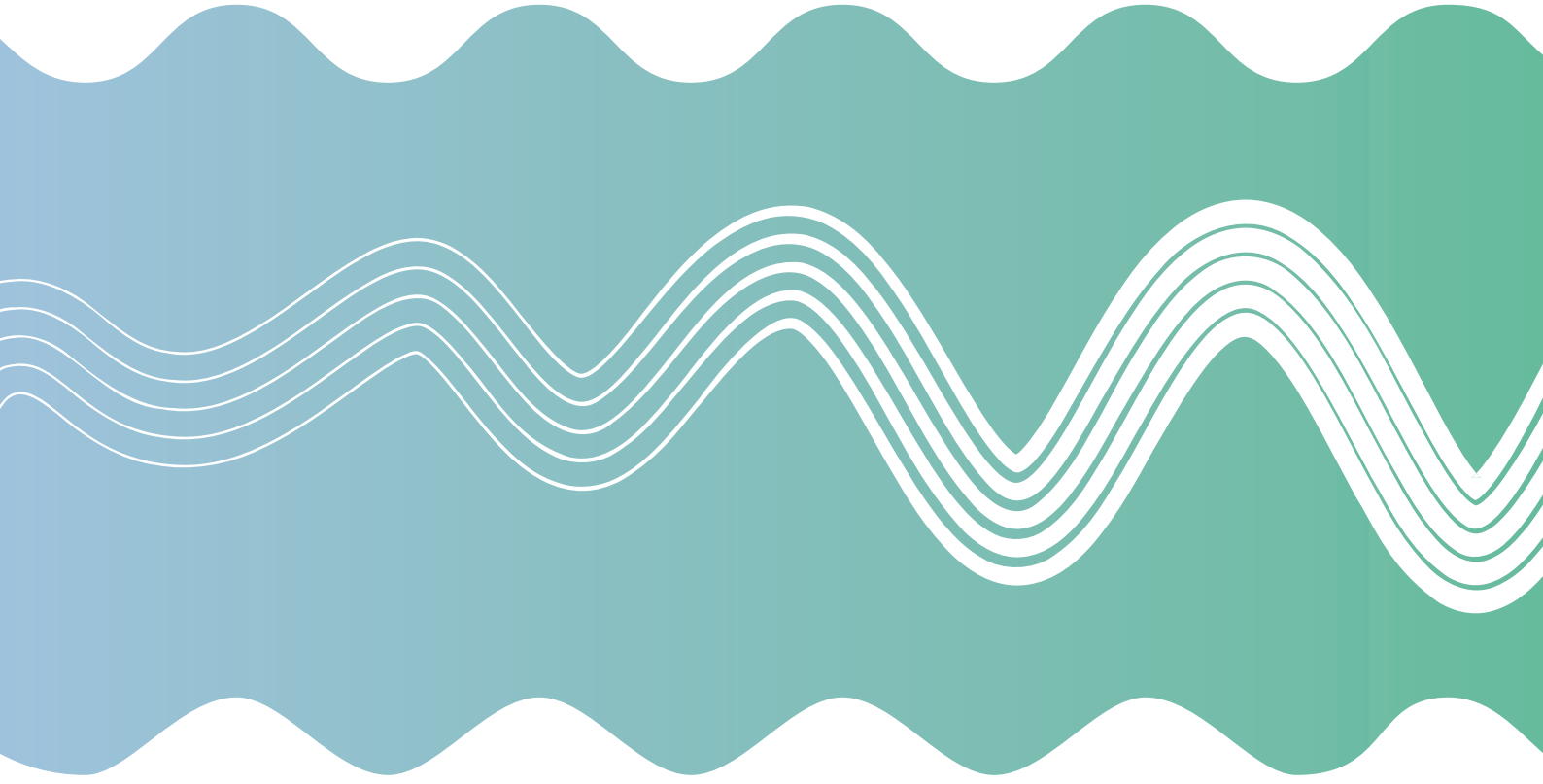
Himalayan Solutions

Co-operation and Security in River Basins



Strategic Foresight Group

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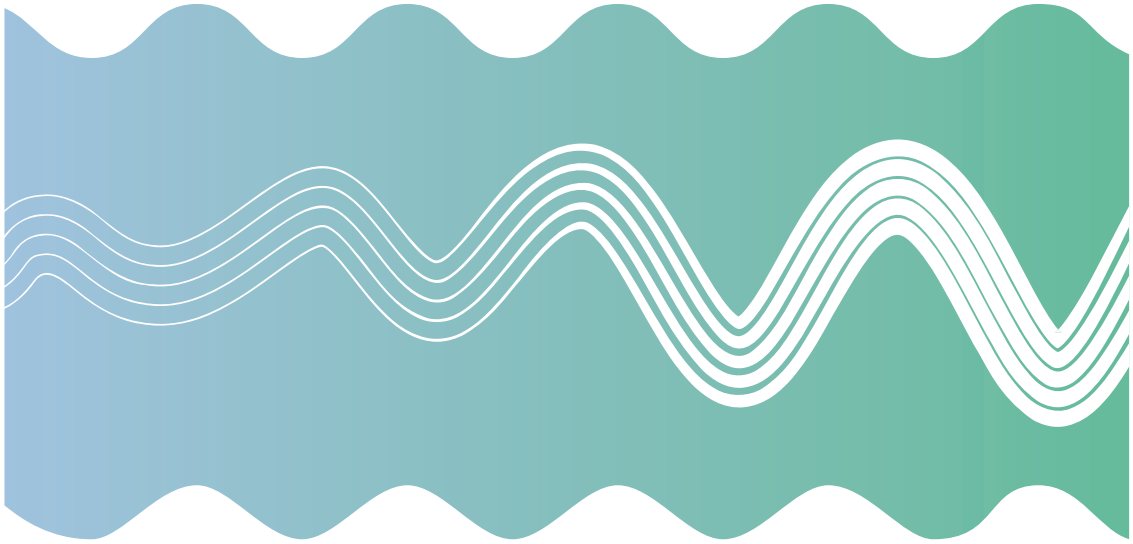

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PREFACE

Since the launch of the Strategic Foresight Group report *The Himalayan Challenge: Water Security in Emerging Asia*, at the Singapore International Water Week in June 2010, water has drawn growing attention in the Asian security debate. This has partially to do with the analysis presented in the report, attracting comment or reference from almost 100 newspapers and websites and partially to do with new developments on the ground.

The growing water stress, plans for dams on shared rivers, and uncertainties about the precise impact of climate change have brought water to the forefront of the political agenda of countries in the Himalayan River Basins. Having defined and analysed the problem in our previous report, we thought that it would be constructive to provide ideas for cooperative solutions to enhance water security in Asia. To this end, a workshop organised in Singapore in December 2010, involving the participation of policy makers and experts from Bangladesh, China, India, and Nepal was very productive.

This report recommends policy options for national governments as well as strategies which can be implemented by local authorities and community groups in a politically viable manner. Some of the ideas may on the surface appear to be addressing micro-level issues. However, such micro-level issues do have an important bearing on security at the macro-level in a large continent such as Asia. This is the experience of many other regions as well, as illustrated in several of the chapters in this report.

Strategic Foresight Group has been consistently committed to building peace and security using water as an instrument for cooperation between countries having difficult relationships. In 2005, we published a report on how integrated water management can help improve India-Pakistan relations. Earlier this year, we published *The Blue Peace: Rethinking Middle East Water*, proposing many new concepts in a challenging region. We are now pleased to present *Himalayan Solutions: Cooperation and Security in River Basins* with a hope that it will lead to fresh thinking in one of the most populous regions of the world. Since Asia is proving to be the engine of economic growth in the 21st Century, improved security in Asia would make an important contribution to global security.

I must thank the John D. and Catherine T. MacArthur Foundation for providing generous support to enable the Strategic Foresight Group to undertake a challenging endeavour, which involved organising three workshops with Asia's leading experts, publication of two reports, interaction with policy makers and the media and significantly, building the capacity of a team of young researchers in a new aspect of Asian Security. I am also grateful to all our collaborators, particularly the International Union for Conservation of Nature (Nepal), Bangladesh Institute of Peace and Security Studies, and S. Rajaratnam School of International Studies and Public Utilities Board of Singapore.

Ilmas Futehally
Executive Director, Strategic Foresight Group

February 2011

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Introduction

The objective of this report is to explore how river basins in the Himalayan region, and particularly shared water resources, can foster cooperation and security between Bangladesh, China, India and Nepal. The conventional view is that depleting water resources, growing problem of pollution, uncertain risks posed by climate change together may lead to competition for resources, migration, social instability, internal conflicts and diplomatic tensions between countries. This view is realistic and was discussed in detail in a previous report of Strategic Foresight Group. It has contributed to spreading the awareness of security risks associated with water crisis in the Himalayan region. The next step is to move from awareness of causes of insecurity and conflicts to the exploration of confidence building and conflict prevention measures. It requires a paradigm shift in our mental frameworks from a mindset of conflict to a mindset of cooperation and security. Such a mental change is a challenging task, but the countries sharing Himalayan River Basins do not have too many other options to sustain their societies, economies and ecology.

The Himalayan River Basins in China, Nepal, India and Bangladesh are home to about 1.3 billion people - i.e. almost 20 per cent of the world's population and almost 50 per cent of the total population of these countries. In the next 20 years, the four countries in the Himalayan sub-region will face the depletion of almost 275 billion cubic meters (BCM) of annual renewable water. At the same time, demand will increase due to growth of population and economic development. The cumulative effect of water scarcity, glacial melting, disruptive precipitation patterns, flooding, desertification, pollution, and soil erosion will be a massive reduction in the production of rice, wheat, maize and fish. Both India and China will face a drop in the yield of wheat and rice anywhere between 30-50 per cent by 2050. At the same time, demand for food grains will go up by at least 20 per cent. As a net result, China and India alone will need to import more than 200-300 million tonnes of wheat and rice.

Undoubtedly, the threat to food security will directly manifest itself in the regional economy. Hundreds of millions of people in these four countries make their living off agriculture. The economies of the four countries are heavily dependent on the agriculture

sector, particularly in Nepal and Bangladesh. Moreover, any new ventures or industries that wish to set up in China, India, Nepal or Bangladesh will strongly consider the availability of water for the functioning of their industrial units before they decide to invest. Apart from agriculture, there will also be an impact on the fisheries and aquaculture sectors.

Water scarcity, decline in food availability, reduction in livelihood opportunities in rural areas, desertification, soil erosion, sea-level rise and construction of dams will lead to displacement and migration of 50 to 70 million people in the four countries by 2050. Based on past trends, millions of people migrating internally or to neighbouring countries will result in social conflict on a communal or secular basis. Between countries, the intention to build dams and increasing cross-border migration could result in heightened tensions.

How do we convert such a high risk scenario to a future of peace and secure society? Strategic Foresight Group (SFG) sought to examine the prospects of such radical change in mindset. The idea for this initiative came from an international conference on Responsibility to the Future, organized by SFG jointly with the United Nations Global Compact in Mumbai in June 2008. The conference recommended that SFG should address the issue of water security, particularly as it relates to the problems arising from the melting of glaciers and flow of Himalayan rivers, from the position of a think tank that looks at geopolitical and strategic future, not from a sectoral perspective. The John D. and Catherine T. MacArthur Foundation offered to support the initiative under the auspices of its Asian Security Initiative.

SFG conducted two workshops to bring together best known experts from the four countries. The First Workshop was held at Kathmandu, Nepal in August of 2009. The World Bank and International Union for the Conservation of Nature, Nepal, cooperated with the Strategic Foresight Group in convening the workshop, which was attended by leading experts on water and climate change from Bangladesh, India, China, Nepal and the World Bank, including former Ministers of Water Resources. The participants overwhelmingly emphasized the need to promote Himalayan sub-regional co-operation to ensure water security. Participants recommended building blocks of regional co-operation beginning with water dialogues, data sharing and awareness building in affected communities, slowly enhancing it to the level of collaborative river basin management. SFG announced in response that it would continue with the collaborative dialogue process and convene another workshop.

Strategic Foresight Group and Bangladesh Institute of Peace and Security Studies (BIPSS) organized the Second International Workshop on Himalayan Sub-regional Cooperation for Water Security in Dhaka in January, 2010. 25 distinguished water experts from India, Bangladesh, China and Nepal, including former Ministers of Water Resources of India, Bangladesh and Nepal, participated in the workshop. The workshop strongly recommended integrated cooperative basin management mechanism for the Himalayan Basin Area.

The SFG report *The Himalayan Challenge: Water Security in Emerging Asia* was launched in June 2010 at the Singapore International Water Week. It was reviewed or quoted in almost 100 newspapers and websites across the world, including *The Wall Street Journal, The International Herald Tribune* and *The Times of India*.

The interest generated by the report led Strategic Foresight Group, in collaboration with the S Rajaratnam School for International Studies (RSIS) to organize the Third International Workshop on Benefits of Cooperation in the Himalayan River Basins in Singapore in December 2010. The Centre for Non-Traditional Security Studies was the co-host, on behalf of RSIS at the Nanyang Technology University of Singapore. 30 distinguished policy makers and scholars from India, Bangladesh, China, Nepal and Singapore including former ministers of Water Resources of India, Bangladesh and Nepal, as well as the President of the International Water Resources Association from China participated in the workshop.

The workshop underlined that regional cooperation should be an instrument to promote human development and security, and not an activity to be pursued for its own sake. The workshop also emphasized that water is at the core of security in Asia and therefore cooperation in the management

of water resources has to be at the core of peace in the region. However, the workshop suggested that efforts for enhancing security and development in Asia, using water as a mechanism for confidence building, must be very concrete and realistic. In this spirit, participants in the workshop made several specific suggestions for the policy community and the civil society, as well as suggesting certain areas for increased co-operation. They were:

01. Modern Management
02. Enabling Technologies
03. Local Initiatives
04. Role of Educational Institutions
05. Inter-disciplinary Research
06. Hydro-electricity
07. Regional Convention
08. Himalayan Rivers Commission
09. Political Forum
10. Experience from Southeast Asia

This report builds on the suggestions made by the Singapore Workshop and examines how each recommendation can be transformed into a functioning reality through inter-governmental cooperation, state policies and local initiatives.

CHAPTER 1

Modern Management

Regional security can be promoted without riparian countries formally entering into a security arrangement but rather improving the order in their own respective countries. Efficient management of water can enhance supply for every citizen, reduce competition and weaken the cause for internal conflict. If countries follow each other in setting certain common standards, it would be helpful. But even if each country were to individually subscribe to the objective of modern management of water sector, it can help improve overall water security.

The objectives of modern management would include increasing efficiency in resource utilization, conservation and demand management. The strategies would involve better management practices, mitigation of subsidies, particularly for industry, improving infrastructure, and training at all levels.

Appropriate Pricing

One method to reduce wastage of water is to price it appropriately. Especially in countries where water is scarce, pricing is valuable tool. This is due to the following reasons:

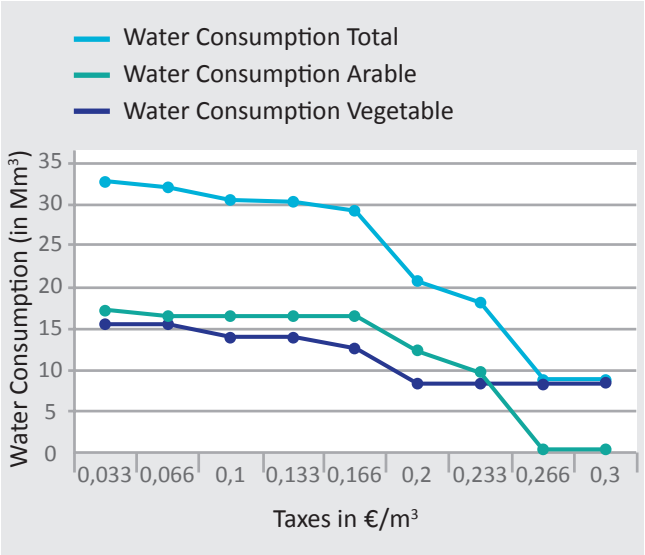
- **High levels of industrialization:** Industry is usually the largest culprit when it comes to water wastage in these countries. China, the world's leading steel producer, utilizes nearly twice the amount of water that developed nations do, to produce 1 ton of steel. The Indian steel sector, which ranks amongst the top ten producers in the world in terms of output, is much worse. On an average, the integrated iron and steel plants in India, consume 20-25 m^3 of water per ton of finished product as opposed to the global standard of 5 m^3.

- **Increasing urbanization:** In the domestic sector, urban homes use more water than the ones in rural areas do for household uses. Urbanization in China and India is rapidly increasing. At the same time, Bangladesh and Nepal are also urbanizing, though at a much slower pace.

- **Enormous agriculture sectors:** The agricultural sector in all four countries is significant. The agriculture sector consumes over 80 per cent of water used in India and China. Water intensive crops such as rice and wheat are the primary crops in these regions.

In view of the inevitable growth in demand for water in the growing economies of Asia, pricing water appropriately will have a significant impact on the amount of water used in each sector. However, water pricing will have to be applied prudently, given a large section of the population in these countries that is below the poverty line.

Water Price Versus Consumption for the Agricultural Sector in the Danube-Tisza Interstice



Source: http://www.ecologic-events.de/tisza/documents/5_Background_Paper_WaterPricing_TT.pdf

The aim will have to be to ensure that industry and agriculture pay more for water, while supplying water for domestic use at an affordable rate. In India and China, and to a certain extent Bangladesh, this will be a difficult task to achieve, given the sheer size of the population. Meanwhile, all of the countries can expect a backlash from industry and farmers for increasing pricing for an essential resource. However, in the long run it is a necessary measure to ensure supply without creating conflict within and between countries.

There are some lessons that can be learnt from other parts of the world. Ukraine's water pricing law is part of national legislation. Colombia has water pricing that is regulated by a special administrative body whose function is solely in the realm of water pricing.

Water tariffs are designed with certain objectives in mind:

- Revenue Sufficiency
- Economic Efficiency
- Equity and Fairness
- Income Redistribution
- Resource Conservation

It is vital to remember that there are stark differences between examples that are taken from the developed world to the ones that are viable in the developing world. It is also important to remember that pricing already exists in the countries of the Himalayan River basin; however, it is not high enough to act as a deterrent against wastage. If the focus has to be shifted back to resource conservation, then existing water tariffs will have to be altered.

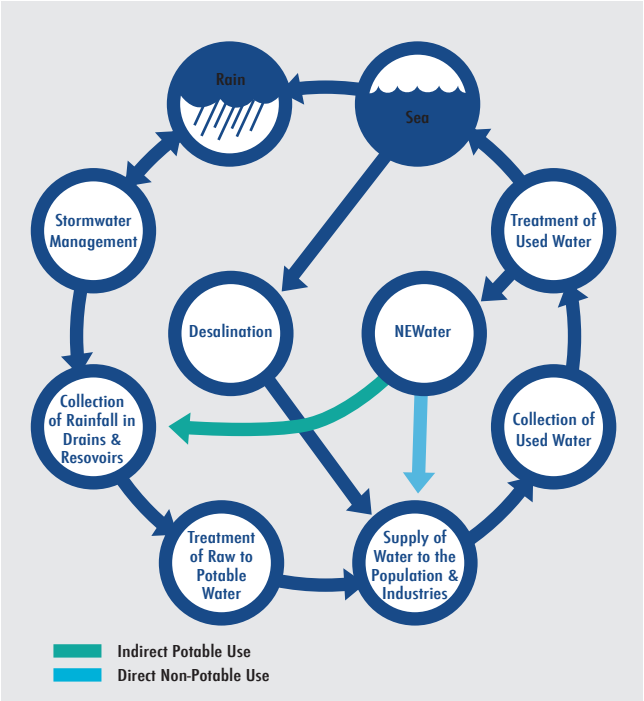
Managing Water Resources

Water management will also have to involve the conservation of water, as well the managing the increasing demand for the resource in the region. Conservation efforts are bolstered by the dozens of local initiatives across the region, as well as by new and emerging technologies that are being pioneered in different parts of the world. To add to this, demand can be managed by expanding training for primary water users, especially farmers and women.

An interesting lesson can be learnt from Singapore Public Utilities Board (PUB), which successfully manages its water resources through a strategy it has named 'Closing the Water Loop'. The PUB has transformed a country that was hamstrung by its lack of water resources in the 1960s and 1970s into a country that has adequate water resources for its population today. The basic concept of 'Closing the Water Loop' entails ensuring that PUB is responsible

for the entire process, from harvesting rainwater, all the way until the end where the water either flows into the sea, or is used and then treated to be used again. Meanwhile, Singapore has invested heavily in supporting research that has created emerging technologies to harvest and treat different types of water to make it potable.

The Water Loop



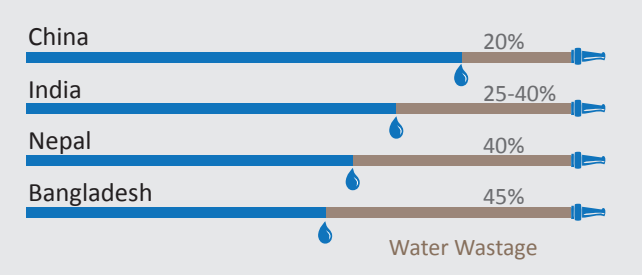
Source: Public Utilities Board, Singapore. http://www.pub.gov.sg/water/Pages/default.aspx

Another vital aspect of managing the countries' water resources will be the training of individuals, from those working in the water resources and management sector to the primary users of water. Conservation of water in the Himalayan River Basin will increase markedly if this can be achieved. An example of this is seen in Cambodia. The Phnom Penh Water Supply Authority (PPWSA), was able to transform its water situation in part by training its staff. Annually, staff of the PPWSA gets around 12 days of training. They also have programmes that evaluate performance and record corrupt activities, while also introducing better salary structures to motivate the staff.

Improving Infrastructure

Improving infrastructure, particularly in urban areas will also conserve water by mitigating conveyance losses. Normally urban dwellings use more water per capita that rural ones. In most urban areas in India, China, Nepal and Bangladesh, the poor quality of the infrastructure has resulted in large loss of water. Water wastage statistics in China, India, Nepal and Bangladesh are startling. About 20 per cent of water from water treatment plants is lost through leaks in distribution pipes across China. In 2005, water lost through leaky pipes across China constituted approximately 1.7 per cent of water usage, or the equivalent of 10 BCM. In India, about 25-40 per cent of the water supplied in the urban areas is lost due to pipe leakages. Nepal's urban areas lose around 40 per cent of the total water supply due to leakages. Bangladesh's estimates for unaccounted for water are around 40-50 per cent. This 'unaccounted' water is lost through a combination of water theft and leakages due to poor piping.

Water Wastage



In all four countries, replacing the infrastructure or strengthening/renovating existing infrastructure will considerably reduce the water being lost due to wastage. Leak detection programmes have shown results in countries like the United States. Moreover, increasing piped water access for residents, particularly in urban areas will result in decreasing water theft.

Overall, better and more modern management in the Himalayan River Basin is likely to lead to a significant increase in water conservation, and thereby lessen the burden each of these countries currently faces. A commitment from all four countries to jointly increase their water sector efficiency, and successfully manage demand could yield positive results across the basin.

CHAPTER 2

Enabling Technologies

Like modern management methods, new technologies can help efficient demand and supply management in the water sector, thus contributing to conflict reduction. There is a growing trend in different parts of the world to use technology as an enabler of social conflict resolution. New technologies pertaining to water supply have led to an increase in the availability of usable water through treatment of wastewater, seawater and brackish water. New technologies also enable conservation of water by introducing efficiency in distribution and usage. As a result, the amount of water needed for a particular activity can be reduced. Commercial and large scale application of water technologies will be critical in the future, as freshwater levels decline. The Himalayan River Basin countries may wish to increase investments in research and development of water technologies. For example, India's strengths in process innovation and cost reduction may be of particular importance in water enabling technologies. At the same time, it will be prudent to develop partnerships with countries presently in the forefront of research such as Israel and Singapore. Some recent advances in water related technologies, which could be of interest to the Himalayan river basin countries are listed below:

Reworking Reverse Osmosis

Reverse Osmosis (RO) is a water filtration and purification process, commonly used in treatment of brackish water, seawater and waste water. Although widely used, it has certain drawbacks which have lead to renewed research efforts to amend the RO process. RO has traditionally had very high energy requirements. More significantly, the RO process leads to the removal of essential minerals from the treated water, the loss of which is regarded as detrimental to human health. Therefore, RO treated water may be more suitable for non – potable usage rather than drinking purposes. Ongoing research efforts in various parts of the world are aimed towards reworking the RO process in a manner which does not lead to a loss of minerals from the treated water.

Desalination through Renewable Energy

Recent advances have made it possible to desalinate water using solar energy and other alternate energies. Desalination can be achieved through multiple thermal processes for e.g. vapour compression, multiple effect distillation, multistage flash distillation, freeze separation, and solar still. Alternate energies including wind energy may be of particular use in water supply applications such as pumping.

Singapore has invested in introducing clean desalination technologies. A desalination plant which is run by energy generated from waste is currently being built on a pilot demonstration basis in Jurong Island. The plant will deploy the Memstill treatment which converts salt water into fresh water by harnessing the heat generated from waste. The initial capacity of this waste to energy desalination plant will be 100 cubic metres. In the future, rising salinity in groundwater will pose challenges in Bangladesh, China and India, particularly in coastal areas. Clean desalination technologies, such as “waste to energy”, may provide a sustainable method of treating brackish water and seawater.

Nanotechnology

Nanotechnology offers great potential in water applications including water treatment and purification, as well as sensing and detection. Nanotechnology applications can enhance water quality, availability of usable water and viability of water resources through nano-filtration materials. Nanotechnology can also detect both biological and chemical contaminants in water. There are various ongoing research efforts seeking to apply nanotechnology to water remediation of industrial and domestic wastewater, and contaminated surface and groundwater.

Nanotechnology can also speed up the desalination process. In 2009, the Computational Biophysics Group at the Research School of Biology at Australia National University discovered a way to treat saltwater using nano-tubes made from boron and nitrogen atoms that can make the desalination process up to 5 times faster. Further, nano-purification is inexpensive compared to traditional treatment methods and hence may be significant for developing countries. For instance, a desalination plant deploying nanotechnology costs only about a quarter of the cost of a conventional desalination plant.

Scientists are also seeking to develop commercially viable small scale applications in nanotechnology water treatment. In March 2010, researchers at MIT published a new approach to salt water desalination, called ion concentration polarization. This system works at a micro scale and can be used in small portable units. Small scale applications of nano-filtration of brackish and seawater has benefits for remote areas of developing countries and can also prove to be useful in cases of disasters and extreme events.

Remote Sensing and Monitoring of Water Quality, Water Levels and Distribution Networks

Remote sensing and monitoring applications have benefits in assessment of ground water and surface water, watershed management, evaluation of water quality and monitoring of conveyance systems. Remote sensing is particularly useful in detecting leakages and reducing water losses during the distribution stage. A case in point may be the TaKaDu solutions which have developed remote water infrastructure monitoring systems. These applications provide real time control in detecting leakages. They also aid in tracking water quality metrics, including chlorine and contamination levels. Effective utilization of remote sensing can lead to reduced non-revenue water and a more effective distribution network. Although the four Himalayan river basin countries have already adopted many of these technologies, particularly in assessment of water levels and tracking water quality, they can look towards specifically improving their water conveyance networks.

Innovative Wastewater Recycling

Innovative technologies in treatment of domestic sewage and industrial waste can lead to wastewater becoming an important alternate water resource. Post recycling, wastewater has important non–potable uses in agriculture and industry. Efficient utilization of wastewater can hence lead to reduced dependency on freshwater. The four Himalayan river basin countries can look towards adopting constructive approaches to maximize the usage derived from wastewater treatments.

An emerging trend in wastewater treatment has been constructed wetlands. The criticality of wetlands in nature has been endorsed by countries across the world in the last 20 years, as evidenced by the Ramsar Convention. Constructed wetlands may be used to treat industrial, agricultural and municipal water. However at present artificial wetlands may be more relevant in developed countries which have high standards for wastewater treatment and discharge.

In addition, countries can look towards utilizing treated wastewater for irrigation. Recent research reports suggest that treated paper mill effluents may be more beneficial for irrigation purposes than freshwater. For instance, use of treated paper mill wastewater has indicated improvements in soil productivity, crop properties, and reduced electricity consumption. Therefore, cost effective methods of utilizing wastewater produced in the industrial sector for irrigation usage may lead to development of alternate water resources for agriculture.

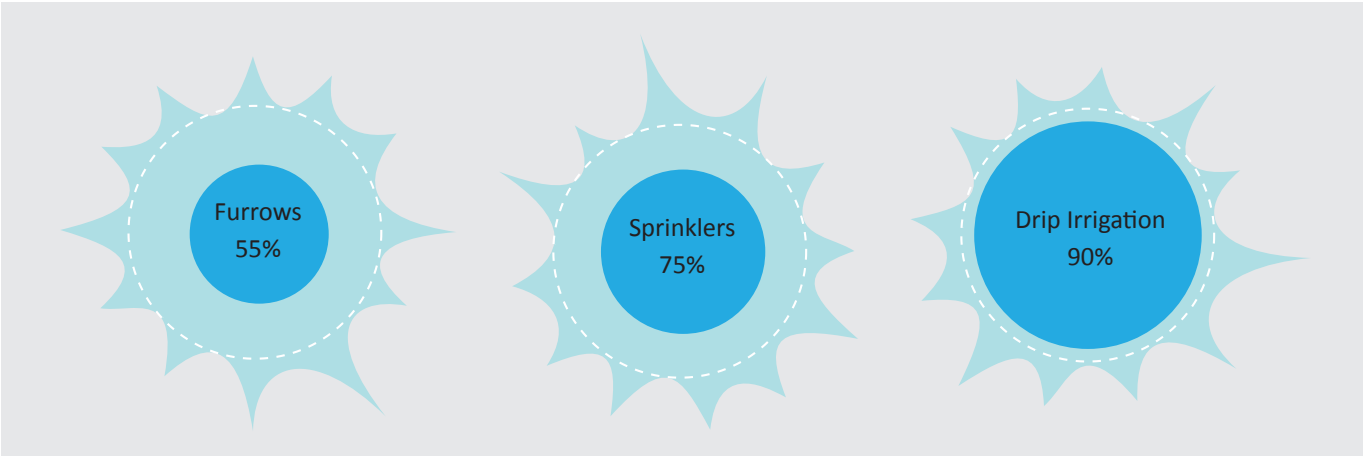
In recent years, Singapore has been successful in treating wastewater to produce highly reclaimed water. The high grade reclaimed water has been named NEWater and it has become an integral component of water sustainability in Singapore. In 2010, it was expected to contribute to 30 per cent of Singapore's water needs. NEWater is primarily aimed at the industrial and commercial sectors for non–potable use. The NEWater process requires only a one-stage reverse osmosis as compared to the two stages needed in conventional methods. The high grade reclaimed water is a positive example of years of investment and R & D bearing fruit and is relevant to other countries grappling with water scarcity.

Drip Irrigation

Agriculture remains the highest consumer of water in the four Himalayan river basin countries. Wastage of water in agriculture can be primarily attributed to inefficient irrigation systems. Water usage in irrigation can be reduced by adopting new technologies such as drip irrigation.

Drip irrigation is also known as micro irrigation or trickle irrigation, and is a method through which water is dripped slowly through valves, piping and emitters directly to the roots of plants. Benefits of drip

Water Efficiency



irrigation include high water application efficiency, controlled distribution of water in alignment with crop and soil requirements, and reduced energy and labour costs. Drip irrigation is an extremely effective water conservation technique, particularly in comparison to prevailing irrigation methods in developing countries.

Drip Irrigation is considered to be one of the most valuable innovations to have emerged in the agricultural sector. The four Himalayan river basin countries can increase demand efficiency and productivity by adopting new irrigation technologies, since the agriculture sector continues have the highest demand for water.

Fog Water Harvesting

This innovative technology harnesses water collected from fog, under favourable climatic conditions. Fog harvesting offers the potential to provide an alternate source of freshwater. Although efforts to deploy fog harvesting have been ongoing for the past thirty years, recent years have seen successes in various South American countries, including Chile, Ecuador, Peru and Mexico.

Fog harvesting has many advantages including low energy requirements, low capital investment and community participation. Amongst the four Himalayan sub – region countries, Nepal has commenced efforts to develop fog harvesting technologies. Nepal Water for Health (NEWAH) and Nepal Community Development Foundation (NCDF) are working towards developing fog harvesting technologies for the benefit of remote hill communities in Nepal.

China, India, Nepal and Bangladesh should look towards adopting a proactive and constructive approach to research and development, and investments pertaining to water technologies. Water technologies on both the supply and demand sides have the potential to solve socio-economic problems and manage challenges in the water sector in the future.

CHAPTER 3

Local Initiatives

Water management through local initiatives can serve as a means to increase equity in distribution and productive use of water resources. Local initiatives have far-reaching effects and can help to identify fundamental policy issues or develop alternative policies.

Moreover, systematic efforts developed to improve planning in water management at the local level can be used at higher levels, while local innovations can also be incorporated in other places. Consequently, it becomes important to engage local stakeholders in the process of developing a transboundary river management plan. Examples of local initiatives in conserving water resources include:

Roundabout Water Pump

In 1999, the organization 'Roundabout Outdoor', based in South Africa, came up with an innovative idea to combine the need for water pumping with the fun of playing. This can be achieved by coupling a low maintenance pump to a roundabout on which children can play. As the roundabout rotates, the water is pumped from a borehole to a water storage tank. Naturally, these play pumps are only useful where children gather, but they can be highly effective if located outside a school. A roundabout outdoor play pump costs USD 5000 to install and provides water for up to 2500 people.

Blue Alternative

Goldman Environmental Prize Winning hydrologist Dr. Michal Kravcikis developed the Blue Alternative system. It utilizes numerous small reservoirs and depressions to catch and store water, takes necessary measures to slow runoff, restores wetlands and transfers control of water resources from central government to local self-government. A pilot project was developed in the Tichy Potok area in Slovakia, where the government had earlier decided to build a large dam. The alternative approach, together with repairs and efficient use of the existing water system, generates sufficient supply of water at a lower cost and with less environmental damage, even with a growing demand from consumers in the cities downstream.

Bamboo Pipe System

In the Indian state of Meghalaya, an ingenious system of tapping stream and spring water by using bamboo pipes to irrigate plantations is widely prevalent. About 18-20 litres of water entering the bamboo pipe system per minute gets transported over several hundred metres and finally gets reduced to 20-80 drops per minute at the site of the plant. The tribal farmers of Khasi and Jaintia hills use this 200-year-old system to irrigate the betel leaf or black pepper crops planted in areca nut orchards or in mixed orchards. Bamboo pipes are used to divert perennial springs on the hilltops to the lower reaches by gravity.

Low Cost Tube Well Technology

Conceived and developed by a British geo-hydrologist, Tim Rees, and promoted by Grassroots, the tubewells combine water harvesting with hand pump technology to provide a constant supply of water. With the loss of tree cover in Kumaon in Uttarakhand State in India, traditional water sources, like nalahs, are drying up and can no longer be harvested. Specially designed for the hill areas, this technology can harvest large quantities of water since deep seepage lines are tapped. These structures are cost-effective as water is not carried over several miles from distant water sources to problem villages. The per capita investment is a mere INR 500 (USD 10), compared to INR 3,000 (USD 60) for conventional gravity flow piped water systems.

Kunds

The villagers of the Thar Desert in Rajasthan State in India evolved an ingenious system of rainwater harvesting known as Kunds. Kund, the local name given to a covered underground tank, was developed primarily for tackling drinking water problems. Usually constructed with local materials or cement, Kunds are built in areas where the groundwater available is moderate to highly saline. These are owned by communities or privately, with the rich having one or more Kunds of their own. Community Kunds were built through village cooperation or by a wealthy individual for the use of the entire community.

Groundwater Dams

Groundwater dams were conceived in the 1980s. Structures are built to obstruct the natural flow of groundwater and provide storage for water underground. The basic principle of the groundwater dam is that instead of storing the water in surface reservoirs, water is stored underground. They have been used in several parts of the world, notably India, parts of Africa and Brazil. The evaporation losses and risk of contamination are less and they can be used in regions that experience heavy rainfall in monsoon months and negligible rain during the dry season.

Rainwater Havesting

Over the years, rainwater harvesting is increasingly being integrated into water management strategies by governmental and non governmental institutions in several parts of the world.

- The Central Government in India plans to introduce a bill to make rainwater harvesting compulsory throughout the country. In some states, such as Tamil Nadu, Gujarat and Rajasthan rainwater harvesting is already compulsory. To promote water conservation in Bihar, the state government will soon enact a law making rainwater harvesting mandatory in urban areas. Also, the Centre for Science and Environment (CSE) has launched a National Water Harvesters Network (NWHN) to promote community-based water harvesting systems. The network is essentially a forum for like-minded people to exchange ideas and experiences.

- In China, the government sponsored the “121” rainwater catchment project to support each

family in building the following: one rainwater collection surface (with an area of 80 to 100 m^2), two underground water cellars (with a capacity of 15 to 20 m^3 each) and one piece of land to be irrigated and grow cash crops. The Project implemented by the Gansu Provincial Government was successful in supplying drinking water to 2.63 million people and irrigating 367,000 hectares of farmland.

- In Bangladesh, rainwater collection is seen as a viable alternative for providing safe drinking water in arsenic affected areas. Since 1997, about 1000 rainwater harvesting systems have been installed in the country, primarily in rural areas, by the NGO Forum for Drinking Water Supply and Sanitation. The rainwater harvesting tanks in Bangladesh vary in capacity from 500 litres to 3,200 litres, costing from Tk. 3000-Tk. 8000 (USD 50 to USD 150).

- In Germany, rain taxes are collected for the amount of impervious surface cover on a property that generates runoff directed to the local storm sewer. So, the greater the amount of rainwater caught and conserved, the lesser the runoff added to the storm drains. Less runoff allows smaller storm sewers, which, in turn, saves construction and maintenance costs at the site. Thus people get rain tax reductions by converting their impervious pavement or roof into a porous one.

- The Indonesian government introduced a regulation requiring that all buildings have an infiltration well. The regulation applies to two-thirds of the territory, including the Special Province of Yogyakarta, the Capital Special Province of Jakarta, West Java and Central Java Province.

- The Department of Urban Development and Construction in Nepal has been working since early 2006 on promoting rainwater harvesting in the urban areas. In addition, the Government of Nepal prepared a policy on rainwater harvesting in 2009 to promote suitable developments in rainwater harvesting for human consumption and domestic use, and facilitate guidance and capacity building.

Lessons from Other Trans-boundary River Basins

Experiences from some river basin organizations offer lessons on methods of coordinating local stakeholders and integrating local initiatives into a trans-boundary river commission. Some successful examples include -

Mara River Basin Transboundary Water Users Forum (TWUF): In 2008, Kenya and Tanzania, which share the Mara River, established the TWUF to spearhead the transboundary water resources management initiative and to ensure participation of stakeholders in water resource management down to the lowest level of a water user. Some of the key achievements of this Forum include:

- Community members were assisted in setting up shallow pans for water harvesting during dry spells for micro-use.

- Water users associations are registered with a mandate to participate in management of water resources in the basin. They work closely with the Water Resource Management Authority in Kenya and the Basin Water Office in Tanzania to ensure that water permits and allocation in the basin allows for the preservation of reserve flows.

- In Kenya, under the provision for Operational Community Forest Associations, 15.5 hectares of the forest area were rehabilitated through planting and reforestation. Under soil and water conservation programmes, 820 farmers were supported to establish terraces on 995 hectares of farms to control soil erosion and improve water conservation. Suitable tree and fodder species were planted to stabilise terraces and provide fodder for livestock.

- In Tanzania, capacity was built among vulnerable community-based groups involved in income generating activities using technologies that support sustainable natural resources and conservation.

Paraguay-Parana Wetland System: This is structured along a corridor of more than 3,400 km of rivers, in Brazil, Bolivia, Paraguay, Argentina and Uruguay. The services and functions of this wetland system are extremely significant to the population that lives in the region – more than 20 million people. A bottom-up participatory process initiated by civil society has resulted in the acceptance by five national governments to manage all wetlands along the Plate basin as a unique Wetland System. They now recognize that the wetlands deserve an innovative and integrative plan that guarantees the conservation of the Wetland System and sustainability of local livelihoods. The System's recognition has been formalized in an agreement to develop a transboundary action plan. As a first step, the governments have committed to present a participatory program.

Other river commissions that have integrated stakeholders within the process of transboundary river management include:

- *Orange-Senqu River Commission (ORASECOM):* Launched in May 2005 by the Water Ministers of Botswana, Lesotho, Namibia and South Africa, it drafted a Roadmap on Stakeholder Participation. The basic objectives were to strengthen institutional mechanisms to engage stakeholder participation and maintain effective horizontal and vertical communication among structures of ORASECOM and basin stakeholders.

- *The Em River Basin Stakeholder Association:* The Em River watershed in south-east Sweden involves local organizations and people in river basin management. The Em River Stakeholder Association has applied a bottom-up perspective. Stakeholders have been participating in river basin projects over several years. Eight task groups have carried out projects within different fields of expertise.

- *Connecticut River Joint Commission:* Five local river subcommittees were formed with over a hundred citizens to represent the riverfront towns and voice the interests of local business, local government and riverfront landowners. The leadership, planning, and expertise are local in nature; however the ideas range far beyond town boundaries as they advise an array of federal and state agencies on river issues.

The examples presented show how community initiatives are capable of resolving conflicts among the competing users of water resources at the transboundary river basin and local level. Transboundary water management, along with mobilizing resources, should aim to build capacity and gradually strengthen isolated projects at the local level. In addition, it should aim to consolidate existing local initiatives and organizations and to streamline their accumulated experience in specific, focused programs within the integrated water management organization.

CHAPTER 4

Role of Educational Institutions

Exchanges between educational institutions are one way of involving the youth, who will have to live with the challenges of water stress in finding solutions. The involvement of educational institutions can enable student citizens to transcend their national view on contentious issues such as water. Cultural exchanges form an instrument of soft power, which can be used to counter water stress issues. In other parts of the world there are examples of successful cooperation between educational institutions on environmental issues. Bangladesh, China, India and Nepal have cooperation in parts of their educational sector, which can be extended to include cooperation on the Himalayan River Basin.

Examples from Other Parts of the World

Existing environmental and related projects can be used as examples or models for cooperation between educational institutions in China, India, Nepal and Bangladesh.

- **Université Franco-Allemande/ Deutsch-Französische Hochschule:** A network of German and French universities, which strengthens the cooperation in higher education and research between the two countries. The goal is to develop the relations and the exchange between German and French universities through bi-national research study programs. One example of a project in this network is the sponsorship of summer schools for scientific exchange on the topic of sustainable land use in the Rhine area.

- **ERASMUS Intensive Program:** This is a short study programme involving students and teaching staff from higher education institutions of different countries.
  - Under this program the University of Agriculture in Prague in cooperation with seven other European Universities, hosts the project 'Environmental Case Studies' in Europe. Students have the opportunity to understand the influence of human activity on the composition and functioning of various ecosystems characteristic of

European regions. Environmental degradation, conservation and natural resource management in Europe including the influence of economy and politics are the part of the study programme.

- Under the same ERASMUS program, the Leopold-Franzens-University in Innsbruck has initiated a project on sustainable development – SUSTMONT - involving 12 European Universities. The project offers training on sustainable development of the European mountain area with a focus on environmental analysis, environmental modelling, environmental monitoring and stakeholder consultation. The project includes studying land management and conflicts from the Ebro Valley to the Pyrenees.

Student Exchange: Every year there is a student exchange between the agriculture school in Rütti, Switzerland and the School for Agriculture and Home Economics in Stadtroda, Germany. The goal of the visit is to gather an impression of the situation in the other country and the exchange of experiences and ideas.

Joint Masters Programme: There is a Master of Science in Trans-national Ecosystem-based Water Management programme developed between the Radboud University Nijmegen, Netherlands and the University of Duisburg-Essen, Germany where students spend one year at each university.

Exchange Programmes: Since 2005, Kunming University of Science and Technology (KUST) in China and Blekinge Institute of Technology (BTH) in Sweden have been developing mutual exchange programs. So far, KUST has sent six professors to BTH for a one-month academic visit, and BTH has also sent six teachers to KUST. 14 undergraduates and postgraduates from various departments of KUST have also been selected to attend BTH to complete their Masters, and five students from BTH have attended KUST to complete their graduation theses.

Partnerships with Organizations

Lessons can also be learnt from educational institutions that partner with other larger organizations and networks over water and environment related issues to contribute and collaborate.

EU.WATER: This is implemented by 12 partners (including two universities: University of Debrecen in Hungary and Odessa National Polytechnic University in the Ukraine) in EU and non-EU countries and is co-funded by the South East Europe Transnational Cooperation Program. EU.WATER is based on the premise that the collaborative and long-term management of water resources is the best way to move forward.

Alterra: This is an institute which is part of Wageningen University and Research centre, Netherlands. Along with local partners in China, including the China Agricultural University (CAU) and the TaiYuan University of Technology, they have come up with a project for the 'Improvement of Agricultural Water Management in North-China'. The objective is to conserve agricultural water requirements in North China, restore the natural discharge of the Yellow River to the sea, and at the same time increase agricultural productivity in the region.

M-POWER: This is a network that brings together people committed to improving local, national and regional governance in Cambodia, China, Laos, Burma/Myanmar, Thailand and Vietnam. Educational institutions who are part of the network include Mekong Sub-region Social Research Center which is part of Ubon Ratchatani University in Thailand; National University of Laos - Faculty of Social Sciences; Chulalongkorn University- Social Research Institute; Cantho University, Department of Environmental and Water Resources Engineering; Helsinki University of Technology; Institute of Tropical Biology, Vietnam Academy of Science and Technology. M-Power's goal is to improve livelihood security, human and ecosystem health in the region. This is done through better water governance in the

Mekong Basin through actions such as research, policy support, and pursuing fair and effective governance.

Existing Projects in Himalayan River Basins

Between the four countries of the Himalayan River Basin, several programmes already exist that encourage the exchange of students. China, India, Nepal and Bangladesh can extend many of these programmes to cover education on water issues, as well as encourage collaboration on water conservation and management research. Environmental activities will be more successful in networks or with exchanges to other universities with similar activities.

- The Government of India offers scholarships annually to students from other countries who wish to pursue their studies in India.
  - General Cultural Scholarships are awarded to international students of certain Asian, African and Latin American countries (Nepal falls under this category) for undergraduate and postgraduate degrees as well as for research at Indian universities.
  - Under the Cultural Exchange Program, scholarships are awarded to international students according to the terms and conditions agreed upon and signed between the Government of India and the Government of the respective country, for studying, training and research. Such contracts already exist between India- China and India-Bangladesh.
  - The Technical Cooperation Scheme of the Colombo Plan is meant for students from Asian countries (including Nepal and Bangladesh). Under this scheme there are scholarships available for undergraduate degrees, post-graduate degrees and PhD programmes.

- The University of Delhi has joined the Universitas 21 network, an international network of leading research-intensive universities, in 2007. This network has a joint PhD program. Under the scheme, two partner universities create a unique program of study for each student, enabling collaboration with another university in the network. Under Universitas 21 the University of Delhi has entered into an in-principle education agreement with the Fudan University in China in 2010.

- An example of local involvement of university students in environmental issues are Eco-Clubs at the Shivaji College in New Delhi. In co-ordination with the Department of Environment, the Eco-Clubs play an important role in creating environmental awareness amongst the youth. They actively engage in overall environmental education by adopting multi-dimensional approach for promotion, conservation, and preservation of the environment. The activities of the Eco-Clubs include motivating students to keep their surroundings clean and green by undertaking plantation of trees, promoting an ethos of water conservation by minimizing water usage.

- Mekong Sub-region Social Research Centre (MSSRC) was established in 2000 to support the Indo-Chinese program for undergraduate and Masters level students. The centre is dedicated to forging links between academics, researchers and students from universities and organisations within the region and beyond. It also promotes sharing knowledge across the region through activities that bolster the dissemination of information, such as an online database, website, publications, workshops, brown bag discussion groups and conferences. In 2003 the MSSRC became involved with Mekong Learning Initiative (MLI), which is aimed at the local level by teaching issues revolving around the environment, rural issues and natural resources management. The MLI is a collaboration between nine universities in five Mekong River Basin countries.

CHAPTER 5

Inter-Disciplinary Research

Given the abundance of water resources that are shared between China, India Nepal and Bangladesh, transboundary water management in a manner that can promote Asian security requires systematic planning; and must incorporate numerous factors, especially while addressing important questions like sustainable water resource management. Hence, water governance requires an interdisciplinary approach in order to make accurate and realistic projections for the future.

It is becoming increasingly apparent that there is a need to bring about structural changes to the water resources management paradigm in the Himalayan region. The key objective of using an interdisciplinary approach is to understand water resources issues, from a human development perspective, with emphasis on exchange, interaction and collaboration at the regional level.

The US National Academy of Sciences defines interdisciplinary research as

> "a mode of research that integrates information, data, techniques, tools, perspectives, concepts and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice".

In other words, interdisciplinary research involves the synthesis of knowledge of various disciplines that helps produce a new conceptual framework. Rather than disciplines operating in parallel, the aim is to integrate the knowledge produced by multiple disciplines.

The need for interdisciplinary research arises as water resource management covers a range of interconnected fields of study such as hydrology, geology, social sciences and security. By linking variables from different disciplines, strategic insights can be obtained on water system management in the Himalayan region.

Proposals for Inter-Disciplinary Research

In a transboundary context, the differences in the available knowledge between the countries may result in different assessments of water in the Himalayan region. Hence, the four countries are required to build joint water management strategies based on complete exchange of information which will then result in standardized forecasts and assessments. Some of the proposals for an interdisciplinary research in the Himalayan River Water management include:

Joint Research Projects

There is a need for joint research projects between scientists from China, Nepal, India and Bangladesh to acquire, collect, generate and process appropriate and updated data, especially where data-sharing is restricted due to security issues. The country-level models do not account for regional trends; hence, regional models need to be developed to study specific trends. Joint research projects must take into consideration local knowledge, participatory research, ecosystem approach involving all stakeholders and also use instruments of international co-operation, like the UN Convention on Biological Diversity and the Ramsar Convention. It is essential to undertake joint assessment studies to determine the future changes as a result of climate change and their impact on the main Himalayan Rivers and their water flows. For example, the Sustainable Management of Available Water Resources with Innovative Technologies (SMART) project uses multilateral, interdisciplinary expertise (waste water, groundwater, geophysics, socio-economy) to develop an Integrated Water Resources Management model for the Lower Jordan Valley. It is composed of a core team of seventeen partners from ministries, water authorities, regulatory bodies, universities, research institutes, NGOs, water providers and commercial enterprises from Germany, Israel, Jordan and Palestine as well as several external experts. The information produced is organized within a modern knowledge management framework and made available to user groups via internet services.

The objective of the joint research projects should be to generate expertise and integrate water professionals to form a substantial network in government and civil society organizations. In addition, involvement of local universities and research centres will play an important role in the implementation of research projects and developing of joint activities at the regional level.

For cooperation in the Himalayan Region, Track II initiatives need to be initiated that function through unofficial channels and result in creating constituencies of support. Such initiatives will set in motion wider cooperation at an official level.

Joint Mountaineering Expeditions

The state of water availability in the Himalayan Rivers is closely dependent on both glacier melt and rainfall patterns in each of the countries. Expeditions to glaciers that are the source of rivers shared by two or more countries need to be undertaken at a joint level.

Map of Meteorological Stations in Tibet and China's Southwest Province

Source: Xi Chen, "Precipitation and temperature trend analyses in the last five decades for the Southwest China" presentation at Second International Workshop on Himalayan River Basins hosted by SFG - BIPSS at Dhaka on January 16, 2010

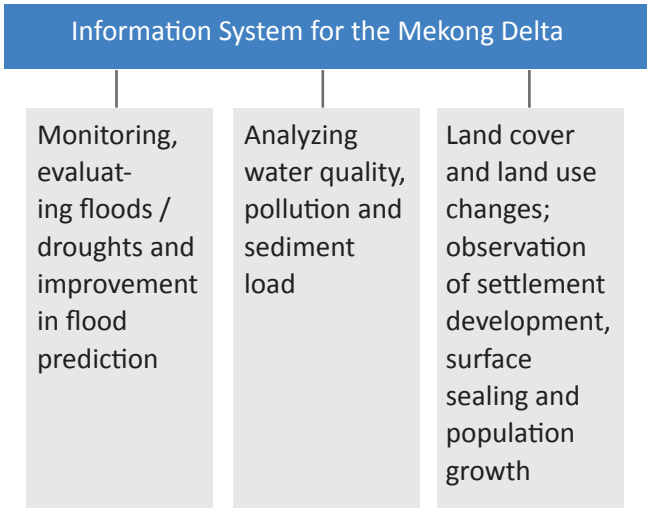
The Third Pole Environment, an international programme led by the Chinese Academy of Sciences' Institute of Tibetan Plateau Research in Beijing, plans

to draft a research programme by autumn 2011 to document the effects of climate change on glaciers, permafrost, water resources, biodiversity and people. In addition, the programme will call for joint expeditions to the Himalayas and the Tibetan plateau. It also includes setting up of multidisciplinary research stations across the region, to cover key geological areas and climate regimes, as well as important river and lake basins. Such arduous studies will require collaboration and integrated research at a joint level between the countries in the Himalayan region.

Joint Monitoring Projects

An important area where interdisciplinary research needs to be developed is monitoring the impact of climate change. The use of interdisciplinary cooperation will become even more important in mitigation efforts, especially while dealing with extreme effects of climate change. Establishing a network of transboundary climate services provides immense scope to improve the management of water resources and enhance food and health security in these countries.

In addition, given the enormous pressure on the available water resources, establishment of a joint water information sharing network that integrates natural and social sciences is required. A Regional Information Sharing Network has been proposed by a Bangladeshi scholar, through which countries can share data along with technical and scientific expertise on a common platform through knowledge-based partnerships. China, Nepal, India and Bangladesh need to build an institutional capacity with effective participation from academic and non-academic stakeholders for sustainable water resource management. One successful example of a joint initiative is the development of the Information System for the Mekong Delta by the Ministry of Science and Technology (MOST) in Vietnam in collaboration with the German Ministry for Education and Research (BMBF). Started in 2005, this project integrates information from the fields of hydrology, sociology, information technology and earth observation.



Remote Sensing Unit

In order to monitor the impact of climate change and develop a water information sharing network, a centralized remote sensing facility needs to be established in the Himalayan region. Along with this, a Geographic Information System (GIS) Unit can provide spatial data from various satellite sensors that will help in mapping wetlands, irrigated areas and vegetation dynamics on a regional and national scale. At present, one of the main issues with data sharing is that China, Nepal, India and Bangladesh share hydrological data only in the monsoon months. Also, detailed hydrological data on the Himalayan Rivers are not made available for open scientific research and publications. This limits the use of data while assessing important research issues. A critical requirement, in addition to developing an extensive information database, will be to make the data accessible to researchers in order to engage them in a comprehensive interdisciplinary water study.

To summarize, interdisciplinary research is necessary for in-depth understanding and effective water governance in the Himalayan region. However, it is also important that research should be built on joint efforts to ensure that measures are effective and sustainable. For this, mutual understanding between, and within, countries as well as between researchers and policy-makers must be encouraged. This understanding is best built through intensive cooperation at the regional level. Moreover, by working jointly, China, Nepal, India and Bangladesh can achieve cost-effectiveness since measures can be implemented where they are most effective, irrespective of national boundaries.

CHAPTER 6

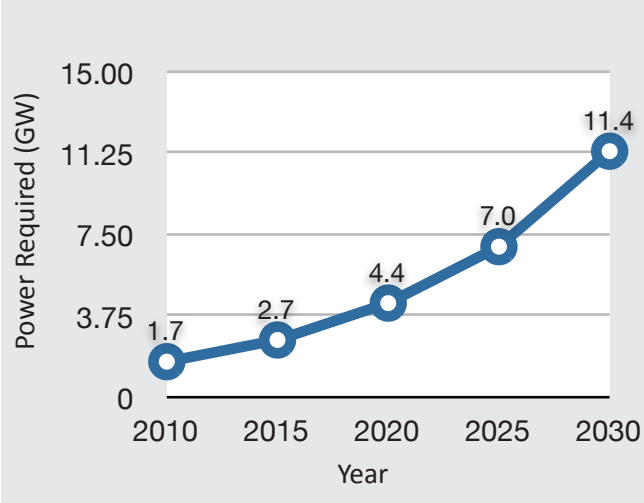
Hydro-Electricity

An important driver of conflict in the four countries is demand for energy at a time of fast economic growth. Bangladesh, China, India, and Nepal all require electricity. Hydro-electricity has tremendous potential for clean energy as compared to thermal power and risk free energy as compared to nuclear power, though dams that will be built in the process can have adverse environmental impact. Overall, hydro-electricity would be an important factor in both internal security and regional relations in the 21st century. There is clearly a necessity for the setting up of a working group with experts from the four countries to examine this area further, to look at economic viability, market realities, transmission costs, and realistic cost benefit analysis.

The Case of Nepal

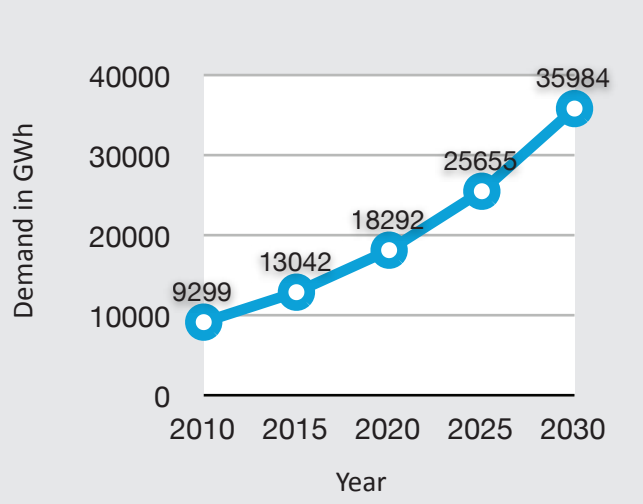
Nepal has a hydropower potential of over 83 GW, of which around 42 is considered economically feasible. At present, Nepal's installed power capacity is 680 MW. Only 40 per cent of Nepal is electrified. In order to reach 100 per cent electrification, Nepal would require more than 1000 MW more. Thus, Nepal's power demand at present is pegged at 1.68 GW or 1.7 GW. Therefore, by 2030, at 100 per cent electrification of Nepal and a steady demand growth rate of 10 per cent, the demand will be 11.4 GW. There are other estimates that put the demand at 23 GW, assuming 100 per cent electrification as well as various other factors, including reaching the GDP of USD 2500, which has not been considered in this report.

Power Required in Nepal by 2030



Annual increase in demand is at 10 per cent in the past few years, we assume that the rate remains steady over the next 2 decades.

Future Electricity Demand in NER

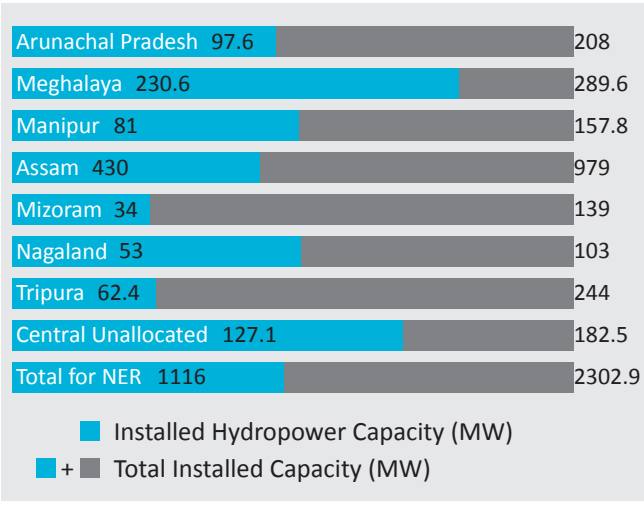


Growth rate at 7 per cent per year, as India's growth in demand for electricity is expected to be 7 per cent.

The North-East Region of India

The North-eastern region(NER) of India is endowed with various perennial rivers and water bodies. The region has a capacity to produce 59 GW via hydropower alone, whereas only 7 per cent of this has been harnessed till date. If exploited further, the resulting power generation could boost the development of the region considerably.

Total Installed Hydropower Capacity in NER

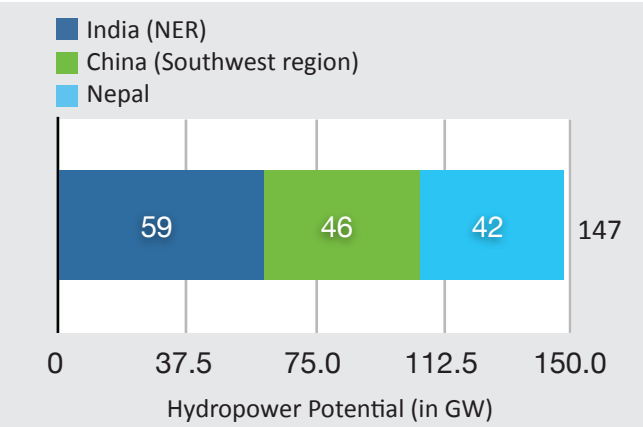


** 2010 Figures*

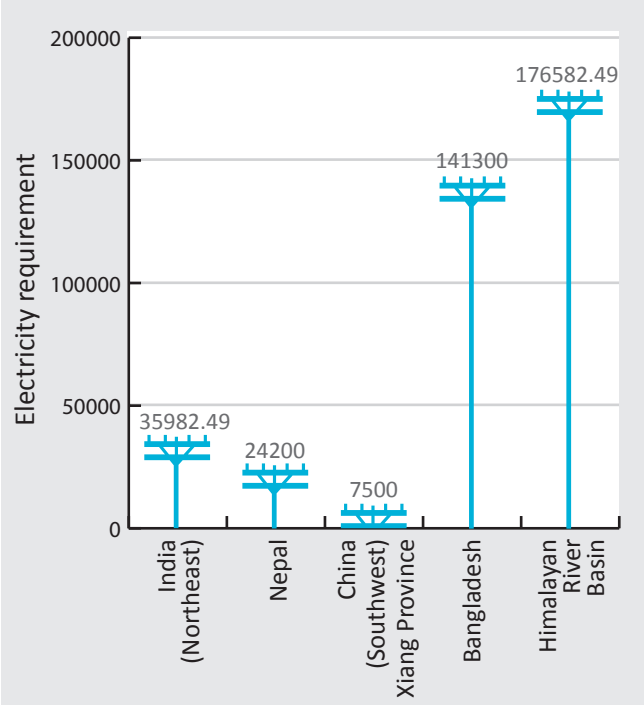
Hydropower Potential of the Himalayan River Basins

The Brahmaputra provides the potential for a large amount of hydropower to India and China. If the two neighbours cooperate, the North-eastern region in India and South-western China will be able to generate 59 GW and 46 GW respectively. Bangladesh is not well suited for hydropower projects but will gain immensely from the power generation in the region, as it will be able to purchase power from its neighbouring countries at low cost, if it is negotiated as part of regional treaty. Nepal can achieve its hydropower potential by collaborating with India and China.

Hydropower Potential in the Himalayan River Basins



Electricity Required in the Region by 2030 (in GWh)



- The electricity demand of North East India is 9298.73 GWh in 2010. Assuming an annual growth rate of 7 per cent, the demand for electricity will be 35982.49 GWh in 2030.

- The electricity demand of Nepal will be around 15,000 GWh by 2025. It has been assumed that the demand for power will be growing at 10 per cent which is the current growth rate of electricity demand.

- The current electricity demand in Xizang province in Southwest China (where the Yarlung Tsangpo River flows) is estimated to be 1600 GWh. The demand for electricity in China is growing at the rate of 5-10 per cent. Therefore, an average of 8 per cent growth rate is used for calculating the demand by 2030, assuming Southwest China has similar growth rate of electricity demand.

- The current electricity demand in Bangladesh is 21000 GWh and the demand is growing at 10 per cent annually. It has been assumed that the growth rate will remain constant in the next 20 years.

Examples from Other Parts of the World

Nile Basin (Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda)

In the past, the Nile Basin's hydropower development, especially in the upper river has been hampered by civil wars and oppressive poverty whereby planned hydropower projects have suffered. The region is home to roughly 300 million people and would benefit greatly from dam projects. The Nile Basin Initiative (NBI) seeks to develop the river in a cooperative manner and through it, promote regional peace and security. Hydropower projects have been promoted as a way to increase socio-economic co-operation between these countries through the NBI. As countries in the Nile Basin develop more quickly, a greater need for power will be visible; leading to more cooperation between these countries to get dams built that will be beneficial to all. For this, the NBI is promoting a Power Trade Project (which is a regional electricity grid), hydropower and large-scale irrigation plans. Several dams already exist and are proposed, including as part of NELSAP, a regional development programme for the Northern region, and ENSAP, a regional development programme for the Eastern region. These include a 100 MW project at Rusumo Falls on the Kagera River in Rwanda, the Baro-Akobo Multipurpose Water Resources Development Sub-Project, Uganda's Bujagali and Karuma dams, Ethiopia's Tekeze and Geba dams, and Sudan's Merowe and Kajbar Dam.

Zambezi River Basin (Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania and Zimbabwe)

Numerous treaties and acts govern the management of the Zambezi River. The Zambezi Water Commission or ZamCom was established in 2004, and was based in its structure on the Southern African Development Commission's (SADC) Protocol on Shared Watercourse Systems. In 1987, the Zambezi Action Plan, or ZACPLAN was signed by the Governments of Botswana, Mozambique, Tanzania, Zambia and Zimbabwe, and endorsed by Council of Ministers of the Southern African Development Co-ordination Conference (SADCC), the predecessor of the SADC. In the same year, Zimbabwe and Zambia created the

Impact of Hydropower Projects on the Environment

While harnessing the latent hydropower of the Himalayan River Basin is essential to the future development of the region, it is important to be mindful of the overall environmental and social impacts of dams, particularly large dams. Hydropower is widely considered the most viable source of alternative energy. Both China and India are expected to rely heavily on their hydropower potential to meet their carbon emission reduction targets. However, this eagerness to exploit the potential of the region and poor planning could lead to mistakes on a large scale, as has been the case with several other projects in the region.

The impacts of dams can be wide and far-reaching, from impacts on the river itself, and the quality of the water, to impacts on the biodiversity (the flora and fauna) that depend on the river, to impacts of inundation on the surrounding land and those that live on it. A large dam can also have impacts on human health in the region, and even on seismic activity. In tropical climates especially, reservoirs are known to increase the incidence of vector-borne diseases like malaria. For example, malaria became endemic to Raichur, Karnataka in southern India, after the Tungabhadra dam was constructed. In terms of social costs, the largest will be paid by those that are forced to relocate due to loss of their homes, or loss of livelihood. The Central Water Commission in study estimates that 2400 hectares of land were submerged per dam after a survey of 116 Indian projects. In Nepal, this problem will not only affect human beings, but also the several National Parks that are spread throughout the country, many of them along river banks.

Careless planning and hasty execution of projects will cause these negative effects. Since these rivers are transboundary, lack of co-operation will also result in the same problems, affecting more than just one country. Despite the seeming benefits of hydropower over thermal power, unless carefully thought and executed with maximum co-operation between all players, there could be some serious repercussions.

Zambezi River Authority (ZRA) after dissolving the Central African Power Corporation (CAPCO). The ZRA manages the Kariba Dam, as well as Lake Kariba, the dam's reservoir. The ZRA undertakes the following functions:

- Operate, monitor and maintain the Kariba Complex which consists of the Kariba Dam and reservoir, telemetering stations relating to the Kariba Dam and any other installations owned by the Authority at Kariba.
- Collect, accumulate and process hydrological and environmental data of the Zambezi River for the better performance of its functions.
- Subject to the approval of the Council of Ministers, operate and maintain any other dams on the Zambezi River.
- Make recommendations to the Council of Ministers to ensure the effective and efficient use of waters and other resources of the Zambezi River.
- Liaise with the national electricity undertakings in the performance of its functions under this agreement.

At present, the Kariba dam supplies around 1.2 GW of power to the two countries. Plans for expansion of the dam are underway in Zambia, and the capacity of the dam is expected to be increased from 615 MW to 1.08 GW on the Zambian side by 2012.

Harnessing the hydropower that is latent in the trans-boundary rivers between China, India, Nepal and Bangladesh will have to come through a consensus that is reached between the countries, and executed jointly, with maximum co-operation. Moreover, given the increasing power needs, as well as irrigation requirements of the four countries, the resulting projects could be a win-win situation for all parties, if embarked upon in a sustainable manner. In particular, these countries are looking at hydropower to not only reduce their carbon footprints and ensure development at the same time, but also to improve energy efficiency and reduce overall costs. It will be imperative in the future that these countries co-operate with each other to bring about ambitious, environmentally sound and mutually beneficial hydropower projects.

CHAPTER 7

Regional Convention

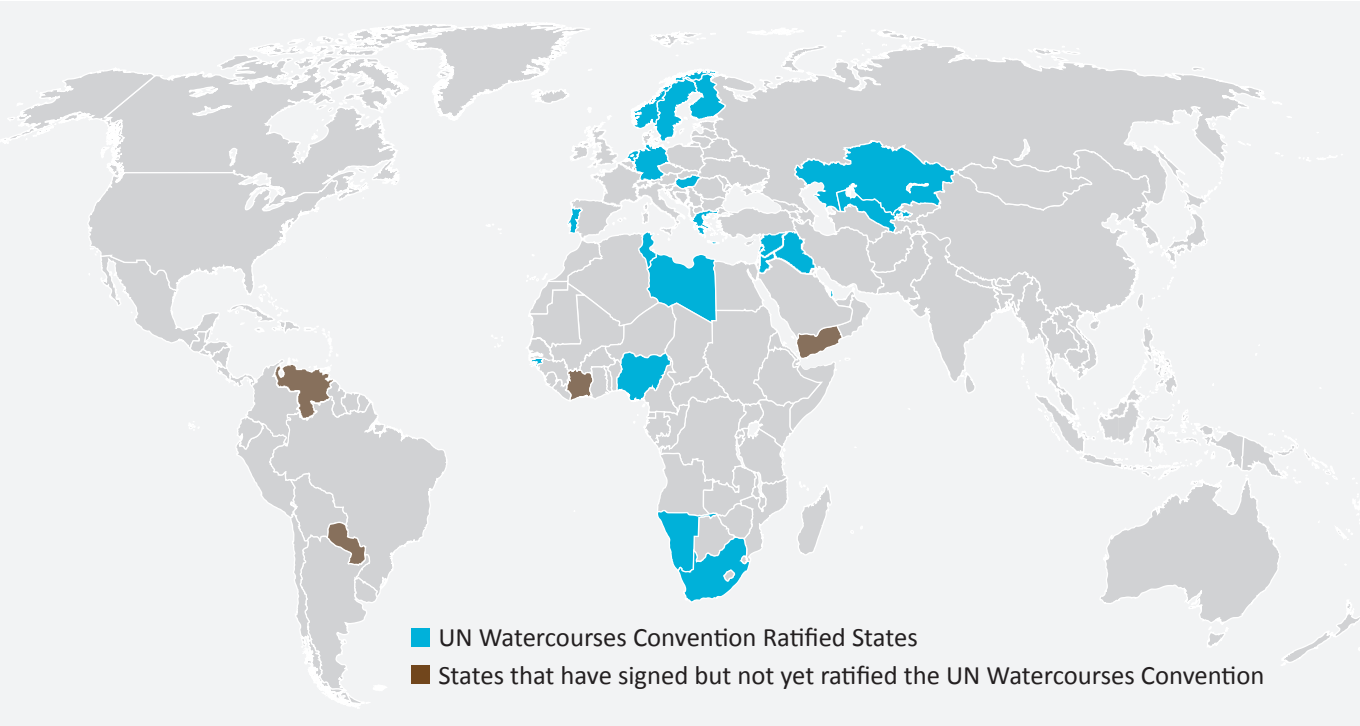
There are no mandatory international legal instruments on water courses binding state parties. The UN Watercourses Convention of 1997 is not in effect, as it has not been ratified by the required number of state parties. In particular, Asian countries have not signed the UN Watercourses Convention. Under the circumstances, the Himalayan basin countries need to conceive a regional convention which takes into account specific features of the region. In doing so they need to review the UN Convention and consider customary law.

Watercourse Convention

The Convention on the Non – Navigational Uses of International Watercourses is a document adopted by the United Nations General Assembly on 21st May, 1997. In order to be effective, it is required to be ratified by 35 countries. As of 15 December 2010, there were 21 Parties to the Convention, with Burkina Faso likely to become the 22nd contracting state in the near future. There are an additional five nations that have signed but not yet ratified the treaty.

None of the four countries under discussion i.e. Bangladesh, China, India, and Nepal are signatories to the Watercourse Convention. Furthermore not a single country in South, East and Southeast Asia has ratified the document, with majority of the signatories belonging to Europe, Middle East and Africa.

UN Watercourses Convention



It is important to analyze the voting records of Bangladesh, China, India and Nepal at the adoption of the Watercourse Convention in the United Nations. Bangladesh and Nepal are Sponsors of the Convention. The states that sponsored and voted in favour of the Convention are not under a legal obligation to become parties. However their sponsorship and approving vote creates a more favourable expectation of them eventually joining the Convention. India abstained from voting back in 1997 and China was one of the only three countries, along with Burundi and Turkey, which voted against the Watercourse Convention.

Principles of Customary Law

There are certain principles and concepts in international relations which have developed over many years and are universally accepted across the world. These principles are usually binding upon countries and are therefore the norm by which international relations are conducted. They are known as the Principles of Customary Law. However these principles are not legally enforceable. It is only when a given country is a signatory to a treaty or agreement; it becomes legally bound to abide by the same. Nevertheless, the Principles of Customary Law have a soft law character and are often the basis on which a country's actions are assessed. These principles also frequently form a part of global treaties and hence may be indirectly enforced if a given country is a party to the general treaty.

While developing a Regional Convention, the most relevant principles would be:

Community of Interest

This principle comprises of two elements:

- The perfect equality of all riparian countries in the use of the whole river
- The exclusion of any preferential privilege of one riparian state in relation to others.

Equitable Utilization

This principle provides that the said watercourse should be shared between the riparian states 'equitably', which means that all riparian countries sharing a given international watercourse have an

equal right to use their required share of the said watercourse. This principle forms the basis of the UN Watercourses Convention, 1997.

No (Significant) Harm

This principle postulates that the upstream state must use the waters of the shared watercourse only in such a manner as will not cause "significant" harm to the downstream state in exercising its own rights to use the international watercourse. This principle is also an essential component of the UN Watercourses Convention, 1997.

Environmental Impact Assessment

This principle recommends that if an upstream country is planning to build a dam or bridge or undertake any other activity, such as artificial diversion of the river, it should assess the impact the proposed activity will have on the environment of the downstream state, prior to the actual construction or commencement of activity. In order to determine the harm that will be caused to the downstream state, a suitable environmental impact assessment should include appropriate technical consultations with the downstream state, as well as inviting specific objections from the downstream state.

Human and Environmental Disaster Rules

In accordance with the general environmental and human rights laws, countries have a responsibility to refrain from causing any substantial environmental and/or human disasters, both within national borders, as well as in areas falling in the jurisdiction of other countries.

Regional Convention for the Himalayan River Basins

It looks unlikely that Bangladesh, China, India and Nepal will ratify the UN Watercourse Convention 1997 in the near future, in particular the two large powers, China and India. A plausible way forward is to formalize regional cooperation on shared watercourses in the Himalayan River Basin. This calls for a mechanism which has its genesis in the region and addresses the unique concerns of glacier fed rivers. The four countries can look to other parts of the world, in order to adopt certain lessons on regional cooperation pertaining to watercourses.

Examples of Regional Cooperation on Shared Watercourses

International Commission for the Protection of the Danube River (ICPDR)

Established in 1998, the ICPDR governs the Danube River Basin, including its groundwater resources and tributaries. 15 countries have ratified the Danube River Protection Convention and comprise the ICPDR. These include Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Moldova, Montenegro, Romania, Slovakia, Slovenia, Serbia, Ukraine and the European Union. Furthermore, under the EU Water Framework Directive, the following countries cooperate with ICPDR: Italy, Switzerland, Poland, Albania and the Former Yugoslav Republic of Macedonia.

Nile Basin Initiative

The nine countries sharing the Nile River Basin formed the Nile Basin Initiative in 1999. The initiative was lent support by the Water Ministers of the nine countries- Egypt, Sudan, Ethiopia, Uganda, Kenya, Tanzania, Burundi, Rwanda, the Democratic Republic of Congo (DRC), with Eritrea as an observer. In May 2010, the five upstream countries: Ethiopia, Kenya, Uganda, Rwanda and Tanzania signed a Cooperative Framework Agreement (CFA). The new agreement is geared towards forming a permanent Nile River Basin Commission which will replace the Nile Basin Initiative. Egypt and Sudan are opposed to the CFA, as of December 2010.

Amazon Cooperation Treaty Organization

The Amazon Cooperation Treaty Organization (ACTO) comprises of Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela. The aim of ACTO is to promote sustainable development in the Amazon basin. The Amazon Cooperation Treaty (ACT) was adopted in 1978 and amended in 1998. ACTO was formed in 1995 to facilitate implementation of the Treaty.

Niger Basin Authority

The Niger Basin Authority (NBA) fosters regional cooperation on the resources of the Niger River Basin in West Africa. The Niger Basin is spread over ten countries, namely Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Guinea, Mali, Niger, Algeria and Nigeria. Nine countries, with the exception of Algeria, (which includes a very small part of the Niger Basin) form part of the NBA. The NBA was formed in 1980; however it traces its roots back to the Niger River Commission from 1964.

EU Water Framework Directive

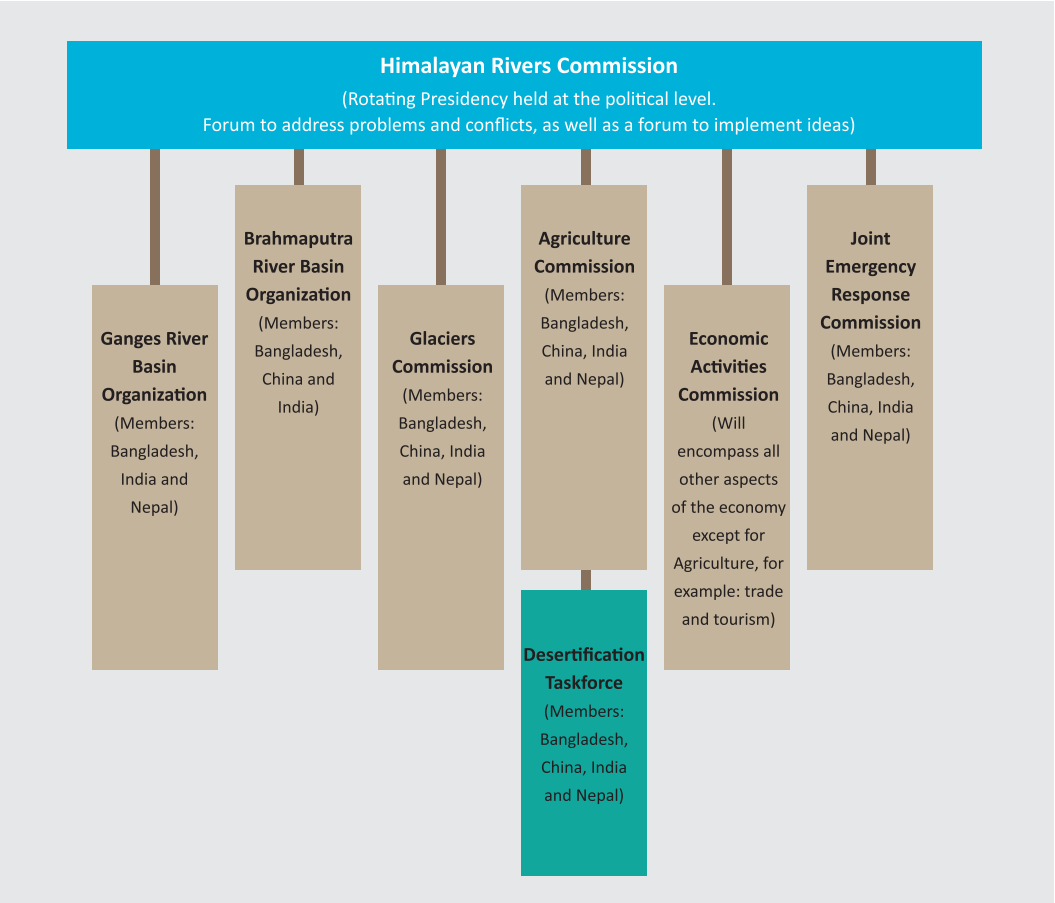
The EU Water Framework Directive instructs EU member countries to achieve good qualitative and quantitative status of all water bodies by 2015. The Directive requires countries to publish River Basin Management Plans in 2009, 2015 and 2021, hence setting a six year planning cycle for water resource management.

A regional convention tailored to fit the specific requirements of the Himalayan River Basin will have to be explored first through the establishment of a study group of legal and water experts along with retired diplomats.

CHAPTER 8

The Himalayan River Commission

The Himalayan Basin region requires a unique and customized solution to help manage its complex trans-boundary water resources. A hybrid system of International River Basin Management (IRBM) is needed to ensure that comprehensive solutions are found to existing problems, and any future issues that might occur are solved jointly, by all involved stakeholders. Such a system will facilitate interaction amongst the countries on river basin-related issues.



Many examples of working international river commissions exist in the world today, from where lessons can be drawn to ensure the proper functioning of the Himalayan River Commission. Examples include Mekong River Commission, the International Commission for the Protection of the Danube River (ICPDR), the Indus River Commission, the Amazon Cooperation Treaty Organization and the Southern African Development Community (SADC) Protocol on Shared Watercourse Systems.

A Himalayan River Commission(HRC) is a plausible next step in protecting the Himalayan River Basins, as all of the four countries are interested in protecting their water resources. What's more, all the parties involved are already looking to work with each other in certain ways. At this stage, the HRC would provide such a forum. The following are important to mention in relation to the setting up of the Himalayan River Commission:

- China, India, Nepal and Bangladesh are all signatories to the Convention on Biological Diversity, which demonstrates their commitment to the conservation of a fragile ecosystem like the mouth of the rivers.

- All four countries are also parties to the Ramsar Convention on Wetlands, while India and Nepal have also endorsed the Convention's Himalayan Wetlands Initiative that was adopted to "promote the objectives of the Ramsar Convention and to implement the Ramsar Strategic Plan through cooperation and collaboration among the countries sharing the greater Himalayan region (Hindu Kush-Himalaya and Pamir-Alay region) for the conservation and wise use of the wetlands and their complexes in the region."

Lessons on the functioning of the HRC can be taken from the principles that govern Integrated River Basin Management or IRBM. Principles of Transboundary River Basin Management, are taken from the Helsinki Rules (1966) and Convention on the Law of the Non-navigational Uses of International Watercourses (1997) and are also applicable here.

Principles of IRBM

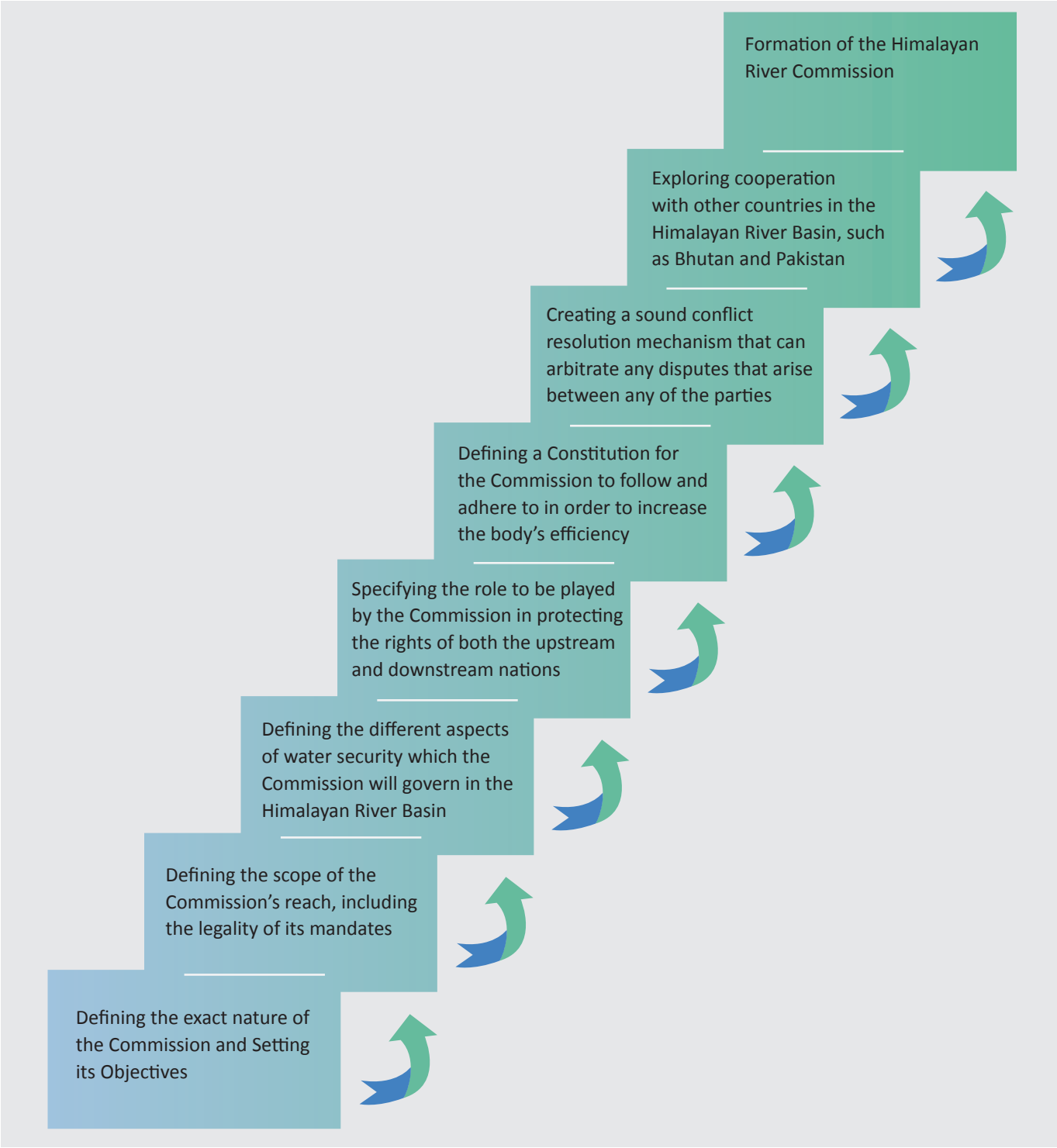
- Participation of Stakeholders
- Planning based on Hydrological Boundaries
- Decentralization and Integration
- Organizational Framework
- Pricing of Water.

Principles of Transboundary River Basin Management

- Notification, Consultation and Negotiation
- Cooperation and Information Exchange
- Peaceful Settlement of Disputes.

In order to set up such a Commission, a number of steps will have to precede it. First among those steps will be the creation of a temporary body that will have a number of duties.

Formation of the Himalayan River Commission



This body, which in its function is really more akin to an exploratory committee will have to be formed with experts from each of the countries who can negotiate the best possible constitution or charter that will allow China, India, Nepal and Bangladesh to form the Himalayan River Commission. Some things will be need to be kept in mind:

- There must be a realistic time frame for the exploratory committee to complete its agenda so that the HRC can be formed in a timely fashion. The Indus River Commission, for example, took

ten years to set up. Due to the pressing nature of water insecurity that is already apparent in the Himalayan River Basin, there is no scope for the HRC to take years to be formed.

- All four countries must demonstrate both political and financial commitment towards the HRC's formation.

- Given that achieving an equitable partnership between all four countries is the main goal, it might be advisable to have a neutral third party present at the exploratory committee stage that can ensure the fairness of the process.

Lessons from Other Parts Of The World

Converting existing organizations or absorbing them into a River Commission: The Mekong River Commission (MRC) is an example of this. The MRC was born out of an organization known as the Mekong Committee. The Mekong Committee was created due to a report released by the United Nations Economic Commission for Asia and the Far East (ECAFE) in 1957. Its member countries at the time included Thailand, Cambodia, Laos and Vietnam. By 1978, the Mekong Committee had morphed into the Interim Mekong Committee due to the presence of the Khmer Rouge regime which prevented Cambodia from being a part of the group. The Interim Mekong Committee lasted until 1995, at which point the Mekong River Commission in its current iteration was born. Since then, the MRC has shown remarkable flexibility by taking on new partner countries as and when required and expanding its functions.

Entering with clear cut principles on the table as to how the negotiations will proceed: An example of this was seen in the Northern Ireland Peace Process. An important feature of the Northern Ireland process was reaching agreement on a set of principles, known as the Mitchell Principles, which set down the ground rules. There was also a negotiated agreement on the details of the process. In other words, substantive talks were preceded by and benefited from 'Talks about Talks'. The Mitchell Principles were used as a basis of the last phase of negotiations in Northern Ireland from 1996 to 1998, when the Good Friday Agreement was finally reached. In effect, pre-negotiation was a vital feature to achieving the desired result.

Expansion of the body to cover other aspects that are vital to the region: The Southern African Development Community (SADC) was formed to further socio-economic, political and security co-operation among its 15 member states. Through the SADC, Protocol on Shared Watercourse Systems was born, which focuses on fostering closer cooperation among SADC countries for the coordinated management, protection and utilization of shared watercourses, through the establishment of river basin organizations. This protocol plays a pivotal role in guiding the establishment of institutional structures capable of jointly managing the depleting water resources in Southern Africa. The SADC's ability to alter its existing infrastructure to accommodate a new issue is something that needs to be replicated in any HRC that may be formed.

Lessons for the dispute resolution mechanism: As mentioned, water security is a contentious issue at present in the Himalayan River Basin region. Thus, a dispute resolution mechanism will be vital to the HRC's functioning. The Indus Water Treaty was signed in 1960 and has India and Pakistan as its signatories with the World Bank as a third-party signatory. The Indus River Commission was set up under this treaty to adjudicate disputes related to allocation of water between the two nations. In cases of disagreement, a neutral expert is called in for mediation and/or arbitration. The Commission is required to meet regularly and has been successful in surviving wars between the member nations. While the Indus Basin Commission is commonly referred to as a successful example of trans-boundary cooperation to share limited water resources, its focus is limited to water allocation and data sharing. The member nations are required to inform each other about any plans to construct engineering works on the river that could affect the other member. The Commission's aim does not include basin wide cooperation in other fields including hydropower, irrigation, navigation and fishing.

CHAPTER 9

Political Forum

Divorcing water issues from the politics of the Himalayan River Basin is unrealistic. A primary aspect of water security is the politics of the region. Given this, to ensure the effectiveness of any regional or transboundary action on water security, it is essential that the politics of water in the region be taken into consideration.

Members of legislative bodies, office bearers of political parties, former ministers who continue to participate in political processes are a link between people and the state. They can encourage the state apparatus for certain policies on the one hand and mobilise the public opinion on the other. It is necessary to have better understanding between political representatives and leaders of the four countries in the form of a forum, which is especially dedicated to the water challenge. It can be in the form of an inter-parliamentary forum on water resources or a broader platform that brings politicians together to discuss the water issue and collaborative solutions in order to enhance overall security of the region.

This is an objective that is already in effect in some way. Senior members of government of the four countries meet on a regular basis in bilateral negotiations on water issues. India and Bangladesh's Water Ministers meet under the aegis of the Joint Rivers Commission (JRC) which was established in the Indo-Bangladeshi Treaty of Friendship, Cooperation and Peace signed in 1972 between the two countries. Meanwhile, ahead of such meetings, Water Resources Secretaries of the two countries meet each other to establish ground rules for the meetings. In March 2010, the two Ministers of Water Resources discussed water sharing of the Teesta River. In a follow up meeting in January 2011, delegations led by Water Resources Secretary of India and Water Resources Secretary of Bangladesh discussed an interim agreement that will facilitate the sharing of the Teesta and Feni Rivers in the dry season for a period of 15 years. The expectation is for Prime Minister Manmohan Singh of India to sign the interim agreement when he visits Bangladesh in the latter part of 2011.

Between Nepal and India, there is a three tier system in place for co-operation in the field of water resources development.

- Joint Ministerial Level Commission on Water Resources at the level of Ministers of Water Resources of India and Nepal.

- Existing Joint Commission on Water Resources at the level of Secretaries of Water Resources of India and Nepal.

- Joint Standing Technical Committee at the level of the Chairman of the Ganga Flood Control Commission.

In November 2010, a delegation led by the Bangladeshi Prime Minister Sheikh Hasina's economic affairs adviser Mashiur Rahman went on a five-day visit to Nepal and Bhutan for talks. The aim was to emphasize Ganges water sharing in Nepal and ask the country to co-operate with India and Bangladesh to augment water flow of the river. Another focus for the Bangladeshi delegates was the generation of hydropower, for which it requires the co-operation of the two upstream countries on the Ganges River.

China and India have set up a Joint Expert Level Mechanism. From the Indian side, the Expert Group from Indian side is headed by the Commissioner, Ministry of Water Resources. On the Chinese side, the team is headed by the Director, International Economic and Technical Cooperation and Exchange Centre, Ministry of Water Resources. Since its formation in November 2006, after a visit from the Chinese President to India, the Joint Expert Level Mechanism has met regularly, in September 2007 in Beijing, New Delhi in April 2008 and Beijing in April 2009. Chinese and Indian officials at more senior levels also frequently discuss issues related to water security between the two countries, due to the sensitive relations between the two countries over this particular matter.

Due to China's increased interest in Nepal, and particularly its infrastructure, there have been meetings between representatives of industry from both countries, facilitated by some political involvement. In this regard, China is particularly interested in Nepal's water resources and its potential hydropower potential. In September 2010, a delegation of Chinese businessmen, led by the Vice Chairman Quan Zhezhu of All-China Federation of Industry and Commerce (ACFIC) attended the 11th meeting of Nepal-China Non-Government Cooperation Forum in Kathmandu. The Federation of Nepalese Chambers of Commerce and Industry (FNCCI) organized a 3 day 'brainstorming session', inaugurated by the Prime Minister, Madhav Kumar Nepal with the theme 'Investment in Hydropower'. Nepal's top bureaucrats, policy makers and entrepreneurs met with the Chinese delegation with the specific aim of expanding China's involvement in Nepal's hydropower sector.

As is evident, political leaders from all four countries have recently renewed interest in engaging with the other countries in the Himalayan River Basin in order to ensure the water security of the region. The aim of the Political Forum is to expand this to include all four countries at the same time and directly engage legislators, i.e. active parliamentarians. This could take place at many levels. On one level, retired politicians who still hold a significant profile in their countries could meet counterparts from other countries to set the ground for a larger meeting. On the second level, active parliamentarians and office holders of all major political parties from each of the four countries can meet on a regular basis, to ensure that the dialogue process at the political level by all four countries on the water issue is not impeded by any other issue. On yet another level, would be the meeting of Ministers of Water Resources and their deputies who can meet to demonstrate political commitment to the cause, at the same time make sure that decisions are made in a collective forum.

Lessons from Parliamentary Forums in Other Parts of the World

Climate Parliament

The Climate Parliament was set up in 2009, born out of e-Parliament. It works on climate and energy issues. Among its actions include organizing international Parliamentary committee hearings, field trips for legislators to see new policies and technologies in

action, and national and regional committees of Members of Parliament to plan strategy in their own parts of the world.

Inter-Parliamentary Union

The Inter-Parliamentary Union (IPU) was established in 1889. It works as a forum for dialogue amongst parliamentarians from across the world on vital global issues. Its primary aims include fostering contacts and co-ordinating the exchange of information and experiences between parliamentarians from different parts of the world. The IPU's issues include: representative democracy, international peace and security, sustainable development, human rights and humanitarian law, women in politics, and education, science and culture.

Asian Parliamentary Assembly

The APA is part of the Association of Asian Parliamentary for Peace and was created in 2006. It has 41 member countries, along with 11 countries that have observer status. Like the IPU, this body has a wide purview and its focus areas include globalization, reducing poverty in Asia (UN Millennium Development Goals), cultural diversity and combating corruption and promoting good governance.

Parlimentarians for Global Action

PGA is a group consisting of around 1350 members, from 118 member countries. Its core issues include promoting peace, democracy, rule of law, human rights, sustainable development and population issues. PGA has a Executive Committee comprised of 15 members which decides the political direction of the group, and an International Council which elects the members of the Executive Committee. The Executive Committee ensures that all regions of the world are given fair representation in the body. PGA also works extensively with international organizations, such as United Nations Development Program, United Nations Children's Fund, United Nations Development Fund For Women, United Nations Educational, Scientific and Cultural Organization, the World Bank and the Asian Development Bank.

Parliamentary groups have been both specific to certain geographic boundaries, such as the APA, as well as devoted to specific issues, such as the Climate Parliament. The parliamentary forum recommended by the Singapore Workshop will be a combination of both, where the body is specific to the Himalayan River Basins, as well as focused on issues of water security and its related areas.

Council of Ministers of Water Resources

The best example to learn from in this regard comes from the Middle East. The Arab League created the Arab Water Ministers Council in 2008. The aim was for the Council to be the forum through which Ministers of Water Resources of the member countries of the Arab League obtain information, exchange analysis and gain insight that will then help them form policies in co-operation with each other. The Council has met regularly since its inception, most recently in September of 2010, with the aim to create an Arab Water Strategy, including issues of food security in the region and providing water for all citizens. Due to the fraught nature of water politics in the Middle East, such a council has proven necessary. Given that the issue of water security has taken on serious political ramifications in the Himalayan River Basins, this is a good example of how a conversation on water issues at the political level can be useful.

Water World Council

There are also international examples such as the World Water Council which organizes regular meetings that are focused entirely on water issues. The mission of the World Water Council is to promote awareness, build political commitment and trigger action on critical water issues at all levels, including the highest decision-making level, to facilitate the efficient conservation, protection, development, planning,

management and use of water in all its dimensions on an environmentally sustainable basis for the benefit of all life on earth.

The World Water Council held its 5th World Water Forum in Istanbul in March 2009, at the end of which the Ministers and Heads of Delegations adopted a Ministerial Statement and accompanying Water Guide, which addresses the global challenges related to water within the context of sustainable development and global changes.

Political Forum in Himalayan River Basins

The four Himalayan countries may not be necessarily inclined towards forming a ministerial level council, as it has significant implications for government policies. However, it would be useful and possible to create a forum of legislators including members of national parliaments, state assemblies from the relevant provinces, office bearers of political parties and advisers to heads of political parties. Politicians provide a link between people and government. They have access to the incumbent and future governments, without committing the governments to the ideas expressed in their interaction with counterparts from other countries. Thus, they provide an ideal vehicle for high level yet informal communication.

The forum of legislators could be formal, such as the SAARC Association of Speakers and Parliaments, where the participants in the interactive process are official nominees of the parliaments, or informal such as the Parliamentarians for Global Action, where politicians participate in dialogues in their individual capacity. There are advantages and disadvantages in both formats. It would be necessary for some of the key politicians from the four countries to compare relative strengths and weaknesses of alternative structures.

Whatever the structure, a non-governmental organisation or a media group or even a chamber of commerce could take the initiative to convene a meeting of legislators and office bearers of political parties to discuss the idea of a parliamentary forum on the Himalayan Rivers. Such a meeting could possibly take place on the sidelines of a large parliamentary conference organised by IPU or APA. Once a small beginning is made, interested politicians can take up the idea with presiding officers of their legislatures and colleagues from across parties and factions to discuss modalities.

CHAPTER 10

Experience from Southeast Asia

Bangladesh, China, India and Nepal can look towards their neighbours in Southeast Asia, to learn from their experiences in securing political cooperation for issues pertaining to the environment, as well as initiatives by academics, industry, civil society and local stakeholders in trans-boundary water management. As a regional bloc, Southeast Asia has been fairly effective in collaboration on key issues as well as in institutionalizing mechanisms for implementation of policies. This is not to say that Southeast Asia has not had its share of obstacles and failures. The countries in Southeast Asia face many of the same challenges as the four countries in this study, including diversity, development challenges and a historical trust deficit. However, while policymakers in Southeast Asia have systematically worked towards developing mutual cooperation, a sense of mistrust and suspicion still prevails in the Himalayan sub-region. Therefore it may be helpful for the four Himalayan River Basin countries to learn from the successes as well as the failures of its Southeast Asian counterparts.

Political practices

Developing Political Confidence

The Southeast Asian countries have historically adopted a top down approach and built goodwill at the highest levels through regular summits and meetings. The Association of Southeast Asian Nations (ASEAN) has hence developed a certain sense of maturity in its approximately four decades of existence. Progress has been achieved in key areas of cooperation including security, economy, energy and disaster management, amongst others. This makes the Southeast Asian region more likely, as well as better equipped, to collaborate on emerging issues such as water scarcity. The Himalayan River Basin sub-region can learn from the ASEAN-way of setting the tone from the top, particularly on the issue of water scarcity which is likely to have far reaching impacts on human security in the future.

Cooperation on Environmental Concerns

Environmental cooperation by ASEAN member states can be traced back to the 1977 ASEAN Sub-region Environment Programme. The last two decades have witnessed increased collaboration on key concerns including trans-boundary haze, marine biodiversity and freshwater management. At present, ten priority areas of regional interest have been highlighted in the Blueprint for the ASEAN Socio-Cultural Community (ASCC Blueprint) 2009-2015. These are as follows:

01. Addressing global environmental issues
02. Managing and preventing transboundary environmental pollution
    - Transboundary haze pollution
    - Transboundary movement of hazardous wastes
03. Promoting sustainable development through environmental education and public participation
04. Promoting environmentally sound technology (EST)
05. Promoting quality living standards in ASEAN cities/ urban areas
06. Harmonizing environmental policies and databases
07. Promoting the sustainable use of coastal and marine environment
08. Promoting sustainable management of natural resources and biodiversity
09. Promoting the sustainability of freshwater resources
10. Responding to climate change and addressing its impacts.

2007 – 2008 also saw the signing of the ASEAN Leaders' Declaration on Environmental Sustainability and the Singapore Declaration on the Environment by ASEAN member countries. The Environment Ministers of the East Asia Cooperation Forum (ASEAN + 6) have commenced meetings on an annual basis, which will serve as a building block to develop goodwill and mutual cooperation.

Collaboration on Water

The need to formulate a regional plan for water resources was first highlighted in the 1999-2004 Ha Noi Plan of Action (HPA). The HPA declared that "ASEAN should cooperate on a regular basis, and use exchange of information, knowledge, and experiences among Member States as a means to improve water resources management and water supply system within the region."

The ASEAN Long Term Strategic Plan for Water Resources Management was endorsed in 2003 and subsequently the member states adopted the ASEAN Strategic Plan of Action on Water Resources Management in 2005. The vision statement with a target date of 2025 states that the member countries should work towards the "attainment of sustainability of resources to ensure sufficient water quantity of acceptable quality to meet the needs of people in terms of health, food security, economy and the environment."

The ASEAN Working Group on Water Resources Management has been formed to achieve this vision. It aims to address issues relating to demand and supply allocation, water quality, sanitation, extreme events, governance and capacity building.

Amongst the ASEAN member states, Singapore is the chair for freshwater resources in the Socio – Cultural Community BluePrint (2009 – 2015). Singapore also organizes an International Water Week on an annual basis, which brings together policymakers, civil society and industry on the challenges and opportunities in the water sector.

Lessons from the Mekong River Commission

The 1995 Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin signed by the governments of Cambodia, Lao PDR, Thailand and Vietnam has provided the highest political and legal mandate to the Mekong River Commission to govern shared water resources in a holistic manner. The Mekong River Commission (MRC) can trace its origins to the UN affiliated Mekong Committee formed in 1957.

The two upstream countries, China and Myanmar, became dialogue partners of the MRC in 1996. In recent years, China has taken steps to strengthen cooperation with the lower Mekong riparian countries. It has started to provide hydrology data from the Yunjinghong and Manan reservoirs on the Lancang River. In 2010, it also provided outflow and inflow information from its reservoirs in the extreme dry season and has expressed commitment towards sharing data in extreme cases. In June 2010, for the first time, China invited foreign delegations from the MRC countries to visit the Jinghong and Xiaowan dams. China also sent a high level delegation to the first MRC Summit convened in August 2010.

The MRC offers relevant insights to the four Himalayan sub region countries:

- A considerable drawback of the MRC is that the two upstream states, China and Myanmar, have not yet accepted invitations to become formal members of the organization and operate as only Dialogue Partners. This lessens the scope of cooperation between the Mekong riparian countries. Given the enormity of a possible water crisis in the Himalayan river basins in the future, it is imperative that the two large powers, China and India, cooperate with Bangladesh and Nepal and voluntarily become part of a joint mechanism.

- The MRC has undergone restructuring since its inception to reach its present model of functioning:

  - There has been a shift from merely undertaking development projects within national borders to having a strategic basin - wide focus. In 2001, the MRC Hydropower Development Strategy specifically stated that basin-wide issues will be preferred over the promotion of specific projects.

  - MRC has moved away from an operational approach to developing a strategic programme, including institutional development, strategic partnerships, high-level political debates, and knowledge management, in additional to its strengths in ground level project management. A draft MRC Stakeholder Policy is under consideration.

  - In 2001, the MRC defined itself as a 'learning organization' with a focus on the livelihoods of the people in the Mekong region. The MRC has also worked towards increased engagement of local stakeholders by adopting bottom-up solutions.

  - The MRC has set a goal towards becoming financially self – sustainable by 2030.

Best Practices from the Ground

Effective Governance - Phnom Penh Water Supply Authority: Cambodia

The Phnom Penh Water Supply Authority (PPWSA) in Cambodia has been hailed as a case study for effective governance and management in Asia. Following the civil war and Khmer Rouge rule, the water supply system was in a dismal state in 1993 and only a quarter of the population in the metropolitan capital region received piped water. Today the PPWSA provides 24-hour service and 90 per cent coverage to a city of 1.3 million. Through an amalgamation of effective management techniques, including introduction of Leak Repair Teams, reforms in the process as well as upgrading of the infrastructure pertaining to piping, distribution and metering; cost-effective billing and payment collection methods and public awareness and anti-corruption campaigns, the PPWSA has managed to radically transform the water

supply system in Cambodia. In the period between 1993 and 2010, the collection rate increased by 50 per cent and non-revenue water dropped by 64 per cent, whilst the total connections increased by 450 per cent. The PPWSA is a model public sector water utility, in particular for developing countries.

Engaging Local Stakeholders-Bang Pakong River Basin: Thailand

The Bang Pakong river basin is located in eastern Thailand and comprises of nine sub-basins. The Bang Pakong Dialogue commenced in 2003, with support from international multilateral organizations including FAO and UNEP. The Bang Pakong Dialogue shows that engagement of local stakeholders in river basin management yields positive results in economic development, as well as environmental restoration of the river. The Bang Pakong River Basin Committee is chaired by the private sector and includes active participation from government agencies, private sector, civil society as well as local community groups including fishermen and farmers. The Bang Pakong River Committee has worked towards reducing conflicts and promoting integrated water resources management. The Bang Pakong experience in engaging local stakeholders is now used as a case study by other river basin organizations, particularly in Thailand.

Public Private Partnerships- Manila Water Company, Maynilad Water Services, Small Scale Private water Providers: Philippines

The last fifteen years have seen increased public-private partnerships in the water sector in Philippines. The Metropolitan Waterworks and Sewerage System commenced privatization in 1997. The Manila Water concession is now regarded as an example of a successful public-private partnership that has worked towards aligning business strategies to include social and environmental concerns. Projects such as the Tubig Para sa Barangay (TPSB) or Water for the Community have been introduced to provide safe drinking water to informal settlements. The other major private sector concessionaire includes Maynilad Water Services Inc. Since 2007, the small scale private water providers have also consolidated and formed the National Water and Sanitation Association of the Philippines (NAWASA), which presently includes 250 members. The small scale private water providers in Philippines have particularly focused their strengths in reaching consumers, neglected by public utilities and major private players.

By virtue of being neighbours as well as developing economies, the Southeast Asian countries face many of the same challenges and opportunities, as Bangladesh, China, India and Nepal. Their rich history of developing an atmosphere of mutual cooperation and goodwill at the highest political level lends credence to the lessons they can offer the four Himalayan sub-region countries. Several initiatives in Southeast Asia, created by governments, and also by industry, civil society and local stakeholders have been accepted as best practices and exemplary case studies across the world. The Himalayan River Basin countries can take advantage of these experiences while charting their own future course of action.

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