be based on clear protocols and supported by an adequate telecommunication infrastructure that is systematically and regularly tested, evaluated and maintained, in order to be effective. Effective

dissemination and alert mechanisms are required to ensure timely delivery of information and warnings to authorities and people at risk, even in the most remote areas of a country.

In developing and least developed countries there are impediments for effective communication of information that include: prevailing rates of illiteracy; language barriers as a fraction of the population may not be fluent in the official language; isolation of rural communities in remote and non accessible areas or environments; poor coordination between warning providers and the media; poor use of information and communication technologies. Challenges in this respect include:

- Ensuring that warning messages reach all at risk;
- Ensuring redundancy of warning systems;
- Use of information and communication technologies for the communication and dissemination of warnings;
- Recognition of a single authoritative voice for issuing warnings;
- Use of standard terminology nationwide and across national boundaries;
- Clarity and packaging of the warnings;
- Clarity of the roles played by various stakeholders;
- Political will to communicate warnings;
- Education and awareness raising to all stakeholders, at all levels and using all structures to ensure understanding of warnings;
- Integration of traditional knowledge in risk assessments and warning messages;
- Collaboration between warning providers and the media;
- Appropriate coordination among relevant actors.

Governance and organizational issues

Good governance and institutional arrangements support the successful development, implementation and sustainability of effective early warning systems. Good governance is effected by robust and appropriate legal frameworks, supported by political commitment and integrated institutional arrangements. Good governance is also reflected in the decentralization of decision-making to allow participation of local communities assisted by appropriate allocation of resources.

Major challenges include:

- Political commitment to the implementation of integrated risk reduction strategies;
- Government support to long term strategies for integrated risk reduction;
- Appropriate legislation, policies and institutional structures;
- Coordination among various actors;
- Proper definition of roles and responsibilities;
- Integration of risk information and early warnings in national development plans;
- Recognition of links between disaster risk reduction and development;
- Promotion of participatory approaches;
- Enhanced understanding on hazards, risks and how to prepare for hazards and respond to warnings.
- Promotion of alliances and partnerships.

In summary it can be said that while significant progress has been made in many countries on the scientific and technical aspects for monitoring, detecting, warning and communication of information major challenges and gaps exist in developing and least developed countries. Countries often recognize the need for early warning systems for all relevant hazards but many do not posses the technical, institutional, human and financial resources to establish systems that cover all relevant hazards equally. Thus, Implementation of multi-hazard early warning systems for integrated risk reduction in these countries is far from being realized, what requires a redoubling of efforts.