SAARC

Regional Cooperation on Application of Science and Technology for Disaster Risk Reduction and Management in South Asia

Road Map

SAARC Workshop on Application of Science and Technology for Disaster Risk Reduction and Management

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1. Introduction

1.1 In pursuit of implementing DRR strategies as envisaged under Hyogo Framework of Action (HFA) and SAARC Comprehensive Disaster Management Framework, it is necessary that the focus on S&T should receive priority. South South Cooperation that advocates building the knowledge networks not only to share the data/info but also to build the institutional base and expertise for DRR. Such cooperation holds greater relevance in South Asia by virtue of sharing the common risks.

1.2 The SAARC Disaster Management Centre (SDMC), mandated to promote regional cooperation for DRR, envisages putting in place a hierarchical framework facilitating the integration S&T inputs into DRR practices. The work programmes developed at regional level viz., hazard detection/forecasts, knowledge management & networking, Early Warning System (EWS), research, policy advisories etc are to harmonize strengthening the national capacity for S&T towards risk assessment, knowledge networks, people centred EWS, research etc, which in turn would enable better preparedness at community level.

1.3 With the above context, SAARC Workshop on Application of Science and Technology for Disaster Risk Reduction and Management in South Asia held during January 21-22, 2008 at New Delhi wherein the key functionaries of SAARC Member Countries participated, has identified following challenges and suggested a road map to be pursued by SDMC in a time bound manner.

2.0 Key Issues and Challenges

2.1 The criticality of S&T in pursuit of implementing HFA has been recognized in following words *"support the development and sustainability of the infrastructure and scientific, technological, technical and institutional capacities needed to research, observe, analyse, map and where possible forecast natural and related hazards, vulnerabilities and disaster impacts"* [1]. The S&T applications are necessary in all stages of disaster risk reduction, from mapping the hazard and assessing vulnerability, through monitoring and forecasting, through dissemination of a warning in an understandable way to the relevant decision makers and the population, and development of appropriate action plans and EWS. Past experiences in the region exposed to high impact hazard events have shown that attention to the scientific and technical elements of disaster risk reduction efforts including early warning systems must be matched by an equal emphasis on strengthening the national S&T capacity and institutional mechanisms to synerzize global/regional efforts with national/local level preparedness. Further, the integration of S&T applications in DRR is to receive priority at all levels.

2.2 The agenda of S&T in South Asia is primarily driven by the governmental initiatives and there is a considerable gap in overall capacity to harness S&T. It is reflected in the existing trends of S&T investments and status of human capitals in this sector. For example, the gross domestic expenditure on R&D (GERD) has been the lowest in South Asia in comparison to the other parts of the Asian region[2]. The relevant applications drawn from multi-disciplinary sciences for multi-hazard disaster risk reduction need to be encouraged. Looking at some of key S&T applications such as Early Warning System (EWS) – modeling, database management, emergency communication; Risk mapping, assessment and monitoring; climate risk analysis, downscaling of global circulation modeling; it is seen clearly that unless there is an enabling S&T infrastructure in place the DRR will continue to be a constraining effort in South Asia.

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[1] ISDR (2006) *Words in Action: Implementing HFA, Document for Consultation Drat Nov 2006*, International Strategy for Disaster Reduction (ISDR) Geneva.

[2] Investment trends in R&D in Asia, UNESCAP Report, 2005.

2.3 The applications of S&T in the context of DRR have also reflected in terms of setting up the observational networks ensuring the available of real time/near real time data/info on the various aspects of natural disasters. In fact, national meteorological and hydrological services systematically monitor, and provide forecasts and warnings of floods, typhoon/tropical cyclone and drought. Many national meteorological and hydrological services also monitor and advise on climate change and variability. In addition, some of the national services monitor and give warnings on earthquakes and tsunamis by making efforts on the densification of the observational networks. Further, innovations in monitoring, such as through Doppler Weather Radars, automatic weather stations, broadband seismic networking and multi-parameter satellites and computer-based prediction modeling, have steadily improved real time data gathering and warning capabilities; but they are yet to harness fully in South Asia.

2.4 While there have been considerable improvements in densification of the observational networks worldwide, there are considerable gaps in South Asia. As per WMO estimates, an optimal observation network in the tropics calls for surface observations at every 50 sq. kms., upper air observations at 100 sq. kms. and land surface parameters at 25 sq. kms. grids. The vast oceanic regions in the monsoon region have a strong influence on the atmospheric circulation and will thus need extensive observations. The current observation network is inadequate in terms of spatial coverage and representativeness. The tropical region of South Asia with non-linear processes need denser network of observations. What is presently available in South Asia is hardly 20-30 per cent of these requirements. An extremely high-risk region is in-fact poorly populated by the observational networks. These gaps lead to sub-standard disaster warning and forecasts; inappropriate mitigation and preparedness measures on the ground; constrained implementation of risk reduction strategies etc.

2.5 There is a need for substantial augmentation of the present network by using emerging technologies such as Advanced Multi-parametric Satellite Systems from Geo-stationary as well as Polar Platforms, Automatic Weather Stations, GPS Sonde, Wind Profiler,

Rain Radar, Doppler Weather Radars, Meteorological Towers, Agromet Towers etc. The country reports from the South Asia provide evidence of the overall capacity gaps with regards to access and absorption of these technologies, which undermine the ability to generate, disseminate as well as use the data/info. In most of the countries there is a gap between the development of regional and national capacities and also the development of effective local capacities to receive and use real time/near real time data/info and early warning to save lives[3]. Institutionally, filling this gap is a challenging issue. At national level it requires enabling mechanisms to be put into place, and at regional level it requires the will, the recognition and ability to cooperate.

2.6 It is important that the scientific knowledge besides the tools and techniques of science and technology is effectively targeted and communicated towards risk reduction. There is a good science base but scientific knowledge about natural hazards is not always shared. This occurs for several reasons: financial; political, commercial; concerns about how the data will be used; insufficient national capacity or systems to utilise or share data[4]. Sometimes knowledge is not shared and acted upon simply in the absence of credible institutional mechanisms at various levels to share it, especially in the context of South Asia.

2.7 The key challenges emerge from the status as well as the trends of S&T in South Asia could therefore be summarized as follows:

- More effective integration of S&T for Disaster Risk Reduction and Management with the marginal institutional base and investments;

- Creating the enabling mechanisms through regional cooperation harnessing S&T for DRR in variety of areas such sharing of data/info, densifying the observational networks, regional networking, contextual R&D efforts etc;

[3] Disaster Risk Reduction, Global Overview 2007, UN Secretariat
[4] The Role of Science in Physical Natural Hazard Assessment, Report to the UK Govt by the Natural Hazard Working Group, June 2005

- Putting in place a right mix of policies, strategies and programmes at regional level to enhance the national capacities in the region enabling the effective S&T integration in DRR;

- Developing and strengthening close cooperation among S&T agencies of South Asian countries in the rapid exchange of experiences, knowledge and information related DRR by forging links to national, regional and international S&T networks; and

- Conducting essential research and training to gain a better understanding of the precursors of disasters for more effective application of S&T-based early warning systems.

3.0 Key Recommendations: A Road Map

3.1 With the focus on implementing the regional perspectives and taking into account the key issues and challenges as discussed above, the recommendations have been classified into three layers – policies, strategies and programmes at regional as well as national levels. It has been recognized that the related efforts at regional level may lead enhancing not only the regional capacity but also national as well as local capacities and thus facilitates disaster risk reduction and management in South Asia.

Regional Level

[A] Policies

A.1 Harmonizing the data/info sharing policies with regional perspectives

3.2 While there is a distinction between needs at regional, national and local levels, it is important to recognize that building the regional capacity in harmony with national and local requirements for data/info would go a long way to enhance the overall capacity for disaster management in the region. The *complexity* and *specificity* of natural disasters and of the cycles of information and information management associated with each,

notwithstanding their inter-relatedness are important to recognize. The demand for data/info at regional level is not just aggregation of demands at national levels, but it is a closely related and it is therefore necessary to create the necessary linkages through a policy paradigm at regional level.

3.3 The regional perspectives should drive the policies of sharing data/info among the countries of the region. Some of the policy elements with regional perspectives include sharing the data/info along with knowledge, expertise and successful practices having the common:

(i) origins of seismic and landslides hazards;
(ii) coastal and marine risks emanating from tropical cyclone, tsunami, coastal erosion, sea level rise, coastal pollution etc;
(iii) river basins for flood risk reduction and management;
(iv) agro-ecological regions for drought mitigation; and
(v) common origins of GLOFs for the risk reduction.

A.2 Enhancing Effectiveness of Early Warning Systems

3.4 Marginal institutional base in S&T is to be used more effectively in the region. To be more specific, following steps in terms of pursuing the policy at regional level could be envisaged:

- Early Warning for Tsunami: India has set-up state-of-the-art National Tsunami and Storm Surge Early Warning System and the warning messages are to be shared with coastal countries of South Asia and South East Asia through the institutional mechanisms involving SDMC;

- Early Warning for Hydro-Meteorological Hazards: While hydro-met agencies in the region do share data/info under WMO protocols, there are considerable gaps locally constraining the quality of forecasts/warnings down the line. Local level warnings are decentralized in most of the countries of the region and unless sharing of relevant data/info at that level especially for common ocean & river basins, agro-

ecological zone etc is institutionalised, the critical gaps with regards to data/info would continue to exist.

In the above context, the policy interventions are required to act locally in harmony with the geo-political sensitivities. For example, India would benefit if there were real time transmission of flood warning from Nepal to India. Similarly, Bangladesh would benefit if such arrangements were institutionalised. The effectiveness of EWS for GLOFs in Himalayan region would again depend transboundary data sharing mechanism. The extent to which such data could be shared may be studied at length at SDMC.

- Seismic risk reduction: Hydro-met agencies – like Indian Meteorological Department (IMD) do monitor all seismic events of magnitude five and above in the Richter scale in the entire South Asian region. The real time exchange of such information would go a long way in seismic risk reduction if the mechanism of such information could be formalized through SDMC.

  Further, there are several centre of Excellence in the region doing valuable research in seismic engineering, developing suitable building codes, resistant building designs, specific building technologies based on locally available materials etc. Indian Institute of Technology (IIT) Roorkee, for example, has established its 'niche' in these areas and it is important that such benefits could be shared thought out the region.

A.3 Access to Remote Sensing Products/Services

3.5 Remote sensing satellite based products and services have demonstrated their operational potentials in disaster risk reduction related activities. Access to these products/services holds the key for a large number of activities especially at regional level. Among South Asian countries, India is a space faring nation with state-of-the-art constellations of thematic satellites – such as Resourcesat, Cartosat and Oceansat/Metsat. The data/products emanating from these satellite constellations are extremely valuable. Access to data/products from

Indian Earth Observation (EO) Satellites for disaster risk reduction in the region is an element of policy, needs to be pursued as a priority action. Efforts are also required to harness other provisions of International Space Charter on Major Disasters and Sentinel Asia enabling the SAARC member countries to have access to remote sensing data/products for DRR efforts.

A.4 Low Cost Access to Disaster Mitigation Technologies

3.6 Disaster mitigation technologies viz., setting up observational networks of AWS, Doppler Weather Radar, deployable emergency communication equipments etc are cost intensive and mostly imported on commercial terms. Some of these technologies have been developed indigenously. For example, India has developed cost-effective, INSAT satellite based AWS as well as Doppler Weather Radar, which could be populated for densification of observational networks. INSAT Satellite has got the footprints covering whole of South Asian Region. A policy towards enabling the access to low cost disaster mitigation technologies, pursued by SDMC, would be helpful in densifying the cost-effective networks.

A.6 Capacity Building

3.7 Some of the South Asian countries have developed advanced infrastructure of scientific, technical and research organisations. Through appropriate educational, research and training networks these capacity could be utilized to address the capacity gaps.

[B] <u>Strategies</u>

3.8 The strategies are essentially to put in place a regional perspective harnessing S&T applications for DRR in South Asia. While institutionalisation of the regional cooperation is the central focus, some of the specific steps as a part of the strategies are listed below:

B.1 SDMC to provide the institutional support

3.9 It is necessary creating the suitable institutional mechanisms with strong political support for SDMC to function as credible regional agencies pursing the regional policies as listed above *(A.1 – A.6)*, HFA and SAARC Framework of Disaster Management especially those aspects related to S&T applications towards DRR.

B. 2 Networking of S&T Agencies in SAARC region

3.10 As also advocated under South South Cooperation, networking of S&T agencies besides aims at addressing the existing capacity gaps also brings in synergy among the capacities. For South Asia, with marginal S&T base, creating a network of the existing networks is a viable option through regional cooperation.

3.11 Setting up the thematic networks for Earthquake/landslides, Tsunami, Floods, Cyclone and Drought pooling the regional resources of key S&T establishments in the framework of South Asia Disaster Knowledge Network (SADKN) may serve the purpose. For example- Indian Institute of Technology Roorkee could be a nucleus to form a thematic network around for Earthquake with a nodal agency in each SAARC country for sharing of information and knowledge as well as other capacity building efforts; same approach could be adopted for other natural disasters with a lead institution as the focal point.

B.3 Free/cost effective Access to Remote Sensing data products towards damage assessment to SAARC countries

3.12 India (Indian Space Research Organization – ISRO) in SAARC region is having more than half a dozen operational remote sending satellites in the orbit and has also built a well knit institutional set up for developing effective geo-informatics solutions. The capacity could be shared in terms of enabling suitable and cost effective geomatic solutions for disaster management in the region. In fact, Indian ground station does cover the whole SAARC region for acquisition of remote sensing data and this advantage could be harnessed in support of populating relevant geomatic applications in the region.

3.13 Also, India (Indian Space Research Organization – ISRO) as a member of International Space Charter which provides free can play a

role in activating the provisions of Charter by way of enabling free of cost access to remote sensing data products (from multiple satellites) towards damage assessment in event of the major disasters in the region. It is important to recognize that Charter products are taken into account by major international relief/funding/donor agencies to support the developing countries in terms of emergency aids during the natural disasters. Such provisions are to be harnessed in support of SAARC.

B.4 Regional repository of lessons learnt from the major disasters

3.14 Considering nearly replicable practices of disaster management in the region, it is worth-envisaging a regional knowledge repository of lessons learnt exercises (LLEs) by member couturiers in handling the major disasters by more effective utilization of S&T tools, for example –Cyclone Sider 2007 on effectiveness of People Centred EWS (Bangladesh), Floods 2007 in India (on effectiveness of geo-informatics for damage assessment) etc. The repository consisting appropriate knowledge products and services related to disaster risk reduction may find great utility and opportunities for replication/scaling up by stakeholders at various levels in SAARC region.

3.15 The LLEs could include best regional practices in (i) realizing people centered EWS for different types of natural disasters, (ii) blending of tacit and explicit knowledge to enhance the resilience at community level, and (iii) in integrating effectively S&T for disaster management in academic curriculum and policy formulation.

B.5 Strengthening National level Risk Assessment Capabilities

3.16 Taking up regional/ sub-regional risk assessment projects in selected pockets of SAARC region to demonstrate the digitalization of regional hazard zonation maps/methods. Efforts could be to demonstrate the feasibility of regional/ sub-regional risk assessment pilot projects covering the areas most vulnerable to earthquake, floods, cyclone, drought etc.

3.17 Risk assessment triggers a wide range of activities in disaster reduction including building the national capacity for risk assessment. Risk indicators, such as hazard, exposure and vulnerability related parameters, are to be harmonized through various control measures like physical planning and economic and technological interventions as well as adaptability related factors. It is therefore necessary to recognize risk assessment as the central focus of the regional strategies.

National Level

4.1 The policies, strategies and programmes at national levels with regards to S&T applications in South Asia need to be harmonized with competing demands for the physical and financial resources as well as with the backdrop of marginal S&T base in the countries. Some of these elements are listed below:

C.1 Areas of the specific focus

- It is to be recognized that S&T applications are necessary for risk identification, reduction and transfer as well as effective 'people-centred' early warning systems, and local preparedness and response capabilities. Up to date databases have an important role to play in risk reduction efforts. The World Bank study reports that every dollar spent in preparing for a natural disaster saves seven in response. The preparedness includes strategic investments in S&T especially risk assessment & monitoring, EWS etc. In the high risk South Asian countries, due priorities are to be attached for enabling S&T applications;

- If the policies/strategies/programmes at national level are aligned well with regional/global policies of sharing data/info, there is significant scope for improving the quality of information contained in databases without necessarily incurring excessive cost. There is also scope to improve the sharing of information currently available, building on existing operational warning systems and capacities in the region and

this is where regional perspective of national policies assume significance;

C.2 Data-information-knowledge & wisdom pyramid

- The national capacity in terms of building suitable S&T infrastructure is to be pooled together to develop data-information-knowledge and wisdom pyramid. There are extensive efforts on developing the observational networks for data collection, more efforts are needed to realize the pyramid. Exploitation of databases involves more than simply sharing raw data. It involves intelligent interrogation and manipulation of information and an understanding of the science that lies beneath the data and then using the knowledge intensive know-how to develop the information base including hazard, vulnerability and risk assessment in connection with risk identification, reduction and transfer;

- National policy is to be put in place with regards to long-term data collection plan. Further, climatic and other physical science data available in the public domain is to combine with socio-economic data necessary to assess relative degrees of vulnerability and to evaluate risk at local levels of exposure.

C.3 Build national people centred early warning systems

- Concerted efforts are required to build national people centred early warning system in harmony with global & regional systems, as demonstrated recently in case of SIDR Cyclone 2007 in Bangladesh.
- The development of early warning systems received an enormous boost from the efforts following the 2004 tsunami. In South Asia, for example, Pakistan and Sri Lanka have made concerted efforts to improving their early warning capacities, the Disaster and Emergency Warning Network in Sri Lanka and the latter's National Plan on Strengthening National Capacities for Multi-Hazard Early Warning and Response System. Such efforts need sustainability and more effective utilization by

community participation, which has been the weakest link in EWS implementation.

C.4 Institutional Strengthening

4.2 With the marginal S&T infrastructure in the region, yet another aspect that is important to examine is to identify those areas of S&T contributing to DRR directly and indirectly. It has been seen is that the overall S&T has got two components relevant to disaster management.

- One is core S&T sector like Earth Sciences – including Meteorology & Atmosphere, Ocean, Geology, Space, Information and Communication Technology (ICT) and other traditional S&T areas including bio-technology, material sciences etc mostly being pursued in academia. Most of the applications emanating from core S&T areas, which are relevant to DRR, are secondary applications and mostly spin offs.

- Two is S&T as enabling sector contributing to the other development sectors such as agriculture, water resources, surveying, and Environment. Thus the contribution is indirect.

4.3 These sectors have close bearing on DRR. In fact, S&T applications for multi-hazard disaster risk reduction provide the convergence of S&T as core as well as enabling sectors. Looking at some of key S&T applications such as EWS – modeling, database management, emergency communication; Risk mapping, assessment and monitoring; climate risk analysis, downscaling of global circulation modeling; it is seen clearly S&T applications either as core or enabling. Strategically, an integrated approach relevant to DRR needs greater focus in teaching, research, education and training of S&T components.

4.4 Multi-disciplinary S&T knowledge is to employ for developing multi-hazard approaches, such as in legislative, organisational, technical and capacity building areas, and develop necessary strategic partnership with relevant actors at international, regional and national levels and follow-up action plans.

C.5 Educational curriculum towards awareness Building

4.5 Education and public awareness provide the knowledge and fosters the attitudes and behaviours needed for DRR. There is considerable gap between disaster risk reduction teaching and actually practices on the ground and national efforts are required. While it is encouraging that all countries in South Asia have made efforts to introduce disaster risk reduction into school curriculum and to launch school education. Nepal, for example, reports an earthquake safety programme for schools. In India, "Disaster Management" has been introduced as a compulsory theme in school curricula through the adoption of an educational text series entitled "Towards a Safer India". Pakistan has developed a programme to integrate disaster risk reduction into educational curricula and support awareness building in educational institutions. It is necessary that all such efforts should graduate from small-scale pilot-projects to large-scale institutionalisation in the region.

C.6 Promoting science for community action

4.6 With community based DRR gaining ground in the region, it is necessary that science of DRR should find expressions at community level. Bangladesh has reported the application of "participatory approaches for community vulnerability and risk assessments in disaster management" by developing a uniform methodology called "Community Risk Assessment" and "Risk Reduction Action Planning Procedure". It is important that such approach should be promoted with support from community-based organisations.