

A Unified Approach to Address Water-Climate Related Issues

Rasul, G.¹

Abstract

Impact of the Climate change will be more pronounced and visible on the water resources as they would send a shock wave to all the socio-economic sectors shattering water, food and energy security. The Integrated Water Resource Management (IWRM) provides opportunity to involve most of the stakeholders to mitigate and adapt the climate change and variability in a holistic manner at a grass root level. The process incorporates the usable knowledge on past, present and future trends of climate and likely impacts on water resources taking care of risks and vulnerabilities. Risk management is done through low or no-regret investments increasing the resilience of vulnerable communities to the future projected climatic conditions which are gaining confidence due to the continued research. Although it is impossible to halt the changing climate yet the mitigation efforts would secure the future of forthcoming generations on the planet earth. At the same time, there is a need to learn how to live with the changing climate by adapting it. Both mitigation and adaptation should go side-by-side reinforcing each other reducing the risks and vulnerabilities in a participatory manner.

Introduction

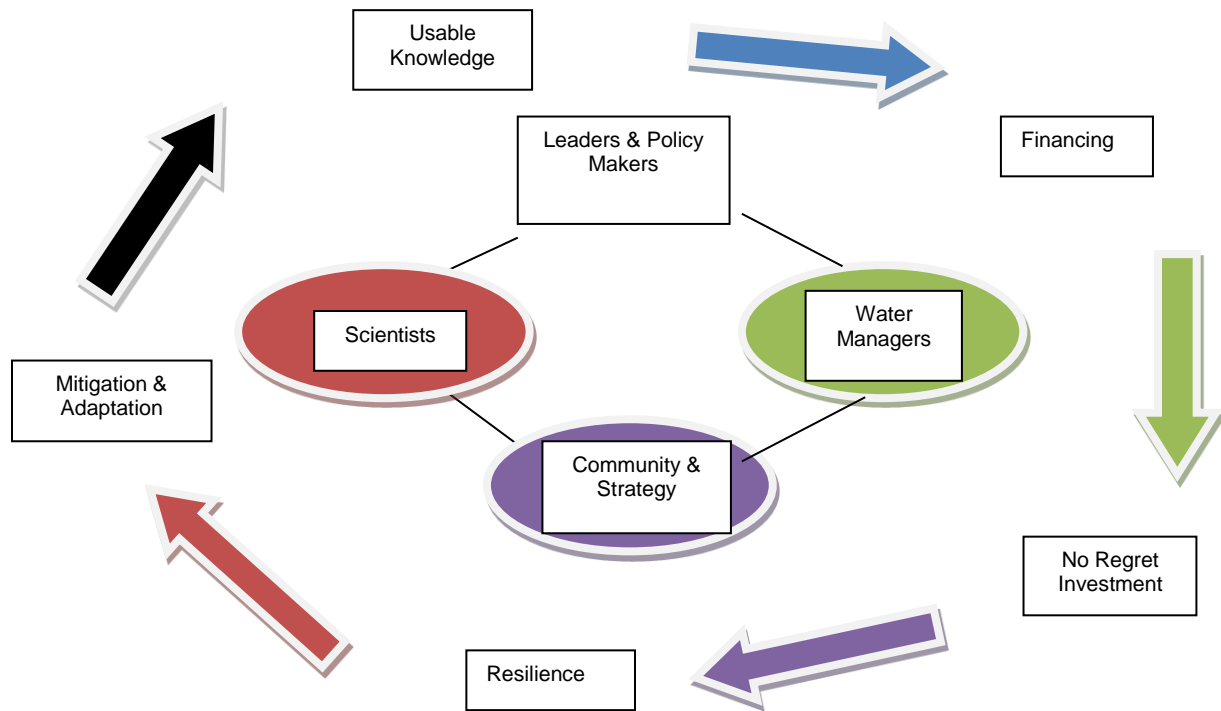
Recent climate change induced water related catastrophes in Pakistan, China, Thailand, India and Philippines serve to remind us that the most prominent and harmful impacts of climate change will be experienced through enhanced variability in the water cycle. Most of the Asian countries have already been struggling with plethora of water related challenges including flood, drought, seasonal shortages, increasing competition for limited supplies, water pollution and over exploitation of ground water. Climate change has added another formidable challenge, and although the impacts are currently far from certain, they are unlikely to be favourable. Asian region possessed diverse climatic, environmental and socio-economic conditions; each subject to unique impacts and risks as climate changes. Highly populated river basins, deltas and low-lying areas are at increased risk of flooding. Asia contains 9 of the 10 countries with highest estimated flood mortality risk (UNISDR 2009). Although leaders, decision-makers and water professionals in the Asian Region are increasingly aware of the risks posed by climate change, appropriate responses are not often easily identified.

Coastal areas have an eye-eye contact with intensified cyclones/ typhoons, storm surges and sea level rise. More than 450 million Asians live within the low elevation coastal zone, including almost 20% of the region's urban population. Asian mountains including Himalayas, Hindukush and Karakoram together hold the third largest ice mass in the form of glaciers which are receding at an alarming rate in the face of global warming (Rasul et al., 2009). About a billion Asians, in river basins dependant on glacial and snowpack storage, face increasing risk from glacial lake outburst floods in the near term; and reduced dry season flows and increasing water stress in the longer term. Socio-economic diversity within the region is equally high, with the world's fastest growing economies existing alongside its greatest concentrations of poverty. Economic growth is neither equitable nor sustainable. While citizens of Singapore, Japan and other developed nations enjoy high levels of water supply and sanitation, in many other nations only a minority do so. Of 2.6 billion people globally lacking access to improved sanitation, 72% are Asians (WHO/UNICEF 2010). Most of the Asian countries are also struggling to maintain security in food production and energy, both of which are mainly linked with water, climate change thus poses a "triple threat" to the regional development and security through the water-food-energy nexus.

Climate change is a process which goes on making the problems more and more complex. Although mitigation is an option but it will never work in isolation until adaptation strategies to changing climate are not devised according to local, national and regional conditions. As we adapt, we must maintain a

¹ rasulpmd@gmail.com, Pakistan Meteorological Department

holistic view of the continuity between climate change adaptation, environmentally sustainable development and enhanced resilience as development themes that enhance our progress toward the Millennium Development Goals (MGDs). A multi-model approach with synthetic ensemble of ground realities (both social and economic) may be effective to solve the water issues (Soroosh et al., 2012). In this process it will be critical to ensure cooperation among policy makers, scientists, engineers, economists, water managers, decision makers, local communities and other stakeholders. The most important and sustainable approach may be community based adaptation strategy which will intake the usable knowledge to develop a climate resilient society. In 2010, the water specialists, social scientists and financiers converged together and the Asian Development Bank (ADB) released a framework document for planners, policy makers and decision makers with a specific focus on the Asian environment. In most of the cases water is thought for agriculture and drinking but all the sectors are dependent of water therefore it relates to blue, green and gray footprints which need a solid framework for the need assessment and judicious redistribution keeping in view how precious this commodity is and it will be when climate change is a visible threat to this resource (Seetharam et al., 2009 and Mekonnen et al., 2011). Following five principles will become the basis of such end-to-end partnership.



A - Usable Knowledge

“We must support scientists and practitioners to work together and develop knowledge that leads to effective actions and increased public awareness”

The science of climate change has progressed a lot during the last two decades developing an understanding of climate system dynamics to identify the reasons of change and to quantify them as assessment and future projections based on the most likely scenarios. Such knowledge is a great resource for different stakeholders in the process of mitigation and adaptation. There is still a disconnect between the knowledge generated by the scientists and the specific needs of the practitioners such as water managers in river basins. It is required to bridge this gap, to re-examine the basic planning methodology,

and to reduce the gestation period from scientific findings to practical implementation. There is a specific need to customize future climate projections to local conditions, particularly in developing countries. The knowledge of climate change must be translated as a “public good” to be easily understood by the common people and shared throughout the world. This could be done by a two-way flow of information and knowledge between the scientists and general public through top-to-bottom and bottom-to-top at village, town, district, province, national and supra-national levels. The cooperative efforts should be accelerated by scientists and practitioners to improve future projections of climate and to reduce the uncertainties for sound decision-making, balanced planning and implementation.

An effective feed-back mechanism should be developed from user communities such as farmers, irrigation managers, river basin developers and water reservoir authorities who can share their practical experiences and visible changes which are generally not covered directly in scientific/instrumental observations. The changes occurring with the ecosystem due to climate change are not only negative but there are numerous positive in a sense to benefit the human-beings. The practitioners in collaboration with the scientific and socio-economic communities should focus their emphasis to convert the challenges of global warming to the opportunities using the knowledge of prevailing conditions and future climate.

B - Financing

Man has been playing with the risks since its inception posed by the environment for its livelihood. In case of delayed rains, the planted seeds do not germinate rather added fertilizers increase the economic burden with a season without food. Sometimes excessive rains destroy his mature crops ending up with no food. Sustainability has always been a great challenge while depending on nature. With the progress of science and technology, the losses have been minimized but still there are many for which either such tools are inaccessible or unreliable. The sustainable development of water resources is unfinished business with respect to adapting to a changing climate, and to utilizing developing technologies for climate projection and adaptation. Floods, droughts and tropical storms are not new to us and many countries have been struggling to reduce the losses incurred by them. If we can improve our capacity to cope with these present problems, we shall be better equipped to deal with possible future increases in their severity and frequency.

The Inter-Governmental Panel on Climate Change (IPCC) released its fourth climate change assessment report in 2007, depicting the mean temperature increase up to 6°C by the end of 21st century and it highlights that the frequency of extreme climatic events will increase and the economic losses will continue increasing year-by-year. Such trends are now quite visible and the damages associated to each event are also following a sharp increase. Although the life losses are considerably reduced due to technological advances, improved skills of storm forecasting and reliable early warning systems but the challenges still remain to develop adaptation strategies in the light of future climate projections. IPCC is committed to publish the state of current climate and much improved projections of future climate with the help of several models in 2013. It can be seen that the post-disaster relief expenditures are often large relative to investments in climate disaster risk reduction. One time investment may avert the economic losses of repeated disasters for a time scale of several decades. It is the right time to invest in the most likely climate disaster risk reduction measures.

C - No-Regret Investments

Considering the uncertainty, we should start now with “no-regrets”, and “low-regrets” investments, which yield benefits at minimal or low cost even in the absence of climate change. We should apply integrated approaches consisting of structural and non-structural measures. Most of the communities are reluctant to invest in the name of climate change due to prevailing uncertainties in the projections of the future climate but it does not mean we give up our preparations to deal with climate variability. We are now experiencing frequent floods and droughts which were not so common in the past; therefore an integrated approach is desirable which may address both the issues. For example, the construction of a dam in a

heavy precipitation zone may help to control flood, provide water to drought stricken areas and produce electricity for industrial and domestic use. Urban flooding is an emerging phenomenon because the drainage infrastructure was not designed to the present time extreme rain storms which have been breaking the previous records. While infrastructure is a vital element of adaptation measures, planning procedures must be fundamentally revised. As design of structural measures relies heavily on the analysis of historical climatic extremes and future climate change projections the refore uncertainties must be dealt in a logical manner.

It must be kept in mind that the uncertainties in the future climate projections increase with the length of time. For example, a climate projection made for next 20 years will be more reliable than the projected data for next 100 years. It is therefore recommended that projections on shorter time scales and finer spatial resolutions should be developed to increase the confidence level of all stakeholders while planning for “no regret” or “low regret” investments. During this process, the involvement of local communities will be of critical importance. They should be involved in the decision-making, take responsibility of governance, devise mechanism of resource sharing, community-based early warning system for disasters and ultimately they should feel the sense of ownership. Investment on mitigation and adaptation go side-by-side but benefits of the latter become visible in a short span of time. The local communities must be convinced that no-regret investments now will ensure socio-economic benefits later on.

D - Resilience

Over one-half of the world’s population resides in Asia and about 25% are the most vulnerable poor to the vagaries of climate change. Scientists say, “The climate would continue changing for the next 50 years even if the Green House Gases (GHG) emissions are switched to zero.” The reason of this continuity is the long life time and great global warming potential of already emitted GHGs to the atmosphere. It does not mean that we should continue emissions and stop mitigation efforts. To secure the future of our forthcoming generations, we must act now to make environment neat and clean. This needs rigorous approach to impart education, training and awareness to the public and establish strong linkages for communication of information from provider to the users. It will improve the knowledge of people about the climate variability, climate change and associated challenges to the sustainable development. People will be encouraged to live with the disasters and the changing climate. Ultimately, such efforts will help to develop climate resilient society which would respond to the voice of the scientists, planners and policy-makers. Although it is often institutions at national or provincial levels that control resources and have the responsibility for their allocation and prioritization but there is need for improved governance systems through community participation.

As the scientists continue their efforts to develop more accurate climate projections and increase the understanding the extent and consequences of future climatic conditions, the planning and policies should incorporate action oriented strategies to strengthen the resilience of the vulnerable communities. These policies accompanying strategies and action plans need to be well articulated and shared with all the stakeholders. Interconnections are an increasingly popular water management strategy that allows water to be redistributed between neighbouring water systems; Not only do they comprise a large part of a utility’s risk management plan, but they also create an incentive to perform more accurate asset mapping (Stacey et al., 2012).

Building a climate resilient society will require the knowledge of downscaled climate change projections of the impacts on different sectors such as water, energy, food production, ecosystem, biodiversity and socio-economic conditions within a specific area. As a systematic approach to build the climate change resilience of a community, we have to identify the gaps in the current knowledge, information flow, governance structure and adaptive capacity of the locals. Focusing on capacity building programs involving local people we can achieve the goal. A local governance system that can support the transfer of information to the communities must be in place. The best example exists in Pakistan where Agha Khan Community in the Hunza and adjoining areas has been enjoying an organized community-based

governance structure. Such participatory governance system has proved more effective than driven by national or provincial authorities and those can be replicated to other regions.

Most of the vulnerable communities are engaged in agriculture which is the highly sensitive sector to climate change. The approaches related to the risk management should be oriented to agricultural diversification which can help build resilience to changes in the climatic conditions; For example through development of drought and/or salinity resistant crop varieties, shifting cropping patterns and crop rotations to maintain soil fertility. Sharing knowledge, experience and success stories on adaptation measures in water and agriculture sectors play vital role in climate change risk management as well as building a climate resilient community. Climate Change policy of Pakistan (Chaudhry et al., 2012) includes the vulnerabilities of Pakistani communities to climate change and suggests mitigation and adaptation strategies to reduce the adverse impacts to different socio-economic sectors.

E - Mitigation and Adaptation

Climate system is a vast sphere which has no political boundary. There are five main components of this system which are briefly described below;

- a. Troposphere - the lowest part of the atmosphere adjacent to planet earth where all the weather phenomena take place.
- b. Hydrosphere- a set of entities containing liquid water which includes ground water, lakes, rivers, sea and ocean.
- c. Cryosphere - the frozen state of water containing snow, ice sheets, glaciers, permafrost etc.
- d. Biosphere - an envelope around earth encompassing the living things including plants, human-beings, animals, micro-organisms etc.
- e. Lithosphere - deeper into the earth crust which includes the soil, sea bed etc.

All the above five components interact each other and they give rise to the dynamics of the climate system which is basically driven by the energy from the sun. The increased concentration of GHGs near the earth surface has resulted into trap of larger amount of heat outgoing from earth than its normal quota. It has disturbed the balance between incoming and outgoing heat hence giving rise to the air temperature near the surface which is called global warming. Increased trap of heat in the biosphere has changed the dynamics of the climate system as a whole. Further increase in emission of GHGs will enhance the concentration of these gases trapping more and more heat in the biosphere pushing the temperature higher and higher. If we continue to follow this way, the environmental degradation will make the planet earth not suitable to live. Future generations will be suffering the most as sustainability will be at risk for the living organisms. The consequences are well known which include frequent heavy downpours, floods, drought, heat waves, fog, tropical storms, storm surges, dust storms, hailstorms etc.

We have to take care of energy balance by capping the level of GHG emissions which are responsible for climate change and world has started suffering from water related disasters with increased frequency and intensity. This is the responsibility of global community to reduce the emissions to acceptable level for mitigation of the impacts of changing climate. Now it is not the time to ask a question of who is emitting and how much. Although mitigation and adaptation are different processes but in climate change management they are considered as relative terms because they operate hand-in-hand simultaneously. As the set of climatic, hydrologic, social, cultural, economic and political circumstances varies across regions, these measures will also need to be customized to the local conditions. Water resources management provides opportunities for investments that deliver both mitigation and adaptation benefits. For example, multi-purpose water infrastructure can deliver clean hydropower (mitigation) as well as irrigation services and flood and drought protection (adaptation). Similarly, investments in watershed management can enhance carbon sequestration (mitigation), reduce floods and help manage soil moisture and groundwater recharge (adaptation). Such measures can also be designed as pro-poor development, to create alternative livelihood opportunities (direct employment, timber and non-timber forest products, fisheries) and to build social capital (user groups and community consultation and representation

committees), making them sound investments across a range of criteria. In agro-based economies, the focus remains on crop production where farming community has to give up flood irrigation practices for irrigating more area with the same amount of water using modern irrigation methods such as sprinkler, drip etc. Flood irrigation leaches the soil nutrients to deeper layers beyond the access of plant roots and hence reduces the soil fertility.

Examples of Climate Change Adaptation Actions as part of the IWRM Process in River Basins

- Develop flood and eco-sensitive zoning plans
- Strengthen water (use) rights systems for water scarce and drought prone areas
- Develop accurate and transparent water accounting and monitoring systems
- Increase focus on water demand management, including the “3R” approach: Reuse, Recycling and Recharge
- Increase storage capacity, including surface (constructing new dams storage, upgrading existing facilities), groundwater recharge (rainwater harvesting), while maintaining and utilizing the natural storage capacity of ecosystems to the maximum possible extent
- Increase use of new and emerging technologies in water scarce and drought prone areas, e.g. membrane filtration.
- Focus on watershed management as a resilience building approach to adaptation
- Introduce economic instruments such as Payment for Environmental Services (PES) in order to maintain healthy ecosystems that contribute to climate change resilience.

Highlights of ADB Framework

Summary

Water being the most important constituent of life has got central position in the climate change debate among the scientists, planners, policy-makers and members of society. Its availability in surplus or deficit both pose a serious threat to the sustainable development planned as a routine matter. In the face of climate change, water related disasters have increased in frequency and intensity and they are expected to increase further according to future climate projections. Now the management of water resources keeping in view the behaviour of future climate is the core issue which could be addressed by a multi-disciplinary approach. This framework encompasses the usable knowledge, financing, no-regret investments, resilience and mitigation as well as adaptation through the involvement of all the stakeholders.

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