

INTEGRATION OF DISASTER RISK REDUCTION (DRR) INTO WATER SECTOR

By

Ahmed Kamal¹

Abstract

Pakistan’s exposure to natural hazards and disasters could be ranked between moderate to severe. Natural hazards inducing avalanches, cyclones and storms droughts, earthquakes, epidemics, floods, glacial lake out burst floods (GLOFs), landslides, pest attacks, river erosion and tsunami pose risks to Pakistani society. Disasters have an enormous impact on development. A close analysis of the development process clearly argues for the need of systematic and more conscious ways of integrating disaster risk reduction (DRR) into development process. DRR being operative at all levels and across sectors, the concerted effort of integrating it into development activities requires consensus and active participation of decision makers and planners at the national level and all related institutions, ministries, with equal support from the donor and development community. It is through the consolidated and concerted efforts of all stakeholders that safer and sustainable communities are to be attained and thus mainstreaming of DRR has been rightly prioritized in the Hyogo Framework for Action (HFA) adopted by 168 countries at the World Conference on Disaster Reduction (WCDR) in January 2005 with Pakistan being one of the signatory country. Water related hazards are major features of natural disasters world-wide and as such DRR integration in water sector is of vital importance both at global as well at national scale. This brief paper while highlighting the causes of vulnerability to water related hazards in line with the global climate change impacts suggests a strategic plan for Pakistan for integrating DRR into: flood control planning & management, water resources development, drought mitigation, dams & barrages and desired need for institutional strengthening.

I. Pakistan’s Exposure to Natural Hazards and Disasters:

Pakistan’s exposure to natural hazards and disasters could be ranked between moderate to severe. Natural hazards inducing avalanches, cyclones and storms droughts, earthquakes, epidemics, floods, glacial lake out burst floods (GLOFs), landslides, pest attacks, river erosion and tsunami pose risks to Pakistani society. A variety of human induced hazards also threaten the society, economy and environment. They include industrial, transport, oil spills, urban and forest fires, civil conflicts and internal displacements of communities, power failures etc. High priority hazards in terms of their frequency and scale of impact are earthquakes, floods, droughts, wind storms and landslides that have caused widespread damage and losses in the past.

II. Rationale For Mainstreaming Disaster Risk Reduction into Development:

Disasters have an enormous impact on development. With every disaster, there is a significant impact on various sectors of development like agriculture, water & power, education, housing and infrastructure. This results in a serious social and economic setback to the development and particularly the poverty reduction priorities of the developing countries, and poses a threat for achieving the Millennium Development Goals (MDGs) and Action Plan for Disaster Management under Hyogo Framework for Action (HFA). To meet with this crisis, the scarce resources that are programmed for development are often diverted for relief and rehabilitation efforts.

On the other hand, the process of development, and the kind of development choices made in many countries, sometimes create disaster risks. A close analysis of the development process with its six aspects namely : i) policy, ii) strategy, iii) programming, iv) project / program cycle management, v) external relations and vi) institutional capacity, clearly argues for the need of systematic and more conscious ways of integrating disaster risk reduction (DRR) into development process.

1. Member (DRR), NDMA.

Thus development activity and DRR representing two sides of the same coin needs to be dealt with in unison, with mainstreaming DRR into development planning, policy and implementation. This is analogous with the initiatives to integrate concerns such as environment, climate change and gender into development process. These initiatives with primarily focusing on developing specific tools / strategies and guidelines have been successful to a great extent given their concerted effort to raise awareness on the usefulness of the tools/strategies amongst the decision makers as well as the personnel at the operational level and also due to the enhanced institutional and human resource capacity to apply the same. The need therefore does exist to take a similar path for DRR.

III. DRR Integration into Development Activities:

DRR being operative at all levels and across sectors, the concerted effort of integrating it into development activities requires consensus and active participation of decision makers and planners at the national level and all related institutions, ministries, with equal support from the donor and development community. It is through the consolidated and concerted efforts of all stakeholders that safer and sustainable communities are to be attained and thus mainstreaming of DRR has been rightly prioritized in the Hyogo Framework for Action (HFA) adopted by 168 countries at the World Conference on Disaster Reduction (WCDR) in January 2005 with Pakistan being one of the signatory country.

To act on this understanding, the development agencies have initiated the process of changing their policies and institutional practices to support the countries. Similarly their corresponding partners of the same development equation namely the Governments are aligning themselves in the same line to ensure a 'win win' situation. This commitment of the governments is reflected in the Regional Consultative Committee program on Mainstreaming Disaster Risk Reduction into Development Policy, Planning and Implementation in Asia (RCC MDRD).

IV. Water Hazard Risks – A Priority For IWRM:

Water related hazards effect million of people, jeopardizing human security and hampering socio-economic activities. Both the Johannesburg Plan of Implementation (JPOI) and the Millennium Development Goals (MDGs) have stressed the need for closer interaction between hazard risk reduction and sustainable development. In addition hazard risk reduction is increasingly recognized as an integral part of water policies and agendas.

Water related hazards are major features of natural disasters world-wide. At almost any point in time, a hazard is threatening communities in terms of both the lives of the inhabitants and their properties. Few of these events are reported in the international media due to their relatively small impact. However, events like 1998-2002 droughts in Pakistan, 2004 floods in Bangladesh & Haiti and tsunami in Asia, unprecedented floods of 2007 in Pakistan and Southeast-Asia, historically unprecedented floods of 2010 in Pakistan, March 2011 tsunami in Japan, 2011 & 2012 climate change induced rains and floods in Sindh & Balochistan drew significant international attention. Floods, droughts, and other water related hazards have major impacts on the socio-economic well-being of countries. In some cases, different parts of a country can experience extreme conditions like floods and droughts simultaneously like the one Pakistan experienced during 2012.

In the last decade of 20th Century (1991-2000), over 665,000 people died in 2557 natural disasters of which 90% were water related events. In 2003, alone, over 254 million people were affected by natural hazards. During the two El Nino events of 1991-1992 and 1997-98, floods in China affected over 200 million people in each event. Floods of 2010 & 2011 alone in Pakistan affected over 29 million people with over US \$ 11 billion loss to various sectors of economy. Losses stemming from disasters have greater impact in developing countries as compared to developed countries. More than 95% of all deaths caused by natural disasters occur in developing countries. In Pakistan, since its independence, 19 major flood events had occurred resulting into over 10,000 deaths and monetary loss worth billions of dollars.

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According to the Intergovernmental Panel on Climate Change (IPCC), the trend is probably leading to worse scenarios, as the magnitude and frequency of floods and droughts might increase during the ongoing century due to climate change. Other factors, such as population growth, increased wealth, demographic shifts, and changes in land use and the value of various goods might also result in an increased level of damage and loss of life associated with water-related disasters. According to Intergovernmental Panel on Climate Change, global temperature increased by 0.6 C over the last century and are forecast to rise by further 1.4-5.8 C before the end of this century. The harmful effects of global warming are already being manifested around the world in the form of extreme weather events such as storms, tornadoes, floods, droughts, biodiversity loss, rise in sea level, food insecurity and lot more.

V. Causes of Vulnerability to Water-Related Hazards:

Water related hazards like floods and droughts, occur naturally in association and are associated with excess or in-sufficient rainfall, river overflow and other natural related phenomenon, although their effects and severity depends on a host of other factors and a combination of local and sometimes distant external conditions/influences many of which are a result of human interventions. Some of the main underlying causes of vulnerability to water-related disasters which are integrally linked and mutually reinforcing are:

Poverty : Factors such a low income, poor housing and public services, and lack of social security and insurance cover, force the poor to behave in ways that expose themselves to greater risk. The poor are forced to exploit/make use of vulnerable environmental resources for their survival, thereby increasing both the risk and exposure to disasters, in-particular those triggered by floods, droughts, landslides and coastal flooding.

Unplanned Urbanization : With an increasing population more and more people are forced to occupy hitherto inhabited areas, often with greater risk of exposure to hazards. In addition, urbanization is influencing the hydrological processes and accentuating flood peaks. Various land-use changes like elimination of natural flood retention coupled with interference by natural drainage conditions due to infrastructure development may also increase the flood hazard both in downstream and upstream reaches.

Environmental Degradation : Failure to environmental degradation resulting from human intervention can increase the vulnerability to risks posed by natural hazards like floods, droughts, land sliding.

Fragmented Institutional Structures : Lack of coordination among institutions at national and local levels is a major constraint to effectively implement disaster risk reduction, as it results in narrow, sectoral approaches and poor planning. It is increasingly recognized that reducing the vulnerability to water-related disasters involves far more groups than just the water sector.

Imbalance Between Prevention and Response Resources : There is growing political awareness of the impediment, which floods and droughts pose for the development of countries, this awareness has not resulted in an adequate allocation of resources.

Traditionally disaster management has essentially been problem response driven : Usually after a severe flood a project would be quickly implemented without giving enough thought to the impact such solutions would have on upstream and downstream reaches. In addition international, national and local resources are still predominantly used for emergency response operations after a disaster occurs. A recent study shows that it is upto 8 times cheaper to invest in longer term prevention, mitigation and preparedness than in post disaster emergency response.

Further, according to the World Water Development Report Water for people, Water for life (WWAP, 2003), the traditional sectoral planning approach of the water sector has limited the capacity for

effective integration of disaster risk reduction concerns. There remains a lack of understanding of the intrinsic links between disaster risk reduction and the broader water agenda and in particular relevant policies and strategies related to the emerging IWRM.

VI. Strategic Plan:

Objective / Goal :

The overarching objective/goal to which the integrated Disaster Risk Reduction (DRR) strategy will contribute to water sector development processes in Pakistan is sustainable water resource development & management in Pakistan ensured through incorporation / mainstreaming of DRR approaches in water sector projects particularly relating to flood control and management, drought mitigation and water storages (mega and small) in the context of earthquakes and safety & security.

A. DRR Strategy For Flood Control:

- Prepare technically sound and economically viable flood control measures giving priority to areas of potentially higher economic flood hazard or human suffering like cities, irrigation works or other vital infrastructure;
- For hill torrents, maximum emphasis to utilize flood flows for development of localized irrigation and other socio-economic activities;
- Adoption of Community Participation Approach for effective flood preparedness, fighting and rehabilitation besides in planning, designing, siting, implementation & post implementation O & M of flood protection facilities;
- Implementation of flood risk management policies through National Flood Protection Plans under integrated approach;
- Based on review of existing design criteria, standardization of designs and specifications for Flood Protection Works duly incorporating DRR aspects even moving away from traditional approaches;
- Flood Risk Assessment of selected on-going flood protection projects with a view to incorporate/experiment DRR aspects, develop cogent DRR tools as a consequence for adoption in future flood prevention schemes;
- Preparation of a program for inbuilt DRR aspects in future Flood Control and Protection measures;
- Promotion of flood retardation through construction of multiple storages and flood embankments and adequate maintenance of existing infrastructure;
- Operation of Major Reservoirs: Tarbela, Mangla and Chashma reservoirs can play an effective role in flood mitigation, provided their operation is optimized, within permissible dam safety criteria. Hence up-dation of flood operation manuals of dams, refinement and further development & improvement of flood flow/rainfall computer model for Indus River System and institutionalizing intimate coordination among all concerned agencies for a joint flood management strategy;
- Defining the Extent of Flood Plains: During recent floods of 2005, 2006, 2007, 2010, 2011 & 2012 it has been experienced that even low / medium level floods caused considerable damage

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to illegal dwellings inside defined flood plains / river course. Continuous encroachment of river beds for residential purposes as well as development of public facilities like schools, roads etc. needs to be denied through defining limits of flood plains, duly notified based on proper legislation on prevention of encroachment of flood plains/river courses;

- Improvement of Flood Forecasting System: Insufficient weather radar coverage and limited network of telemetric stations, especially in KP and Balochistan, besides in the lower plains of Punjab in addition to cross the border (River Chenab) is highlighted as a serious vulnerability. Installation of required weather radars and other flood monitoring system for enhancing flood forecasting capabilities, especially for River Kabul and remote areas of Sindh/ Balochistan, Gilgit-Baltistan need to be addressed at priority;
- Placement of effective monitoring system in Gilgit-Baltistan to forewarn downstream communities of glacial movements giving rise to glacial lake out burst floods (GLOFs);
- Coordination between Flood Management Agencies: Need to further improve coordination between various flood management agencies for overall effective disaster risk reduction & management (long term prevention, mitigation, preparedness, prompt response to any flood situation) to minimize losses to lives/property cannot be over emphasized. To this end, related provincial and federal agencies need to be further strengthened and made more effective;
- Capacity Building for Rescue Operation : The requirement of specialized equipment, especially excavators and concrete breakers to undertake relief / rescue operations under sudden cloud burst, flash flood, collapse of heavy structures and triggering of mega slides has been established during recent floods. Specialized equipment needs to be placed centrally at Federal/ Provincial level;
- Role of Media: Inadequacy of early warning of impending flood threat to public through media has always been noticed. The concerned agencies to regularly interact with media at National / Provincial levels to pass on timely information of warning the public, likely to be affected by floods to minimize damages to lives and properties;
- Flash Floods Monitoring & Warning System: In view of the experiences of 2005, 2006, 2007, 2010, 2011 & 2012 rains and flash floods in Gilgit-Baltistan, AJ&K, KP, Punjab and Balochistan, Flash Flood Monitoring & Warning System (consisting of mobile radars) needs to be established in hilly areas of upper Punjab, KP, AJ&K and Gilgit. The implementation of this system needs a serious consideration with priority;
- Issuance of timely warnings in the hazard hit area is most important in the event of an eventuality. Hence local flood warning dissemination system needs to be further improved upto district level & tehsil level;
- Carry out comprehensive flood management of various zones of hill torrents of Pakistan in order to:
 - a) Utilize the flood flows of hill torrents for the promotion of agro-economic activities.
 - b) Reduce flood damages in different hill torrent areas.
 - c) Minimize adverse effects on natural eco-system and environment.

(Studies indicate that there is a potential of nearly 10-15 MAF of flows becoming available for dispersion and utilization on vast cultivated tracts of land (17MA) in D.G. Khan Katchi Basin, Kirthar Range and D.I Khan areas of Pakistan)

- Better manage the hill torrent flood flows for drought mitigation through:
 - a) Provision of flood dispersion structures, drains, Off-takes.
 - b) The above will result in increased water quantity to the local farmers for enhanced irrigation practices.
(To carry out similar practices to tame and utilize the flood waters of hill torrents of Sindh, KP, Balochistan, A J & K and Federal Capital).

B. DRR Strategy For Water Resources Development:

- Construction of large storage dams/reservoirs to ensure water availability for irrigation, power generation etc;
- Augmentation of existing storages;
- Further supplementation of available water resources through construction/provision of Small & Medium dams in the four provinces to meet local irrigation and water supply needs with a view to share burden of ever increasing water requirements at the national scale;
- Improvement of water conveyance infrastructure including modernization of barrages, system improvement through remodeling, rehabilitation and lining of canals and water courses (where ground water is brackish);
- Improvement in drainage & reclamation system including safe disposal of drainage effluents, improving on-farm and off-farm drainage of irrigated lands, use of chemicals and bio-chemical techniques to tackle sodicity problems;
- Improvement of overall irrigation efficiency from about 40% at present to 45% in next 20-25 years to save about 6 MAF of water to ultimately cater for the drought like conditions in future;
- Encourage effective coordination of policies and activities of relevant agencies, authorities, and individuals, which impinge on conservation and the sustainable use and management of country's watersheds including soil, water and vegetation;
- Develop a comprehensive and strongly coordinated legal and administrative system to address planning, environmental protection & water resource management and consolidation of existing legislation into a manageable number of concise but comprehensive Acts; and
- Strict monitoring & quality control of river training/flood control, drought mitigation, irrigation/water supply, dams safety projects.

C. DRR Strategy For Drought Mitigation :

- Floodwater storage for groundwater recharge: To store precious flood water at suitable places with appropriate technologies so that maximum water:
 - a) Infiltrates in to the soil ;

- b) Contributes to recharge the aquifers ; and
- c) Subsequent uses of these aquifers at the time of need, especially in droughts.
- Adoption of excavated large water pits in the foothills/mountainous plains (before commencement of monsoon season) ;
- Retention of rain/floodwaters in green belts in cities, natural depressions in suburban/rural areas as a means of water conservation. This will result in:
 - a) Availability of tens of billions cubic meters of flood water every year for useful irrigation and other purposes in the drought stricken areas.
 - b) Raising of the underground water table through ponding of maximum flood water.
 - c) Cultivation of large areas of land available on both sides of the nullahs, streams, rivers with consequent growth of food production.
- Achieve higher underground water table for:
 - a) Availability of more water from wells at lower depths commensurate with the water depth in the available water pits.
 - b) Increased groundwater recharge.
- Application of retarding basin techniques in plain areas to:
 - a) Bifurcate a part of the flood peak for flood management purpose.
 - b) Its storage as a source of irrigation and drinking water for a particular local community affected from drought.
 - c) Augment both surface and groundwater in a localized area for various daily purposes besides cultivation of rain water/flood water crops.
- Rainwater harvesting of watersheds of hill torrents and small streams through:
 - a) Construction of check dams to retard the speed of flows.
 - b) Construction of delay action dams to flatten the flood peaks.
 - c) Use the net runoff either for recharging the groundwater aquifer or
 - d) To divert it into channels for use in flood irrigation.

(The above techniques have become popular in the water scarce areas of Balochistan, KP and parts of Punjab (Potohar region and D.G Khan area)

- Application of flood water harvesting methods i.e., collection of water in specially designed storage ponds having minimum seepage and evaporation losses;
- Accord due consideration to the concept of rain water harvesting for household and agricultural uses. For this purpose, first of all pilot projects in water scarce/drought hit areas of the country may be implemented;

- Implement a concerted effort in watershed management to reduce degradation of upper catchments so that runoff is moderated and sedimentation is minimized;
- Adopt drought tolerant crops and cropping patterns based on experience of regional countries;
- Motivate farmers in non-irrigated areas to construct small ponds in their fields for preserving the rain as well as the flood water for irrigation;
- Use of rain water harvesting techniques in Urban and Rural areas:
 - a) Rainwater can be collected from the rooftops through drain pipes into a pit.
 - b) The pits to have layers of sand, pebbles and broken bricks for good filtration.
 - c) This in itself will improve the groundwater table, open wells may be sunk, into which a PVC pipe can conduct water from the pit.
 - d) The terraces and roofs of houses and building complexes can be converted into catchment areas for rainwater by this simple technique.

(Also introduce rain harvesting in public and community wells situated near slums and in villages, draining water from nearby rooftops and streets into them).

- Experiment rainwater harvesting by compaction and shaping of slopes of stabilized dunes as natural catchments and inter-dunal valleys as cultivated areas;

D. DRR Strategy For Dams & Barrages:

- Proper set up for continuous Dam Break Study, Sub-Basin Hydrological Studies and Flood Routing Studies;
- Measures to improve the condition, safety & security status of existing dams & to strengthen the allied practices, based on inspection of sample of small, medium and large dams and barrages, assessment of existing dam safety assurance measures;
- Identify needs and options to implement a long term program on dams and barrages safety improvement in Pakistan;
- Devise a consensus based agreed road map and action plan (program) for reforming and strengthening of dam safety setup and improvement of dam safety assurance in Pakistan;.
- Develop a dam & barrage registry information management system (using modern GIS system and remote sensing products) for a modern regulatory system for dam & barrage safety assurance, which should apart from including their geo-referenced location should also include their key attributes (i.e. physical characteristics, age, condition, purpose, and links to relevant documentation);

E. DRR Strategy Through Strengthening Institutional Arrangements:

- Strengthening appropriate legal frameworks available to address integrated flood management, drought mitigation, dam safety assurance based on risk management strategies with due consideration to development processes;

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- Informed decision making based on sound scientific knowledge, as well as local, indigenous knowledge by using tried and tested techniques, and by evaluating any promising innovations;
- An information base which supports planning and a pro-active response to disaster mitigation and reduction;
- Participatory and transparent approach which includes a representative range of stakeholders in the decision making process;
- Regional and sub-regional approaches, strategies and cooperation arrangements where rivers span two or more national boundaries for a harmonized approach;
- Partnerships among different levels of Government, civil society, private sector groups and communities;
- Decentralized decision-making through local authorities and basin communities, including the provision of adequate resources and clarify division of responsibilities at various levels;
- Effect policies to regulate future growth of human settlements in risky areas including appropriate economic policies, such as fiscal incentives for orientation of economic activities away from disaster-prone areas.
- Placement of a model Decision Support System (DSS) to effectively depict the future disaster mitigation policy encompassing the effective warning system, inter-agency coordination, decision making, preventive measures for the community likely to be affected;
- Arranging of work-shops, seminars at the national & regional levels on Flood Loss Prevention & Management, Drought Mitigation, Earthquake vulnerability to water reservoirs/flood infrastructure / barrages, dam safety & security etc. in order to share the experience at the local and regional level for common objective of disaster reduction. Local NGO groups, representatives of riverine communities, managers /owners of water management infrastructure and farmers should be the target participants;
- Pursue overall Human Resource Development in the Flood & Drought Management, Dam Safety & Security, Earthquake vulnerability etc. to major irrigation & flood control infrastructure through imparting of area specific trainings (Local as well as Foreign);
- Capacity building and human resource development under dams & barrages safety through related international/national training programs that may include:
 - a) Risk analysis and assessment- modes of dam & barrage failures, consequences or potential impacts, causes (earthquakes, floods, maintenance failures, aging etc);
 - b) Criteria & standards for dam safety assurance; use of classification system, maintenance & monitoring standards & practices;
 - c) Hydrologic analysis for dam design and safety, including review of existing practices & standards, International best practices, procedures & criteria for review of hydrologic safety of existing dams & barrages;
 - d) Modern dam monitoring, surveillance and inspection practices for dams and appurtenant structure including dams safety review: and

- e) Emergency response planning including impoundment water management plans.

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