

Ist Draft

Adaptation to Climate Change for managing Water Sector

Abstract

Bangladesh is one of the most densely populated countries in the world. Economies of this country are highly dependent on the agriculture. More than 80 per cent of withdrawn water is used in the agriculture sector. Failure of the monsoon season heavily affects the agriculture sector. Flood as well as other extreme hydrological events such as precipitation, sea level rise, cyclones, storms and surges also affect economies by reducing crop yield, infrastructure damage and leave a footprint in the livelihoods of the poor people in the country. Some people although demonstrated partial resilience by adapting to recurrent onslaught of natural hazards and disasters but a large section of people still now unable to cope with these calamities. Institutional capacities and their governance against hazards are inadequate. The hardship of people can be reduced by increasing their adaptive capacities through developing institutional supports at various levels. This paper highlights the importance of adaptation and coping mechanisms in water as well as health sector in Bangladesh and is supposed to be an entry point for the following I&FF assessment on the water sector, giving suggestions on how to carry out this assessment.

Introduction

Bangladesh frequently faces crucial natural behavior not only for its geographical position but also for the rapid changing of global climate. The effects of global climate change are evident now, as the people across the planet are experiencing through irregular weather conditions. This will have impacts on the composition of the atmosphere, hydrology, geomorphology, ecology, soil, land use, biological diversity, and vegetation etc. Most of the impacts is associated with climate change will occur through the effects on the water sector. Risks will increase due not only to changes in the hydrological cycle but also to increases uncertainty in projecting hydrological conditions. There are considerable regional and seasonal variations in water-livelihoods relationships: monsoon rainfall, river discharge fluctuations, groundwater availability, saline intrusion, fish availability etc. As a result, rural communities, and especially the poor, in all parts of Bangladesh are severely affected by climate variability.

Bangladesh is highly influenced by the Ganges-Brahmaputra-Meghna (GBM) river system, exhibiting high degree of vulnerability to current climate variability and the key realities in the water sector of the country are too much water during the monsoon causing floods and too little or scarcity of water during the dry season. And being the lowest riparian in the Ganges- Brahmaputra-Meghna (GBM) river systems, this country bears the brunt of floods, discharging over 80 percent of the GBM basin-wide runoff within the five-months, and receives residual flows from the trans-boundary rivers during the lean season. High intensity of extreme weather events as well as hydrological events has been posing a serious threat to the passage of Bangladesh's sustainable development. Climate change threat for Bangladesh is integrally related to the country's

sustainable development. Adapting to climate change in water sector is now seen as a prerequisite for sustainable development.

The national economy of Bangladesh is consequently highly responsive to climate variability and change. In terms of environment, economy and social aspects, Bangladesh is highly at risk for her higher dependency on the use of the water resources. The poor are particularly dependent upon the safe and the reliable water resources for their health and livelihoods. These will affect all aspects of the lives and livelihoods. Similarly, the overall growth and development of Bangladesh's economy will be retarded by reduced agricultural viability and productivity, deteriorating health conditions, which threatens to the integrity of the country's environment and increasing natural disasters.

This paper provides a brief overview of the projected changes and variability of the climatic parameters, primarily based on the IPCC fourth assessment report. The possible impacts of the changes/ variability of key climatic parameters on the water sector have been discussed in detail. In addition, impacts of climate change and variability on health issues have also been discussed.

The specific objectives are :

- ❖ To know how climate change will affect the water sector
- ❖ To observe what changes are going to happen in the near future
- ❖ To identify the possible adaptation measures in these two sectors to cope up with the vagaries of climatic manifestations.

How Climate Change affects the water regime

The accelerating changes in our global climate will undoubtedly cause major changes in the patterns of water cycle. The magnitude and frequency of extreme hydrological events including precipitation, floods, cyclones, storm surges, and droughts and these phenomena would increase and adversely affect the water sector. Water sector in

Bangladesh is already experiencing significant stresses of these natural hazards. Consequently agriculture will migrate and traditional areas for crops will change. In other words, climate change will alter the geography of traditional crop areas, which may impact on the country's capacity to provide enough food for all. Due to escalating impacts of climate change in the water sector in Bangladesh, following changes are happening:

- Changing the Hydrological Cycle
 - Increases in water vapors
 - Changes in precipitation pattern
 - Intensity and extremes : Rainfall is likely to become heavier and more erratic
 - Melting of ice and snow cover : The Himalayan glaciers are likely to melt causing higher river flows in the short and medium term
 - Changes in soil moisture and runoff
- Increasing in risk of flooding ,drought, cyclones and storm surges

Local people's perception regarding climate change

Some studies were carried out in the coastal areas of Noakhali District on behalf of IUCN Bangladesh Country Office in order to assess the concept of people in these areas. Local peoples experiences the following type of impacts due to climate change:

- ❖ Excessive rainfall at present, untimely and irregular distribution

The annual rainfall over the coastal zone is increasing. Bhola and Chittagong show the decreasing trend. The rainfall of the winter and pre-monsoon seasons were found to have increasing trend except Bhola.

- ❖ Increase in tidal bores, number of cyclonic conditions, variation in tidal flow

The 5 deadliest tropical cyclones (super cyclones) of the Bay of Bengal were recorded in a study. Among these cyclones four cyclones hit the Noakhali-Chittagong coast.

- ❖ Increase in frequency of flash flood

In the last 25 years, Bangladesh has experienced six severe floods. In 2007, two successive and damaging floods inundated the country in the same season. During high floods, river bank erosion is common. It can result in the loss of thousands of hectares of agricultural lands and villages.

- ❖ Increase in surface temperature

It was observed from a study that surface air temperature is increasing at the rate of $.03 \text{ } ^\circ\text{C}/\text{decade}$. The Sea Surface Temperature has increased by $0.47 \text{ } ^\circ\text{C}$ during the period of last 50 years and at the rate of $0.094^\circ\text{C}/\text{decade}$.

- ❖ Increase in droughts and dry spells, storms and hailstorms

- ❖ Intensity of mist/fog increased in the winter

- ❖ Monsoon rainfall has shifted as a result land preparation and crop plantation of Kharif II has also shifted

- ❖ Severity of cold and its duration is decreasing

- ❖ Because of reduced winter period insect infestation in the crop field is increasing.

Likely Impacts of Climate Change in Bangladesh

Bangladesh is widely recognised to be one of the most climate vulnerable countries in the world. It experiences frequent natural disasters, which causes loss of life, damage to infrastructure and adversely impact on the lives and livelihoods of the poor people, especially women and children. The projected climate change and variability would directly or indirectly affect a wide range of natural and human systems and sectors. Natural and human systems that are particularly vulnerable to climate change include hydrology and water resources; agriculture; terrestrial and freshwater ecosystem; coastal zones and marine ecosystems; human health; human settlement, energy and industry; and insurance and other financial services. Impacts of changing climate will be complex, both biophysically and socio-economically, and will vary greatly by production activities. Uncertainty and uneven distribution of rainfall, prolonged no rainfall condition, floods, cyclones, and salinity intrusion will impact productivity in agriculture adversely. Owing to climate change use of fertilizers and irrigation would increase. There may be changes in cropping patterns and crop management technology.

The Intergovernmental Panel on Climate Change (IPCC) predicts that global temperature will rise between 1.8 C and 4.0 C by the last decade of the 21st century. In Bangladesh, the following changes are expected:

- ❖ Frequency of extreme hydrological events will increase
- ❖ Intensity of extreme hydrological events will increase

- ❖ Occurrence of erratic and unusual behaviour of weather will be frequent
- ❖ Sea Level will rise; to what level is being debated
- ❖ Hot and humid conditions will increase the incidence of water borne and vector-borne diseases like malaria, dengue fever and diarrhoeal diseases.

Adaptation options for the water sector

Although Bangladesh is virtually zero contributor to the greenhouse gas emissions which affects global climate change, it is ironic that it has to suffer so disastrously from the effects of climate change that are likely to occur in the coming decades. It must, therefore, adapt itself to the changing circumstances.

The people of Bangladesh have become adapted over generations to the risk of floods, droughts and cyclones. In areas where inundation is at risk, they raise their houses on mounds, above the normal flood level, and adjust their cropping patterns to take advantage of the flood water. Farmers across the country are adapted to local flooding and rainfall patterns by growing a wide range of indigenous and high-yielding varieties of rice and other crops. Rural roads, paths, tracks and other infrastructures, such as schools, are also raised above flood level, where possible. Potential adaptation measures those pertinent for water regime are described below :

➤ FLOOD MANAGEMENT

- **Flood forecasting system:** Improvement of the existing flood forecasting and early warning systems by increasing lead times and strengthening dissemination mechanisms

- **Flood Evacuation shelters:** Establishment of multipurpose shelter more as well as there should be ensure proper management of this infratructure
- **Flood Zoning, Flood Insurance, Adjustment Cropping Calendar, Watershed management**
- **Flood management infrastructure:** Effective management and up-gradation of existing flood management infrastructures such as polders, embankments, sluices, pump stations and construction of additional one.

➤ **DROUGHT MANAGEMENT**

Drought in Bangladesh is seasonal and can devastate crops, causing hardship to poor agricultural labourers. Drought most commonly affects the northwestern region, which causes lower rainfall than the rest of the country. We should take initiative for preparing essential

- infrastructures for harnessing surface water by setting up the Barrages, deep Tube Wells and
- it is also necessary to adjust this situation in the existing cropping pattern.

➤ **WATER SUPPLY AND SANITATION**

The projected climate change and variability is likely to have a significant impact on the water supply and sanitation sector in Bangladesh. The water supply and sanitation systems, particularly in the coastal region of the

country, are vulnerable to such factors as cyclonic and storm surges and flooding. To improve this situation we need to

- conserve water effectively
- harvest rain water
- recycle and reuse of water
- set up deep tube wells.

➤ **URBAN DRAINAGE**

The current drainage systems of the major cities were designed by using the historical rainfall data. These design capacities will be exceeded in the future. One of the major impacts of climate change is likely to be an increase in the number of episodes of short duration and heavy rainfall. This will result in water logging due to drainage congestion. Following initiative can be taken as adaptive measures in terms of this issue:

- Improvement in the urban drainage capacity including pumping provisions, detention storages
- Restoration of pervious surfaces for enhancing infiltration capacity
- In new urban areas adequate sewers must be designed and constructed to take account of the likely impacts of climate change.

➤ **STORM SURGES AND CYCLONES**

To protect the coastal belt, an extensive network of polders has already been constructed in Bangladesh. However, with the sea level rises expected as a result

of climate change, the height of the dykes will need to be raised further. In addition to, following scheme needs to be taken

- Effective management and up-gradation of existing polders and construction of additional new polders
- Provide support to scale up afforestation and reforestation
- Develop coastal green belts as a measure against storm surge
- Repair, maintenance, and construction of cyclone shelters for protection against storm surge
- Improve existing cyclone forecasting and warning system and
- Analysis of meteorological data to improve prediction of changes in the pattern of cyclonic events.

➤ **EROSION CONTROL MEASURE**

Climate change is likely to increase rainfall in the Brahmaputra-Ganges-Meghna basin in the monsoon season. This is likely to cause further instability in the already unstable river system. Higher rainfall in upper catchments may also increase sediment movements. Overall, river systems are expected to become more unstable as a result of climate change. Effective River training works is the only option as an adaptation measure to control river erosion.

Adaptation options for Health Sector

The 4th IPCC report indicates that one of the major impacts of global warming and climate change will be an increase in vector borne diseases (e.g., malaria and dengue fever). Recent studies by the International Centre for Diarrhoeal Disease

Research, Bangladesh (ICDDR, B) demonstrate that diarrhoeal diseases are on the increase, which attributes partly to increase flooding and drainage congestion. This is expected to get worse with climate change. Global warming will also raise temperature in the summer season, increasing the incidence of heat stroke, which could be further aggravated by shortage of drinking water. Possible other threats from other vector borne diseases such as Kala-azar and typhoid have yet to be assessed. Possible adaptation measures may be as follows in this sector:

- Vector multiplication should be regulated
- Awareness raising programme to combat diarrhoeal diseases should be organized
- Awareness against heat strokes also should be created.

One of the best ways to adapt to climate change is to involve people at the grass-root level. The people of Bangladesh are very innovative. They have been living with disasters for a long, long time. Adapting to changing situations is a familiar traditional practice in Bangladesh. At this moment, there is necessary to carry out detailed scientific studies, to make the people aware of the impending dangers, and to develop, along with them, methods of adaptation.

Tools and methodologies for analysis

Statistical analyses based on probability functions on the basis of previous observed data (preferably of 30 years) is used by engineers and professionals to plan and design irrigation projects, flood management infrastructures, drainage systems (also bridges/culverts) etc. There should be necessary to modify these approach which will be required because of the projection of past trend will no longer be valid.

Results from General Circulation Models or any Climate Models, which have been developed at regional or country level, on the basis of small grids that will predict future conditions, will be required to 'climate proof' in all infrastructures and should be decided upon planning and design parameters.

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Concluding remarks

It is clear that there are significant uncertainties in the overall projections of the climate change and variability and their possible impacts on the water sector. Appropriate adaptation strategies must be considered to strengthen the capacity of Bangladesh to address the reality of climate change in these two sectors. Bangladesh should consider seriously for adopting anticipatory long-term strategies rather than short-term reactionary responses in meeting the impacts of climate change, because human induced climate change effects are long-term, extremely slow, with complicated cross-sectoral implications.

The important climate change effects in the water sector are related to increased water demand and reduced availability, degraded water quality, and damaged water supply and sanitation infrastructure. Adaptation strategies should therefore,

focus on these particular issues. Both physical and institutional adaptation strategies should be considered because while the physical adaptations are required for protection and enhancement of human made or natural systems, institutional adaptations, that may include socio-economic measures, changing the use of resources through non-structural measures, and increasing awareness level, are essential in reducing vulnerability.

The threat to human health is one of the most important risks of climate change. Bangladesh is already vulnerable to outbreaks of infectious, waterborne and vector-borne diseases. It is likely that the projected climate change induced warmer and wetter conditions in Bangladesh would further increase the prevalence of these deadly diseases.

Considering all of these we must prepare for Adaptation to Climate Variability (the already occurring extreme events) and keep in mind the trend indicated in Climate Change forecasts. Time is now to act on Adaptation in these two sectors. The Bangladesh Climate Change Strategy and Action Plan -2008 has identified several programmes towards effective adaptations in Water, agriculture, health, water supply and sanitation, and urban drainage sectors.

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