BBIN SUB-REGION

Perspectives on Climate-Water-Energy Nexus

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PREFACE

The Bangladesh, Bhutan, India, Nepal (BBIN) initiative is a sub-regional framework of countries in the eastern geography of South Asia, which has a rich social, cultural, lifestyle and economic exchange. Officials representing the BBIN countries meet to formulate, implement and review quadrilateral agreements across sectors such as water resources management, connectivity of power, transport and infrastructure.

In December 1996, during the Seventeenth Meeting of Council of Ministers of South Asian Association for Regional Cooperation (SAARC) in New Delhi, the idea of a South Asia Growth Quadrangle (SAGQ) comprising the northeastern parts of India, Bangladesh, Bhutan and Nepal was discussed. A few months later, in April 1997, the SAGQ was formally launched. The following month, at the Ninth Summit of the SAARC in Male, the SAGQ was endorsed as a sub-regional initiative under SAARC. Growth triangles and quadrangles are seen as cooperative ventures involving three or more countries and are often described as 'sub-regional economic zones' with the end objective of creating 'economic complementarities'. The primary task of the SAGQ was to improve cross-border connectivity, bolster trade and strengthen sub-regional economic integration.

The SAGQ was by all accounts a pathbreaking initiative. The template helped fructify the BBIN pact, signed in Thimpu, in 2015 to facilitate cross border movement of passengers and cargo. For India, the BBIN initiative was more than welcome as it could bypass the political logjam of SAARC and discuss economic integration through intraregional trade and connectivity with Bangladesh, Bhutan and Nepal. It equally complemented India's 'Look

East Policy', which now is the 'Act East Policy'. The current geographical reality of BBIN was historically a powerful 'geographic–economic entity'. The reintegration, notwithstanding the challenges, is not only a strong political narrative vis-à-vis Pakistan but also a useful economic one within the BBIN. Mahendra Lama interestingly observes the integration to disintegration to reintegration:

> "This region was, after all, once integrated.... It eventually and abruptly disintegrated, however, because of various politico-historical reasons, and today it is venturing to reintegrate. The demarcation of these borders in the post-Partition period not only disconnected the entire spectrum of infrastructure but also dislocated huge communities."[1]

While the BBIN or the eastern fringe of South Asia is one of the most dynamic sub-regions in the world, it is also one of the least integrated in terms of trade and connectivity. In addition, it is one of the most vulnerable to risks of climate change. There can be little doubt that greater the integration among the BBIN countries the more the likelihood for significant gains. It can increase annual intraregional trade, expand clean energy and hydropower capacity, and help mitigate climate risks in vulnerable hotspots. However, the political questions of dominance, mistrust and suspicion remain obstacles for achieving long-term benefits of the BBIN initiatives. Heavily paper-based procedures, overlapping policies and regulations and inadequate logistics continue to haunt efficiency in trade. Several reports, including the World Bank's 'Connecting to Thrive', find it easier for Indian companies to trade outside the region than with adjoining Bangladesh. While between 2005–2019 trade increased six-fold within the BBIN, the estimated potential remains huge, "estimated at 93 percent for Bangladesh, 50 percent for India, and 76 percent for Nepal."[2]

Without getting into the details of how to make borders irrelevant to trade, the book shares perspectives on the climate-water–energy nexus in the BBIN. The nexus methodology is popular among the academia and policy circles to study and evaluate the use and management of water and energy resources together in the backdrop of climate change. While the nexus can be analysed independently, doing so overlooks the interdependencies that jointly affect their sustainability. Is this nexus incomplete without food? Probably yes, and several literatures and documents include food in the climate-water–

energy nexus. But from the book's perspective, food is inherent in water and energy. For example, electricity is important for cultivation of crops and pumping of water to irrigate fields. The principal utilisation of water, the world over, is for irrigation and food production. Instead of food, climate change, given its ubiquitous nature, is more relevant to the water–energy nexus. Climate change has created existential risks with rising temperature, impact on snow, ice and permafrost and changing precipitation for water and energy sectors at national and sub-regional scales. The ecosystem processes have also been severely undermined, further impacting water and energy resources.

A web of trade-offs and interdependencies define water and energy outlook. The more it is understood in an integrated way the better it is to overcome the sub-regional challenges of cooperation. The BBIN countries have witnessed progress in energy cooperation, but it has predominantly been bilateral with each country entering into separate energy and trade agreements with India. Historically, water cooperation has been attuned to bilateral cooperation and arrangements with several water treaties with India. The shift from the bilateral to a sub-regional multilateral framework on water and energy is yet to be fully realised. A more recent sub-regional approach of electrical grid interconnections and hydro-energy cooperation has positively pushed BBIN countries to think of multilateral energy-sharing agreements. The multilateral trend needs to fully manifest in technical cooperation, information-sharing and institutional traction across the BBIN countries and not just in a bilateral format. There can be little doubt that India has to be the engine and the principal driver to lock the BBIN sub-region into shared benefits and prosperity.

The emphasis throughout the book is on transboundary rivers in the BBIN. There are several beneficial spinoffs and outcomes if rivers are politically managed. Hydroelectricity, for one. Inland navigation trade, for another. Hydrometeorological disasters such as floods, landslides and mudslides, which are increasingly becoming frequent in the BBIN, require cross-border collaboration. To avert or mitigate such hazards, early warning systems, response strategy and coordination between upstream and downstream countries are imperative.

That said, there is also something elementary and inherently wicked about water because searching for diverse solutions to manage and cope with water

issues creates a set of different problems that are political, emotive and divisive. As the most shared resource in the sub-region, competition among various uses and users in trans-border river basins precipitating into disputes and unwelcome outcomes remains a concern. Yet, while the outlook for water is challenging, it has the ability to create breakthroughs that compel different users to cooperate.

The BBIN is a sub-region of multiple challenges where water and energy resources are interlinked to the challenges of development and economic growth. Described as a crowded and a fast-evaporating sub-region, it has a high population density with Bangladesh the world's ninth most densely populated country and India the twenty-fifth. Societal challenges are compounded by the fact that the region is highly vulnerable to climate change particularly, as mentioned, the retreat of Himalayan glaciers and the changing precipitation that affects the flow pattern of perennial rivers such as the Ganga–Brahmaputra–Meghna river systems. These great rivers, in turn, are the lifeline of tens of millions of people in Bangladesh, Bhutan, India and Nepal.

Many of the Himalayan rivers are intimately tied up with the issue of territory, as the rivers enter areas where there are questions about the demarcation of borders. For example, the Brahmaputra is linked with the Sino–Indian border interpretation in the eastern Himalayas, where China 'claims' the territory of Arunachal Pradesh. Since most of the rivers originate from, flow through and drain into territorially defined boundaries, the competitive nature of water or the hydrological fault lines cannot be ignored. The fact also remains that the BBIN countries have developed along river systems that are intricately connected right from the source in the mountain glaciers to the mouth in the deltas. This interdependence adds value to the BBIN prosperity.

It is also important to observe that transboundary rivers in the BBIN cascade from the towering heights of the Himalayas, therefore, there is enormous hydro-potential, particularly in Nepal and Bhutan. The various assessments of climate change on the glaciers suggest that there is going to be, in the short-to-medium time, an increase in melt-flow, resulting in increased flow and flooding. Construction of facilities to store this excess water and release it during dry periods would engage development planners. Beyond the

economics of water management, including the need for dams and water storage facilities for economic development, there is the political reality of fear among lower riparian states, especially over such structures. Clearly, the hydrology of the BBIN sub-region is not only tied up with economic development but also with security and misperception.

With water assuming centrality and increasingly becoming both a bilateral and sub-regional agenda, the BBIN can be viewed as a 'hydropolitical security complex' in which states are simultaneously part 'owners' and part 'users' of rivers. This framework has opened various levels of analysis on how riparian states behave (hydro-behaviour), upstream–downstream contestation (hydro-competition), prior use issues and clash of priorities.

Water relations can never be permanently settled since flows in rivers are not constant. The flows in turn are determined by seasonal variations and usage, particularly those that are non-consumptive in nature. Also, interventions and diversions on rivers impact flow. Political relations can easily be impacted by the changing quantitative and qualitative nature of rivers. Varied interpretations on the use of river water have resulted in claims and counterclaims. Given India's riparian linkage, whether upstream (with Nepal and Bhutan) or downstream (with Bangladesh), and given its diplomatic investment in a number of treaties with these riparian neighbours, hydrodiplomacy will be a vital component of its BBIN drive. The water dynamics adds great complexity with China as a hydro-heavyweight in the BBIN hydrography.

Understanding, evaluating and connecting the climate–water–energy nexus to the development process will be vital for operationalising the BBIN initiatives. Take for example, the BBIN Motor Vehicles Agreement (MVA). Bhutan temporarily withdrew from the MVA dialogue in 2017. The official statement issued by the foreign ministry stated, "The Royal government has decided to give its consent for the entry into force of the agreement among the three member-states without any obligation to Bhutan."[3] The land-locked country continues to be an observer to the dialogue process, and the implementation of the MVA will require its ratification. The BBIN MVA meeting in March 2022 emphasised the "importance of operationalising the MVA expeditiously to enable seamless movement between them for facilitating

trade and people-to-people contact."[4] One of Bhutan's principal worries, if not opposition, regarding the MVA is over sustainability and environmental issues. Bhutan's top priority, as is officially stated, is to 'remain a carbon-neutral country'. The many infrastructure initiatives planned under the BBIN would require factoring in ecological sensitivity and impact assessment for the long-term sustainability of these projects.

Another example is the hydropower projects in Nepal. In recent years, and seen as a positive for the BBIN, Nepal has handed over several of its hydropower projects from Chinese developers to Indian companies. The reason has less to do with economic or ecological considerations but more from a political perspective. India is Nepal's principal buyer of exported electricity but not from projects that involve China. Politico–security factors are influential as seen in the 750-megawatt (MW) West Seti project, a Nepal–China joint venture. For several reasons, including lower-than-expected returns, the Chinese company pulled out. Having first suggested downsizing the project from 750 to 600 MW, it eventually lost total interest. In May 2022, the prime minister of Nepal, Sher Bahadur Deuba, gave the West Seti project to India, and a few months later, signed an MoU that included Seti River-6. India–Nepal hydroprojects are explicitly projected as 'harbinger of development', however, there remains a strong perception in Nepal that India fails to act quickly upon the promises. Several projects such as Upper Karnali and Arun III have well exceeded the timeline. What can be observed in the hydropower sector in Nepal is that there is intense rivalry and competition between China and India. For the former the interests are defined by 'returns and money-making business'. India, on the other hand, has strategic and security considerations. Therefore, there have to be several lenses, not least the ecological and the sustainable lens, to look at development and economic prosperity in the BBIN.

The climate–water–energy nexus comes as a useful framework of analyses to carefully balance development and security perspectives along with environmental assessment.

Notes

1. Mahendra Lama, "BBIN Initiatives: Options for Cross-border Power Exchange," *ORF Issue Brief*, Issue No. 137, April 2016. https://www.orfonline.org/wp-content/uploads/2016/04/Issue-Brief_137_MLama.pdf. Accessed on September 12, 2022. Also see, Smruti S. Pattanaik,

"Subregional as New Regionalism in South Asia: India's Role", *Strategic Analysis*, 40 (3), May-June 2016.

2. Shomik Mehndiratta and Erik Nora, "What will it take to connect the Bangladesh, Bhutan, India, Nepal (BBIN) sub-region?", *World Bank Blogs*, January 24, 2022. https://blogs.worldbank.org/endpovertyinsouthasia/what-will-it-take-connect-bangladesh-bhutan-india-nepal-bbin-sub-region. Accessed on September 12, 2022. Also see, *Connecting to Thrive: Challenges and Opportunities of Transport Integration in Eastern South Asia*, World Bank Report, Washington DC, 2021.
3. *The Hindu*, April 27, 2017. https://www.thehindu.com/news/national/bhutan-backs-out-of-motor-vehicle-pact/article18260565.ece. Accessed on September 13, 2022.
4. *ANI*, March 8, 2022. https://www.aninews.in/news/world/asia/south-asian-group-bbin-meet-on-motor-vehicles-agreement-to-enhance-regional-connectivity20220308210938/. Accessed on September 13, 2022.

INTRODUCTION
BBIN Neighbourhood: Defined, yet Diffused

Scoping Climate and Waterscape

The Bangladesh, Bhutan, India, Nepal (BBIN) sub-region presents a vital paradox of development theory: 'ample resources, ample poverty.' Resource sharing in the sub-region has the potential to create widespread challenges related to resource security, particularly with transboundary rivers criss-crossing the BBIN countries. These rivers increasingly interact with the political, economic and the societal. Though the BBIN countries' dependency on transboundary river basins for economic growth is high, their collaboration over shared waters remains less inspired. With increasing population, economic targets, irrigation and urbanisation, water demand will exponentially increase while, on the other hand, climate change will exacerbate uncertain water supply. These uncertainties along with complex political landscapes can stymie future water–energy cooperation despite the strong imperative for it.

This nexus is now a familiar concept in the resource management debate. It has acquired great attention in understanding the relationship between the three vital systems (climate–water–energy). The nexus as a policy approach brings together the concept of 'security and sustainability'. However, the framing of the nexus around a scarcity crisis narrative often pushes states towards control and possessiveness of the resources rather than driving them towards stability and durability solutions. The nexus perspective has ushered in a new brand of resource realism. Overall, one can see that scarcity narratives around environmental thresholds are creating new policy configurations and responses

to these crises. It will require governments, corporates and communities to increasingly get interlinked in nexus governance.

The nexus approach will lead to identifying mutually beneficial responses, providing an informed and transparent framework for determining trade-offs and synergies that meet the demand without compromising sustainability. As economies expand, governments will have to choose whether to allocate water to agriculture or to uses such as energy, industry and manufacturing. This approach is also now strongly linked with the emergence of the green economy idea, which also refers to the idea of 'clean energy'.

From a climatological and glaciological perspective, rivers crossing through the BBIN countries are connected to the Tibetan plateau and the HinduKush Himalaya (HKH) mountains.[1] This mountain system that runs across four BBIN countries plus Afghanistan, Pakistan, China and Myanmar, is one of the world's most fragile and hazard-prone region. Temperature rises faster at higher elevations, which means that a global temperature increase of 1.5°C could rise to 2.1°C in the HKH. India's area in the HKH region has a population of 86.21m (2017) that includes 11 mountain states and the districts of Darjeeling and Kalimpong in West Bengal. By adding the mountain population of Bangladesh (Chittagong district, 1.78m), Bhutan (0.78m) and Nepal (28.75m), a total of 118m people with diverse cultures, languages, religions and traditional knowledge are dependent on the HKH ecosystem services to sustain their livelihood.[2] As the largest area of permanent ice cover outside the North and South Pole and home to four global biodiversity, the HKH becomes an existential zone where decisions on investment and economic development have to be carefully assessed and administered. Adaptation alone cannot be the way for preventing crises such as flood and drought, migration and future change in water availability of the major river basins in the HKH. It needs to be bolstered by increasing analytical capacity, improving the information base and early warning system, conduction of integrated climate risk assessment and improving communication between government and non-government institutions.

The distribution and the uses of water often account for disagreement, which is more commonly referred to as hydropolitics. Upstream and downstream water extractions exemplify the problem. Extensive and inefficient

utilisation is already reducing water availability during the dry season, and any future water development could further challenge it. While downstream countries can improve the efficiency of its internal uses of water across sectors, they cannot influence upstream water decision-making unless there is a dialogue or agreement. Despite agreements and accompanying transboundary water treaties and mechanisms, the BBIN countries continue to prioritise self-serving interests that reinforce sub-optimal water solutions. Accompanied by principals of regional hydrodiplomacy, efforts towards coordinated development need well-assessed infrastructure and reforming the national energy and agricultural sectors to reduce demands for water.

Climate change will impact the physical environment as precipitation patterns alter and glaciers recede. More than 50 per cent of cultivated land in the BBIN sub-region is rainfed. Future precipitation patterns in major food production regions that have shared socio-economic pathways, including the BBIN, are predicted to negatively impact crop yields. Studies and simulation from the International Maize and Wheat Improvement Center project that a 2.5–4.9°C increase in temperature across the BBIN region could lead to a decrease of 41–52 per cent in wheat yield and 32–40 per cent in rice. The impact of climate change on rising temperatures further impacts the availability of water with decrease in seasonal rainfall and extreme rainfall events.[3]

Critically, groundwater resources as a major contributor to irrigation are being exhausted faster than are being replenished. This raises questions about food security of populations and their struggle to access resources due to social inequities. Under prevailing conditions, it is calculated that the demand for water will exceed supply by 40 per cent in 2030.[4] What would this mean for the management of the transboundary river basins in the BBIN?

The Himalayan plateau plays a vital role in the BBIN. It generates the monsoonal rains and seasonal ice-melts that feed rivers and deliver nutrients. These rivers are already threatened by climate change. China, the extra-regional power in the BBIN, becomes an important actor. During the past 20 years, China has increased activities by building large-scale mines and hydroelectric dams in this sensitive ice-pack region, thereby integrating these fringes into its national economy. Many of these projects have been developed within the transnational Brahmaputra River basin. The Brahmaputra's headwaters are in

China, but most of its catchment area is in Arunachal Pradesh. The environmental and biodiversity impacts of China's continued entrenchment are not significantly prioritised by the BBIN countries.

The Ganga–Brahmaputra–Meghna (GBM) river system with interlinked dependency is politically dynamic, particularly as the BBIN seeks to establish closer links between rivers and transportation and an integrated energy–water system. Increasingly local governance structures will be relevant. In fact, it is already discernible in the BBIN, where the provinces are significant political actors. For example, the 1996 Ganga Treaty between India and Bangladesh expires in 2025 and before India can consider renegotiating it, it has to contend with the problems the states of Bihar and West Bengal have on the river. In Nepal, the new constitution has created a federated system that will have an influence on the hydroprojects with India.

From the above it is vital, therefore, to identify, frame and resolve challenges surrounding transboundary rivers in the BBIN and associated existential issues, which are conceptually described as the climate–water–energy nexus. Beyond this framework, a more nuanced political–economy understanding of shared rivers is essential. It is thus important to take a broad view of how rivers are managed and situate it in the changing political landscape to inform policy action.

For an integrated development perspective, it is important to look at rivers as a 'living system' that cannot be disassociated from the larger ecosystem. The interconnectedness of a river basin with its cross-domain features needs a comprehensive analysis. Stakeholder analysis is necessary since rivers in the BBIN are transboundary. It is also a useful tool in the climate–water–energy nexus. To maximise the advantages or even to optimise them, it is relevant to look beyond the silos and compartments and work multilaterally for larger and shared benefits. Consequently, a comprehensive knowledge base is required across the BBIN countries to effect inclusive development. It is often argued that to enhance inland navigation or other such benefits, rivers need to be treated as 'one personality and one living'. It is instructive, without blindly adopting it, to look at China's approach on dealing with Hwang-Ho, known as the river of sorrow, by establishing connect between river planning and its population. It has trained the river for benefits rather than concentrating resources on taming its natural force.

Political boundaries fundamentally do not synchronise with the free-flowing spirit of rivers, which are the source of livelihoods for millions of people. Joint management of rivers is essential for several reasons: from restoring rivers and preserving the fragile ecology to connecting people, as well as for employment generation to boost the economy. As rivers connect various locals, cultures and lifestyles, the communities living in these areas develop their own perspectives that can add value in bolstering river management plans.

Facilitating non-state actors into the decision-making process is vital for politico-diplomatic relations in the BBIN. Decision makers appreciate the big picture but often search for ways to incorporate and implement. Precise ground-level information from the ground can help decisions on power trade and navigation among the BBIN countries. A good example, despite the adverse political relations, is the hydrological information sharing established between India and China on the Brahmaputra in 2002 and later on the Sutlej as well. For India, as a lower riparian, the information sharing has been helpful. There is, therefore, considerable scope to work in tandem on water development and management between the BBIN countries.

Future cooperation on water resources must be assessed through the cost of non-cooperation and benefits sharing, which could further build trust among riparian countries. The old trust building mechanism of water-sharing needs adjustment and reinvigoration. Inviting water-intensive industries to operate in the basin, for example, can help in revenue generation. Apart from inland navigation, the silt and sedimentation along the course of several shared rivers could material for construction in Bangladesh.

Emphasis on a basin-wide approach is the mainstay to future cooperation on rivers. Though it is politically sensitive, it nonetheless has the potential to bring common grounds for cooperation and calculating the cost of not working collectively. For example, the Brahmaputra is an integrated basin, but all four countries do not always have common interests. Geographically it may not be possible to bring navigation benefits to Bhutan and thus its interest in hydropower will be a higher priority.

Climate change can be a unifying factor both on the upstream impact that Nepal and Bhutan are facing and the downstream difficulties that India and Bangladesh often encounter. Data sharing and joint studies on climate

impact can lead to better understanding, remove mistrust and fear, and thereby enhance cooperation on transboundary rivers. Bhutan, which often remains elusive, can be drawn into the BBIN initiatives on climate issues linked to river management. The physiography of Bhutan makes it vulnerable to climate change impact on water resources. Bhutan's climate action could lead to a comprehensive understanding of the vulnerabilities and risks in the water and energy sector.

The interface between water sector and policy making needs to be frequent and meaningful to set guidelines on benefit sharing and institution building. Water is always subjected to 'who gets what and how'. Despite being a fundamental resource for basic survival, it often, and not surprisingly, becomes a security issue, creating impediments to cooperation. A chapter on the changing narrative of security positions the debate whether such existential issues even need to be treated as a security issue. Normalising water issues without raising the pitch will be an important diplomatic action, while the economic framework of water sharing will be an important driver in reducing security perceptions.

The Pandemic: Its Impact and Opportunities

The shocks and after-shocks of the pandemic (COVID 19) posed enormous development challenges to the BBIN countries, including its mountain communities, due to its high population density, poverty, and dependence on exports. The timing of the pandemic – during the planting and harvesting season of many crops including wheat and paddy – meant that these two major staple foods for the region could not be adequately processed. The movement of goods and cross-border supply chains were disrupted and posed further challenges. The BBIN countries experience different levels of growth. The lockdown clearly impacted their economy with declining GDP across the sub-region. Fall in the projected growth rate put brakes on many regional activities related to water and energy development and climate mitigation. Build-back-better and economic recovery will be crucial to the wellbeing of the BBIN region. With India's economy rebounding strongly, Bangladesh showing strong recovery and Bhutan's GDP growth rate at 3.7 per cent in 2022, the sub-region is not in a deep hole.

The pandemic was an eye opener with several lessons learnt. One, resource security and its related livelihood issues are of high priority and cannot be ignored from development planning point of view. Second, there is greater scope to focus on the benefits of renewable and reduce dependency on fossil fuels. Amongst the BBIN countries only Bhutan is not a net energy importer. A stronger shift towards renewable energy sources can result in substantial savings, particularly for large oil importer countries such as India and Bangladesh. Resource transition from fossil fuels will positively impact climate action plans. The lockdown had a positive impact on the environment with cleaner air and water, thus it is important to leverage this situation towards cleaner energy and water investment and sustainably harness more hydropower potential across the region.

As the recovery path sets in, and not to discount the challenges towards it, the interaction of the social, economic and the environmental requires deep understanding that can reframe the sub-regional dynamics. It will be perilous to think about regional security without considering and identifying intervention areas that can help maintain sustainability and climate mitigation. Access to clean water and sanitation is critical to health and wellbeing. As they criss-cross boundaries, rivers will hopefully acquire greater salience both in terms of their management and in terms of economic gains. The fragile mountain ecosystems require that environmental sustainability be central in all recovery plans and the long-term response to crisis. It can equally be a catalyst for societal transformation toward sustainability and a means to achieve the 1.5°C climate ambitions, as set out in the Paris Agreement (2015).

India in the Sub-region

Since 2014, India has tried to maximise sub-regional interaction with the aim of promoting cooperation in the economic, social, cultural and scientific fields. This has opened new thinking and opportunities, complementing the pace of globalisation and liberalisation. Emphasis on governance and institutionalism has been actively pursued by India in the BBIN, which locks into its 'neighbourhood first' approach. The fear, of course, is that this approach, which requires patience and continuity, can easily dissipate in the face of security complexities and political difficulties, resulting in reactionary measures.

Complementing the 'neighbourhood first' policy is the 'credible first responder' approach that reflects India's capabilities and willingness to contribute resources to prevent and mitigate crises with particular attention to natural disasters. In 2015, India responded to the massive earthquake in Nepal within six hours by sending in the national disaster response force and in the next few days contributing 520 tonnes relief. In 2017, in response to Cyclone More, India was first to respond to the devastating floods in Sri Lanka and Bangladesh.

Both the 'neighbourhood first' and the 'credible first responder' approaches are a reflection of sub-regional interdependence that is being reinforced by geography, and where the bio-physical surrounding is no longer independent of the actions of state and people. Issues are increasingly getting anchored to specific terrains and the environmental interpretation is becoming crucial. For example, viewing seas as a 'commons' or considering the Himalayas as the ultimate watershed or charting the monsoon as a rain-dependent phenomena gives new lenses to look at the sub-region with.

One can recall Mackinder's summarisation of his article *The Geographical Pivot of History* that "man and not nature initiates, but nature in large measures controls."[5] This is critically relevant in the context of climate change, which requires urgency for more technical/scientific and multilateral policy arrangements. In effect, the impact of climate change and the responses will move beyond the quest for protecting or conserving nature to advancing a range of infrastructural interventions aimed at sustainability, resilience and human life. Over the next 20 years a large proportion of the world's infrastructure will be built in India. While infrastructure projects are designed for a long life cycle, climate and weather-related hazards will almost certainly impact durability. Given the vulnerability of the BBIN states to climate change impact, it is important for India to partner with its neighbouring countries to build a coalition of disaster resilient infrastructure.

As a dominant regional power though not necessarily domineering, it is almost incumbent on India to ensure that peace, stability and order prevails. Therefore, problem-solving approaches to resolve challenges to common interests become a rational choice. Assessment of a country being a dominant power does not hinge upon a single major criterion – whether it's the strength

of the economy or its military capabilities or sometime even its sheer physical size and population. Values and principles or its ideational elements are also important. The combination of these power sources informs policy choices and preferences.

Many argue that India needs to break free from the 'claustrophobic confines' of its neighbourhood and think world stage. This globalist rhetoric negates the geographical reality of the region to which India is intricately connected. In attaining great power status, the core and periphery cannot be permanently divided, in fact, their interaction has to be constantly reconfigured and made dynamic. Peripheral realism is what the BBIN seeks by developing India into a sub-regional economic hub. No other region in the world is culturally more homogenous, except for Europe, than the BBIN. The Bengalis of West Bengal and the Bengalis of Bangladesh share a common culture. While Nepal has its unique cultural heritage, it remains an integral part of the cultural and tradition of India. It must be noted that the regionalism of today is a product of multilateralism in the global system, often described as 'spontaneous processes'. Its comprehensiveness and multi-dimensional features mark a shift from the earlier decades of regionalism that was primarily based on security alliances. Today the process of regionalisation takes place at interregional, interstate as well as sub-national levels.

India's engagement with its neighbours in the last nine years of the National Democratic Alliance (NDA) government has been striking. It is a clear enunciation that India will not be a reluctant player but a driver to regional economic agenda. The rationale for such thinking is far too stark to ignore. For example, the high cost of limited regional integration can clearly be seen in the sub-region. Inadequate transport and communication connectivity have resulted in physical and social isolation of the rural poor from public services and markets. The seven land-locked states in the north-east region are among the poorer states in India despite its advantageous geographic location between Bangladesh and Myanmar. The economy of this region is highly dependent on low productivity agriculture; its private sector is dominated by small and informal retail enterprises; and most of its exports are concentrated in low value-added primary products. It is also dependent on import of consumer goods and various products from mainland India at very high transportation cost.

Other land-locked examples facing similar challenges are Bhutan and Nepal. While both these countries are far removed from seaports, their north–south movement is constrained by physiographic barriers, leaving many communities with limited access to local and international markets. Bangladesh, on the other hand, is strategically located to play a vital role in regional trade and logistics and as a transit country. It can facilitate movements between mainland India and its north-east region, Nepal, Bhutan and Bangladesh as well as overland trade flows between the BBIN and Myanmar/ASEAN and the rest of the world. However, trade between the BBIN is constrained because of inadequate existing infrastructure network that connects the rural and the urban areas.

Leveraging proximity is an important rationale in the sub-regional context. For Bangladesh, the north-east region in India is a natural market given its proximity to India's eastern border. But poor connectivity within this region limits the development of trade. Improved infrastructure and direct connectivity between the north-east region, Bangladesh and other parts of India could significantly reduce congestion on the narrow Siliguri corridor (the Chicken Neck) through which the bulk of goods going in and out of Nepal, Bhutan and the north-east region must pass. For Nepal and Bhutan, transit through the Siliguri corridor is key to enabling trade with Bangladesh and to accessing the seaports of Mongla and Chittagong in Bangladesh as alternatives to the congested Kolkata Port. Consumers in the north-east region will gain from better connectivity and trade openness, allowing them to get cheaper goods. In turn, all four South Asian countries – Bangladesh, India's north-east region, Nepal and Bhutan – would undoubtedly benefit from improved transport connectivity with Myanmar, and through Myanmar to points further east.

Another important rationale that is not much discussed but has a vital role in the overall economic growth in the region is women's economic empowerment. South Asian countries have among the lowest female labour force participation rates in the world. Further, the most vulnerable workers in the BBIN are women, that is, without social safety nets or legal protection. Bringing women into the growth rate is essential to regional economy. According to a study by the McKinsey Global Institute, India's gross domestic product in 2025 would be 60 per cent higher if women attain equal status at

work than if it stays at current levels.[6] This would be similar trend for other countries in South Asia as well.

Since coming to power in 2014, the NDA government has majorly focused on women issues, particularly the upliftment of women in the agriculture sector, where 65 per cent of the total female workers are engaged. A good example of this is the *Mahila Kisan Sashaktikaran Pariyojna* implemented by Ministry of Rural Development. It empowers women in agriculture by making systematic investments to enhance their participation and productivity. Under the *Pariyojana*, projects are conceived in such a manner that the skill base of the women is enhanced to enable them to pursue their livelihoods on a sustainable basis. India's gender sensitive approaches to enhance women's access to critical resources through various programmes and services will add great robustness to regional development.

Splintering SAARC

The South Asian Association for Regional Corporation (SAARC), which came into existence in 1985, had limited success with Pakistan often being the spoilsport to many of the regional efforts. At the SAARC summit in Kathmandu in 2014, when the SAARC Motor Vehicle Agreement fell through, India decided it would pursue sub-regionalism; that is, pursue a similar agreement with Bhutan, Bangladesh and Nepal (BBIN MVA). The Indian Prime Minister Narendra Modi made the need for this agreement explicit by stressing on greater connectivity with the region (SAARC minus one) and said, "The bonds will grow. Through SAARC or outside it. Among us all or some of us." When India pulled out of the SAARC summit scheduled to take place in Islamabad, following the Uri terror attacks, Afghanistan, Bhutan, Bangladesh and the Maldives followed suit.

The question is not whether the SAARC will revive but more importantly, how the sub-regional should be further energised. The sub-regional is an eastside story of integration that is primarily based on three pillars: achieve a regional electricity market that can be sufficiently viable to be connected in the future with Central Asia and East Asia; create transport infrastructure to move South Asia towards ASEAN levels of intra-regional trade and investment; and improve the management of shared natural resources and disaster risks through

collaborative institutional arrangement. These three elements are not easy to achieve and require policy persistence, implementation strategy and an unwavering commitment from India.

Along with the BBIN, several sub-regional initiatives such as the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) and the Indian Ocean Rim Association (IORA) are feeding into the effort to boost regional cooperation and create infrastructure for the public good. In other words, leveraging mutual strengths rather than being dragged by bilateral difficulties. These initiatives are not in isolation but connected to each other. The BBIN links the eastern part of South Asia while BIMSTEC connects South and Southeast Asia. The BBIN is a regrouping of the earlier trilateral mechanisms within the SAARC, for example, the Nepal, India and Bangladesh (NIB) trilateral on the development of the Ganga basin and Bangladesh, India and Bhutan (BIB) on hydropower development on the Brahmaputra.

Sub-regionalism since 2014 has been a centrepiece of India's diplomacy. Prime Minister Modi at the Kathmandu SAARC summit in 2014 said, "The future I dream for India is a future for our entire region."[7] This is a far-reaching liberal-institutionalist vision that argues for providing regional public goods. At the meeting of the SAARC foreign ministers during the summit, India's foreign minister, Sushma Swaraj made a strong pitch for connectivity and commerce. Later in a speech she noted, "We also recognise that India, by virtue of its size and location, has a special responsibility in driving the locomotive of South Asian growth and renaissance. I have no hesitation in saying that we will continue to institutionalise positive asymmetry in favour of our neighbours and allow all to benefit from our economy and market."

The inescapable politics in the region has a nasty habit of raising its ugly head and scotching initiatives. Sadly, the immediate periphery does not allow India the luxury to relax. The year 2017 was a reminder of India's continued political struggle with its neighbourhood, particularly with Nepal, Maldives and Sri Lanka. With China's ingress in the region, India's regionalism will be tested as never before. As an interloper in the region, China, unlike India, does not have the baggage of history and nation-building. President Xi Jinping will extend China's influence beyond its borders, including South Asia, with

the possibility of setting new rules of dependency and a larger objective of gradually encircling India. The last thing India would like is to jostle with China in its backyard and thereby run the risk of changing its regional priorities. India must deal with China at several levels and simultaneously cooperate, compete and contest. Resetting relations with China will be important for India's sub-regional engagement.

The sub-region is a strategic necessity. Despite the difficult politics, India's best approach is to continue its effort to provide leadership and through economic integration raise growth via increased intra and inter-regional trade. By focusing on both bilateral and sub-regional initiatives through connectivity, infrastructural build-up and where necessary, unilateral economic concessions to boost intra-regional trade, the question 'who is the regional power' may even become superfluous in the long-term. Looking at the region as a market can help contribute to India's own economic development. Regional integration has thus assumed primacy under the NDA government. The two-decades-old 'Look East Policy' has been replaced by the 'Act East Policy', which is intended to be more proactive in India's engagement with ASEAN. This policy is of relevance for sub-regional mechanisms and focuses on boosting the sub-regional countries' productivity and participation in new economic opportunities that will arise as a result of better connectivity to ASEAN markets.

For India, having taken the lead, financial resources to translate policies into action will be vital. Failure to deliver will erode India's credibility, resulting in loss of trust. Not surprisingly, therefore, budget allocations for sub-regional engagement have seen an increase. By addressing some systemic weaknesses, India can pick up the pace of engagement in a sustained manner and at multiple levels, thereby demonstrating that it has the capability and capacity to promote sub-regional peace and development.

The book first conceptualises the notion of 'expanding security', analysing whether existential issues such as climate, water and energy are necessary to be prioritised as security, and how is India taking a lead. What the COVID crisis tells us, and like all crises before, that we should take nothing as predetermined. In fact, everything has to be seen as a complexity that allows for convergence and contingency. Living in the 'Anthropocene' means that security issues are intertwined and interdependent. Climate change likewise and its impact on

water and energy can be framed as extraordinary circumstances across all sectors. The explanatory chapters follow. An important functional chapter, one that is commonly described as way forward, looks at inland navigation in the BBIN.

Notes

1. The mountain system is referred to as Hindu Kush Himalaya (HKH), coined by Kathmandu-based International Centre for Integrated Mountain Development (ICIMOD).
2. The 11 mountain states are: Assam, Uttarakhand, Himachal Pradesh, Manipur, Jammu and Kashmir, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Arunachal Pradesh.
3. "Climate Change Drives Down Yields and Nutrition of India Crops," *Third Pole Report*, July 14, 2022. Accessed on August 12, 2022.
4. UNEP Press Release, March 21, 2016. https://www.unep.org/news-and-stories/press-release/half-world-face-severe-water-stress-2030-unless-water-use-decoupled. Accessed on January 12, 2021.
5. H.J. Mackinder, "The geographical pivot of history", *The Geographical Journal*, vol. XXIII(4), April 1904, p. 422.
6. Cited in *Mint*, December 2, 2015. https://www.livemint.com/Politics/vGSjSt72LCVC6sRYezfFxM/India-could-add-60-to-2025-GDP-by-bridging-gender-gap-at-wo.html. Accessed on August 12, 2022.
7. Text of Prime Minister Modi speech at 2014 SAARC Summit in Nepal, November 26, 2014. https://www.narendramodi.in/text-of-prime-ministers-speech-at-2014-saarc-summit-in-nepal-6941. Accessed on August 13, 2022.

1

Securitising the Nexus: Is it Useful?

Context

As a concept, security commands great disciplinary power in that there is "always something worth securing."[1] From time immemorial people have always delegated their fears to emperors and sovereign states to secure from uncertainties. History has further shown that discourses on security are often competing against each other in order to gain legitimacy and to become 'the' discourse. Security, thus, has many interpretations with no overarching definition or broad consensus.

The non-state security or the non-traditional security as it is commonly referred to today is not entirely a new thinking.[2] It was given as much importance to territorial security by the founders of the United Nations.[3] The framers of the UN Charter strongly felt that WWII was largely a product of the social and economic pressures of the 1930s depression and, therefore, recognised that freedom from want is crucial to maintaining international peace and security.

During the Cold War the bipolarity of the international system meant that states were preoccupied with the traditional notions of 'defending' national interest and ignored the necessity to 'redefine' national security based on existential threats. Explaining this, Arnold Wolfers in his 1952 seminal work *National Security as an Ambiguous Symbol* writes, "In a very vague and general

way national interest does suggest a direction of policy which can be distinguished from several others which may present themselves as alternatives. It indicates that policy is designed to promote demands which are ascribed to the nation rather than to individuals, sub-national groups or mankind as a whole. It emphasises that the policy subordinates other interests to those of the nation. But beyond this, it has very little meaning."[4] Arnold did not explicitly define the term security in military terms, nevertheless, implicitly national security is exclusively related to the state security or in other words, with the traditional notion of security.

In the "dominant centre, less-dominant periphery"[5] matrix of the Cold War, security was based primarily on the 'realist' framework of defence and military with little space for alternative interpretation. Soon after the end of the Cold War, the bipolarity diffused, and the realist-dominated security gave way to an international system impacted by varied political, economic, national and environmental issues – described as "decentred security."[6] As a result, the discourse and queries on security underwent a profound change from being primarily state-centric to a "reinvention of security in terms other than military."[7]

In the immediate post-Cold War times of peace-dividends, institution building and new approaches to resolving conflict, the spotlight fell on environmental issues. The UN Security Council Resolution (January 1992), in a new favourable international system, acknowledged that "The absence of war and military conflicts amongst states does not in itself ensure international peace and security. The non-military sources of instability in the economic, social, humanitarian and ecological fields have become threats to peace and security. The United Nations membership as a whole needs to give the highest priority to the solution of these matters."[8] Environmental issues, so to speak, became "located in a security logic."[9]

What made environmental problems a case so compelling as to brush aside state-centric proprietorship of security? First, since environmental problems cut across borders, they challenge the dominant security themes of 'territoriality' and 'impermeability'.[10] Considering climate change as one of five different interacting sectors of security – along with military, political, economic and societal – highlights the fact that the state is being challenged

by a new set of intertwined problems.[11] Second, in the traditional security understanding, the protection of territorial integrity is primarily based on the threat from an enemy 'other'. In the case of the environment, the threat comes from the imbalances in the ecosystem, policies of the state, the attitude of people and the mindset of corporations. Third, in the traditional security approach, actor participation and contribution to enhancing the understanding of security is limited, whereas mapping environmental threats and seeking remedies to prevent it requires a broad-based participation.

Both from policy and practice perspectives, the *Human Development Report* (1994)[12] became a defining document that not only presented a holistic approach to human security linked to human development but also emphasised the need for broader concepts of security. In terms of concept and content it drew inspiration from the *Commission on Global Governance* (1992), which outlined ways in which the international community might cooperate to further the agenda of global security. Despite the questioning on the policy relevance of the idea or the criticism of it being conceptually overstretched and not having analytical traction, the *Human Development Report* reset the question on what needs to be secured both from an intellectual perspective and from a practical approach. The foreword of the Report says, "Behind the blaring headlines of the world's many conflicts and emergencies, there lies a silent crisis – a crisis of underdevelopment, of global poverty, of ever-mounting population pressures, of thoughtless degradation of environment. This is not a crisis that will respond to emergency relief. Or to fitful policy interventions. It requires a long, quiet process of sustainable human development."[13]

The Report did not romanticise that the state will disappear but expanded security 'horizontally' beyond the military to include other interlinked issues such as the environment, economy, culture, gender and health. More importantly, it expanded 'vertically', questioning the state-centric views and suggesting that security might have other referent subjects. The expansion was both upward to embrace regional and global identities and downward to the society and to the individual. The Report noted: "The threats to human security are no longer just personal or local or national. They are becoming global: with drugs, AIDS, terrorism, pollution, nuclear proliferation. Global poverty and environmental problems respect no national border. Their grim consequences travel the world."[14]

In a changed international context, a renewed search for international order and cooperation contributed to the "humanization of security and the development-security linkage."[15] A series of UNDP documents can be highlighted during the decade including *Integrating Human Rights with Sustainable Human Development* (1998) and the *Human Development Report* (2000). Further, a number of important reports highlighting the need for holistic security came about. The UN *Millennium Declaration* (2000) emphasised on good governance, access to education and health care noting that "Freedom from want, freedom from fear and the freedom of future generations to inherit a healthy natural environment – these are the interrelated building blocks of human – and therefore national security."[16] The *Responsibility to Protect* (2001), unequivocally stressed on the security of people "...their physical safety, their economic and social well-being, respect for their dignity and worth as human beings."[17] The World Bank *World Development Report* (2000/1) worked out a strategy for alleviating poverty through empowerment, security and opportunity.[18] Building on all these reports and documents, the Commission on Human Security, in 2003, presented its report *Human Security Now* to raise public consciousness and to develop the concept as an operational tool for policy formulation and implementation.[19]

New Age Security

Security in the 21st century has manifold meanings and as a concept has become increasingly institutionalised.[20] The realist minimal understanding and the liberal maximal notion of security continues to present tensions in both the understanding and the approaches in dealing with security. While traditional security paradigms such as great power rivalries, force capability, great power status and threat perception continue, domestic factors and non-military sources of instability through the weakening of the social fabrics continuously challenge the state-centric approach to security.

That said, traditionalists continue to argue that attempts to broaden and deepen the scope of security beyond its traditional scope makes it intellectually incoherent and practically difficult. This constituency remains influential in policy making and resultantly debates over 'alternative understandings' and 'rethinking security', revealing an unfortunate tendency to foreclose arguments

in understanding the complexities of contemporary security and a clearer assessment of their relevance.

Beyond the conceptual debate on security, there is now an acceptance that the global security landscape has significantly changed with the emergence of new threats, particularly the widespread effects of climate change and its impact on food, water and energy resources, which in turn have a spiralling effect on the economy of nations, migration and outbreak of pandemic diseases that cut across political boundaries. Other threats such as transnational crime, regional and global financial crises are equally debilitating with repercussions on national, regional and global security. Given the non-military threats potential to exacerbate existing tensions and deepen the faultlines, these threats can dangerously transform to being territorial and military. Hence, a blurring of the lines between what constitutes traditional security issues, as represented by military concepts, and those that are non-military by definition, which challenge the very survival and wellbeing of people, is taking place.

Today, non-traditional security issues are, therefore, being perceived to be vital to national and global security. Consequently, they are being accorded increasing prominence in policy formulation within the strategic and academic community as well as business and international organisations. These issues are often transnational in scope, defy unilateral remedies and require comprehensive political, economic and social responses.

Broadening Security: How Helpful?

It is also now fashionable to view security as being all-inclusive and as a basket full of everything. This is neither helpful nor is it useful. To give it policy coherence, the comprehensive nature of security needs to be bereft of "individual idiosyncrasies and non-human element."[21] In other words, the optimisation of security should be "delimited in terms of causal factors for which human groups/communities are responsible."[22] If that be the case, then a need to develop a continuum in which differentiating between security issues based on the application of hard power or those less so and those which are not would be important.

Not all concerns are threats; it would be a dangerous proposition to search for threat in every issue. An enlarged security definition would always remain

discomfiting and the suggestion of a "security audit"[23] to signify the relevance of issues and where to draw the line is a useful methodology. Prioritising or categorising issues either as a zero-sum or non-zero-sum challenge is a practical way to shape responses.[24] Therefore, a proper assessment and evaluation is required not only from the security practitioners' perspective but also drawing in collective knowledge from the academic and strategic community as well the media and civil society. A compartmentalised approach to threats that are multidimensional as well as complex can only lead to a weak and wobbly response mechanism. Many would argue that the distinction is not so much about what constitutes traditional and non-traditional security threats as it is about finding new approaches in dealing with new set of challenges that are clearly far more interlinked and transgress national boundaries.

In an important sense, the understanding of comprehensive security, which has Asian resonance and pedigree,[25] facilitates the acceptance of non-traditional security. On the other hand, human security because of its emphasis on justice and emancipation tends to draw hesitation. However, the purpose of this chapter is to look at security as a continuum rather than a binary, with an aim of making foreign policy a tool for more cost-effective security.

The chapter hereon identifies some of the important non-traditional issues for India in the regional context. Because non-traditional issues are interlinked and interconnected, searching for 'security optimality' is crucial. While doing so it does not undermine the role of the state or the importance of national security but reframes the role of the state in providing security and development. The non-traditional issues identified such as climate change and the food–energy–water nexus along with connectivity and infrastructure development are challenges both within and between nations and often originate from growing socio-economic deprivation and disparities. These are essentially non-zero-sum challenges and therefore the cost of non-cooperation in terms of ecological, social and economic costs can be high. Further, creating interdisciplinary evidences and communicating evidence-based information to policy makers plays an important role, particularly in the sustainable management of natural resources. The importance of transparency and information-sharing, institution building and an emphasis on governance rather than governmentalisation brings in new perspectives in dealing with the non-traditional security issues in the neighbourhood.

The BBIN Neighbourhood

The interspersing of religious and linguistic groups across national boundaries in the Bangladesh, Bhutan, India and Nepal (BBIN) initiative presents an intimate intertwining of external and the internal security issues. India's stature in the sub-region apart from its size and economic and military prowess also comes from its pluralistic social fabric. India's pluralism gives it the strength to transcend ideological barriers. The *sab ka saath sab ka vikas* (alternative perspective on unity with inclusive growth) perspective while rooted in India has a sub-regional span. The BBIN is, as earlier observed, one of the least economically integrated. Intra-regional trade is low and investment even lower. Resultantly, the sub-region is poorly connected to global economy. Yet, it is one of the most dynamic and has enormous potential. This sub-regionalism is a functional integration that overlays political divisions by spreading a network of activities and agencies and seems to blur the distinction between the national and the regional, the political and the non-political.[26]

Of all the non-traditional issues, climate change is possibly the greatest challenge to state and society. Over the last decade, with substantial evidences, climate change is no longer a matter of dispute but a hard reality that encompasses issues such as energy, economics, health, food production and other existential issues that affect daily activities. Besides, the vulnerability to disasters from both natural and man-made activities has increased considerably – earthquakes and forest fires, tsunamis, oil spills, droughts and floods. These disasters cause devastation to both human life and infrastructure and have a ruinous impact on the economies of nations.

With increasing population, rapid urbanisation, deterioration of natural ecosystems, ever-greater concentration of people, capital assets and economic activity in natural hazard prone areas, the risk of disaster losses is rising. More than 90 per cent of disasters in India are related to hydro-meteorological phenomenon such as floods, droughts and cyclones.[27] In the next 10 years, a large proportion of the world's infrastructure will be built in India and it is expected that India will double its energy output, increase the length of its national highways by 50 per cent and increase the length of its metro lines by six times.[28] This entire infrastructure will be exposed to hydro-meteorological hazards. The UN Office for Disaster Risk Reduction (UNISDR) Global

Assessment Report 2015 pegs India's expected Annual Average Losses (AAL) from disasters at US$ 10 billion per year. Of these, the AAL for floods account for 70 per cent of the total expected losses.[29] While infrastructure projects are designed for a long life cycle, climate and weather-related hazards will almost certainly impact their durability. According to the Economic Survey (2017–2018), the current infrastructure gap in India stands at US$ 526 billion and approximate US$ 1 trillion will be needed to make existing and future infrastructure climate resilient.[30]

Given the vulnerability of the BBIN states to climate change impact, it is important for India to partner with its neighbouring countries to build a coalition of disaster resilient infrastructure. In 2016, Prime Minister Narendra Modi announced that India will work with partner countries and stakeholders to build a coalition for promoting disaster resilient infrastructure. Since 2017, India along with UNISDR has been working on the development of such a coalition with an emphasis on infrastructure finance development, operation and maintenance as well as reconstruction and recovery of key infrastructure sectors after disasters.[31] Climate resilience policy and disaster risk reduction clearly needs to be incorporated in larger strategic planning and overall development and progress. This also aligns with the Sustainable Development Goal 9 to "build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation."

Need for Climate Diplomacy

There is enough evidence to suggest that climate change is an existential threat to humanity and developing countries are particularly vulnerable to its impact. Mitigating climate-related impacts can help in regional stability and conflict prevention. But with varied stakeholders and their competing interests, international climate negotiations invariably end in deadlocks and incompatible political outcomes. The IPCC report in 2018 and 2021 strongly suggested a sharp reduction in global carbon emissions by 30–50 per cent by 2030 to avert catastrophic climate change. The international system is yet to develop a profound politico-climate consciousness and has been unable to unshackle the messiness of politics, culture and economics. Given the current situation concerning challenges to food, energy and water supply in the medium and long-term, diplomacy in the regional context has an important role to play.

The Asian Development Bank (ADB) forecasts that the cost of climate change and adaptation for six countries – Bangladesh, Bhutan, India, the Maldives, Nepal and Sri Lanka – will see an average economic loss of around 1.8 per cent of their collective annual gross domestic product (GDP) by 2050, rising sharply to 8.8 per cent by 2100 in the current fossil fuel-intensive path.[32] Understanding the causal dynamics of climate change is essential for rationally managing the risks, especially in cases where adaptation is needed rather than simple mitigation. 'Conflict constellations' can occur, for example, climate change can accelerate natural disasters, degrade freshwater resources and reduce food production, which in turn can induce migrations. Such situations can lead to political crises and diplomatic deadlocks, particularly if the affected states are fragile and unstable. Both in terms of political boundaries and geographical cohesiveness such a scenario is not improbable in South Asia.

Himalayan Hotspot

Unabated warming in the Hindu Kush Himalaya (HKH) mountains is eroding the glacier-covered peaks with projected reductions in pre-monsoon river flows and changes in the monsoon, which will "throw urban water systems and food and energy production off kilter."[33]

India can take a leadership role in framing a new climate security mechanism in the region. Some of India's recent initiatives have been noteworthy, for example, setting up the International Solar Alliance (ISA) and anchoring the first summit in New Delhi in 2018. The ISA is not only an expression of India's global outreach to fight climate change through cost-effective renewable energy but also equally a positioning of its global power status that is benign, rule-based and creates opportunities for wider diplomatic engagement on crucial development issues. Similarly, India has taken a strong lead in reaffirming its commitment to the cause of Disaster Risk Reduction by hosting the Asian Ministerial meeting for the second time in 2016.

Since the Himalayas are now popularly known as the Third Pole,[34] a strong case has been argued for introducing research and science cooperation and building the necessary trust that will enable the establishment of an intergovernmental cooperation in the Himalayas similar to the Arctic Council, which to recall had brought former adversaries of the Cold War to cooperate

and share scientific information on snow, water, ice and permafrost. Such a regime, with India's regional leadership, could become the basis of informed diplomatic and political cooperation in the Himalayas.[35]

Bringing science, an underutilised tool in diplomacy, into the conversation adds to the collaborative framework on climate change, weather forecasting, land monitoring, efficient resource mapping and quick response to natural disasters. The launch of the South Asia satellite (GSAT 9) in 2017 is seen as India's technology largesse to the people in the region. As Prime Minister Narendra Modi noted, "With its position high in the sky, this symbol of South Asian cooperation would meet the aspirations of economic progress of more than 1.5 billion people in our region and extend our close links into outer space."[36] In 2018, Prime Minister Modi set up the International Rice Research Institute South Asia Regional Centre in Varanasi as a hub for South–South collaboration on rice research that would develop high nutritional value rice with low sugar content and grow on less water. This brings in an important understanding of the interconnection between science and technology and society. Any knowledge produced or innovations created needs to be distributed effectively within the geographical clusters that share natural and social characteristics. By 2030, the government aims to place India among the top three countries globally in science and technology. To realise this vision, the Union Budget increased its allocation in these areas by 7.5 per cent in 2018–2019 to Rs 65,741 crores.[37]

India has an unrivalled youth demography in which half of the country's population of 1.3 billion people is under 25 years of age. This aspirational youth growing up in the post 1991 liberalisation of the Indian economy period brings in an important view about the role of the youth bulge in the economic development and changing technology. But with the poor quality of education and low rate of female participation the dividend can be a loss, leading to societal friction and unrest. Reforming the higher educational sector along with vocational education and emphasising on skill development at a time when programmes are designed to facilitate investment, foster innovation and build manufacturing hubs is crucial for India's stability and progress.

Crisscrossing Rivers

India and its neighbouring countries share one common trait: high level of dependence of a large part of the population and economy on agriculture. Other relevant common traits include inadequate focus on water use efficiency in all sectors of the economy, rising manufacturing base that demands more water resources, and increasing urbanisation that leads to rising water requirements. With the National Democratic Alliance (NDA) government's plan to raise manufacturing levels in India (also a way to increase jobs), demand for water from the industry will only rise in the coming years and decades. Industries such as food processing, organic chemicals, thermal and solar energy, steel and mining, and fertilizers are large users of water, and these are vital to the Indian economy. The waterscape is set for tougher negotiations over shared water resources among neighbouring countries and hydrodiplomacy will be a key enabler for regional cooperation, with opportunities for dialogue, consultation and data-sharing both between and within states.

Transboundary rivers link their riparian states in a complex network of environmental, economic and security interdependencies. Cooperation among the riparian states in the region is well below its potential with competing claims for water. By all accounts, water will remain deeply political. Often water agreements are not always about water. History and hegemony play an important role in understanding the strategic interaction among riparian states. The contextual framework determines whether politics interferes with cooperation or the sharing of water acts as a neutralising factor in difficult political situations.

While the possibility of future tension over water cannot be ruled out, evidences suggest that there are always avenues for benefit-sharing. For example, India's National Waterways Act 2016 that declared 111 rivers suitable for navigation and as a cheaper form of transport, which can also be extended to benefit trade with BBIN countries. Bangladesh has been in the process of developing a large number of waterways, some of them to connect with those in India to facilitate transboundary navigation. Nepal has agreed to develop inland waterways for cargo movement within the framework of trade and transit arrangement with India; Bhutan is waiting in anticipation to be connected to the Indian seaports via the waterways. The transboundary

navigation projects could result in greater and faster economic growth but more importantly, lead to wider cooperation on water among the South Asian countries. For example, water storage in the upper reaches of the rivers could provide multiple benefits such as adequate water flow for navigation, better flood management, lower pollution levels, greater climate change adaptation, and spur higher water use efficiency across all sectors.

Treaties/arrangements on water sharing have persisted between countries in the BBIN despite political difficulties. Some of these treaties are under severe hydrological stress and might require reformulation or even a new text. But any resetting cannot be attempted unilaterally as it might lead to other political spillover. Restructuring of treaties based on new hydrological knowledge, the impact of climate change and new infrastructure designs has to come through dialogue and discussion involving wider stakeholder participation. In the short-term, however, while not disregarding the water treaties, India can initiate a multi-basin approach to water management.

China will present a new set of hydrodynamics in the region and none of the BBIN countries, more so India, can escape the reality of China as an upper and powerful hydrological neighbour. There is, of course, a Joint Expert Level Mechanism between India and China and a MoU on hydrological and flood data sharing that needs to be reinforced. Any linear thinking based on fear psychosis that China will intentionally harm India on the Brahmaputra is reductionism. There are concerns but that needs best to be dealt with downstream actions. India can build a lower riparian basin coalition on the Brahmaputra with Bangladesh and Bhutan to tackle both the bane of floods and the boon of navigation. There are about 1,800 km of potential waterways and navigation in the north-east along with viability to build more water storages to exert prior rights with China. International law, international institutions such as the UN or third party mediation cannot be relied upon, and therefore, India must overcome the challenges of a water stress future domestically, bilaterally and or by developing a multi-basin approach. For long water allocation decisions have rested with hydraulic engineers but with water becoming more of a social problem these decisions now cannot rest entirely with the 'technocratic–bureaucratic–official–state'.

Differentiating between military and non-military security is becoming

difficult and is probably not necessary. One can continue the debate whether the issues, as discussed in the chapter, are security issues or not but they certainly seem to be critical drivers to regional diplomacy. Specific terrains and natural frontiers define many of the non-traditional issues today. The internal dynamics and extraneous factors are orienting a new set of diplomatic approaches. The traditional contours of territorial-based diplomatic engagement in South Asia are moving beyond 'protected peace' to 'functional peace', taking into account the wellbeing of the people. The socio-political context and development dynamics cannot be kept out of any national security debates. In conclusion, the chapter calls for foreign policy to be pluralistic, in the strong sense of valuing and integrating different intellectual approaches and methods, and to rise above the orthodoxy and be informed by voices and conversations beyond the traditional and insular policy communities.

Notes

1. Hugh Dyer, "Environmental security and international relations: the case for enclosure", *Review of International Studies*, no. 27, 2001, pp. 441–450.
2. Aspects of weather, terrain and environment change in both the Kautilyan precepts of power, place and time as well as Sun Tzu philosophy was understood from a very traditional security perspective.
3. At the San Francisco Conference (April to June 1945), the US secretary of state, Edward R. Stettinius identified two fundamental components of human security: "The battle of peace has to be fought on two fronts. The first front is the security front, where victory spells freedom from fear. The second is the economic and social front, where victory means freedom from want. Only victory on both fronts can assure the world of an enduring peace...No provisions that can be written into the Charter will enable the Security Council to make the world secure from war if men and women have no security in their homes and their jobs." Cited in UNDP, *Human Development Report 1994: New Dimensions of Human Security*, (New York: United Nations Development Programme, 1994), p. 3.
4. Arnold Wolfers, "'National Security' as an Ambiguous Symbol", *Political Science Quarterly*, vol. 67(4), 1952, p. 481.
5. James Der Derian, "The Value of Security: Hobbes, Marx, Nietzsche, and Boudrillard", in David Campbell and Michael Dillon (eds.), *The Political Subject of Violence*, (Manchester: Manchester University Press, 1993), p. 94. See also, Der Derian, *On Diplomacy: a Genealogy of Western Diplomacy*, (Oxford: Basil Blackwell, 1987).
6. Ibid, p. 95.
7. Barry Buzan, Ole Waever and Jaap de Wilde, *Security: A New Framework for Analysis*, (London: Lynne Riener Publishers, 1998), p. 210.
8. United Press International archives. https://www.upi.com/Archives/1992/01/31/The-following-is-the-text-of-the-Security-Council/3433696834000/. Accessed on July 12, 2022.
9. Jef Huysmans, in Robert Miles and Dietrich Thranhardt (eds.), *Migration and European Integration. The Dynamics of Inclusion and Exclusion*, (London: Pinter Publishers, 1995), p. 54.

10. John Herz, *International Politics in the Atomic Age*, (New York: Columbia University Press, 1959), p. 76.
11. Barry Buzan, *People, States and Fear*, (London: Harvester Wheatsheaf, 1991), p. 17.
12. Members of the UNDP team included an Indian, Saraswathi Menon, and a Bangladeshi, Selim Jahan. The panel of consultants included Meghnad Desai and Sudhir Anand. Mahabub ul Haq, the Pakistani development economist, conceptualised the Report and later wrote an acclaimed book *Reflections on Human Development*, (Oxford: Oxford University Press, 1995).
13. *Human Development Report 1994: New Dimensions of Human Security*, UNDP, (New York: United Nations Development Programme, 1994), p. iii.
14. Ibid., p. 2.
15. Neil MacFarlane and Yuen Foong Khong, *Human Security and the UN: A Critical History*, (Bloomington: Indiana University Press, 2006), p. 63.
16. *UN Millennium Declaration, 2000*. http://undocs.org/A/RES/55/2. Accessed on July 12, 2022.
17. International Commission on Intervention and State Sovereignty, *The Responsibility to Protect*, 2001. http://responsibilitytoprotect.org/ICISS%20Report.pdf. Accessed on August 13, 2022.
18. https://siteresources.worldbank.org/INTPOVERTY/Resources/WDR/approutl.pdf. Accessed on August 12, 2022.
19. https://reliefweb.int/sites/reliefweb.int/files/resources/91BAEEDBA50C6907 C1256D 19006 A9353-chs-security-may03.pdf. Accessed on August 12, 2022.
20. Ewing John Jackson, "Traditional and Non Traditional Security: Exploring Practical and Conceptual Challenges", in Shebonti Ray Dadwal and Uttam Sinha (eds.), *Non-Traditional Security Challenges in Asia*, (London: Routledge, 2015), p. 30.
21. TK Oommen, *Understanding Security: A New Perspective,* (New Delhi; Macmillan India, 2006), p. 7.
22. Ibid., p. 8.
23. Kanti Bajpai, *Human Security: Concept and Measurement*, Kroc Institute Occasional Paper no. 19 (Notre Dame, Ind.: University of Notre Dame, August 2000), p. 57.
24. Shivshankar Menon speech at the 14th Asian Security Conference on Non-Traditional Security Issues, February 14, 2012. https://idsa.in/keyspeeches/ShivshankarMenon_14ASC
25. Amitav Acharya, *Human Security: East versus West*, RSIS Workpaper, No.17, September 2001. https://dr.ntu.edu.sg/bitstream/handle/10220/4416/RSIS-WORKPAPER_25.pdf? sequence =1&isAllowed=y. Accessed on August 13, 2022.
26. David Mitrany, historian and political theorist, in his acclaimed work *A Working Peace System* (1943), presents his thoughts about the voluntary cooperation of nations to create institutions with common interests.
27. Kamal Kishore, "Disaster Risk Management in Changing Climate: Reflections from India", A Think Piece for IDSA-PRIO event on Climate Mitigation and Adaptation: Key Strategies Bonn, November 17, 2017.
28. Ibid.
29. Ibid.
30. Aparajit Pandey and Ritwik Sharma, 'Our infrastructure must become climate resilient', *Hindustan Times* (New Delhi), August 30, 2018.
31. *India Seeks Coalition on Resilient Infrastructure,* UNISDR. https://www.unisdr.org/archive/56630. Accessed on August 14, 2022.
32. *Assessing the Cost of Climate Change and Adaptation in South Asia, 2014*, ADB Report. https://www.adb.org/sites/default/files/publication/42811/assessing-costs-climate-change-and-adaptation-south-asia.pdf. Accessed on August 14, 2022.

33. "Two-degree Temperature Rise Could Melt Half of Glaciers in Hindu Kush Himalaya Region, Destabilizing Asia's Rivers", Press Release. http://www.icimod.org/?q=33860&fbclid=IwAR05CoZPKfweL_K_3kBsZ4_7OH_2i4KLki5ECtKlZtVyUjxK6ofYjNM2mD0. Accessed on August 14, 2022. Also see, ICIMOD Report, *The Hindu Kush Himalaya Assessment: Mountains, Climate Change, Sustainability and People*, Philippus Wester, Arabinda Misra, et al (eds.), (Switzerland: Springer, 2019). https://link.springer.com/content/pdf/10.1007%2F978-3-319-92288-1.pdf. Accessed on August 14, 2022.
34. Ólafur Ragnar Grímsson the President of Iceland has spoken extensively on the Arctic and the Himalaya regions. http://english.forseti.is/media/PDF/2015_02_05_Butanraeda.pdf. Shailesh Nayak, former Secretary Ministry of Earth Science, Government of India also spoke of a Himalayan Scientific Forum at the IDSA BIMSTEC Track 1.5 Security Dialogue Forum, September 22, 2017.
35. Ibid.
36. Madhumathi DS, "India Launches Satellite to Help South Asian Nations", *The Hindu*, May 5, 2017. https://www.thehindu.com/sci-tech/science/india-launches-south-asia-satellite/article18391277.ece. Accessed on August 14, 2022.
37. Budget speech by Arun Jaitley, February 1, 2018. https://www.indiabudget.gov.in/ub2018-19/bs/bs.pdf. Accessed on August 14, 2022.

2

Climate Footprints and Landmarks

Science of Climate Change

Scientific evidence and studies indicate that risks and uncertainties are increasing in the sub-region due to climate change, warmer temperatures and increased frequency of extreme events. Nowhere are food, energy and water needed more urgently than in the Bangladesh, Bhutan, India and Nepal (BBIN) region. The intersection of climate, water and energy – the 'nexus' – has been popularised in policy discourse and while it is interesting to interrogate and unpack the 'nexus' idea, the aim is to promote discussion on how the sub-region can best address the threats and opportunities latent in the nexus between climate change, water security and energy security. Increasingly, these are tightly interconnected in ways that extend well beyond national borders. Their associated shocks and vulnerabilities are global and regional, even if their impacts and the responses to them vary locally. How ideas around the climate–water–energy nexus play out is highly dependent on the national and regional political context and is deeply influenced by framing and interest politics. For example, the BBIN countries are facing a 'hydrological moment' that is redefining the politics of water and the relations between nation states in the sub-region. New connections between epistemic and policy communities with a sub-regional basis are being forged that suggest a fundamental rethinking of transboundary water and politics. Clearly such interconnected challenges

require effective solutions, sufficient levels of preparedness and coordinated responses at the regional level.

The following section will highlight the Intergovernmental Panel on Climate Change (IPCC) Working Group Contribution to Assessment Reports (AR) 5 and 6 (2013–2014 to 2021–2022). The reason for the exercise is to observe the climate change trends and impacts in the BBIN in the 10-year period.

In 2013, the IPCC released the Working Groups (WG) 1, 2 and 3 of the AR5. The Synthesis Report followed in 2014. Briefly, WG2, in no uncertain terms, warned of the increases in frequency of extreme weather events from the impact of climate change. WG3 focussed on solutions to curb carbon emissions by assessing mitigation options in different economic sectors. Without additional mitigation efforts, the report says that the world may be headed to a 3.7–4.8°C temperature increase by the end of the century. Worrying was the fact that in spite of great attention to climate change mitigation policies worldwide, the annual greenhouse gas (GHG) emissions grew on average 1.0 billion tonne of GHG per year from 2000 to 2010.

Some of these impacts captured in the Summary for Policy Makers (SPM) are:

> "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.
>
> Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. In the Northern Hemisphere, 1983–2012 was likely the warmest 30-year period of the last 1400 years.
>
> Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90 per cent of the energy accumulated between 1971 and 2015.
>
> Over the last two decades, the Greenland and Antarctic ice sheets have been losing mass, glaciers have continued to shrink almost worldwide, and Arctic sea ice and Northern Hemisphere spring snow cover have continued to decrease in extent.

> The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia (high confidence). Over the period 1901 to 2010, global mean sea level rose by 0.19 [0.17 to 0.21] m."[1]

The WG3 report underlined that about half of cumulative anthropogenic CO_2 emissions between 1750 and 2010 have occurred in the past 40 years. This observation has political ramifications. First, by shrinking the emission period to a contemporary timeline of 40 years, the Report over emphasises emissions from developing countries. It is during the last 25–30 years that developing countries such as China, India and South East Asia countries have started to grow economically. Second, by focusing on the time period of 40 years, it deemphasises the historic emissions between 1750–1970, most of which happened in the developed countries to meet the consumption needs of just 20 per cent of the global population. The fact remains that during the period 1750–2010, 6.5 out of every 10 tonnes of CO_2 have been emitted by rich countries. The statistical shrinking weakens the developing countries strong claim to common but differentiated responsibility and respective capabilities (Article 3 UNFCCC).

The inequality between the developing and developed world is further stark in terms of per capita emissions. During the period 1750–2010, the cumulative of per capita CO_2 emissions is about 1,120 tonnes for the UK and the US. In comparison, it is about 100 tonnes for China and 35 tonnes for India. Even in the 25 years framework between 1980–2005, the total emissions of the US were double that of China and seven times more than India. Equity, justice and fairness will remain very much part of the climate change debate, especially when apportioning climate action to different countries.

There is, however, a convergence on sustainable development and equity as concepts and the basis for mitigation policies. Importantly, the world is slowly but steadily seeing merit in collective action to the challenges posed by climate change as most GHGs accumulate over time, spread and mix globally. That said, the consequence of the historical emission cannot be ignored as the responsibility is directly linked to it. Attempts by the developed countries to wash down the past and stress on the future emissions will be disastrous for any effective and equitable global climate change deal.

According to the IPCC 2013 report, CO_2 emissions from fossil fuel combustion and industrial processes have contribute to about 78 per cent of the total GHG emissions increase from 1970–2010. It is no rocket science that robust mitigation pathways would require substantial cuts through changes in energy systems and land use. The IPCC 2013 report calls for 'low-carbon energy' action plan requiring a mix of energy efficiency, renewable energy, fossil energy with carbon capture and storage (CCS) or bioenergy with CCS (BECCS) by 2050. The International Energy Agency (IEA) has said that annual spending on low-carbon technology and energy efficiency needs to double to about US$ 790 billion by 2020 from 2013 levels to help the world keep temperatures from rising more than 2°C from pre-industrial levels. However, this still does not take care of the accumulated carbon emissions in the atmosphere, which would require large-scale deployment of CO_2 removal technologies, the knowledge, experience and understanding of which is very limited. Moreover, 'low-carbon energy' option does not mean that the fossil fuel industry will fizzle away. It will continue to grow and continue to pollute. Furthermore, CCS technology that involves trapping carbon-dioxide emissions from factories and power plants and pumping them underground for permanent storage is very expensive and can take away precious investments from renewable energy. Another possible game changer in the energy option is natural gas including shale gas. While there is a lot of debate over shale gas and its environmental cost particularly related to water, it is being estimated to what percentage natural gas can replace coal-fired power plants. Some energy experts view natural gas as the bridge fuel till the time CCS is developed and becomes cost-effective.

The IPCC Sixth Assessment Report, 2021–2022 with its Working Groups (I, II and III)[2] was released in 2021 and 2022. The WG II *Climate Change 2022: Impacts, Adaptation and Vulnerability* in its Summary for the Policymakers notes, "Risks are projected for the near-term (2021–2040), the mid (2041–2060) and the long-term (2081–2100) at different global warming levels and for pathways that overshoot 1.5°C global warming level for multiple decades."[3] The Summary warns of increase in the frequency and intensity of climate extremes with a high confidence of impacting food and water security, and hindering efforts to meet Sustainable Development Goals.[4] Overall while food productivity has increased in the last 50 years, but it could have achieved

higher levels had it not been for the impact of climate change. The negative impacts of climate change were in the mid- and low latitude regions while some positive impacts were observed in the high latitude areas. The impact on water resources were witnessed in several locations across the world, including in South Asia. Resultantly, nearly half of the world's population is experiencing severe water scarcity "for at least some part of the year due to climatic and non-climatic drivers."[5]

With extreme weather events, the economic impacts are noticeable. Regions with lower energy demand have been less impacted by climate change. Some regions exposed to extreme weather events, such as tropical cyclones, have had reduced economic growth in the short-term. 'Non-climatic factors' such as urbanisation and infrastructure expansion have contributed to the "exposure of more assets to extreme climate hazards increasing the magnitude of the losses."[6] The Summary further notes, "Individual livelihoods have been affected through changes in agricultural productivity, impacts on human health and food security, destruction of homes and infrastructure, and loss of property and income, with adverse effects on gender and social equity."[7]

Carrying from the earlier AR5, the Summary observes South Asia as a global hotspot along with West- Central- and East-Africa, Central South America, Small Island States and the Arctic. Vulnerability to climate risks is compounded with high poverty, governance challenges and limited access to basic services. In the 10-year period (2010–2020), "human mortality from floods, droughts and storms was 15 times higher in highly vulnerable regions, compared to regions with very low vulnerability."[8]

The IPCC AR6 describes 'Near-term Risks (2041–2100) and Mid- to Long-term Risks (2041–2100)'. In the near-term, global warming reaching 1.5°C would cause unavoidable increase in multiple climate hazards and present multiple risks to ecosystems and humans. Beyond 2040, the impact will be multiple times higher. It makes a pertinent observation, "The magnitude and rate of climate change and associated risks depend strongly on near-term mitigation and adaptation actions, and projected adverse impacts and related losses and damages escalate with every increment of global warming."[9]

The IPCC AR6 draws various increase-in-temperature scenarios and the impact assessment. At a 1.5°C and 2°C global warming level, the impact on

food production and access, intensity and severity of droughts, floods and heatwaves, and continued sea level rise will be from moderate to high. At 2°C or higher, food security risks will be severe in regions including South Asia. Food productivity will be particularly undermined due to degrading soil health and water shortage. At 3°C or higher in the long-term, areas exposed to climate-related hazards will expand substantially, exacerbating regional disparity in natural resources and creating instability. Observing climate complexities, the IPCC notes, "Climate change impacts and risks are becoming increasingly complex and more difficult to manage. Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions. Some responses to climate change result in new impacts and risks."[10]

On climate adaptation, the IPCC observes, "There are feasible and effective adaptation options" that can reduce risks to people and nature. "The feasibility of implementing adaptation options in the near-term differs across sectors and regions... Integrated, multi-sectoral solutions that address social inequities, differentiate responses based on climate risk and cut across systems, increase the feasibility and effectiveness of adaptation in multiple sectors."[11]

Scoping Climate and Regional Evolution

The BBIN can be regarded as an extreme climate disaster prone region. The South Asian Environment Outlook Report, 2014, an initiative of the UNEP and SAARC, noted some disturbing trends, which when studied with the IPCC AR6 (2021–2022) holds credibility. Covering five key issues on climate change, food security, water security, energy security and managing urbanisation, the report noted:

> "The report highlights that South Asia is very vulnerable to climate change. Impacts of climate change have been observed in the form of glacier retreat in the Himalayan region.... These glaciers form a unique reservoir, which supports perennial rivers such as the Indus, Ganges and Brahmaputra, which, in turn, are the lifeline of millions of people in South Asian countries (Bangladesh, Bhutan, India, Nepal, and Pakistan). This will exacerbate the challenges of poverty reduction and improving access to safe drinking water, two of the Millennium Development Goals."[12]

Earlier in May 2011, the Secretary General of South Asian Association for Regional Cooperation (SAARC) presented a draft SAARC Agreement on Rapid Response to Natural Disasters in Male, which was agreed and signed by all member-states in November 2011.[13] The statistics were startling. According to the International Disaster Database (EM-DAT), over the past 40 years, South Asia faced as many as 1,333 disasters that killed 980,000 people, affected 2.4 billion lives and damaged assets worth US$ 105 billion, by far the highest among various regions.[14] The then Secretary-General of SAARC Fathimath Dhiyana Saeed said, "Every major earthquake in the Himalaya would affect more than one country, every cyclone in the Bay of Bengal and the Arabian Sea had the potential to affect two countries at a time, every major flood had its origin and consequence beyond a single country."[15] The agreement clearly reflected the concern over the increasing frequency and scale of natural disasters and their damaging impacts and a need to institutionalise regional cooperation on disaster response.

The impact of climate change also brings in growing concern on the demand-side of the energy–water nexus in the region. Various estimates suggest that the demand for food and energy will grow by 50 per cent by 2030 and 30 per cent for freshwater. The problem is compounded by the fact that the supply-side will be considerably affected by climate change. Water and food management, in particular, will face major challenges due to increasing uncertainties caused by climate change and by fast-changing socio-economic boundary conditions.

Since climate extremes are predicted to increase in frequency and intensity in future, droughts and floods will become more severe and more frequent. This will have an effect on food security as droughts can dramatically reduce crop yields and livestock numbers and productivity in semiarid areas. This means that many parts of the BBIN, with high levels of chronic undernourishment, will also be exposed to the highest degree of instability in food production. This raises important concern about achieving food security in South Asia. While the impact of climate change on the bio-physical aspects of production is known, the impact on food accessibility and utilisation and the distribution and access is still unknown. The crucial issue for food security is not whether food is 'available' but whether the monetary and nonmonetary

resources at the disposal of the population are sufficient to allow everyone access to adequate quantities of food.

Water lies at the heart of social, economic and political issues in the BBIN. It is indisputably an economic and social good unlike any other and also a crucial connector between humans, environment and all aspects of the economic system. Several transboundary rivers in the BBIN connect different spatial scales "creating hydrological, social and institutional territories linking physical, socio-economic, cultural and institutional spaces."[16] It is imperative, therefore, to understand the multiscale interlinkages at the sub-regional, national and sub-national levels. Demographic trends, urbanisation and increased consumption levels will drive the climate–water–energy nexus thinking and trade-offs at the policy-making level and encourage an inter-sectoral approach of breaking the silos between various sectors.

Climate Change and Water

Water security remains central to the concept of the nexus. In short, food and energy security can only be achieved through water security. Increasingly, climate change is becoming a prime driver impacting water security in South Asia. Reports and findings on water challenges in the HinduKush Himalaya (HKH), which extends from Afghanistan in the west through Pakistan, India, Nepal, Bangladesh, and Bhutan to Myanmar and China in the east, suggest that the region is in a crisis and as The Third Pole Report suggests, "further conflict could result from the natural and human-made pressures facing the HKH region over the next twenty years."[17] The report concludes that many water scarcity-induced crises may escalate into developmental "catastrophes" unless vital knowledge gaps are addressed and necessary preparatory steps are taken.

The region is characterised by numerous river basins and is shared between countries of unequal size and power. Sharing waters of transboundary river systems has been a source of various levels of tensions as well as cooperation, particularly when countries build large dams and hydropower projects. Further, China's growing use of the eastern Himalayan waters has emerged as a source of concern. Climate change has brought further challenges such as glacial melting, flash floods, landslides, intermittent rainfall, increased sea levels and risk of salinity ingress in absence of freshwater flows.

The HKH contains the largest source of permanent (frozen) freshwater outside the Polar Regions (hence referred to as 'the third pole'), although the glaciers are now retracting rapidly – notwithstanding the recent controversy around the exact rate of melting. Economic and population growth in the BBIN region will put increasing demands on the diminishing water resource for human consumption, sanitation, irrigation and power production. According to several World Bank reports, India will not be able to meet half of its water needs by 2030 unless drastic measures are taken.

It is being fast established that the HKH hydrology will be one of the critical frontlines in the global battle against climate change and water scarcity. The HKH mountain system is of crucial importance to the river system of the BBIN not only in terms of influencing the monsoon but also in terms of the glaciers thatare the source of many of the great rivers. The impact of global warming and climate change, as studies indicate, will gradually shrink glaciers, resulting in the decrease of water runoff in the long-term. In the short-term, earlier water runoff from glaciers when combined with seasonal rains can result in flood conditions.

Perceptions of a rapidly changing ecosystem may prompt nations to take unilateral actions to secure resources and territorial sovereignty. Any willingness to engage in greater river basin cooperation will depend on a number of factors, such as the behaviour of other competing countries, the economic viability and other interests that states are reluctant to either compromise or concede.

The risks and uncertainties over the impact of climate change on water resources are potentially high. For example, Bangladesh given its location and geography is extremely vulnerable to any variations in water flow. Being the lowest of the riparian states, it shares 54 rivers with India. Bangladesh, geographically speaking, is in a double trap – extremely water dependent and simultaneously witnessing sea-level rise. According to a modelling study, the mean global temperatures for Bangladesh may rise by 1.5–1.8°C by 2050 and correspondingly sea levels may rise by about 30 cm accompanied by an increase in annual rainfall.[18] For India, decreased snow cover and changing precipitation will affect the flows in the Ganga and the Brahamaputra, all originating from the HKH and the Tibetan plateau. 70 per cent of the summer flow of the Ganga comes from the melt water and thus can potentially impact the agriculture sector.

Some Observations

- Climatic and anthropogenic changes impact river flows and affect upstream–downstream dynamics. This includes the Sino–Indian relations, and more specifically transnational river management issues between Bangladesh, Bhutan and Nepal. The existing arrangements may collapse under increasing water stress, and possible interstate disputes over pollution and altered consumption patterns, as well as domestic concerns relating to food production and livelihoods. The development of large hydropower plants to meet increasing demands is especially relevant as it may carry significant adverse implications for downstream communities with respect to the quality, quantity and seasonality of water availability.
- Tibet's water resources and its ecosystem that is under considerable exploitation will have implications for riparian countries. The Ganga–Brahmaputra–Meghna (GBM) is particularly dependent on the vast water resources of Tibet. This raises the difficult question: should China alone determine the fate of the resources in Tibet? How China approaches this issue will not only determine the riparian equation but also the larger geopolitics of the BBIN.
- There are security implications of freshwater degradation and depletion. The Indo–Gangetic plains are among the most densely populated areas of the world; here groundwater depletion and degradation of water quality are rampant. Rapid increases in agricultural intensity, (unsustainable) irrigation and the use of biochemicals over the last century made food security for the burgeoning population possible. However, the ecosystem is under severe stress, agricultural yield is vulnerable to the climate vagaries and urban drinking water supply is a huge challenge. The magnitude, causes and societal consequences of water resource depletion needs deeper understanding.
- Rainfall variability, drought and social unrest while tend to be localised can become widespread with abrupt shortages of freshwater and food.
- It is evident that current water technologies and supply-side approach based on big dams and hydro projects need a relook, bringing in more the concept of supply-side management, conservation and efficiency. Communities' sensitivities, long-term and widespread negative ecological and livelihood impacts also have to be factored.

Regional Response to Climate Change

The complex nature of the climate change crisis in the BBIN region inevitably demands a regional response. Ironically environmental issues entered the phase of regional cooperation rather late as compared to other regional groupings in the world.

SAARC was formed in December 1985. The basic objective was to promote the welfare of the peoples of South Asia and to improve their quality of life; to accelerate economic growth, social progress and cultural development in the region; and to promote and strengthen collective self-reliance among countries of South Asia. The SAARC Secretariat came into existence in January 1987 at Kathmandu to co-ordinate and monitor the implementation of SAARC activities, service the meetings of the Association and serve as the channel of communication between SAARC and other international organisations.

The Third SAARC Summit in 1987 in Kathmandu decided to commission a study on the 'Protection and Preservation of the Environment and the Causes and Consequences of Natural Disasters'. The Summit leaders noted that South Asia was afflicted with such natural disasters as floods, droughts, landslides, cyclones and tidal waves that have had a particularly severe impact, causing immense human suffering.[19] In December 1991, the Report observed:

> "The region is one of the poorest in the world and has a high rate of population growth and population density – the SAARC Member states comprise 20 per cent of the world's population living on 3.5 per cent of the total land area and generate only 2 per cent of the world's GNP. The pressures that these socio-economic conditions create on the natural environment are enormous. In addition, development programmes in the area of industry, agriculture and energy, which are necessary to improve the standards of living of the people, create environmental problems through the generation of wastes and heavy demands they put on natural resource base. SAARC region because of its high level of poverty and degradation of the environment has a particularly adverse effect on the poor, and results in increased natural disasters, especially in the high slopes of the mountain regions, dry and desertified areas, and in the flood plains. The natural resource base of South Asia has to be managed extremely carefully and with great ingenuity to ensure increased productivity on a sustainable basis so that present and future

> generations can meet their needs and aspirations and live in harmony with their environment."

The Report's recommendations included environmentally sound land and water planning, research and action programme on mountain development in the Himalayan Region, coastal zone management programme, integrated development of river basins, SAARC forestry and watershed programme, network on traditional water harvesting techniques, people's participation in resource management, information exchange on low-cost and environmentally sound habitat related technologies, SAARC network of environmental NGOs, participation of women in environment, SAARC Fund for environment, SAARC report on the state of environment and cooperation among SAARC Members on environmental issues in international forums.

Further, the Report incorporated measures and programmes for strengthening disaster management capabilities and covered topics on networking of institutions on natural disaster planning and management, establishment of a SAARC relief and assistance mechanism for disasters, cooperation on the development of modern disaster warning systems, programme for research related to drought prone areas and information exchange system on management of human activities in disaster prone areas.

Finally, the Report suggested an appropriate institutional mechanism for coordinating and monitoring implementation of its recommendations in the form of a SAARC Committee on Environment.

Landmarks on Climate Change

Common Position in UN Conference of Parties

SAARC Member states also evolved a common position on climate change. On the eve of the Fourth Session of the Conference of the Parties to the UN Framework Convention on Climate Change (COP-4), which was held in Buenos Aires, SAARC Environment Ministers met in Colombo on October 30–November 1, 1998 and agreed to urge Annex-1 countries to expedite signing of Kyoto Protocol for its ratification and coming into force and further to take urgent and effective steps domestically to implement commitments undertaken by them to reduce their emission of GHGs. Significantly, the

SAARC Environment Ministers also emphasised fundamental prerequisite for designing emission trading, as provided in the Kyoto Protocol, and determining equitable emission entitlement of the Parties. It was maintained that the entitlements cannot be derived from past emissions, which were inequitable. Earlier, in Tenth SAARC Summit held in July 1998, the leaders expressed their satisfaction on adoption of a common position prior to the adoption of Kyoto Protocol.

SAARC Year of Green South Asia: 2007

SAARC declared 2007 as the Year of Green South Asia. SAARC leaders meeting for the Fourteenth Summit in April that year reiterated that collaboration in addressing the problem of arsenic contamination of groundwater, desertification and melting of glaciers and assistance to affected peoples should be deepened. They expressed deep concern over global climate change and the consequent rise in sea levels and its impact on the lives and livelihoods in the region. They emphasised the need for assessing and managing its risks and impacts. They called for adaptation of initiatives and programmes; cooperation in early forecasting, warning and monitoring; and sharing of knowledge on consequences of climate change for pursuing a climate resilient development in South Asia. They agreed to commission a team of regional experts to identify collective actions in this regard.

In December 2007, SAARC Council of Ministers discussed the issue of climate change in the context of increasing vulnerability of the region due to environmental degradation. The Ministers felt that given the vulnerabilities, inadequate means and limited capacities, there was need for rapid social and economic development in the region to make SAARC climate change resilient.

SAARC Action Plan on Climate Change

SAARC Environment Ministers meeting in Dhaka in 2008 adopted SAARC Action Plan on Climate Change. The objectives of the Action Plan were to identify and create opportunities for activities achievable through regional cooperation and south–south support in terms of technology and knowledge transfer, to provide impetus for regional level action plan on climate change through national level activities and to support the global negotiation process of United Nations Framework Convention on Climate Change (UNFCCC)

such as Bali Action Plan, through a common understanding or elaboration of the various negotiating issues to effectively reflect the concerns of SAARC Member States. The thematic areas of the Action Plan included adaptation to climate change, actions for climate change mitigation, technology transfer, finance and investment, education and awareness programme, management of impacts and risks associated with climate change and capacity building for international negotiations. The Action Plan epitomised the predicament and frustration of the developing countries on the slow progress and virtual negation of the concerns of Non-Annex-1 countries defined in the Kyoto Protocol. The efforts at collective self-reliance as indicated in the objectives of the Action Plan were reminiscent of older era when North–South stalemate debate was at its peak.

Sixteenth SAARC Summit: Focus on Climate Change

The Sixteenth SAARC Summit held at Thimpu, Bhutan in April 2010 was dedicated to the theme of Climate Change. The Summit Declaration, which was on the silver jubilee of the beginning of SAARC, was termed 'Towards a Green and Happy South Asia'. The Thimpu Statement on Climate Change adopted at the Summit meeting called for a review of the implementation of the Dhaka Declaration and the SAARC Action Plan on Climate Change and ensure its timely implementation. There was an agreement to establish an Inter-governmental Expert Group on Climate Change to develop clear policy direction and guidance for regional cooperation as envisaged in the SAARC Plan of Action on Climate Change. It was resolved that the Inter-governmental Expert Group on Climate Change shall meet at least twice a year to periodically monitor and review the implementation of this Statement and make recommendations to facilitate its implementation. It was also decided that the Expert Group would submit its report through the Senior Officials of SAARC to the SAARC Environment Ministers.

The Thimpu Statement, 2010, as if anticipating probable failure of Cancun conclave, resolved to attempt and carry on with comprehensive regional self-reliance efforts and adopted the following:

(i) Direct the Secretary General to commission a study for presentation to the Seventeenth SAARC Summit on 'Climate Risks in the Region:

ways to comprehensively address the related social, economic and environmental challenges;

(ii) Undertake advocacy and awareness programs on climate change, among others, to promote the use of green technology and best practices to promote low-carbon sustainable and inclusive development of the region;

(iii) Commission a study to explore the feasibility of establishing a SAARC mechanism which would provide capital for projects that promote low-carbon technology and renewable energy; and a Low-carbon Research and Development Institute in South Asian University;

(iv) In corporate science-based materials in educational curricula to promote better understanding of the science and adverse effects of climate change;

(v) Plant ten million trees over the next five years (2010-2015) as part of a regional aforestation and reforestation campaign, in accordance with national priorities and programmes of Member States;

(vi) Evolve national plans, and where appropriate regional projects, on protecting and safeguarding the archeological and historical infrastructure of South Asia from the adverse effects of Climate Change;

(vii) Establish institutional linkages among national institutions in the region to, among others, facilitate sharing of knowledge, information and capacity building programmes in climate change related areas;

(viii) Commission a SAARC Inter-governmental Marine Initiative to strengthen the understanding of shared oceans and water bodies in the region and the critical roles they play in sustainable living to be supported by the SAARC Coastal Zone Management Center;

(ix) Stress the imperative of conservation of bio-diversity and natural resources and monitoring of mountain ecology covering the mountains in the region;

(x) Commission a SAARC Inter-governmental Mountain Initiative on mountain ecosystems, particularly glaciers and their contribution to sustainable development and livelihoods to be supported by SAARC Forestry Center;

(xi) Commission a SAARC Inter-governmental Monsoon Initiative on the evolving pattern of monsoons to assess vulnerability due to climate

change to be supported by SAARC Meteorological Research Center;

(xii) Commission a SAARC Inter-governmental Climate-related Disasters Initiative on the integration of Climate Change Adaptation (CCA) with Disaster Risk Reduction (DRR) to be supported by SAARC Disaster Management Center;

(xiii) Complete the ratification process for the SAARC Convention on Cooperation on Environment at an early date to enable its entry into force.

SAARC Draft Agreement: Rapid Response to Climate Change

An inter-governmental meeting on draft SAARC Agreement on Rapid Response to Natural Disasters held in Colombo, Sri Lanka, in May 2011, reached a broad consensus on the Agreement. This agreement was adopted in the Seventeenth SAARC Summit in Maldives in November 2011. The draft agreement based on the principle of respect for the sovereignty, territorial integrity and national unity of all member states aimed to put in place an effective mechanism for rapid response to disasters to achieve substantial reduction in loss of lives and loss of social, economic and environmental assets in times of a disaster.

Regional approach to the climate–water–energy has been much debated in South Asia. However, with new climate and hydrological knowledge and wider understanding on the interconnection, a push towards actions such as regional basin management and joint ecosystem cooperation has gained traction. Such an approach views the region as an organic continuum. An idea gaining momentum is to view natural resources as endowments to be sustained for future generations rather than to be degraded. The regional vs bilateral is a political question. Both have merits and demerits. The question is to find the right approach. Myopic bilateralism can be as bad as a doctrinaire regionalism. The right approach may vary from case to case. A regional approach can also be centralised, techno-centric and prone to gigantism. As upper riparian states plan interventions in rivers, they must inform and consult lower riparian states in advance and take their concerns into account. Sharing information and transparency is probably the biggest incentive to regional cooperation. Some analysts have observed the region through the prism of 'sustainable security'. In other words, rethinking or redefining national security

in an integrated world; this redefining is based on new knowledge of risks and vulnerabilities that increasingly requires preventive and precautionary policy approaches.

Joint Ecosystem Cooperation: Case of Sundarbans

This is a new approach that evaluates the cost of non-cooperation and joint cooperation. A good example of long-term ecosystem cooperation for protecting social interest is the Sundarbans cooperation between India and Bangladesh. As the world seemingly shrinks physically with increasing number of linkages between countries, the necessity of working across borders becomes critically important. The need for new frames, methods and approaches for working across borders to deal with natural systems is increasingly growing. According to the 2021 IPCC report, "it is established that impacts and risks of coastal flooding at 1.5°C of global warming are severe and widespread, 'coastal areas will see continued sea level rise throughout the 21st century, contributing to more frequent and severe coastal flooding in low-lying areas and coastal erosion."[20] For the mangrove ecosystems, the risks are visible and attributable to climate change. The impacts will increase significantly at 1.5°C and would be catastrophic for coastal communities at 2°C. The Sundarbans region is already affected at 1.2°C warming.[21] Ecosystem integrity is being undermined due to rising salinity as a result of saltwater incursion and inundation, net land loss and more frequent high intensity weather events as per IMD classification.

Bilateral cooperation between the two countries on Sundarbans thus has the potential to not only bring an ecological outlook but also help in reducing poverty with climate adaptation measures. The beginning of all this is the need for an effective collaborative process. The existing bilateral process is useful though inadequate. The MoU was signed in September 2011 and the first and only Joint Working Group (JWG) meeting was held after almost five years. This, however, is not commensurate with the pace of climate change that is being witnessed in the sensitive Sundarbans region. While the 2011 MoU is a good starting point but without building a mechanism that is sensitive to new knowledge on ecosystem management the mechanism will remain rigid and inflexible.

Environmental policy response in the region for the last many decades has been rule-based and many a times prohibitory in character. Rule-based approach for managing ecosystems has its limitations, particularly in habitat restoration. Evidences of best outcomes occur when the land manager is positively motivated to implement techniques whereas a top-down, prescriptive approach, a conventional tool favoured by sovereign states, tends to produce less than optimal outcomes. In response, an increasing interest in adaptive ecosystem management is evident in scientific circles as it seeks to manage certain ecosystems in an integrated way, adjusting measures to context-specific needs. A shift from the hard-bound fixed rules that states are generally used to is a necessary condition to respond to the ever-changing demands of ecological management. While it is easy to dismiss the state-approach in dealing with such integrated risks, the fact that political lines and boundaries complicate ecological management efforts cannot be easily wished away. Therefore, to achieve ecological success in transboundary context the stewardship needs to correlate in the best possible way to arbitrary divisions rather than be confrontational.

When an ecologically connected natural system, such as the Sundarbans, spans a border, lack of coordination and information exchange can lead to misplaced and inefficient actions. In the absence of effective governance for transboundary natural systems either mutual losses will accrue, or joint gains will not be advantaged. Therefore, a joint institution is needed to provide a platform for dialogue and wider stakeholder engagement, to harmonise differing perceptions and to re-plan the shared ecological space with the integrity of the ecosystem over existing political borders. The process need not be emotional or activist in its orientation but rationale and logical. However, the existence of such an organisation does not automatically ensure positive ecological outcomes. Institutions have their entrenched problems but when well-calibrated they can provide stability and predictability and thus bring forth collective action.

During the India–Bangladesh Joint Statement, 2000-2022, the two prime ministers called for the effective implementation of the 2011 bilateral MoU on 'Conservation of the Sundarbans' so that the "ecosystem of this deltaic forest and the people dependent on this ecosystem can live sustainably."[22] Achieving sustainable development in the Sundarbans requires an "institutional

mechanism with skillsets and flexibility to work across multiple sectors, engage multiple institutions in both the countries from local to national level, and employ a mix of dedicated and flexible funding sources."[23] To establish the right institution, the two countries can learn from several international initiatives such as such as the Trilateral Wadden Sea Cooperation, Amazon Cooperation Treaty Organization, Mekong River Commission and Senegal River Basin Development Organization. Successful climate-resilient and inclusive development in Sundarbans will serve as a global model for other deltaic regions as well as the Small Island Developing States. For the sake of the Sundarbans unique ecosystem as well as nearly 11 million persons whose lives and livelihoods are intrinsically tied to it, the two countries should pursue out-of-the-box institutional innovations.

The need for a joint institution on ecosystem management is as follows:

- *Inclusiveness and involvement of as many stakeholders as possible:* The Niger Basin Authority and the Nile Basin Initiative include all 11riparian nations to the respective basin.
- *Need for broad coverage of related issues:* The Tennessee Valley Authority (TVA) created in 1933 is one of the most comprehensive regional development organisations based on watershed and river basins. The TVA at its root was concerned with total social development.[24] It integrated water uses from hydropower to flood control to generate wealth for the region, which covered seven states of the United States (Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee and Virginia).[25]
- *To act within mandate:* The Delaware River Basin Commission (DBRC) created in 1961 was a concurrent compact legislation with a legal mandate to oversee a unified approach to managing the river system without regard to political boundaries.[26]
- *Information gathering, knowledge distillation and dissemination:* Most eco-system management institutions across the world serve as central repositories of data and knowledge. An example from Asia is the Yellow River Conservancy Commission (YRCC), which is responsible for unified management of the basin and its resources, including flood control, most of the water uses, coordination and planning. The YRCC has a large and competent technical staff that collects and uses data

for sophisticated scenario planning using decision support systems and advanced networks of technology.[27]

- *Decentralised conversations and discussions:* A good example is the Murray Darling Basin Commission that has a Community Advisory Committee consisting of 26 members; two of whom are state representatives chosen on a catchment basis spread between each state in the same proportion as the main sub-basins in each state plus representatives of four special interest organisations and aboriginal representatives.[28]
- *Dispute resolution mechanisms:* A good example is the Indus Waters Treaty signed in 1960 under which the Permanent Indus Commission looks at resolving issues of differences between the parties concerned and dispute within the bilateral format and if unsettled a provision for involving third party arbitration and settlement through the International Court of Arbitration. In the Niger Basin, issues that cannot be resolved bilaterally by members of the Niger Basin Authority are referred to the Summit of the Heads of State and Government for arbitration.[29]
- *Future-action:* Ecosystem management institutions must have built-in flexibility and capacity for change based on regular review of changing knowledge. The Canadian Prairie Water Board (PWB) that is built on a master agreement among Canadian Prairie Provinces of Alberta, Saskatchewan and Manitoba is flexible and its rules can be refined as it grows.[30]

Notes

1. IPCC, 2013, "Summary for Policymakers, in Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change", (Cambridge, United Kingdom and New York: University Press, 2013).
2. The Working Group I Climate Change 2021, *The Physical Science Basis* (Released on August 9, 2021); The Working Group II Climate Change 2022, *Impacts, Adaptation and Vulnerability* (Released on February 28, 2022); and The Working Group III, *Mitigation of Climate Change* (Released on April 4, 2022).
3. WG II, *Summary for Policymakers*. www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf, p. 8.
4. Ibid., p. 9.
5. Ibid., p. 9.
6. Ibid., p. 11.

7. Ibid., p. 11.
8. Ibid., p. 12.
9. Ibid., p. 14.
10. Ibid., p. 18.
11. Ibid., p. 21.
12. South Asia Environment Outlook, 2014. http://www.sacep.org/pdf/Reports-Technical/2014-South-Asia-Environment-Outlook-2014.pdf
13. Text of the Agreement. http://www.covid19-sdmc.org/sites/default/files/SARRND.pdf
14. Cited in *The Hindu*, New Delhi, May 30, 2011.
15. Ibid.
16. Avash Pandey, Anjal Prakash, et al, "Upstream-downstream linkage in the Ganges-Brahmaputra-Meghna basin: The Hydro-social Imperatives", *Water Policy*, 22, 2020, p. 1083.
17. "The Waters of the Third Pole: Sources of Threat, Sources of Survival", *Third Pole Report*, 2010.
18. NJ Ericksen, QK Ahmad and AR Chowdhury, *Socio-Economic Implications of Climate Change for Bangladesh*, (Dhaka: Bangladesh Unnayan Parishad, 1997).
19. Text of the Kathmandu Declaration 1987. https://www.saarc-sec.org/index.php/resources/summit-declarations/21-third-saarc-summit-kathmandu-1987/file#:~:text=SAARC%20Summit%2C%20Kathmandu.-,The%20President%20of%20Bangladesh%2C%20the%20King% 20of %20Bhutan%2C%20t he%20Prime,warmth%2C%20cordiality%20and%20mutual%20understanding.
20. https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/. Also see, Anamitra Anurag Danda, "Environmental security in the Sunderban in the current climate change era: Strengthening India-Bangladesh Cooperation", *ORF Occasional Papers*, November 1, 2019.
21. https://www.carbonbrief.org/mapped-how-every-part-of-the-world-has-warmed-and-could-continue-to-warm. Also see, Anamitra Anurag Danda, Nilanjan Ghosh, Jayanta Bandyopadhyay and Sugata Hazra, "Strategic and Managed Retreat as Adaptation: Addressing Climate Vulnerability in the Sunderbans", *ORF Issue Brief*, July 30, 2020.
22. India-Bangladesh Joint Statement During the State Visit of the Bangladesh Prime Minister to India, September 7, 2022. https://www.mea.gov.in/bilateral-documents.htm?dtl/35680/India__Bangladesh_Joint_Statement_during_the_State_Visit_of_Prime_Minister_of_Bangladesh_to_India.
23. Sanjay Gupta and Uttam Kumar Sinha, "Sunderbans", *Hindustan Times*, September 27, 2022. Also see, Anamitra Anurag Danda, "The significance of the Sunderbans in India-Bangladesh relations", *ORF Raisina Debates*, March 25, 2021.
24. http://www.transboundarywaters.orst.edu/research/case_studies/River_Basin_Organization_New.htm
25. http://www.britannica.com/EBchecked/topic/587358/Tennessee-Valley-Authority-TVA
26. http://www.state.nj.us/drbc/about/
27. http://www.transboundarywaters.orst.edu/research/case_studies/River_Basin_Organization_New.htm
28. Ibid.
29. Susanne Schmeier, "The Institutional Design of Rover Basin Organizations – Introducing the RBO Institutional Design Database and Its Main Findings." http://www.transboundarywaters.orst.edu/research/RBO/Schmeier_2013_InstDesignRBOs_TFDD_RBO_Database_Paper%20%281%29.pdf.
30. http://www.transboundarywaters.orst.edu/research/case_studies/River_Basin_Organization_New.htm

3

Energy Outlook and Sub-regional Trends

Interdependent but Frayed World

We live in an interconnected world with interlinked issues. Looking at various reports, documents and scenario-building analyses, three common challenges keep emerging – meeting global energy needs with clean solutions; providing abundant clean water; and maximising productivity of agriculture. These have become the central challenges to humanity. With current climate change impacts and projected risks, any efforts towards a green economy and sustainability development goals will have to factor in the deep interaction between water–energy and the embedded food – 'the holy trinity' of sustainable development.

Without access to energy there can be no development. Yet, one in five people still lack access to modern energy services. The primary global and regional challenge is to provide sustainable energy for all – energy that is accessible, affordable, cleaner and more efficient.[1] These are interlinked but without an expanded use of renewable energy sources the challenge will remain insurmountable.

The 19th century engine of growth was powered by coal. Oil became the driver of the 20th century economy. Today, these very sources have contributed to carbon emissions that have disturbed the ecological balance and impacted global climate (coal, mainly for electricity generation, accounts for 44 per

cent of CO_2 emissions; oil, used primarily for transportation, accounts for 36 per cent and natural gas, used for electricity and heating, accounts for the remaining 20 per cent).[2]

It is often said, "It's dangerous to look to the future, but irresponsible, not to do it." Evidences increasingly point out that global warming is worse than predicted and, according to Intergovernmental Panel on Climate Change (IPCC), global greenhouse gas (GHG) emissions must 'peak' before 2025 and be reduced by 43 per cent by 2030 if resulting climate-induced chaos is to be avoided. Policies towards a sustainable post-carbon world can emerge from the understanding of the science of climate change, not by political and economic expediency, no matter how challenging the transition to a clean energy economy might be. Therefore, it should interest everyone as to how the energy landscape is likely to develop.

Driven by rise in fossil fuel processes, oil insecurity and climate instability, a new energy outlook is emerging. This does not mean the abandoning of oil, coal and natural gas (these primary sources will remain important), but an increasing emphasis on an economy powered by wind, solar and geothermal energy. This is an emphasis that suggests embracing renewable energy and expanding the energy basket. The 21st century is about designing a carbon-and-pollution-free energy economy. Is it realistic? What are the factors influencing such paradigm shift, what are the global trends? What is the potential for renewables in the Bangladesh, Bhutan, India, Nepal (BBIN) sub-region?

Factors Driving a New Energy Outlook

Climate Change

Global warming, much beyond nature's capacity to absorb, is already creating climate changes and bringing about a set of dangerous consequences that threaten human wellbeing and challenge economic development. Scientists believe that GHG emissions have already reached levels where some debilitating climate changes are inevitable. Atmospheric CO_2 concentrations have increased by almost 40 per cent since pre-industrial times, from approximately 280 parts per million by volume (ppm) in the 18th century to 412 ppm in 2022. This represents a 68 per cent increase. The current CO_2 level is higher than it

has been in at least 800,000 years.[3] Some volcanic eruptions released large quantities of CO_2 in the distant past. According to US Geological Survey (USGS), human activities now emit over 30 billion tonnes of CO_2 every year, which is 135 times as much CO_2 as volcanoes each year.[4] This accumulation in the atmosphere is like water filling a tub, where more water flows in from the faucet than the drain can take away. Atmospheric carbon concentration and the global commitment to limit warming to no more than 1.5°C, which already is 1.2°C, appears to be already lost. The effect of this, however, will only manifest after 10–20 years. According to International Energy Agency (IEA), "Today's pledges cover less than 20 per cent of the gap in emissions reductions that needs to be closed by 2030 to keep a 1.5°C path within reach."[5]

The dilemma, therefore, is how to balance the increasing demand for energy with the need to reduce atmospheric GHG emissions. In other words, how can the world shrug off its energy demand and allow a shift to clean energy. For BBIN countries with growing energy needs and high vulnerability to climate change, there is a constant attempt to build synergy between energy exporting and energy importing countries. Cross-border interconnection to improve energy supplies has been adequately acknowledged. But the biggest challenge will be to move towards a 'Low Carbon Energy System' (wind, solar and hydropower) without sacrificing the imperatives of socio-economic development. Electrification is the principal contributor towards building a low-carbon energy system and, therefore, the BBIN countries need to concentrate on leveraging the vast renewable energy potential of solar photovoltaic (PV), wind and hydropower, and substantially revise their national plans with enhanced funding for the latest clean technologies. An argument exists, repeatedly underlined by the IEA, for the need for an energy revolution – a revolution that is not driven by concerns for climate change only, but equally driven by the need for the security of long-term energy supplies at affordable and stable prices. The emphasis on energy efficiency and renewable energy to enhance effective carbon abatement regimes is crucial.

Water and Energy

Water and energy systems are inextricably and reciprocally linked. The continued economic health of states depends on a sustainable supply of energy and water. Production of energy requires large volumes of water while the

treatment and distribution of water are equally dependent upon readily available low-cost energy. Both energy and water are used in food production and generating energy through biofuels.[6] Both energy and water resources are under serious pressure from climate change and there's growing competition for their use – domestic, industry, agriculture and ecosystems. Various studies project that with population reaching 8.6 billion by 2030, demand for agricultural production will increase by 50 per cent and there will be a 15 per cent rise in demand for already-strained water withdrawals. According to the IEA, by 2035, the world's energy consumption will increase by 35 per cent, which in turn will increase water consumption by 85 per cent. It further notes that 'over the next 25 years, the amount of energy used in the water sector will more than double, mostly because of desalination projects. By 2040, these desalination projects will account for 20 per cent of water-related electricity demand. Large-scale water transfer projects and increasing demand for wastewater treatment (and higher levels of treatment) also contribute to the water sector's rising energy needs.'[7]

To maintain reliable and sustainable supplies of both energy and water it is essential to develop policies that balance the needs of all users and to develop technologies to reduce water use and loss (i.e. water conservation and efficiency). Renewables such as wind power and solar are exceptions to the energy–water nexus. No water is needed to produce power from these sources. In a warming world, these power sources will have a clear advantage. Even hydroelectricity, as it is intrinsically dependent on rainfall, is an uncertain option in a future of changing climate.

Technology and Investment

The importance of new energy technologies to achieve energy security and environmental sustainability cannot be underplayed, especially in light of possible future climate consequences and oil shocks. However, how the future will unfold in the form and quality of energy technology innovation is unclear. Already advancements in technology are seeing forward movement, particularly in solar power, for example, the development of solar windows. Solar windows generate clean electricity on see-through glass windows by making use of the energy of natural sunlight and artificial sources such as fluorescent and LED lighting, typically installed in offices, schools and commercial buildings. Energy

will be one of the first applications to gain traction with the development of nanotechnology, especially to reduce energy consumption and help in sustainable energy production, storage and use. Development in nanotechnology will help energy solutions through more efficient lighting, fuel cells, hydrogen storage, solar cells, locally distributed power generation and decentralised generation and storage by reinventing the power grid.[8] But to be successful it has to do so as a low-price high-performance choice.

Cost is critical but not a complete dampener. For several regions, clean energy supply system is still a dream. With the exception of very small-scale devices such as compact fluorescent bulbs, most clean energy technologies – such as solar water heating systems, PV systems and biogas digesters – are too capital-intensive to be affordable. However, new pathways, for example, the UNEP End-User Finance for Access to Clean Energy Technologies in South and Southeast Asia (FACET), helps to strengthen domestic bank lending to end users in South and Southeast Asia.[9] Such mechanisms help strengthen local financial institutions and create an enabling environment for sustainable growth in financial markets, becoming an important driver for renewables in the global energy outlook. The IEA's World Energy Outlook, which is published annually, consistently advocates the need to overcome the approximate annual fossil fuel subsidies. In 2020, as a result of falling fossil fuel prices and overall energy use the value of fossil fuel consumption subsidies slid to an all-time low, down 40 per cent from 2019 levels. But as the economy started to build-back post the COVID-19 pandemic, fuel subsidies reached a record US$ 440 billion in 2021.[10] Policy makers are reluctant to reform subsidies schemes particularly in midst of economic recovery. Reducing some of the subsidies and the money saved can go to support renewables and energy conservation and help the poor.

Supply and Demand-side Management

Promoting energy efficiency and demand-side management for sustainable development is another critical factor that is changing the energy outlook. Demand-side management was widely debated in the eighties as the alternative to supply-side overuse and overspending in energy and water systems. The demand-side approach, in energy meant ways to reduce the demand by focussing on conservation and to shift demand from peak periods to off-peak

periods (load-management), in other words resource optimisation. Energy economics in a 21st century world is no longer the only policy driver. Environmental concerns, global climate change and grid reliability/security have become even more important market and policy issues. There is far greater awareness and concern among various stakeholders, including decision-makers and the public. In addition, technology opportunities are developing, allowing for more sophisticated means to apply intelligence and communication in the power systems and to make use of small-scale renewable resources in tandem with demand-side management and efficiency. In the 21st century, with the imperative demand to create sustainable energy systems to prevent climate change and at the same time provide for more welfare to more people, demand-side planning has to be re-invented as a tool. In doing so, the wide application of demand-side application will generate more efficient and more innovative energy technologies. According to IEA, "demand-side activities should be active elements and the first choice in all energy policy decisions designed to create more reliable and more sustainable energy systems."[11]

This section will look at the broad global energy trends in the decade (2010–2020) and the BBIN countries' initiatives.

Mixed Trends in Electricity

In the climate change debate oil is not the real villain, not when compared to coal. Oil is used to produce only 5 per cent of the world's electricity. Since oil is used for transport, it can be gradually eased by electrifying the transport system or moving towards plug-in hybrid and all-electric cars that run largely on clean electricity. Calculations by the World Watch Institute suggest that wind-generated electricity to operate cars could cost the equivalent of 80-cent-per gallon gasoline. Recently, the scientific community is challenging the natural gas industry's claim that its product is fairly climate benign. Natural gas produced by hydraulic fracturing, or fracking (a much-touted key to expanding production), is even more climate-disruptive than coal because of methane gas leakage; methane is a potent contributor to climate change.

In the United States, coal use dropped by 15 per cent from 2010 to 2017 and by 18 per cent by 2019 as dozens of coal plants were closed.[12] It used to be the number two coal consumer after China but now ranks third. In 2020,

coal accounted for under one-fourth of electricity generation, which was less than the combined total of renewables and nuclear.[13] This trend is expected to continue, due in part to widespread public opposition to coal as well as strong federal environmental regulations. Natural gas has been a major disrupter to coal as well. Boom in shale gas production has driven natural gas prices lower. The US Energy Information Administration projects that the majority of US dry natural gas production through 2050 will be from shale and tight gas resources.[14] Big coal producers in the US are shifting their attention to markets overseas, where coal-fired power plants are being built. In the last decade, carbon emissions from coal and fossil use in the US have declined considerably and in 2019, emissions dropped by 0.9 per cent.[15] The net effect of these trends was that US carbon emissions dropped by 7 per cent in four years.

In Germany, the use of coal to generate electricity has declined steadily from 1990 – from 56.7 per cent in 1990 to 43.5 per cent in 2011, a decrease of more than 10 per cent. Yet, total electricity generation during the same period has increased by 10 per cent. Coal combustion further declined by 2020 but despite these substantial reductions, Germany remains one of the largest polluters. Germany's share of renewable energy in the electricity mix has increased substantially. By 2020–2021, Germany's onshore wind increased up to 23.0 per cent, PV by 17.3 per cent, biomass was up by 3.7 per cent and offshore wind saw an increase of 5 per cent. Correspondingly, conventional electricity production from nuclear fuel, coal and gas dropped by 6.7 per cent. By the first half of 2022, renewables accounted for 49 per cent of power use.[16]

But on the other side, for a high-speed economy such as China coal remains a reliable, inexpensive and the most important fuel to produce electricity. China's coal consumption and total energy consumption recorded its biggest increase in 2021, up 5.2 per cent from 2020,[17] a trend that started from 2011. It was reported that in China, demand for coal in 2010 resulted in a 75-mile-long traffic jam that was caused by more than 10,000 trucks carrying supplies from Inner Mongolia. From 2012 to 2016, the global demand for coal increased from 7.9 billion tonnes to 8.9 billion tonnes. Seventy per cent of that increase (700 million tonnes) came from China.[18] In 2021, China consumed 5.24 billion tonnes of coal, the most in 10years. Some 'most likely' projections

suggest that China's coal demand growth will peak in 2030 and thereon decline by 0.1 per cent a year.[19] President Xi Jinping, without setting limits on total energy use, has pledged to bring the country's carbon emissions to a peak by 2030 and achieve carbon neutrality by 2060.

Coal in India accounts for 55 per cent of its energy needs. India's industrial heritage was built on its coal and in the last four decades commercial primary energy consumption has grown by about 700 per cent.[20] Compared to other alternatives, coal is a predictable, dependent and an inexpensive energy source. Estimates suggest that coal still costs about one-third as much as using renewable energy such as wind or solar. A core advantage of using coal is to reduce dependency on foreign oil from unstable regions and is therefore a national security priority. Coal is also labour intensive, requiring a large number of workers to actualise it. In India, the coal sector directly employs a 1.2 million workforce along with a substantial informal ecosystem and local mono-economies that take the figures much higher.

India is the second largest producer and consumer of coal after China. In order to balance between the high energy demands and the slow supply of renewables, coal consumption has seen resurgence in India with increasing coal imports. According to Coalmint, a consultancy firm, India's thermal and coking coal imports grew about 12 per cent, as compared to the previous year, in the eight months ending August 2022. Comparatively, China's overseas coal purchase fell by 26 per cent in the first seven months ending July 2022 from a year earlier. Coal demand in India will peak by 63 per cent or 1.3–1.5 billion tonnes by 2030. In a written reply in the Lok Sabha (March 22, 2022), India's union minister of coal, expressed that "transition away from coal is not happening in foreseeable future. Although there will be push for renewable/non fossil based energy but share of coal in the energy basket is going to remain significant in year ahead."[21] Challenges in balancing the demand for energy security and the need for climate protection are critically important. The energy sector raises critical issues as India has embarked on "deregulation of the electricity market in parallel with decarbonisation of supply."[22]

Electricity is fast becoming the core of energy security and in particular a driver to BBIN cooperation. Advancing technologies in renewables and political alignments are opening opportunities for electricity transmission. This trend

will provide "more than half of the additional electricity generation to 2040 in the Stated Policies Scenario and almost all the growth in the Sustainable Development Scenario."[23] Policy makers and regulators in the BBIN will have to keep pace with technological change and the need for flexible operation of power systems.

For Nepal, rich in hydropower, coal consumption has fluctuated in the last two decades ending at 586,000 short tonnes in 2021. Nepal has enormous potential to reduce its coal consumption by unlocking its hydropower, which is technically and economically estimated at 83,000 MW and 42,000 MW respectively.[24] Its demand for electricity has been growing at 9 per cent between 2006–2017 with power outages lasting up to 18 hours a day. The development of hydropower can not only provide clean energy for Nepal but also catalyse the development of the region. With medium-term and long-term strategic approach including risk sharing arrangement between public and private developers, reforming Nepal Electricity Authority (NEA) and setting up bilateral mechanism between its neighbours, Nepal has become energy surplus, mainly during the wet season. Ninety per cent of its population has access to electricity. In a first-ever effort to sell electricity, the NEA in May 2021, participated in a competitive bidding process to export 40 MW to the Indian state of Punjab.[25] The demand for electricity is high in Punjab, increasing from 11,705 MW in 2017–2018 to 13,148 MW in 2020–2021 as its capacity to produce electricity fluctuates broadly between 4,300 MW and 5,700 MW, making it dependent on outside sources. Nepal can export electricity to help ease Punjab's power woes.

In what can be regarded as an important synergy in India–Nepal relations, NHPC Limited signed an MoU with Investment Board Nepal on August 18, 2022, for the development of two hydropower projects West Seti (750 MW) and Seti River 6 project (450 MW) in Nepal.[26] The Nepalese prime minister soon after expressed, "...the need for strengthening mutually beneficial bilateral cooperation in this [power] sector." The agreement can be seen as a strategic gain for India since the Chinese firms withdrew from the West Seti project. It is estimated that Nepal by harnessing its hydropower potential and selling electricity to India can earn up to Rs 31,000 crore per year by 2030 and Rs 1 trillion per year by 2045.[27]

In the sub-regional context, the India–Nepal MoU can be viewed as an important turn of events. Bangladesh is keen to purchase 500 MW electricity from the 900 MW Upper Karnali hydropower project in Nepal to be developed by India. The two have requested India to allow export of 40–50 MW electricity from Nepal to Bangladesh in the initial phase, "utilising the high voltage direct current power systems located in Bheramara of Bangladesh."[28] To recall, in 2013, India and Bangladesh inaugurated the cross-border power transmission link to facilitate the exchange of 500 MW electric power with an option to enhance it to 1,000 MW in the future. The then Indian Prime Minister Dr Manmohan Singh had described the transmission link as a "safe and reliable interconnection between the countries." The secretary-level Joint Steering Committee for energy cooperation between Nepal and Bangladesh met in October 2022 and placed their request to India's NTPC for a trilateral energy sales and purchase agreement utilising the Baharampur–Bheramara cross-border power transmission link.

Nuclear Power

Nuclear power once touted as 'too cheap to meter' has come under introspection. The first commercial nuclear power station started in the 1950s and in seven decades since, nuclear energy provides 10 per cent of global electricity. *The Economist*, marking the first anniversary of Japan's Fukushima disaster in its March 10, 2012 issue noted, 'Nuclear Power: The dream that failed'. Although nuclear energy is a clean and carbon-efficient source, one can, with varying thoughts, argue about its future significance in terms of location, waste, price and public perception. The biggest blow to nuclear energy came from Japan. With public confidence low, Japan suspended operations at 46 of its 50 nuclear plants. In 2019, Japan was producing 7.5 per cent of electricity from nine nuclear power reactors. Likewise in Germany, post-Fukushima Chancellor Angela Merkel announced the immediate shutdown of eight of the country's oldest reactors, and decided to phase out nuclear power entirely by 2022. The *New York Times* reported that China suspended approvals for new reactors pending a safety review.[29] The news report says that "This has resulted in a downward revision of China's unofficial pre-Fukushima goal to install 86 gigawatts of nuclear capacity by 2020. It now looks like that will be set around 60 gigawatts (up from around 12 currently)

or just a little higher."[30] Taiwan too has considered a phase-out of its four reactors. Israel and Venezuela have calmed their earlier nuclear power ambitions post-Fukushima incident. In Japan, not surprisingly, the nuclear 'capacity factor' dropped sharply from 71 per cent in February 2011 to 51 per cent in May. The overall trend post-Fukushima was definitely not encouraging.

The London-based World Nuclear Association predicted a 30 per cent increase in global nuclear generating capacity by 2020–2022 and foresaw 79 more reactors by 2020, for a total of 514.[31] By 2030, it predicted a 66 per cent increase, with additions mainly from China, India, South Korea and Russia. The reality, however, has been different. During the period 2011–2020, about 48 GWe of nuclear energy was globally lost with a total of 65 reactors shutdown.[32] One country that bucked the trend was the US. After a careful review of its nuclear power installations post-Fukushima, the US decided to remain committed. The US currently houses 93 nuclear reactors; in 2021, nuclear energy accounted for roughly 20 per cent of the country's electricity generation, "just 1 per cent less than the total electricity generated by renewables such as solar, wind, and hydro."[33] The nuclear energy debate continues to intensify. As mentioned earlier, safety, land acquisition and the issue of long-term nuclear waste storage when factored in does not make the industry seem cost-effective, energy efficient or environmentally friendly. However, with current levels of warming triggering irreversible changes and with the global energy crisis, resistance to nuclear energy is steadily fading after stagnating for a decade. "Governments in Japan and South Korea are removing anti-nuclear policies, while China and India are looking to build more reactors to avoid future supply shortages and curb emissions. Even developing nations across Southeast Asia are exploring atomic technology."[34]

India is committed to enhancing its nuclear energy capacity, which is largely indigenous. India currently has 22 operable reactors producing 6,795 MWe electricity and with several reactors under construction an additional 6,029 MWe of electricity is expected.[35] While nuclear energy lacks attention in the BBIN sub-region, in March 2018 there has, however, been a uniquely interesting development with a tripartite MoU between India, Bangladesh and Russia for civil nuclear cooperation. Russia is building the Rooppur nuclear power plant on the bank of Padma River in Bangladesh on a 'turnkey basis'

and Indian companies, while equally participating in the construction, will supply 'equipment of non-critical category.' Almost a year before the tripartite cooperation, an Inter-Agency Agreement was signed between the Indian Department of Atomic Energy and the Bangladesh Atomic Energy Commission on 'Cooperation Regarding Nuclear Power Plant Projects in Bangladesh.'[36] In May 2022, a Joint Committee Meeting on peaceful uses of nuclear energy was held between India and Bangladesh. According to the press release "the entire gamut of our bilateral cooperation in peaceful uses of nuclear energy applications in the field of health, agriculture, water purification including capacity building, training among others was discussed."[37] Nuclear power electricity has the potential to bolster cross-border energy cooperation in the BBIN. "India has been very keen to develop synchronised grid connectivity. It will also allow seamless power from Bhutan and Nepal."[38]

Energy Independence or Energy Interdependency

What does it mean for a country to be energy independent? Is it even possible to be energy secure in an increasingly interdependent world where energy sources mainly petroleum and gas are unevenly distributed? The definition or the measurement of energy independence depends on how a country views its national interest. For some countries, being energy independent means zero import of energy or continuously reducing energy import. For others, it would mean exporting more energy sources than importing. Some may measure energy independence as producing more energy than consuming it. Bringing all this together, energy independence can be defined by factors affecting the balance of energy imports and exports. Despite the variedness in definitions, every country would like to achieve energy independence or reduce dependency to protect its economy over the long term.

Countries such as the US have eventually achieved energy independence, which has been one of US' primary objectives since Richard Nixon 'energy independence project' in 1973. He had famously proclaimed, "Let us set our national goal that by the end of this decade we will have developed the potential to meet our own energy needs without depending on any foreign sources." In 2020, the last year of President Donald Trump, US imports of petroleum decreased, and US became a 'net exporter' for the first time since 1949 when

President Dwight Eisenhower justified his decision to send troops to the Middle East (West Asia) on the basis that the region had "two-thirds of the presently known oil deposits." The petroleum export–import figures of the US in 2020 were 8.49 and 7.86 million barrels per day respectively.[39] In 2021, it exported 8.63 and imported 8.47 million barrels per day.[40] It is expected that increased oil production combined with the growing production of natural gas will help the US sustain its energy independence. Across the Atlantic, several European countries have long aspired to wean themselves off Russian oil and have been motivated to accelerate the transition to clean energy. In reality, given the interdependency of trade in energy and economy, no country can totally achieve energy independence. It is, as many would argue, rhetoric and a political slogan to "imply that a country is insulated from global energy markets."[41]

At the other end of the energy spectrum is China. Throughout its economic rise thermal power has remained and continues to be the primary source of energy, contributing roughly 79 per cent of China's power generation. In 1993, it became a net importer of oil and since has steadily increased its oil imports. As a result, China is the world's largest importer and second largest refiner of oil. Dependency has risks but in the case of China it is a calculated dependency. The need to secure and diversify oil supply have driven Chinese national oil companies to invest in international projects and form strategic commercial partnerships with international oil companies while also stepping up equity deals both for security of supply and to hedge price risk exposure in future.

While China is the *numero uno* importer, it is not the world's largest consumer of oil. This has worked to China's advantage as it has been increasing its oil import in recent years, including during the COVID-19 pandemic, when oil prices were remarkably low. China stores a portion of its imports in national oil reserves for future use. Its total oil stocks rival in size US strategic stockpiles. China's 'unusual' buying spree before the Ukraine crisis underlines its strategic orientation to oil import. Reports suggest "crude oil inventories in China are up roughly 30 million barrels since mid-November [2021], with 10 million barrels in refineries and 20 million in commercial terminals."[42] Natural gas usage in China has also increased; it is looking to raise natural gas imports via pipeline and liquefied natural gas (LNG). Given its enormous

energy requirement, China will want to make sure that it has sufficient physical stake in oil and gas globally. When will China reduce its oil dependency? The recent official figures show a drop in oil import, the first time in two decades, from 73.6 per cent in 2020 to 72 per cent in 2021.[43] The decline is consequential, showing that China may have passed from its calculated oil import period to becoming more self-sufficient and thus enhancing its energy security.

India is an energy dependent country. It is the world's third largest importer and consumer of crude oil and petroleum products, importing over 80 per cent of the crude consumed. India's oil import was at 4243.758 barrels a day in 2021, an increase from 4033.050 barrels a day in 2020.[44] India has set a target of becoming an energy independent nation by 2047 and has also committed to reach net-zero GHG emissions by 2070. The roadmap to achieving this would fundamentally require India to reduce its oil import. In 2015, India had set a target of reducing oil import by 10 per cent by 2022. However, since then India's oil import has continued to increase.

In other BBIN countries, Bhutan and Nepal while being self-reliant on hydropower resources are not wholly energy independent. Both countries are dependent on external technical capabilities and finances to develop their hydropower. Bhutan has surplus power for export, while Nepal after suffering from huge domestic power deficit has only recently started exporting surplus energy. Projects in Nepal have higher cost structures than in Bhutan. The difference can be attributed to different developmental and operational approaches of the respective governments and dissimilar hydrological conditions of project sites. Bhutan's hydroprojects are "more optimal in design thus making them more cost-efficient and less risky and intended for power exporting, which allows Bhutan access to attractive funding resources, including carbon finance."[45] In contrast, Nepal's projects are planned primarily to make up for the shortfall in domestic electricity availability. "To maximize output generation, Nepal's project facility structures are designed to emphasize greater water volumes in larger reservoir storages, which increase both the project costs and the social and environmental risks. As a result, Nepal's project implementation becomes more challenging and makes funding more difficult. Thus, Nepal's overall hydropower development slows down, being caught in a vicious circle."[46]

Bangladesh, like India, is predominantly dependent on external fossil fuels. Demand of electricity is projected to reach 50,000 MW by 2041 and the government plans to increase power generation beyond the expected demand to propel growth in the export-oriented economy and meet the needs of the middle class.[47] In the immediate, it plans to increase import of fuel oil by about 15 lakh tonnes in 2023, mainly to feed fuel oil-based power plants to tackle chronic power outages already hitting life and livelihood hard.[48] The fuel mix of Bangladesh's power plants is heavily based on natural gas and in order to reduce dependence on domestic supplies, Bangladesh has decided to increase the use of imported LNG and not increase coal use in the energy mix. Till very recently Bangladesh was considering plans to generate as much as 50 per cent of total electricity using coal-based power plants by 2030. Bangladesh's 8th Five Year Plan (2020–2025) provides strong evidence of an increased focus on renewable energy, energy efficiency and the financial sustainability of the power system. The Integrated Energy and Power Master Plan (IEPMP) lays emphasis on renewables and grid investment and LNG to replace coal in the face of pressure from environmental groups and development partners. Bangladesh is also considering importing more electricity from neighbouring countries and expanding the use of renewable resources, including solar and wind power.

As can be observed, the BBIN countries have variation in their energy resource endowments but share common socio-economic characteristics with similar energy demands and challenges in attaining emissions reduction targets. Energy production constraints and increasing dependence on external energy sources continue to raise environmental and security concerns across the sub-region. While energy independence is a strong objective, there are considerable benefits that can be derived from energy interdependence and cross-border power trading.

World of Renewables

Energy trends in the last few years suggest a steady growth in renewable energy markets, support policies and investment. Thrust towards moving renewables beyond 'niche' status requires broad-based participation – government (comprehensive national policy), industry (energy efficient), investors (money for clean technologies), knowledge sector (new research), civil society (advocacy

and transparency) and the media (awareness).[49] According to the Renewables Global Status Report 2020, "installed power capacity grew more than 200 gigawatts (mostly solar PV, PV) – its highest increase ever. As in previous years, government policy was a main driver of both the growth and decline of renewable energy markets."[50] The report also suggests that for over a decade renewable sources supplied 16.7 per cent of global final energy consumption where the share of modern renewables increased while the share of traditional biomass declined slightly. Also, 118 countries implemented renewable energy targets with more than half in developing countries. Overall:

- Investment in renewable increased 17 per cent to a record US$ 257 billion, despite a widening sovereign debt crisis in Europe and rapidly falling prices for renewable power equipment.
- Photovoltaic module prices dropped by 50 per cent and onshore wind turbines by close to 10 per cent, bringing the price of the leading renewable power technologies closer to grid parity with fossil fuels such as coal and gas.
- Trends illustrate a significant and rapidly growing share of renewables in energy markets, industrial policy and investments, moving renewables beyond 'niche' status.[51]

The renewables outlook suggests that harnessing power from the sun and wind will revamp clean energy economy. Globally, solar cells that convert sunlight into electricity have expanded. According to Global Status Report (GSR) 2020, a revolution in PV installations has boosted current installed capacity to 70,000 MW. The Report noted: "Despite an increase in final energy demand, global energy-related carbon dioxide (CO_2) emissions did not grow in 2019, following two years of increases. This flattening was mainly due to declines in emissions from the power sector in some countries, which were mostly related to improvements in energy efficiency and to rising shares of renewable energy, but also to some extent to fuel switching from coal to gas."[52]

Wind, the other renewable, has become a healthy competitor to solar. In the last decade, the electricity-generating capacity from wind has grown at a healthy 30 per cent per year. With no requirement of water or fuel and with little land, wind energy is inherently attractive and can be quickly installed and brought online, unlike coal, gas and nuclear plants. No other renewable

energy matches this combination of features. Wind energy can have positive spin-offs. For example, by reducing the burden on coal and gas in power generation, water will be freed up for irrigation and other needs. Planning and investment in wind projects is occurring on a scale not previously seen in the traditional energy sector.

However, any shift towards renewable sources of energy will have to also consider rapidly increasing the energy efficiency of industry and electrifying the transportation sector. Clearly the world energy outlook shows that for the first time there is genuine opportunity to invest in alternative sources of energy and move onto a path of sustained economic development and growth. According to the latest GSR 2022, "The role of renewables in improving energy security and sovereignty by replacing fossil fuels became central to discussions, as energy prices increased sharply in late 2021 and as the Russian Federation's invasion of Ukraine unfolded in early 2022." The Report also notes, "A structural shift in the energy system is increasingly urgent. An energy-efficient and renewable-based economy is a game changer for a more secure, resilient, low-cost – and sustainable – energy future."[53]

Renewables in the BBIN

There can be little argument that BBIN's energy interdependence can help in substantially reducing energy poverty for its millions. A sustainable economic policy would require energy planning and development that not only focusses on efficient harnessing of available natural resources but also on establishing delivery mechanisms to meet the needs of growth, equity and self-reliance. Energy security is best secured from available domestic resources, which renewables attract, making for good economic sense. Development imperatives and climate stabilisation in the sub-region make a compelling case for using renewable energy.

The BBIN countries have had experiences in renewable projects starting in the seventies after the world oil shock. Unfortunately these projects failed to take-off because of several factors, including declining oil prices. But with the sub-region being highly vulnerable to climate impact there is greater renewable energy drive through incentives such as subsidy and tax benefits. External financial aid and technical assistance are being provided by various

international funding agencies such as the World Bank, United Nations Development Programme (UNDP), Food and Agriculture Organization (FAO), Commonwealth Secretariat and Asian Development Bank (ADB) to boost renewable energy. The SAARC also conducts surveys and studies to evaluate the role of renewables.[54] The BBIN countries have the opportunity to discuss energy issues and action plans under The Group of 77 (G-77), Regional Wood Energy Development Programme (RWEDP) and the UN's Economic and Social Commission for Asia and Pacific (ESCAP) Energy Programmes. India as a fast emerging and the world's fifth largest economy by nominal gross domestic product (GDP) is taking the lead in renewable energy. India's active voice in various groupings such as the Group of 20 (G20), Brazil, Russia, India, China and South Africa (BRICS), Group of Eight + Five (G8+5) can equally catalyse the BBIN sub-region with initiatives towards clean and sustainable development. India is to hold the presidency of the G20 (2022–2023) and as part of the tradition has invited Bangladesh as a guest country to take part in the G20 meetings.

Of the renewables, wind energy has great potential in the sub-region and a key area of cooperation can be to build transmission lines to link wind-rich regions with population centres. There are positive examples around the world where electricity can be moved from one part to another by high-voltage lines linking grids. One such project is the Tres Amigas Super Station (TASS), an onshore wind farm, being built in eastern New Mexico, US to link the three US electricity grids — the Eastern, Western and Texas grids.[55] The primary objective is to rid the region, particularly Texas, of its oil dependence.

Across the BBIN countries, several programmes have focused on capacity building at the national level and implementation strategy at the local level. In Bangladesh, Grameen Shakti (GS), a not-for-profit organisation under the micro-financing institution Grameen Bank has made great contribution in renewable energy, particularly in bringing solar technology to households.[56] In Bhutan, a country with surplus hydroelectricity, plans to extend the grid supply to all villages and is experimenting with micro hydel-power projects such as the community managed 70kw Chendbji.[57] The Druk Green Power Corporation will begin construction of three small hydropower projects, one each at Lhuentse, Zhemgang and Haa, with a total generation capacity of 104

MW.[58] In Nepal, the Rural Energy Development Programme (REDP) has been successful in promoting decentralised energy planning at the district level and increasing energy access from micro-hydro systems.[59] The REDP operates at three levels. At the community level, activities focus on planning, implementation, operation and maintenance of energy systems. At the district level, the focus is on building capacity to plan, manage and monitor the rural energy development process. At the national level, the attention is on policy support and coordination.[60] In all the mentioned projects, sustained support from the lending agency, project managed by private institutions, matching funds provided by the government and minimal dependence on foreign expertise for the design of small hydro and solar systems are important factors for the success of the renewable.

The global energy market is dynamic with great diversity of energy sources development as well as technology setups and investment. Energy efficiency is a 'key option' in transforming global energy systems onto a more sustainable path. Equally important will be reducing the energy intensity as the BBIN countries industrialise their economy. To become self-sufficient in energy, wind, solar and other types of low-carbon energy will remain attractive. The energy transition has to work on a studied timeline that accommodate both traditional fossil fuel energy and renewables. In addition, it must focus on conserving energy and changing the energy mix.

Notes

1. "Sustainable Energy For All." https://www.un.org/millenniumgoals/pdf/SEFA.pdf
2. Earth Policy Institute (EPI) Facts Sheet. http://www.earth-policy.org/mobile/releases/climate_change_fact_sheet
3. *Advancing the Science of Climate Change*. National Research Council, (Washington, DC: The National Academies Press, 2010).
4. Ibid.
5. *World Energy Outlook 2021*, *Executive Summary*, IEA. https://www.iea.org/reports/world-energy-outlook-2021/executive-summary
6. "Will Water Constrain Our Energy Future", World Bank. https://www.worldbank.org/en/news/feature/2014/01/16/will-water-constrain-our-energy-future
7. "Water-Energy Nexus", *IEA World Energy Outlook*. https://www.iea.org/reports/water-energy-nexus
8. "Nanotechnology and Energy", Understanding Nano. https://www.understandingnano. com/nanotechnology-energy.html
9. UNEP. http://www.unep.org/energy/Activities/FACET/tabid/79474/Default.aspx

10. "Energy Subsidies. Tracking the Impact of Fossil Fuel Subsidies", IEA. https://www.iea.org/topics/energy-subsidies
11. IEA-DSM. http://www.ieadsm.org/Content.aspx?ID=3
12. Robinson Meyer, "America's Coal Consumption Entered Free Fall in 2019", *The Atlantic*, January 2, 2020. https://www.theatlantic.com/science/archive/2020/01/americas-coal-consumption-entered-free-fall-2019/604543/
13. David Cherney, "Coal Unstoppable Decline Means Carbon Emissions From Electricity Will Keep Dropping for Years To Come", *Forbes*, January 13, 2021. https://www.forbes.com/sites/davidcherney/2021/01/13/coal-producers-affirm-us-carbon-emissions-from-electricity-will-keep-declining/?sh=6f7ba8ce2ba1
14. "Natural Gas Explained. Where Our Natural Gas Comes From", US Energy Information Administration. https://www.eia.gov/energyexplained/natural-gas/where-our-natural-gas-comes-from.php
15. *New York Times*, December 3, 2019. https://www.nytimes.com/2019/12/03/climate/carbon-dioxide-emissions.html
16. "Renewables Provide 49% of Power Used in Germany in First Half of 2022", *Reuters,* July 5, 2022. https://www.reuters.com/business/sustainable-business/renewables-provide-49-power-used-germany-first-half-2022-2022-07-05/
17. "China's Sees Biggest Growth in Energy and Coal Since 2011", *Reuters,* February 28, 2022. https://www.reuters.com/markets/commodities/china-sees-biggest-growth-energy-coal-use-since-2011-2022-02-28/
18. Harrison Schwartz, "Peabody Energy: Thermal Coal Soars, But China Risks Loom Large", Peabody Energy Corporation, September 13, 2022. https://seekingalpha.com/article/4540726-peabody-energy-thermal-coal-soars-but-china-risks-loom-large
19. Lydia Powell, Akhilesh Sati and Vinod Tomar, "China and India Postpone Peak Coal", *Observer Research Foundation*, October 15, 2021. https://www.orfonline.org/expert-speak/china-and-india-postpone-peak-coal/
20. Ministry of Coal, Government of India, https://coal.nic.in/en/major-statistics/coal-indian-energy-choice
21. "Coal Demand in India to Surge By 63% in 2030, Says Union Minister", *Mint*, March 22, 2022. https://www.livemint.com/news/india/coal-demand-in-india-to-surge-by-63-in-2030-says-union-minister-11648035767385.html
22. Op. cit., 20
23. *World Energy Outlook*, *2019*, IEA. https://www.iea.org/reports/world-energy-outlook-2019
24. Deepak Rauniar, "Balanced Hydropower Development in Nepal", *The National Bureau of Asian Research*, June 16, 2022. https://www.nbr.org/publication/balanced-hydropower-development-in-nepal/. For further reading see, Nihar R. Nayak, "Energy and Development: Assessing the Viability of Hydroelectricity Trade in the Himalayas", *Strategic Analysis*, 47 (3), May-June 2023.
25. Prithvi Man Shrestha, "Once Power Starved Nepal Now Aims to Export Electricity", *The Kathmandu Post*, August 10, 2021. https://kathmandupost.com/money/2021/08/10/once-power-starved-nepal-now-aims-to-export-electricity
26. "NHPC Hosts 46th Annual General Meeting", *Press Information Bureau*, August 26, 2022. https://pib.gov.in/PressReleasePage.aspx?PRID=1854653
27. "Indian to Develop Two Hydropower Projects in Nepal As China Abandons Projects", *Business Standard*, August 21, 2022. https://www.business-standard.com/article/current-affairs/indian-to-develop-two-hydropower-plants-in-nepal-earlier-quit-by-china-122082100114_1.html

28. "Nepal, Bangladesh Agree on Energy Cooperation, Beginning with 50 MW Power Trade", *The Kathmandu Post*, October 22, 2022, https://kathmandupost.com/national/2022/08/26/nepal-bangladesh-agree-on-energy-cooperation-beginning-with-50mw-power-trade
29. Stephen Cooke, "After Fukushima, Does Nuclear Power have Future?", *New York Times*, October 10, 2011.
30. Ibid.
31. World Nuclear Association, *Nuclear Century Outlook*. http://www.world-nuclear.org/outlook/clean_energy_need.html
32. Henri Paillere and Jeffery Donovan, "Nuclear Power 10 Years After Fukushima: The Long Road Back", IAEA, March 11, 2021. https://www.iaea.org/newscenter/news/nuclear-power-10-years-after-fukushima-the-long-road-back
33. "Is Nuclear Energy Renewable Or Sustainable? Pros and Cons", *Perch Energy*, September 1, 2022. https://www.perchenergy.com/blog/energy/is-nuclear-energy-renewable-sustainable
34. Stephen Stapczynski, "Global Energy Crisis Spurs a Revival of Nuclear Power in Asia", *Bloomsberg*, August 27, 2022. https://www.bloomberg.com/news/articles/2022-08-27/global-energy-crisis-spurs-a-revival-of-nuclear-power-in-asia
35. World Nuclear Association. https://world-nuclear.org/information-library/country-profiles/countries-g-n/india.aspx
36. Text of the Agreement. https://www.mea.gov.in/Portal/LegalTreatiesDoc/BG17B3022.pdf
37. "India–Bangladesh Joint Committee Meeting on Peaceful Uses of Nuclear Energy Held in Dhaka", *Doordarshan News*, May 13, 2022. https://ddnews.gov.in/international/india-bangladesh-joint-committee-meeting-peaceful-uses-nuclear-energy-held-dhaka
38. Indian High Commissioner to Bangladesh quoted in *The Business Standard*, August 30, 2022. https://www.tbsnews.net/economy/india-synchronised-grid-link-power-supply-bangladesh-bhutan-and-nepal-doraiswami-486318
39. US Energy Information Agency. https://www.eia.gov/energyexplained/oil-and-petroleum-products/imports-and-exports.php
40. Ibid.
41. Reuters Fact Check, "Which Factors Determine US 'Energy Independence'?", *Reuters*, March 24, 2022. https://www.reuters.com/article/factcheck-energyindependence-explainer-idUSL2N2VQ2ZV
42. Chen Aizhu and Dmitry Zhdannikov, "China Boosts Oil Reserves, Ignoring US Push for Global Release", *Reuters*, February 28, 2022. https://www.reuters.com/business/energy/exclusive-china-boosts-oil-reserves-ignoring-us-push-global-release-2022-02-25/
43. The State Council, The People's Republic of China, February 24, 2022. https://english.www.gov.cn/news/topnews/202202/24/content_WS6216e221c6d09c94e48a569e.html#:~:text= China%27s% 20dependence%2 0on%20crude%20oil,in%202021%2C%20official %20figures%20said.
44. CEIC Data. https://www.ceicdata.com/en/indicator/india/crude-oil-imports
45. Kaoru Ogino, Sambit Dash and Mikiyasu Nakayama, "Change to hydropower development in Bhutan and Nepal", *Energy for Sustainable Development*, vol. 50 (3), June 2019, p. 1.
46. Ibid., p. 1.
47. International Trade Administration. https://www.trade.gov/country-commercial-guides/bangladesh-power-and-energy
48. Shakhawat Hossain, "Bangladesh Plans More Fuel Oil Import", *New Age Business,* October 19, 2022. https://www.newagebd.net/article/184053/bangladesh-plans-more-fuel-oil-import
49. "Renewable Emery Policies in a Time of Transition", *International Renewable Energy Agency*

(*IRENA*) *Report*. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_IEA_REN21_Policies_2018.pdf

50. *The Renewables 2020 Global Status Report*. https://www.ren21.net/gsr-2020/chapters/chapter_01/chapter_01/
51. Ibid.
52. Ibid.
53. *The Renewables 2022 Global Status Report*. https://www.ren21.net/wp-content/uploads/2019/05/GSR2022_Full_Report.pdf
54. SAARC Energy Centre has a Technology Transfer Centre.
55. The project has been scaled down and is now concentrating on the western and eastern region. S&P Global Market Intelligence. https://www.spglobal.com/marketintelligence/en/news-insights/trending/n1EMlU68VrXOHJAus5_FwQ2
56. Grameen Shakti. https://www.gshakti.org/. Also see, *SAARC Energy Newsletter*, vol. 3, no. 2, June 2009.
57. Ibid.
58. Dechen Dolkar, "Bhutan Embarks on Small Hydropower Projects for Energy Security", *Kuensel*, July 9, 2022. https://kuenselonline.com/bhutan-embarks-on-small-hydropower-projects-for-energy-security/
59. Op. cit., 57.
60. "Rural Energy Development Programme (REDP)", *Inter-American Development Bank (IDB)*. https://generoeninfraestructura.iadb.org/en/sector/43/projects/rural-energy-development-programme-redp

4

Water, the Sub-regional Enabler

Himalayas and the Rivers

The Bangladesh, Bhutan, India, Nepal (BBIN) countries are intrinsically connected to the river systems. This interdependence has been less understood as the focus of policymakers, traditionally, has remained on borders and territorial disputes.

The transboundary rivers, fed by glacial melt and precipitation, are critical to sustainable economy, health, environment, and peace and security. These rivers are increasingly being impacted by climate change. Studies indicate that the duration and intensity of the summer monsoon will change resulting in increased period of dry and wet spells. Heavy precipitation events will increase the occurrence of floods, river bank erosions, landslides and glacier lake outburst floods. Further, increased precipitation will lead to increasing sedimentation thereby affecting hydropower production.[1] Construction of facilities to store excess water and to release it during dry periods bedevils planners, given the temptation to generate benefits on the one hand and on the other the dangerous spin-offs. Beyond the economics of water management, including the need for dams and water storage facilities for economic development, there is the political reality of fear among lower riparian states, especially over such structures. Clearly, the hydrology of the region is tied up with economic development as it is with security and misperception.

Like many parts of the world, the BBIN is witnessing a periodic interplay between the geo-physical, the geo-economics and the geopolitical. Policies and approaches require adequate adjustment and timely response to the impact of climate change on ecosystems. For example, we know very little about water and the precipitation pattern and we have never learned to manage it efficiently. Every time we interact with water, we change it, redirect it or otherwise alter it. While the territorial perspective of hydrology is a reality, a better understanding could be gained by viewing water resources as a scientific enterprise, building on past and present water knowledge and technical reaches that allow the sub-region to sustainably share the benefits. India's riparian position along with its several river integrated development plans will be a key driver to a riverine BBIN.

The 21st century of risks and vulnerabilities presents a unique context for water relations. Whether it is reducing risks of climate change or planning sustainable development goals, water will be central to all. Thinking up new water regimes will draw cooperative ventures. The idea of a Himalayan scientific forum to develop scientific knowledge is a forward-looking approach that will bring in basin countries to monitor, study and collectively find solutions to the changing water profile of the region. Every riparian actor, upstream and downstream, is a critical player. India is often viewed as an upstream player but can equally play an important downstream role in the Brahmaputra basin. A new water regime, for example, a downstream developer council, can be strongly considered as a regional initiative.

Why the Water Sector Matters

Water is a critical enabler to economic growth. The stable supply and protection of water encompassing rivers, groundwater, lakes and wetlands is the backbone on which a nation moves forward. India's water resources are a core feature of BBIN initiatives. Although the attention on India's water resources has been realised in the past, policy response has been inadequate and conceptually weak. Realising the significance of water to support the expected growth rates of 7–8 per cent over the next decade, India has reset its policy approach. While acknowledging that the task at hand is daunting, it must, in the same breath, be stated that the process of abstraction is bold, going beyond water being merely administered to incorporating other aspects such as the ecological,

sacred, social, aesthetic and cultural functions. Such attributes were earlier missing in policy planning, dominated as it was through the complex hydraulic bureaucracies of engineering, population and territory.

According to the 2011 census, the average annual per capita availability of water reduced from 1,816 cubic meters in 2001 to 1,545 cubic meters in 2011. Eighty per cent of the water is used for irrigation, with canals and groundwater extraction, the mainstays of irrigation, reaching their upper limits. Unsustainable agricultural practices, rampant industrial pollution and poor urban planning have further reduced the per capita availability of utilisable water. With more than half of India facing high water stress, farmers, industry and urban residents will increasingly compete for scant supplies. Estimates by the National Water Development Agency (NWDA) indicate that to meet the irrigation potential of 160 million hectares by 2050, up from the current potential of about 100 million hectares, new strategies will have to be adopted, especially since India's population is likely to be anywhere between 1.6 to 1.7 billion by then. Consequently, the country will have to produce some 450 million tonnes of food grains, almost doubling the output in less than four decades. More crops for every drop will be a vital component of the development strategy.

India's challenging hydrology thus calls for a holistic and integrated outlook that includes its domestic water management as well as the transboundary nature of water sharing. How has the current government responded to it? The following sections make an assessment. But before doing so, it will be useful to understand why the water sector is pertinent to overall progress and development.

Why and What of Water

Three broad interlinked and interconnected significance of water emerge:

- *Economic security is closely linked to water security*

Nearly 60 per cent of the population in India is dependent on the agricultural sector (farmers, landless labourers who work on the farms, small traders), which itself is heavily dependent on water resources. With increasing stress on horticulture and floriculture, water consumption in farms is bound to rise.

With the Indian government's plan to scale up manufacturing demand for water from the industry will significantly increase. As mentioned in the preceding chapter, sectors like food processing, organic chemicals, thermal and solar energy, steel and mining, and fertilizers will be large consumers of water.

With increasing urbanisation, demand for water from towns and cities will rise significantly on a per capita basis; an urban resident uses more water than a rural resident in India.

Water-related disasters (floods and droughts) cost the Indian economy significantly; poor communities and women are more impacted by such disasters than others. In 2015, India accounted for nearly 60 per cent of people globally affected by floods – of the 27.5 million people affected by floods in the world, 16.4 million of them were in India. A rising phenomenon in India are the incidences of urban flooding, which lead to high levels of economic losses.

• *Climate change impact will be greatly manifested in the water sector*

India's river basins, including the large transboundary rivers will be impacted by climate change in the near and distant future. Climate change will impact the snow and ice melting patterns as well as the rainfall (intensity, quantity, monsoon cycle). Such impacts will bring about change in river flows, both in volume and time.

Farmers will have to adopt techniques in terms of new climate-resistant varieties of crops, change cropping times and patterns and adjust to new rainfall patterns and water availability.

Sea level rise and changes in rainfall patterns may affect the saltwater ingress in coastal areas, thereby threatening the drinking water security of these regions.

• *Inter-state disputes related to water will become increasingly common*

In the future, water disputes will only exacerbate with higher demand for water and increasing uncertainty due to climate change. Within India, inter-provincial disputes will continue to fester with legal and constitutional

ramifications. Evolving an efficient and equitable mechanism for water sharing will test centre–state relations.

The external dimension of water is equally crucial and in the Indian 'neighbourhood first' approach, rivers are a catalyst for bi-lateral and sub-regional cooperation. India and its neighbouring countries share many common water traits (among several others) – high level of dependence of a large part of the population and economy on agriculture. Since more and more water is being utilised, the stage is set for tougher negotiations over the shared water resources among the South Asian countries. With India sharing rivers with all its continental neighbouring countries, hydro diplomacy will be a key instrument in bolstering relations. Reviewing and strengthening the existing treaties, most notably the Ganga Treaty, formulating new ones (as on the Teesta and other shared rivers) with Bangladesh and continued water dialogue with China on the Brahmaputra will help bolster the BBIN initiatives.

Leadership Investment

It is not uncommon for leaders to appropriate rivers as a symbol of power and a public relations exercise. Mao Tse Tung is a classic case. In the summer of 1966, at the age of 73, a politically weakening Mao entered the Yangtze River and reportedly swam 15 km in 65 minutes to emerge as the 'Great Helmsman', strong and confident and ready to lead the country once again. This is regarded as one of the most powerful political publicity, full of symbolism and messaging. Dr Klaus Töpfer, the German federal minister for environment, in 1988 swam in the Rhine River to rally the people to stand up against water pollution. Contrast these to Indian Prime Minister Modi's statement soon after being elected from Varanasi in May 2014. He said, "It is my destiny to serve Maa Ganga." In significance it was a clarion call for national awakening about the sorry health of India's most revered river. Ganga thus becomes the sullied symbol of all rivers flowing in India and needs a collective will to clean and rejuvenate it. In a very elementary and functional orientation, Prime Minister Modi while addressing the Indian community at Madison Square Garden in New York said, "If we are able to clean it, it will be a huge help for the 40 per cent population of the country. So, cleaning the Ganges is also an economic agenda." The prime minister has repeatedly articulated the challenges and opportunities that water resources present.

Water crucially fits into the transformational outlook the prime minister has envisioned for India. This outlook emphasises on the exchanging of ideas, encouraging public–private participation and raising the standards of governance or what the prime minister has often expressed as "overall benefit." Two significant crucibles of this water transformation emerge: first, is to see the complexities 'not as a state', to rephrase the title of the acclaimed work by James C Scott, *Seeing like a State*, or to put it in another way, to judiciously involve the state where required and to keep it away where not needed. Second, to evaluate and re-orient a range of institutional, legal and regulatory frameworks.

Structural Intervention

Water is a complicated issue with different levels and structures. India, in recent years, has taken steps to structurally mend and prioritise the water resources sector. What is significantly different from the past is that the leadership has water on the political agenda. Over-extraction, encroachment and uncontrolled pollution were seen as impeding natural flow. Severe pollution, despite the Ganga Action Plan (GAP) that started in 1986, made the Ganga's water unfit for even bathing standards. The *Namami Gange* was launched in 2015 to address the shortcomings of the GAP. While the challenges of implementation remain, the programme has brought in great enthusiasm and participation to re-examine the Ganga from an economic, cultural, social and regional importance.

Responding to new challenges and priorities with time-bound action and accountability, the current government decided to rename several key ministries in 2014. The Ministry of Water Resources changed to the Ministry of Water Resources, River Development and Ganga Rejuvenation (DoWR, RD and GR) and in 2019 to the Ministry of Jal Shakti. The two earlier ministries, DoWR, RD and GR along with the Ministry of Drinking Water and Sanitation are now departments under the Jal Shakti. Both the National Ganga River Basin Authority (NGRBA) and its implementation wing the National Mission on Clean Ganga (NMCG) were shifted from the Ministry of Environment, Forests and Climate Change to the renamed water ministry. In what can be seen as interdisciplinary and inter-ministerial policy planning, the entire

functioning of the NMCG has been reconstituted with greater coordination and support by State Programme Management Group of Uttarakhand, Uttar Pradesh, Bihar and West Bengal. It was also important to consolidate the Ganga funding under a single ministry and link about 15 ministries to the effort to clean the Ganga, including launching an urban river development front and Ganga Task Force. The budget has been divided into several subheads. With several anomalies in the earlier GAP implementation, it was important for the government to infuse new confidence to break bureaucratic lethargy and corruption.

The *Namami Gange* has a budget allocation of 10,271 crores for 5 years (2015–2020). For the year 2020–2021, the allocation was 1,300 crores and the estimated allocation for 2021–2022 is 1,450 crores.[2] The Namami Gange Mission II has been approved with a budgetary outlay of 22,500 crores till 2026. The policy emphasis is on cleaning and curbing toxic discharges into the Ganga. In January 2016, the cabinet approved a plan to give the responsibility of urban sewage management in all the 118 towns on the Ganga to private and public sector companies instead of municipal agencies and urban local bodies, as was done in previous attempts to clean the river. The plan, described as "hybrid annuity based PPP model", through transparent bidding process would not only help companies recover their costs but also ensure profits. In the coming years, it will help create a market for treated water. By June 2016, all the 118 towns on Ganga have been brought into the infrastructure roadmap. Clearly, there is considered action on the Ganga and the water sector overall is showing integrated momentum.

But while the focus is on cleaning and de-polluting the river (*nirmaldhara*), decisions on augmentation and continuous flow (*aviraldhara*) will equally be critical. This is not easy and will require consultation and cooperation with the Uttarakhand state and inter-ministerial coordination, especially in the wake of the Supreme Court directive of 2013 "not to grant any further environmental and forest clearances to any hydroelectric power project in the State of Uttarakhand, until further orders." Rejuvenation of the Ganga is as important as its cleaning and, therefore, with proper assessment an enlightened approach has to be established. Accounting, documenting and ground investigation has to continue.

It is heartening to note that the Gangetic dolphins, a rare freshwater species, are now spotted in the Ganga between Kaushambi and Handia, indicating the improved water quality of the Ganga. Beyond the Ganga cleaning and rejuvenation, additional money is being allocated to the Ministry of Jal Shakti. The budget allocation of 6,887 crore for the year 2017–2018 for the ministry is a sharp rise of 45 per cent as compared to 2016–2017 revised estimate of 4,755.5 crore. This reflects the government's push for irrigation schemes that are key for boosting agriculture. However, the implementation process needs to keep running and for that more diagnosis of the problem is required.

Significance of Inland Waterways

Post-independence, the importance of inland waterways in the stream of development thinking and process remained much neglected in India. Valuing the significance of waterways in creating economic wealth, the NDA government passed the National Waterways Act, 2016. The Act has identified 111 inland rivers and channels as national waterways, up from the earlier figure of six. Nature has bestowed India with great navigable rivers, but narrow commercial considerations have prevented state involvement in developing river navigation, while road and rail enjoy continuous state support. India has 14,500 km of potentially navigable waterways. Calculations suggest that it costs Rs 1.5/km to carry cargo via road and Rs 1 via rail whereas through waterways it reduces to only 25 paise/km. In an age of environmentally sound approaches, trade via waterways leaves a small carbon footprint. It is to the credit of the NDA government to have realised the great potential to increase cargo movement on the waterways. The government's emphasis on infrastructure development is bound to give a boost to inland navigation.

The emphasis on inland waterways opens opportunities to enhance regional cooperation on international rivers, particularly the Ganga and Brahmaputra. With the current government's receptiveness to river management, it is indeed a good time to engage with the neighbouring governments on the benefits of water transport, especially so with Bangladesh. Details of inland navigation will be explained in an exclusive chapter.

Basin Approach

India's revised National Water Policy was adopted in August 2012 and later approved by the National Water Resources Council. Unlike the earlier policies, it lays strong emphasis on the river basin/sub-basin as a unit for planning, development and management of water resources. The basin approach has huge relevance for the NDA government's 'Neighbourhood First' policy. The natural water mostly used in the neighbourhood comes from the Ganga–Brahmaputra–Meghna (GBM) river basin, and India along with Bangladesh, Nepal and Bhutan share this second-largest river basin of the world. Interestingly, China is also part of the GBM basin and is a powerful hydrological player, creating in the process a new space for hydrological engagement. In the sub-regional initiatives, for example, the 2015 BBIN envisions improved economic cooperation and connectivity, the GBM basin will be a force multiplier. Earlier initiatives such as the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) and Bangladesh, China, India and Myanmar Forum for Regional Cooperation (BCIM) naturally lead to regional development and integration with rivers as a prime catalyst. While the BBIN has reached some roadblocks with Bhutan's Upper House rejecting the Motor Vehicle Act but by addressing some of the concerns related to environmental issues that Bhutan has expressed, it is hoped that the initiative will be back on track. Undoubtedly, the geographical traits of the subcontinent are fabulous and rivers in South Asia introduce interdependencies as they criss-cross political boundaries, which can either reinforce or reduce differences. In Modi's reconceptualization of the region as a riverine neighbourhood, a win–win outcome is a possibility.

Settling River Water Disputes

Water disputes have always been managed in a political way in India with no emphasis on legislation. Constitutionally water is a state subject (Entry 17 in the State List). Central intervention comes in when there is an inter-provincial water dispute. The provisions (Entry 56 in the Union List) are clearly laid out in the Rivers Board Act (1956) and the Inter-State River Water Disputes Act (1956). But with the approved amendment to the Inter-State River Water Dispute Act of 1956, the NDA government has decided to constitute a

permanent tribunal to adjudicate on all inter-state river waters disputes. The current practice of having a separate tribunal for every dispute that arises has proved untenable.

With this spirit and forward thinking, the NDA government can do well to consider introducing a law on groundwater. For long, the legal position on groundwater has remained fuzzy, and there is no law that explicitly defines groundwater ownership. It is only customarily accepted that water below the land belongs to the owner of the land and neither the Land Acts nor the Irrigation Acts mention groundwater. Having moved forward on various dimensions of water, it might be a worthy exercise for the government to initiate discussions on water as a Natural National Resource and thus revisit various laws and constitutional provisions of water.

Data Generation and Data Sharing

India has always grappled with a severe lack of credible data on water resources, leading to inflated claims and faulty policies, both domestically and externally. This is further exacerbated by the secrecy attached to data on transboundary rivers – this secrecy not only enhances mistrust but also provides an incentive to national agencies to adopt a lackadaisical approach to data collection as it will never be used and/or challenged in the public domain. In order to achieve credible and largely acceptable (as per international norms and protocols) technical data on water resources and to bolster long-term planning and water negotiations (international and inter-state), the approved amendment to the 1956 law seeks to create an agency, the National Water Commission (NWC), to collect and maintain all relevant water data, such as rainfall, water flow and irrigation area, in each of the river basins of the country. The NWC will replace the existing Central Water Commission and Central Ground Water Board, and it will ensure that its water data is always available in an updated form and does not need to be collected after a dispute has arisen.

Water is wicked as much as it is political. Overall, in terms of institutional arrangements, revisiting laws and emphasising governance, the NDA government has responded to the challenges that the water sector presents. Moving away from discretionary to system-based administration with transparency and objectivity in decision-making as a hallmark, one can with a

fair degree of confidence say that water has got its rightful place in the overall development and regional plans of India.

Lessons of Global Basin Management

More than 45 per cent of Earth's land area lies within the world's 263 river basins that cross national boundaries. These international river basins are home to about 40 per cent of the world's people and account for 60 per cent of the flow in the world's rivers.[3] The Helsinki Rules on the Uses of the Waters of International Rivers (1966),[4] defines an international drainage basin as a "geographical area extending over two or more states determined by the watershed limits of the system of waters, including surface and underground waters, flowing into a common terminus." However, the UN Convention on the Law of the Non-navigational Uses of International Watercourses (1997),[5] avoids the term 'basin', which is replaced by the term 'watercourse'.

As explained, river basins are important from the hydrological, economic and ecological points of view. Management of the basins helps to provide fresh drinking water as well as access to irrigation, hydropower, navigation and recreational opportunities.[6]

To manage transboundary river basins effectively, the development and implementation of joint strategies are essential. Technical cooperation and information exchange form a good base for building trust and political cooperation between riparian countries. Multi-sector involvement can broaden opportunities for cooperation. Furthermore, involving the civil societies and the public in transboundary management can attract donors to finance transboundary projects.

Trends in Managing Transboundary River Basins

Transboundary river basins are determined by a diversity of political situations between riparian neighbours, changing physical/environmental conditions (precipitation, run-off, etc), and institutional structures (water treaties, river basin organisations). Political jurisdictions do not correspond to basin boundaries, thus the challenges for cooperation between riparian states or provinces. River basin management is often described as "fitting biophysical systems to political-administrative territories."[7]

Agreements on sharing the waters of international basins are challenging. Most water treaties ignore issues of water allocation, and the treaties that adhere to it often allocate water in fixed volumes. Riparian relations are more often than not embedded within the influential dimensions of historical and political relations between riparian countries. Power asymmetry on the basins also influences negotiations. From a realist perspective, agreements on a river basin are often imposed and shaped along the interests of the stronger party. A weaker riparian country, in aggregate power terms, is often not in a position to satisfy its needs or achieve its aim. Resultantly, the desires of the stronger riparian prevail.

When dialogue or negotiations reach a standstill, or when the existing treaty or the river basin organisation reaches paralysis, introducing 'other' issues, such as trade or the impact of natural disasters owing to climate change, can potentially re-energise the institutional mechanisms. Likewise, experiences from other transboundary river basins can equally revitalise and reinstall confidence in the basin.

A common lacuna or weakness experienced in several transboundary basins management is the lack of effectiveness for joint management. While basins are not one size fits all, yet a range of approaches/actions can be studied from the scaling up of executive powers beyond the riparian states to strengthening River Basin Organisations (RBOs) as facilitators for water infrastructure and development rather than just as regulatory bodies for ensuring fair and sustainable allocation of water among different users.

Monitoring and data sharing are fundamental conditions for transboundary water management and are a strong confidence builder among riparian countries. A common feature in many transboundary basin agreements, particularly in the developing regions, is that the mechanisms for monitoring and enforcement of data sharing are weak and even while such mechanisms exist, the implementation is ineffective. This is because sentiments of territorial sovereignty challenge the sharing of data. States do not want to lose control and authority over the river. Exchange of data and knowledge sharing is crucial to understanding the complexity of both the hydrology and the benefits derived from water. Without such comprehensiveness, it is difficult to reach an agreement over the equitable use of the water resources of an international river.

The RBOs remain the fulcrum for regional water governance and have the potential to remain the most effective avenue for basin-wide water-resource management. Changing political relations, power asymmetry, lack of awareness and insufficient hydrological data compound the management of waters in basins. Basin institutions do not exist in isolation and many external events or politico-economic changes influence their functioning. For example, the food–energy–water nexus has a strong bearing on basins. The impact of climate change on resource variability may exacerbate pressure on water. Ecosystem dynamics are hard to comprehend, are often nonlinear and require adaptive management. In other words, both basin-based arrangements and wider policies must remain flexible and capable of incorporating change.

In developing regions where development imperatives are paramount, strategies for river basin management need to recognise and address the imbalances in access to water. Learning from developed and affluent countries' institutional arrangements on river basin management is vital.

Some Basin Case Studies Outside the BBIN

Despite basins and rivers not being the same in physical reality, it is possible to harvest guidelines and lessons that can be applied to the context of the South Asian river basins. It is important to have clarity of the context of the challenges addressed in the case studies without sensationalising the relevance. A general exploration into the international basins mentioned in the Module, reveal, or at times fail to reveal, common features, concerns and challenges. The common feature that emerges from all the basins under study is that institutions remain an important body for regional water governance and have the potential to remain the most-effective avenue for basin-wide water-resource management. The following can be observed:

- While the basins are water abundant, the long-term sustainability of water resources in the basin is challenged by the competing interests of energy and agriculture. This stress/conflict requires countries in the basin to approach water resources management more collaboratively as well as involve the private sector, non-governmental organisations and local communities in decisions around water usage. This is evident in the Mekong Basin. Whereas in the Nile Basin, the

institutional mechanism is not inclusive, instead it is an outcome of diplomacy and political arrangements. However, institutions are evolving in the Nile and bringing in multi-level governance.[8] An instructive lesson is the recent experience on the Yellow River Basin, where local governance and human–nature interaction helped overcome massive engineering solutions.

- Extensive hydropower development and climate change-related natural disasters represent some of the greatest threats to water security in the Mekong Basin. In the Mekong, new hydropower dams could negatively impact the basin's livelihood. However, in the La Plata Basin, Itaipu, the world's largest hydro project and a result of a bilateral agreement between Paraguay and Brazil, helped end a prickly and emotional border dispute between the two countries.
- Developing mechanisms to adapt to climate change, improving water and sanitation infrastructure and providing agricultural innovations that reduce water use that, together with other interventions, are among the most effective solutions to address water resource challenges. Creating economic corridors such as the Greater Mekong Subregion, which was conceived in 1992 between Cambodia, Laos, Myanmar, Thailand, Vietnam and the two sub-regions of China (Yunan and Guangxi Zhuang) is an interesting example based on three Cs: connectivity, competitiveness and community. Similarly, on the Danube, the waterways and harbours are kept in good condition and are regularly maintained, ensuring that both the present and future communities benefit from its offering. If the waterway is not easily and efficiently navigable, it simply results in reduced market potential and a loss of revenue.
- The absence of war does not mean the absence of conflict or the presence of 'peace'. Similarly, the existence of a treaty or some form of cooperation over transboundary water does not mean the absence of conflict. Dispute resolution mechanism or the lack of it within the treaties governing the shared river basin is an important element of future water cooperation. In other words, when the rate of change within a basin exceeds the institutional capacity to absorb the change, the likelihood of tensions rises. Cooperation between riparian states

decreases as conditions, political or hydrological, change more rapidly than institutions can manage. The Nile Basin Initiative set up in 1999 to promote economic integration has worked to ensure cooperation between the riparian states, particularly to reduce tensions between Egypt, Sudan and Ethiopia on the construction of the Grand Ethiopia Renaissance Dam. Egypt realises that it is better to object within the Nile Basin Initiative than to pull out of it.

Reconfiguring the Hydro-setting: The three R's

Risks and vulnerability over the growing knowledge on hydrological variability is driving new thinking and reconfiguring waterscape and, hopefully, in the process debunking some water myths and shibboleths.

First, is to rethink internal water management policies. Water-related social risks are higher and can easily lead to internal/societal conflict, which can then impact external water relationships. Transboundary water management cannot be successful without an efficiently functioning national water management policy that includes a good water strategy, a legal framework, implementation standards and feedback. BBIN states need to relook at their respective national water policies.

Second, is respecting river treaties. Some of the water treaties that have evolved in South Asia, including the BBIN, have been a by-product of a settlement of a larger political dispute. For example, the Indus Waters Treaty in 1960, which partitioned rivers between India and Pakistan, was the result of the territorial partition of 1947, and the Ganges Treaty with Bangladesh in 1996 was a water sharing treaty based on mutual accommodation and in the mutual interest of the peoples of the two countries. The fairness or the effectiveness and the implementation of such treaties are always subject to the politics of the time. While these treaties are formally expressions of consensus, states' interests and power calculations leave the treaties open to interpretations. However, these treaties, in midst of contestations, offer the political space for dialogue and engagement.

Third, the idea of revisiting treaties/mechanisms is based on the upward knowledge curve of the region's understanding on water. The existing water treaties in South Asia are being tested by the growing demand for water,

competing needs and the backlash of the ecosystem. New upper–lower riparian dynamics are challenging the existing agreements with increasing pressure to relook, revisit and reconsider the frameworks and strengthen them in the context of the hydrological changes. Pressures are also growing to reinforce some of the effective clauses of the water treaties, such as the role of the 'neutral expert' as defined in the Indus Waters Treaty. Some of the existing treaties lack joint initiatives for collecting and analysing data and executing prescribed mechanisms; this can be strengthened. Since all the South Asian treaties have been bilateral, a movement toward joint basin management with co-basin countries is a riparian rationality though often political intractability hinders progress.

India's Hydrodiplomacy

Critical for India is the fact that diplomatically it must strongly articulate its middle riparian position. Firstly, to change the perception in the neighbourhood that India is an upper riparian 'water hegemon', as often expressed by Pakistan and Bangladesh, in spite of the robustness of the water treaties with them. Also importantly, in an emerging federalisation of India's foreign policy with the increasing involvement of the river-border provinces, the leadership at the centre will have to play a consultative role with state leaders. It is here that India's hydrodiplomacy will have a new avatar – a challenging prospect in times of coalition politics.

Second, to draw China into the South Asia water equation through a multilateral basin approach, thereby sensitising China to downstream concerns and upstream responsibilities. Hydrodiplomacy has to be well nuanced and not always framed in legalistic terms but through managing and engaging China. This has significant political value when dealing with China over the Tibetan water resources. The question, however contested it might be, that China alone cannot be the claimant to the waters in Tibet, gives India the opportunity to articulate an ecological perspective and resource conservation principles.

China – the 'hydraulic empire' and a supreme upper riparian state – through its promotion of large-scale and capital-intensive water projects on some of Asia's mighty rivers has beleaguered a crescent of lower riparian

countries from Central Asia, South Asia and Southeast Asia. Far from restraining itself, Beijing plans to resurrect more hydroelectricity dams on the Nu (Salween), the Lancang (Mekong) and the Yarlung (Brahmaputra) river basins. These are not only internationally shared rivers but are also in ecologically and seismically sensitive areas. China's blueprint is the reassertion of an aggressive 'supply-side hydraulic' approach of increasing storage capacity by building dams and reservoirs, water transfer and prospecting and extracting groundwater.

China will use its riparian advantage as a response to the political temperature, what in the strategic circle is described as 'non-confrontationist aggression'. It suits Beijing to be ambiguous and work on bilateral understandings rather than multilateral arrangements with its lower riparian countries. While it has recently upgraded and extended hydrological information to India, this information still needs to be verified for its timeliness and correctness. On the Brahmaputra, India's concerns, now with some hydrological facts emerging, are not so much about water scarcity as it is about flood water release in the monsoons. The solutions for Indian planners are essentially two-fold: to consider, after careful cost-benefit analysis, building storage dams at scientifically assessed locations and effectively put in place flood mitigation programmes.

And finally...

We know very little about water and have never learned to manage it efficiently. Each time we interact with water, we change it, redirect it or otherwise alter it. While the territorial perspective of the BBIN is a reality, a better understanding could be gained by viewing the sub-region as a scientific enterprise, building on past and present water knowledge and technical reaches, which allows the sub-region to sustainably share the benefits than just the flow. India's riparian position will be critical and crucial to this.

Notes

1. Arthur F. Lutz, Herbert W. ter Maat, René R. Wijngaard, Hester Biemans, Abu Syed, Arun B. Shrestha, Philippus Wester & Walter W. Immerzeel, "South Asian river basins in a 1.5°C warmer world", *Reg Environ Change*, 19, 2019, p. 833.
2. The actual fund release for the period 2015–2020 was 8,590 crores. Ministry of Jal Shakti,

Details of Funds Spent on Nami Gange Programme. https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1739094

3. UN Water. http://www.unwater.org/water-facts/transboundary-waters/
4. Text of the Helsinki Rules, 1966. http://www.thehinducentre.com/multimedia/archive/03021/The_Helsinki_Rules_3021443a.pdf. This section is part of the work written by the author for the IUCN project. Permission to reproduce the text has been accepted.
5. Text of the UN Convention on the Law of the Non-navigational Uses of International Watercourses, 1997. http://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf
6. For information on these river basins, see FAO's global water information system called AQUASTAT. It is the most quoted source on global water statistics. http://www.fao.org/nr/water/aquastat/main/index.stm
7. "International Water Management Institute Report on Water for Food, Water for Life", *Earthscan*, 2007, p.608.
8. J Dore, "An Agenda for Deliberative Water Governance Arenas in the Mekong", *Water Policy*, 16, 2014, pp. 194–214.

5

Hydrological Reality

Water is a transboundary resource. A large volume of water, over 90 per cent, crosses international borders. Water treaties and agreements are a result of bilateral and multilateral understanding and hinge on the cooperative value of water sharing. Projections of a looming water shortage in many regions raise critical questions in terms of availability, accessibility and distribution as well as of equitability and legal acceptability. States will have to constantly grapple with the rising demand for water and its sustainable uses. It is now a common national security refrain that a stable supply of water is critical to a country's political, social and economic stability.

Framing of water issues cannot be done in isolation. A variety of broader contextual issues, particularly energy, food and wealth generation, has to be considered. Also, internal water challenges that states are rapidly going to encounter will greatly impact transboundary riparian relations. Both these points help to understand the politico-strategic aspect of water.

Every region now needs to be measured by its impact on water. The World Economic Forum (WEF) noted in 2011, "Water sits at the nexus of so many issues, including health, hunger and economic growth..." Water, thus, cannot be seen in isolation. Further, several studies indicate that the cost of adapting to the impacts of a 2°C rise in the global average temperature, with a timeline of 2050, could range from US$ 70 to US$ 100 billion per year. Strikingly, between US$ 13.7 billion (drier scenario) and US$ 19.2 billion (wetter

scenario) will be related to water challenges, predominantly water supply and flood management.[1]

In the BBIN countries, water is a high priority that includes domestic water management as well as the transboundary nature of sharing water and benefits. There are good reasons for this. First, in the future disputes related to water will become common, and these will only get exacerbated with higher demand for water and increasing uncertainty of supply due to climate change. The BBIN countries share a common trait (among several others): a high level of dependence of a large part of the population and the economy on agriculture. Other relevant common traits are an inadequate focus on water use efficiency in all the sectors of the economy, a rising manufacturing base that demands more water resources and increasing urbanisation that leads to rising water requirements. With growing water needs and issues of sustainable water management, challenges to the shared water resources will frequently emerge, and water diplomacy will be a key enabler. Reviewing and strengthening the existing Ganga Treaty with Bangladesh and the water dialogue with China on the Brahmaputra will be critical. So will be the many rivers that India shares with Bangladesh. Water development and benefits will continue to be a core element in India–Nepal relations and likewise in relations with Bhutan.

Transboundary Water Conventions

Water is a transboundary resource. Over 90 per cent of fresh water crosses international borders, making water a subject of cooperation. That, however, does not discount the fact that disputes and contestations are inherent in water relations. In the post-Cold War period of peace dividends and institution-building, transboundary water resources received emphasis at both political and technical levels. For example, the Convention on the Protection and Use of Transboundary Water courses and International Lakes (Water Convention) was adopted in Helsinki in 1992 by members of the UN Economic Commission for Europe and it entered into force in 1996.[2] Later, in 1997, the United Nations General Assembly (UNGA) in its 99th Plenary meeting on May 21, 1997, adopted the Convention on the Law of Non-Navigational Uses of International Watercourses and invited "states and regional economic integration organizations to become parties to the convention."[3] Both these

conventions underline "equitable and reasonable utilization" of water and outline efforts to "reduce significant trans-boundary impact or no harm rule." The 1992 Water Convention obliges the riparian states to enter into agreements, whereas the 1997 Watercourses Convention recommends that states conclude specific agreements.

The 1997 Non-Navigable Watercourses Convention is interesting in the context of South Asia. As per the voting records, the convention was adopted by a vote of 106 states in favour, 26 abstentions and 3 against. China, along with Turkey and Burundi voted against the convention. Amongst the South Asian countries, India and Pakistan abstained and Nepal and Bangladesh voted in favour but have not ratified it. China, the extra-regional power in South Asia, felt that the text, particularly the principle of reasonable and equitable use and the no-harm rule lacked balance and factual basis between the interests of the upstream and downstream countries. It also voted against the dispute settlement provisions, which it considered inappropriate. India, a regional power in South Asia, while abstaining from voting on the convention in the General Assembly had, along with China, Turkey, Colombia and France, voted against the dispute settlement provisions in the Working Group.

Some upstream states, including India, were reluctant to surrender their riparian position or accept as mandatory the submission of disputes to the International Court of Justice for arbitration. India is often categorised along with China as an 'objector'. This is, however, a wrong assumption. India's bilateral water resources cooperation predates the 1997 Convention. With Nepal, it signed the Sarada Agreement (1920), the Kosi Agreement (1954), the Gandak Agreement (1959) and the Mahakali Treaty (1996). With Pakistan, it signed the Indus Waters Treaty (1960) and with Bangladesh, the Ganga Treaty (1996). These agreements and treaties were the result of bilateral understandings and hinged on the cooperative value of water-sharing and benefit-sharing.

This chapter explores the increasing interdependence and vulnerability of water resources within the BBIN at three levels: first, hydrological interdependencies in terms of uses (consumptive, non-consumptive, rural, urban, etc); second, exogenous interdependencies, in particular, the impact of climate change and hydrological alteration; and third, transboundary interdependencies that relate to inter-state hydrological cooperation.

It is important to note that the BBIN sub-region, in spite of its rugged politics, has had a track record of participation towards settling water disputes. India's diplomatic and material capability is often seen as being hegemonic by its smaller neighbours. The hydrological analysis also expands to include China's water polices and their impact on downstream riparian BBIN countries.

The BBIN is a hydrological paradox. In some parts of the region scarcity or portability is critical, while other parts experience floods. Seventy per cent of the region's population lives in rural areas and is predominantly engaged in agriculture. Thus, water is crucially linked to livelihood. The natural legacy of water in the BBIN is defined by two important features: the monsoon and the Himalayan glaciers.[4] Both these features are being disturbed by climate change, making the region one of the most vulnerable to climate impact. As a resource under extreme pressure, water has assumed strategic significance for these countries. Transboundary rivers, in particular, are becoming an issue of national security, where foreign policy as well as domestic stability is at stake.

India is the only country that shares the Himalayan rivers with all its neighbours, thus making it uniquely an upper, middle and lower riparian country. India's water relations with Nepal, Bhutan and Bangladesh are an essential component of sub-regional stability. Undeniably, water is a sensitive issue as the region's economy and predominantly rural livelihood depends on water. More than 80 per cent of the water in the region is used for agriculture. Many Himalayan rivers are intimately tied up with the issue of territory as the rivers enter areas where there is contestation. For example, the Brahmaputra is linked with the India–China border issues. China's claim on Arunachal Pradesh, where the Brahmaputra enters India is well known.

As observed earlier, the BBIN countries have enormous hydro-potential, particularly in Nepal, Bhutan and Northeast India. However, the mountain kingdom of Nepal has only developed 3 per cent of its hydropower potential.[5] Comparatively, India has developed 25 per cent.[6] Studies on the climate change impact on the glaciers suggest that there is going to be an increase in melt-flow, resulting in regular flooding. Building capacity to store this excess water and releasing it during dry periods is enormous. This will be more on the Indus than on the Brahmaputra and the Ganga as the contribution of snow and glacial melt varies from the eastern part of the Himalayas to the western

part – glaciers roughly contribute to about 10 per cent of flow in the Brahmaputra and the Ganga, while they account for almost 45 per cent in the Indus.[7] Beyond the water dynamics, such as dams and storages that are needed for economic development, there is the political reality of fear and misperception of lower riparian states over such structures. The hydrology of the region is not only tied with economic development but also with security.

Hydro-political Lens

The BBIN states are part of intricately connected river systems. This interdependence has been less understood and often de-prioritised over conventional and territorial disputes. Ironical in many ways because some of the major transboundary rivers crossing boundaries in South Asia, for example, the Indus and the Brahmaputra, are in areas that remain politically contentious. Moving away from a territorial perspective with unsettled borders, the more South Asia is viewed as an exponential function – increase in population leading to a greater demand for food and larger claims for areas of cropland and volumes of water – the better the hydrological understanding of the region will emerge. Significantly, planning any water resource utilisation policy will have to consider the assessment of the impact of climate change in terms of seasonal flow and extreme events. In both direct and indirect ways, climate change is related to water as is evidenced through floods, drought and glacial melt.

From a hydrological perspective, China cannot be ignored from the sub-regional configuration. Increasingly, China is making its presence felt in the sub-region and in the process competing directly with India, which considers the sub-region as part of its integrated development. From a hydrological position, India is a lower riparian state vis-à-vis China and Nepal, and an upper riparian state vis-à-vis Bangladesh. India's middle riparian position, from a politico-diplomatic perspective, not from a legal position, has not been effectively articulated. It has concerns over water uses with China and has the responsibility of sharing waters with its lower riparian neighbours. India's middle riparian position increases its dependency on headwaters of river sources such as Indus, Sutlej and Brahmaputra, which originate in the Tibetan plateau, and increases the pressure of sharing with its downstream riparian, Bangladesh.

Of the nine major tributaries of the Ganga that flow in from Nepal, the three principal tributaries Karnali, Gandaki and Kosi rise from Tibet.

'Asymmetric power' and 'power parity' governs the river basins – on the Ganga–Brahmaputra–Meghna (GBM). The hegemonic reference point cannot be ignored with China and India being the states with substantial concentration of material capabilities in the river system. Importantly, such assessment also differentiates a hegemon that is generous and benevolent from one that is aggressive or predatory. Since China is the supreme upstream country with no formal river sharing agreement or treaty with its neighbours and India, a middle riparian, with a number of water treaties with its neighbouring countries, a hegemonic analysis would suggest that China exhibits a negative hegemonic role on the waters as compared to India. In fact, the hegemonic analysis would place India in the category of a generous hegemon.

Another important feature that each individual state in the BBIN must consider is to integrate and harmonise external water policies with internal water resource management. Such an approach would require treating river systems, particularly the GBM, in a holistic way and reorienting hydro-diplomacy on a multilateral basis than just a bilateral format. This would entail a shift from 'sharing waters' to 'sharing benefits'. Ecological considerations should be the overarching perspective as it would allow a far greater understanding of the impact of climate change on water resources. In the past, the dominant perspective was engineering and economics, now the emphasis should be on ecology and climate change. Keeping the principle of just and wise use of water, sensible riparian policies in the BBIN can be framed, and this also includes China's effective participation.

The BBIN states will have to juggle competing and conflicting water-energy concerns, yielding a set of difficult consequences. A "perfect storm" of natural resource shortages by 2030 has already been predicted.[8] These sets of critical drivers will present difficult-to-manage outcomes and will reinforce each other as never before. First, as population grows, competition for water and energy will correspondingly increase. Increasing demand for food grains will claim larger areas of cropland and greater volumes of irrigation water. Second, with the risks that climate change attaches, water and energy will be subject to various stresses and strains. Clearly, for BBIN countries food security

cannot be achieved without water security. India, for example, feeds 17 per cent of the world's population but only has 4 per cent of water. Together Bangladesh, Bhutan and Nepal have 2.50 per cent of world population. Except for Nepal and Bhutan, the per capita water availability is rapidly declining in India and falling in Bangladesh below the world average. For the year 2025, at a projected population of 1.44 billion, the water availability in India will be 1,341 cubic meter/person/year.[9]

The hydropolitics of the sub-region will also be defined by Tibet's water resources, which raise controversial questions. Should China alone be the claimant to the fate of the waters in Tibet? China has rampantly exploited all the rivers from the Tibetan Plateau. Lower riparian countries' concerns and international attention to defining vital resource as 'commons' would be significant in preserving and sharing the waters of Tibet.[10] While such redefinition is politically sensitive, as it clashes with national jurisdiction, it nonetheless, merits attention keeping in mind future water requirement of the lower riparian BBIN countries, including the countries of Southeast Asia. International laws on allocating water within a river basin are difficult to implement and often contradictory. The 1997 UN Convention on the Non-Navigational Uses of International Watercourses requires watercourse nations (Article 5) to participate in the use, development and protection of an international watercourse in an equitable and reasonable manner.[11]

The rapidly changing Himalayan hydrology will require genuine willingness of states to engage in greater river basin cooperation. However, China, the upper riparian, has taken unilateral actions to secure resources and territorial sovereignty. The lower riparian states extending from Afghanistan to Southeast Asian countries can consider a lower-riparian coalition and show hydro-solidarity to overcome China's excessive water utilisation in Tibet. It is of existential importance to draw China into a water dialogue and evolve new mechanisms and approaches to solve transboundary water issues.

Several questions then arise in assessing future water challenges and risks in the region. How would the current conditions and projections regarding the melting of glaciers in the Himalayas impact downstream ecosystems? How would China and the construction of dams on the rivers from Tibet effect the water situation in India, and how that, in turn, would affect the neighbouring

countries, particularly Bangladesh? How can a mechanism for harmonisation of interests amongst all South Asian countries sharing common rivers through a joint development action be achieved? Can the Tibetan Plateau be defined as a global transnational resource? Can an impending water crisis drive South Asian countries to create a new means of consultation and data-sharing among public and private stakeholders?

Riparian Treaties

Before evaluating the river water treaties it is essential to know that there are two types of water in question: *big water* and *small water*. Drinking water and water for domestic services, which is about 10 per cent of the water needed, is small water. The big water concerns the production of food, almost 90 per cent, and is crucial to states and central to the treaties – water for irrigation, dams and hydroelectricity production.

River treaties in the BBIN reflect a measurement of cooperation and offer states a structure to coordinate actions. There are various propositions that govern river treaties, particularly those that are bilateral in nature for example, freshwater scarcity motivates cooperation.[12]

The basis for any river water treaty is to continuously find an equitable approach for meeting vital human needs. Water treaties in South Asia are also a barometer to gauge state behaviour and the political climate. It raises a few interesting observations: to what level does changing political climate effect existing treaties? Does signing of river water treaties lead to more cooperative ventures between the concerned riparian countries and thereby enhance the overall peace environment in the region? Is the negotiation process that precedes the signing of a treaty a final solution or only a provision that temporarily conceals the claims and counterclaims and the real and perceived fears of the riparian states (particularly the lower riparian states)? Do 'the real and perceived fears' lead to non-compliance of the treaty with an overriding 'militarised' approach in which the 'possession' of water is determined unilaterally? And finally, what are the linkages and trade-offs associated with transboundary waters?

River water treaties are time-specific and are a translation of a political will at a particular time and cannot be viewed in terms of finality. As the lives

and livelihood of people exponentially grow around the river basin, so does the demand for and consumption of water. The efficacy of treaties between the riparian states will always be tested, if not completely severed or abrogated. In South Asia, the following broad characteristics define water treaties:

(1) River water treaties are both 'rights-based' and 'needs-based'. The former is dominant during negotiations. In the post-treaty period, issues are more 'needs-based'. This is why water treaties in in the BBIN have to cope with the changing ground realities.

(2) Both the upper and the lower riparian states have stakes in the continuation of a treaty, and non-water linkages play an important role. The upper riparian state in most cases is a strong military power, which leaves the lower riparian state to seek non-military means thus making linkages a crucial component of a treaty. Such linkages or tactics to 'enlarge the pie' particularly include political concessions. In the domestic settings of Bangladesh, water is staged as 'victims' vis-à-vis India.

(3) A third-party role is critical to water agreements. First, to help initiate a cooperative framework on the shared water basin and then to financially assist in the projects. A third-party role is an attractive mechanism for lower riparian states to enter into a treaty arrangement as it offers space for third-party intervention/adjudication of disputes. The Indus Waters Treaty came into effect through the mediation of the World Bank. The BBIN countries do not have a third-party involvement.

(4) While a 'rights-based' to 'needs-based' approach defines river water treaties, a dispute resolution mechanism in existing treaties will play a very important role. However, it would need strengthening with new hydrological knowledge. With the growing importance of 'river watershed management' and with easy availability of new monitoring technology, an entirely new set of enforcement mechanisms can be structured and infused into the treaty with lasting value.

River equation between India–Bangladesh

Fifty-four international rivers, which are part of the GBM basin, are shared by India and Bangladesh. Cooperation on the management of the common river

basins has a healthy past with the Ganga Treaty in 1996. In fact, the best practices of the Ganga Treaty and their robustness can act as a good example to resolve other longstanding water issues and to find common ground to cooperate on other common rivers. Based on the principle of accommodation, the two countries have past experiences and lessons for evolving future water mechanisms if not treaties. According to the Joint River Commission (JRC) of Bangladesh, "The Ganges, the Brahmaputra and the Meghna river systems drain a total catchment area of about 1.72 million sq km through Bangladesh into the Bay of Bengal. Out of this large catchment area, only 7 per cent lies in Bangladesh. The other co-riparian countries are India, Nepal, Bhutan and China."[13] There can be no further explanation in not considering cooperation on shared rivers that form the lifeline of food and commerce between the two countries. On the Ganga, issues connected to the flushing of Kolkota port, providing drinking water to Kolkota and ensuring that Bangladesh gets its legitimate share of water were resolved through the Treaty and water sharing in the lean season was determined. The Farakka project goes back to the British time when a barrage was planned and several studies were instituted to find the value of such a structure. Like many water projects, the Farakka project also failed to find a consensus.[14] Between 1957–1960 when the Indus waters was being negotiated and then after when the Treaty was signed, India and Pakistan held four meetings to resolve the issue of Farakka. Finally in 1968, with Pakistan politically involved in East Pakistan, the Farraka issue went into cold storage and reopened with the creation of Bangladesh.

To resolve the issue, the two countries (India and Bangladesh) established a JRC in 1972. On April 21, 1975, a limited agreement spanning 49-days was signed, allowing the JRC to study the Farraka barrage and determine the quantum of water to be shared during the lean season. With the political situation deteriorating within Bangladesh and the unhealthy impact on the overall relations with India, no long-term agreement could be discussed. Like on the Indus with Pakistan raising its concerns internationally despite the Permanent Indus Commission (PIC), Bangladesh also internationalises water issues with India. Before the 1996 Ganga Treaty in 1996, two interim short-term agreements in 1977 (with a guarantee clause of 380 per cent share), a memorandum of understanding in 1982 (without any guarantee clause) and

a 1985 agreement (burden sharing clause if the water level falls below 75 per cent of the standard flow) was signed.

The profile of the Ganga and its tributaries and their changing course and seasonal variation contributed to the difficulties in reaching an understanding. Soon after the Ganga Treaty was signed, a first review was undertaken to observe its functioning. Slowly the confidence of the Treaty's functioning grew between the states, particularly in Bangladesh. After the first review it was agreed that further reviews should happen after a 5-year period, and keeping in mind the lower riparian's concerns stated that 90 per cent of Bangladesh's share will be guaranteed in case of any future disagreement over the Treaty. Unlike the Indus Waters Treaty dispute resolution mechanism, the Ganga Treaty is bilateral in its resolution with no international arbitration. This format will be tested when in 2025 the two countries will start negotiations on the extension of the Ganga Treaty. Whether the Treaty will provide the suitable framework for future treaties on other significant rivers between India and Bangladesh or will fear and lack of trust act as an impediment to the water relations is yet to be seen. Issues over India being a water 'bully' and 'unfair' will inevitably come up despite the rather generous water agreement that prevails. The water issue will be in the realm of perception, which has to be handled with care and sensitivity.

Climate Change Impact on the Hydrology

The Himalayas which are the subcontinent's principal water tower has a monsoonal climate. The rainfall is seasonal, received in three months and the intensity is concentrated in a few weeks. Precipitation varies from very low (100 mm or less) in the extreme west to very heavy (11000 mm or more) in the extreme east.[15] Correspondingly, conditions vary from arid in the west to very wet in the east. The subcontinent is straddled by two very large river systems: the Indus in the west and the GBM in the east.

It is being fast established that the Himalayan hydrology will be one of the critical frontlines in the global battle against climate change and water scarcity. The Himalayan mountain system is of crucial importance to the river system of South Asia not only in terms of influencing the monsoon but also in terms of the glaciers, which are the source of many of the great rivers in Asia.

Initial findings on global warming, though still being researched, indicate increased precipitation in some areas to increased variability of precipitation in others. Changes in precipitation and evapotranspiration will greatly influence groundwater recharge. The expected decline in glaciers and snowfields will affect the flows of rivers. A wait and watch policy for clear evidence may not be prudent. Whereas a precautionary approach and alertness to possible changes is wise.

Geologists often regard all the Himalayan rivers, including those originating from Tibet, collectively as the "circum-Himalayan rivers."[16] The impact of global warming and climate change, as studies indicate, will gradually shrink glaciers, resulting in decrease of water runoff in the long-term. In the short-term, earlier water runoff from glaciers when combined with seasonal rains can result in flood conditions.

Over the next 20 years, perceptions of a rapidly changing ecosystem may prompt nations to take unilateral actions to secure resources and territorial sovereignty. Any willingness to engage in greater river basin cooperation will depend on several factors, such as the behaviour of other competing countries, the economic viability and other interests that states are reluctant to either compromise or concede.

The risks and uncertainties over the impact of climate change on water resources are potentially high in many South Asian countries. For example, Bangladesh, given its location and geography is extremely vulnerable to any variations in water flow. Bangladesh, geographically speaking, is in a double trap. While on the one hand rivers flow in, making it increasingly water dependent, on the other hand it is witnessing sea-level rise. According to a modelling study, the mean global temperatures for Bangladesh may rise by 1.5–1.8°C by 2050 and correspondingly sea levels may rise by about 30 cm, accompanied by an increase in annual rainfall.[17] For India, a middle riparian state, decreased snow cover will affect the flows in the Indus, the Sutlej, the Ganges and the Brahmaputra, all originating from Tibet. Seventy per cent of the summer flow of the Ganges comes from the melt water and thus can potentially impact the agriculture sector. Studies indicate that each degree Celsius increase in the global mean temperature would, on average, reduce global yields of wheat by 6 per cent, rice by 3.2 per cent, maize by 7.4 per cent

and soybean by 3.1 per cent.[18] India's National Communications (NATCOM) has projected a decline in wheat production by 4–5 million tonnes with even a 1°C rise in temperature. India's wheat production, due to an exceptional heat wave, is projected to have declined nearly three per cent in the 2021–22 crop year. In March 2022, India recorded its warmest month in 122 years and temperatures observed in April were the fourth highest for the month in 122 years.

Enhancing Basin Cooperation

Changing water conditions in terms of quality, quantity and uneven distribution will be a growing concern. Unheeded it can impact relationships at the inter-state level (between states) and equally contribute to tensions at the intra-provincial level (within states). Much of policy understanding on water has been narrowly framed on the principle of 'water management' that entails manipulation of water for specific uses through water-based projects. A more comprehensive protection, development and utilisation of water resources, including both the surface and underground, needs to be developed at the national, bilateral and basin-level. This would mean a shift to a more rational and integrated 'water resource management' that treats water bodies as one hydrological unit and embraces in the process the 'conjunctive use' of both surface and underground water resources and their sustainable development.[19]

The GBM will have to be looked at as a river system, treating it holistically and reorienting hydrodiplomacy on a multilateral basis.[20] This would entail a shift from not only 'sharing waters' but also 'sharing benefits', linking together natural sciences, politics and policy. Ecological considerations should be the overarching perspective. This would easily allow a far greater understanding on the nature and impact of climate change on water resources. In the past the dominant perspective was engineering and economics, now the emphasis should be on ecology and climate change.

The challenge for India, as the central riparian state in the region, will be to imbibe hydrodiplomacy in its regional approach; not an easy task as India's diplomacy has traditionally been bilateral rather than multilateral.

The BBIN countries have had a remarkable history of water treaties but

the strains on these treaties are beginning to show with changing consumption pattern and impact of climate change. Countries share common water concerns: disturbing inefficiency and wastage along with rapid pollution. The urban areas and lopsided urban planning have largely failed to take into consideration protection of the water resources. The irrigation system and new water projects, which earlier ignored ecological consideration, efficiency and human insensitivity in terms of displacement and rehabilitation need a complete turnaround. The role of enforcement and monitoring agencies such as the Environment Impact Assessment (EIA) needs to be effectively enforced in respective countries. The purposeful participation of the civil society will be equally crucial for greater awareness and balance of development and water resources.

Water concerns in the BBIN specifically relate to sharing waters in the lean period and augmentation of flow. Hydropower generation and distribution has its advantages but equally creates concerns for downstream-riparian countries. Flood forecasting and control is a vital part of basin cooperation in which timely intervention can save thousands of lives and material damage. Navigational benefits, much overlooked, needs an emphasis. All these specific issues suggest a just and wise use of water through a basin-wide approach. A forward movement would include a combination of structural and non-structural measures. Dams or reservoirs and storage at geological-suited locations are part of structural planning. Non-structural polices include sharing hydrological data and information, setting up monitoring systems to study flow changes and joint study on glaciology and watershed management.

While the BBIN countries have good experience in bilateral water treaties, basin cooperation and management are yet to mature. There is plenty to learn from the experiences of river basin organisations, such as the Mekong River Commission, the Nile Basin Initiative, the Rhine Basin Cooperation and the Danube Basin Management Plan. These basin approaches, despite being of economically and politically disparate countries, underscore the importance of shared interests and of sharing the benefits.

There are practical reasons for multilateral engagement on river-basin issues, which cannot be achieved through bilateral means as it does not factor the negative and positive externalities.[21] For example, construction of reservoirs

for multipurpose uses such as irrigation, flood control, hydropower and navigation in the GBM basin concerns the interests of all the basin countries – Nepal, India, Bhutan and Bangladesh – and benefits to all can be achieved only through multilateral cooperation. The multilateral approach helps to reach a lasting and meaningful agreement through greater levels of participation.

On the other hand, single purpose storage projects only for the interest of one basin country hardly makes economic sense and is less attractive. Any structural intervention will need to fuse technical, social and environmental knowledge of all the basin countries. For example in the GBM, Nepal has the potential to supply hydroelectricity and release water from storages to India as well as Bangladesh, while India can help navigation and transit facilities, grant money and expertise for hydro projects to Nepal. Likewise, with Bangladesh, India can assure minimum flow and in return Bangladesh can permit navigation and transit access to India and to Nepal Hydropower cooperation is an important feature of India-Bhutan bilateral relations. Bhutan supplies hydroelectric power and water storage benefits to India, and in return the latter provides money and technical expertise to Bhutan. Since the first hydropower agreement (Jaldhaka project) was signed in 1961, a series of agreements have over the decades come about. All these reciprocal activities are done in one basin with co-riparian states by sharing equitable benefits and not just water itself. Countries in South Asia will have to increasingly come together and equitably allocate the benefits derived from water that will lead to a win-win, integrative basin-based negotiation and not focus on water to be divided – a zero-sum, rights-based approach.[22]

Navigation is one area in river dynamics that has been overlooked by over emphasising on hydro projects, particularly in Nepal. Navigation will have to take a central role in the development process of the basin countries.

Much of India's water relations with Nepal have been hydro-power centric and despite the political and financial investment not much has been achieved. Nepal, a landlocked country, can benefit hugely through river links with the inland water transport network of India and Bangladesh. The rivers' course can allow Nepal access to the ports of Kolkata in India and Mongla in Bangladesh.

Another area that requires strengthening is flood forecasting and early warning. While there is cooperation between India and Bangladesh for flood mitigation since the devastating floods in Bangladesh in 1988, more scientific assessment and technological monitoring will be required. Again, from a basin perspective, all the basin countries will have to evolve a mechanism to share water-level and rainfall data correctly and constantly. These regional cooperation are non-structural management measures and will also have to include China more actively. China has been transmitting data on the Brahmaputra to Bangladesh since 2006; with India also, through an MoU in 2002, it provides water flow information and hydrological data on the Brahmaputra. However, there is still significant scope for strengthening the existing cooperation and extending it further in a regional perspective.

To sum up, the combination of rising population, increased urbanisation and rapid economic growth compounds the challenge of securing water in the future. South Asia, with a heavy population density and worrying per capita water availability will undoubtedly face mounting challenges, both internally and externally. The interconnection of climate–water–energy is crucial, and if not framed sensibly into respective state polices, the cascading effect on food production, livelihood and migration will impact the region's political stability.

Notes

1. Statement by Maude Barlow, Canadian social activist and author of *Blue Gold: The Fight to Stop Corporate Theft of World's Water*, (New York: The New Press), 2005.
2. Convention on the Protection and Use of Transboundary Watercourses and International Lakes, 1992. https://unece.org/DAM/env/water/publications/WAT_Text/ECE_MP.WAT_ 41.pdf
3. Convention on the Law of the Non-navigational Uses of International Waterways, 1997. https://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdfIt entered into force in 2014.
4. World Bank, *South Asia Water: An Overview*, 2012. http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/0,,contentMDK:22013344~pagePK:146736~piPK:146830~theSitePK:223547,00.html
5. Independent Power Producers' Association Nepal and Confederation of Indian Industry, *Nepal-India Cooperation on Hydropower (NICOH) Final Report*, January, 2006, p. 1. http://cii.in/WebCMS/Upload/CII%20-%20Nepal%20India%20Cooperation%20on%20 Hydropower.pdf
6. Asian Development Bank Report, *Hydropower Development in India: A Sector Assessment*, (Philippines: ADB Publication, 2007), p. ix.

7. *INCCA Report*, "Climate Change and India: A 4X4 Assessment", Ministry of Environment and Forests, Government of India, November 2010, pp. 119–120. http://moef.nic.in/downloads/public-information/fin-rpt-incca.pdf
8. As noted by John Beddington, UK Chief Scientist on March 18, 2009. http://www.guardian.co.uk/science/2009/mar/18/perfect-storm-john-beddington-energy-food-climate
9. Population Growth and Per Capita Water Availability in India. 1951, 1955, 1991, 2001, 2025 and 2050. http://www.indiastat.com/table/percapitaavailability/24/watersupply/18198/365176/data.aspx. Also see, *Water: The India Story*, Report by Grail Research and World Bank Report, *India's Water Economy: Bracing for a Turbulent Future*, 2005.
10. Uttam Kumar Sinha, "Tibet's Watershed Challenge", *The Washington Post*, June 14, 2010. http://www.washingtonpost.com/wp-dyn/content/article/2010/06/13/AR2010061303331.html
11. Convention on the Non-Navigational Uses of International Watercourses, 1997, p. 4. http://untreaty.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf
12. S. Dinar, A. Dinar and P. Kurukulasuriya, 'Scarcity and Cooperation Along International Rivers: An Empirical Assessment of Bilateral Treaties', *International Studies Quarterly,* vol. 55, 2011, p. 810.
13. The Joint River Commission of Bangladesh. http://jrcb.gov.bd/new/index.php
14. Ben Crow, *Sharing the Ganges* (Dhaka: University Press Limited), 1997, pp. 26–54.
15. *INCCA Report*, op. cit. 7, pp. 16–17.
16. Geochemistry of the suspended sediments of circum-Himalayan rivers and weathering budgets over the last 50 years. http://adsabs.harvard.edu/abs/2003EAEJA....13617G
17. N. Ericksen, Q. Ahmad and A. Chowdhury, *Socio-Economic Implications of Climate Change for Bangladesh* (Dhaka: Bangladesh Unnayan Parishad), 1997.
18. Proceedings of the National Academy of Sciences' (PNAS). Cited in *Mint*, August 16, 2017. https://www.livemint.com/Politics/CyZL6IneKyB8pfKiXvyORJ/Each-degree-Celsius-rise-in-global-temperature-to-reduce-cro.html
19. 'Water management' has traditionally been understood as manipulation of water for specific uses leading to independent legal regimes and the development of isolated water-based projects. The concept of 'water resources management' includes the comprehensive protection, development and utilisation of the whole of a given body of water, surface and underground, constituting one single hydrologic unit. Water resource management is viewed as being 'rational' and 'integrated'. It embraces the 'conjunctive use' of surface and underground water resources, the control of their quality and harmful effects; their sustainable development for multi-purpose beneficial utilisation and the administration of corresponding use rights. B. Wohlwend, "Equitable Utilisation and the Allocation of Water Rights to Shared Water Resources." http://www.aida-waterlaw.org/PDF/EQUITABLE.pdf
20. J. Bandyopadhyay and N. Ghosh, "Holistic Engineering and Hydro-Diplomacy in the Ganges-Brahmaputra-Meghna Basin", *Economic and Political Weekly*, vol. 44, no. 45, Nov 7–13, 2009, pp. 50–60.
21. B. Crow and N. Singh, "Floods and International Relations in South Asia: An Assessment of Multi-track Diplomacy", in Peter Mollinga (ed.) *Floods in South Asia*, (Hyderabad; Orient Longman, 2009). Cited in Infrastructure Development Financing Corporation (IDFC), India Infrastructure Report 2011, *Water: Policy and Performance for Sustainable Development* (New Delhi: Oxford University Press, 2011), p. 40.
22. Ibid., p. 39.

6

China Factor in Lower Brahmaputra Basin

Riparian Equations

Rivers, the great carriers of freshwater, are complex natural realities. At one level, particularly when they criss-cross political boundaries that are intensely competitive, they lead to contestations and unwanted outcomes and, at another level, they create cooperative pathways of water sharing and benefits with a possibility of larger political goodwill. Without emphasising on 'water wars' or overstressing the norms and principles of 'equitable utilisation', the 'no-harm rule' and 'restricted sovereignty', there are several river hotspots, such as the Nile, the Jordan, the Euphrates–Tigris and the Indus, that can set up an inherently combative relationship amongst its basin countries. The Yarlung Tsangbo–Brahmaputra Basin can potentially fall in this category. The lower part of the basin constituting Bhutan, India and Bangladesh continues to be a source of cultural and economic engagement, providing livelihood to almost 130 million people in the basin. There are three major challenges, commonly described as 3Is, being faced by the Yarlung–Brahmaputra Basin: information, investment and institution. Hydrological information is important for water-related decision-making; investment is critical for water development projects, generating livelihoods, developing early warning system and joint research; and institution-building at basin-level is needed for knowledge generation and 'common vision'. Collectively, the 3Is can help build trust and confidence

not only amongst the lower riparian states but also amongst all relevant stakeholders.

From time to time, water emerges as a contentious issue between the sharing countries on the Brahmaputra Basin, particularly China and India. As riparian neighbours, the two are part hydrological owners and part technical users of the Yarlung Tsangbo–Brahmaputra Basin. No international river basin can match such a powerful interface of two dominant global actors who compete, contest and, at times, cooperate. While China is in a unique position, given its upstream geographical location, to unilaterally secure its water supplies, India, as the downstream partner, is strategically hindered, if not completely impeded, by Chinese upstream water development projects. Moreover, as the Brahmaputra meanders into Bangladesh and becomes the Jamuna before draining into the Bay of Bengal, India carries the added responsibility of ensuring that Bangladesh is not disadvantaged. The middle riparian position that India finds itself on the Brahmaputra presents a unique challenge to its sub-regional diplomacy. Further, the Yarlung Tsangbo–Brahmaputra, despite its massive basin expanse and as the fifth-largest river in terms of volume, remains ungoverned with no permanent agreement or treaty. There, however, exists a non-permanent mechanism for hydrological data sharing that is contractual, limited in scope and non-binding.

To recall, in 2002, India had entered into a memorandum of understanding (MoU) with China for a period of five years on the provision of hydrological information on the Brahmaputra during flood season. Information related to the water level, discharge and rainfall at three specified stations – Nugesha, Yangcun and Nuxia – from June 1 to October 15 every year, was utilised in the formulation of flood forecasts by the Central Water Commission. This arrangement ended in 2007. A new MoU with the same provisions and with a validity of another five years was signed in 2008.Meanwhile, in April 2005 another memorandum was signed for the supply of hydrological information with respect to the Sutlej (Langquin Zangbu) in flood season for a period of five years and was subsequently renewed in 2010, and again in 2016.[1] Clearly, and as can be observed, China does not want a permanent mechanism on water sharing with India. By reviewing and renewing the MoUs on the Brahmaputra and the Sutlej, Beijing dictates the proceedings as an upper riparian state.

Further, in November 2006, during President Hu Jintao's visit to India, it was agreed to set up an expert-level mechanism (ELM) to discuss wider cooperation beyond the flood season hydrological data for emergency management. Subsequently, a joint ELM was constituted at the joint-secretary level.[2] The ELM meets once a year, alternately in Beijing and New Delhi, and essentially focusses on the exchange of hydrological information and on the smooth transmission of flood season hydrological data. Though limited in scope, it can form the base on which future water cooperation can be developed. This, however, remains a long shot given the current political climate.

One can also recall that during the visit of the Chinese Premier Li Keqiang to India in May 2013, serious time was spent discussing water issues. India's proposal of a joint mechanism for better transparency on the dams being constructed on the Yarlung Tsangbo failed to elicit a clear commitment from China, but it extended the MoU for another five years stating, "China will provide to India twice a day [earlier it was not specified] the hydrological data of the Brahmaputra River in the flood season between June and October."[3] The scope of cooperation was expanded by signing a new MoU in "ensuring water-efficient irrigation."[4] Later, in October 2013, when the Indian Prime Minister Manmohan Singh visited Beijing, an MoU on 'Strengthening Cooperation on Trans-Border Rivers' was signed. It laid out the specificity of hydrological sharing. "Hydrological information of above-mentioned stations [Nugesha, Yangcun and Nuxia] will be provided to India within 30 minutes after 08.00 hrs and 20.00 hrs in Beijing Time (05.30 hrs and 17:30 hrs in Indian Standard Time) from May 15 to October 15 each year [earlier it was June 1 to October 15]. The Chinese side also agrees to provide hydrological information if water levels of above-mentioned stations are close to or reach warning water levels in non-flood season."[5] Interestingly, the Chinese gave a cost breakdown for the hydrological information that India received. "The Indian side will transfer payments to the Chinese side amounting to RMB 850,000 by US dollar (convert RMB Yuan into US dollar according to exchange rate of pay-day) at the end of every April within the period of validity of the present Implementation Plan."[6]

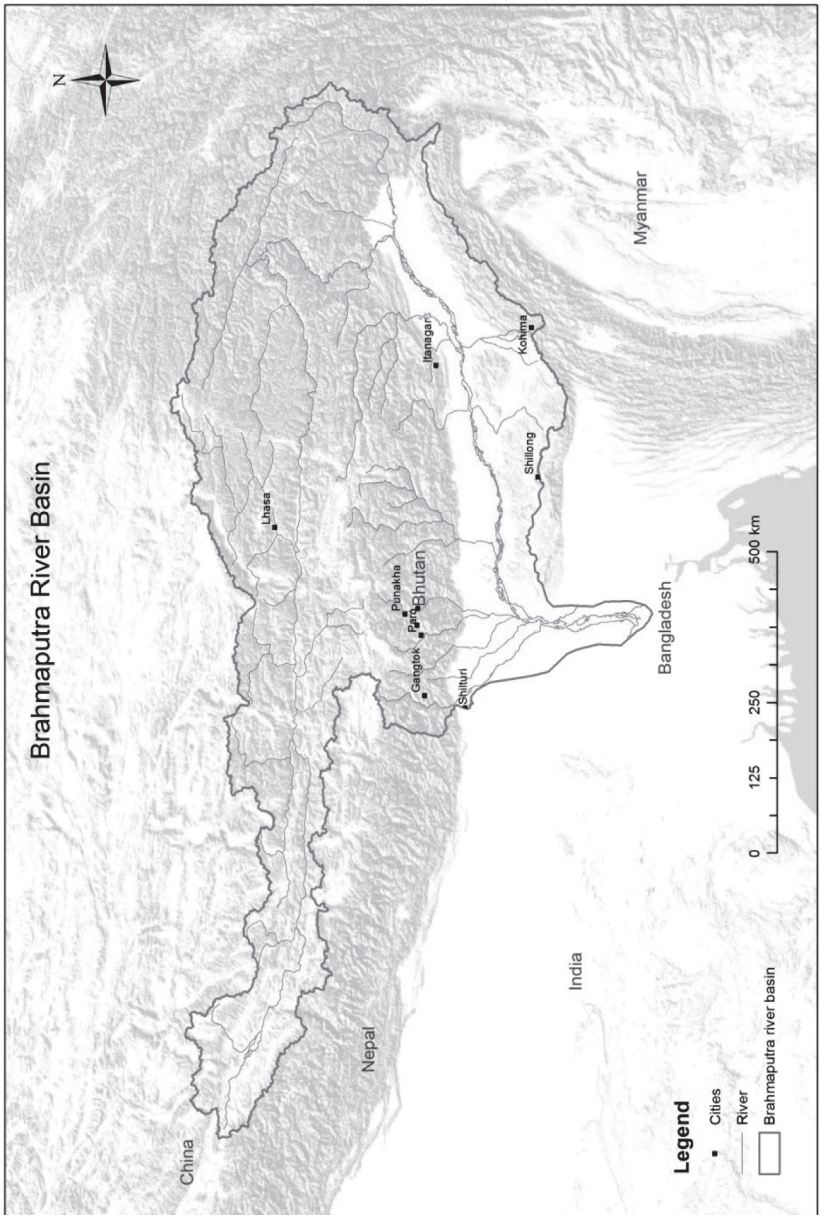
These mechanisms apart, any hydro-relations with China cannot ignore the border stand-offs. Beijing is notoriously known to mix 'compliance' with

'intimidation' – what Antonio Gramsci termed 'a mix of force and consent'.[7] Amid the Doklam stand-off in 2017, China had withheld data on the Brahmaputra and Sutlej. The spokesperson of the Ministry of External Affairs had observed then, "China normally shares the hydrological data with India during the period May 15 to October 15 every year. But this year it has not shared the data so far."[8] The spokesperson, however, did qualify this by saying that it would be 'premature' to link the Doklam incident with China's failure to share the hydrological information.

That said, military face-offs and political tensions with India can allow China to turn a blind eye to the existing water mechanisms or even disband them altogether. The riparian relations between the two countries will increasingly be influenced by the prevailing political dynamics and strategic considerations or what analysts describe as a 'hydropolitical security complex'. In this security complex, factors such as availability, distribution, quality and competing uses will not only contribute to regional water insecurity but also influence peace and stability in Asia.[9] It is also becoming clear that water cannot be understood in isolation from a variety of broader contextual issues – particularly food and energy security, as also wealth generation. The internal water challenges that both India and China face will also greatly impact the transboundary water relations.

Yarlung Tsangbo–Brahmaputra Profile

Bestowed with enormous glaciers and alpine lakes, the Qinghai–Tibetan Plateau, the 'rooftop of the world', is the location of the Yarlung Tsangbo–Brahmaputra River Basin. The meandering river traversing a large geomorphological territory links China (Yarlung Tsangbo), India (Brahmaputra and Siang), Bhutan (through tributaries) and Bangladesh (Jamuna), eventually drains into the Bay of Bengal. The river carries around 138 million litres, or 364 million gallons, of water during flood season, which is more than one-and-a-half times that of the Amazon River.[10] With varied territories, differing perspectives and an estimated 625 million people living in its basin, the Yarlung Tsangbo–Brahmaputra acquires a set of challenging approaches and multiple pressures to manage it. Climate change evidence suggests that in the next 30years, the river's ability to support the basin-dependent population will



Source: International Centre for Integrated Mountain Development, Kathmandu

drop by 30–40 million people, even as the population of the area is expected to nearly double.[11] And, as earlier mentioned, the absence of a bilateral or multilateral water management accord raises serious concerns for regional stability and only serves to increase the potential for tension over water resources.[12]

Facts indicate that China's hydrological position is one of upper-riparian supremacy. According to the Ministry of Water Resources, China shares more than 50 major international watercourses with its downstream riparian neighbours, which include 13 directly bordering countries and three closely neighboured countries.[13] It is interesting to note that approximately less than 1 per cent of water comes from outside China's territory, while the volume of surface water flowing out of China is about 730 bcm (billion cubic meters) annually.[14] India alone receives nearly half of all river waters that leave China, or 48.33 per cent. This translates to about 354 bcm of water flow into India from Tibet, of which the annual average flow in the Brahmaputra is 78.10 bcm.

Often less emphasised is the fact that India is a multi-river dependent country with the Brahmaputra on the east, and the Indus and the Sutlej on the west. Thus, the country's riparian relations with China are exceptional and critical. While China has no water sharing treaties/agreements on its transboundary rivers, India, on the other hand, has entered into water sharing treaties with its lower-riparian countries – Pakistan (Indus Waters Treaty of 1960) and Bangladesh (Ganga Treaty of 1996). China's per capita water resources in 2013 was just over 2,000 cubic meters with an overall water availability at nearly 2.8 trillion cubic meters.[15] The average annual per capita availability of water in India as per the 2011 census was 1,545 cubic meters, with utilisable water resources of only 1,123 bcm.[16] While both China and India are currently in the high water stress category, it is projected that by 2040 both will be in the top 50 water scarce countries.[17] Currently, both countries face wide-ranging challenges, including deteriorating water quality, uneven distribution of water resources in volume and time and inefficient utilisation. The critical difference between the two is that while China is far more water secure, India receives a large portion of its water from outside its territory and is, hence, water dependent. The hydrological equation gives China

a huge strategic advantage that can be translated into political leverage and bargaining with India.

China's Legacy of Hydro-control

Rivers are not only territorial, but also symbolise status political supremacy. The history of the Chinese civilisation is, in many ways, a history of hydraulic engineering, canal-building and water conservation. Mao Zedong, one of the most enigmatic personalities of the 20th century, established the People's Republic of China in 1949 and transformed it into a modern, industrialised, Socialist state. In 1950, Mao issued a directive, 'the Huai River must be harnessed', that entailed constructing a new route from the river to the sea in order to mitigate flooding. It was an audacious plan, but for Mao it was a "triumph of political mobilisation over seemingly overwhelming obstacles",[18] or, as he would often state, "nature is an enemy that had to be beaten" and that "man must conquer nature." Systematically, since 1950, Mao's leadership created a hydraulic society, with control of water supply for irrigation as the basis of the Chinese mode of production and of a powerful, exploitative bureaucracy.[19]

Some historical narration suggests that Mao had first come to Tibet in the 1930s as part of the Long March of the Communist revolutionaries, who were on the run from the advancing Kuomintang troops. And as the narration goes, Mao returned to China wearing "Tibetan clothing and disguised as Khampa traders."[20] In 1949, after a string of military victories against Chiang Kai-shek's nationalist party, Mao proclaimed the establishment of the People's Republic of China. In 1950, the Communist regime 'invaded' Tibet with its natural resources and strategically important border with India. The Chinese Communists, projecting themselves as modernisers sold to the pre-industrialised Tibetan society scientific and technological progress, while intimidating them with military might. Of course, the official Chinese historiography describes the resolution of the 'Tibetan question' as a 'peaceful liberation'.

Having established authority over Tibet, what Mao referred to as a 'British colony', he soon started admiring his new territorial acquisition and gloated over the mighty rivers flowing from the landscape. In 1952, Mao made a

seemingly innocent but purposeful remark: "... the south has a lot of water, the north little.... If possible, it is okay to lend a little water."[21] Since then, the Chinese establishment has unveiled major water development projects to establish control and authority over the Tibetan watersheds. This spawned a whole breed of Chinese leadership who think hydrologically and understand the strategic value of the rivers flowing from Tibet.

In contrast, India never weighed the significance of Tibet's water and when, in 1954, the then prime minister, Jawaharlal Nehru, signed the Panchsheel (Five Principles) Treaty forfeiting all the British inherited extra-territorial rights and privileges, Chinese control of Tibet became unhindered.[22] Nehru failed to understand the outcome of his actions and his famous statement in Calcutta after his return from Beijing in October 1954 that "the people of China do not want war" was proven gravely wrong. Mao created a cult of personality to legitimise his rule and quickly realised that without the control of the Tibet massif, China's unity and power would be overturned – and had it not been for Tibet, China would not have been the world's most independent riparian country. In fact, Beijing's total control over Tibet in effect is its 'total' control over the water resources.

Tibet: A Water Tower

The Tibetan landscape, which forms part of the Hindu Kush Himalaya (HKH) region, is a storehouse of freshwater and serves as the headwaters for many of Asia's mighty rivers including the Yellow, Yangtze (in mainland China), Mekong, Brahmaputra, Salween, Indus and Sutlej (transboundary) rivers. Tibet's water resources, as explained earlier, have become a crucial strategic, political and cultural element for Chinese authorities. Marking 70 years of Tibet, China brought out a white paper in May 2021 titled *Tibet Since 1951: Liberation, Development and Prosperity*. While claiming to be a "balanced account of the enormous transformation that has taken place in Tibet",[23] in reality, it is a statement and a counter to "Tibet independence as a product of imperialist aggression against China in modern times."[24]

Interestingly, the white paper describes the Qinghai–Tibet Plateau as the 'water tower of Asia', probably recalling Mao enviously eyeing at Tibet's water richness and states, "A holistic approach to conserving mountains, rivers, forests,

farmlands, lakes, and grasslands has been adopted. The Plan for Protecting and Improving the Ecological Safety Barriers in Tibet (2008–2030) and the afforestation project in the watersheds of the Yarlung Zangbo River, Nujiang River, Lhasa River, Nianchu River, Yalong River, and Shiquan River have been implemented."[25] There is no mention of the huge dams that China intends to build on the Yarlung and other transboundary rivers in Tibet; rather, the whole document is promoted as a 'green development model' that "... from 2015 to the end of 2020, 6.5 billion kwh of clean energy-generated electricity was transmitted, which greatly reduced carbon dioxide emissions."[26]

The rivers in the HKH–Tibetan region are among the most meltwater dependent in the world. But there are large variations in terms of glacial and snow melt contribution to the rivers. While the upper Indus Basin has about 41 per cent glacial melt and 22 per cent snow melt, the upper Yarlung Tsangbo–Brahmaputra runoff is dominated by 59 per cent rainfall, meltwater contributes only 25 per cent.[27] On the western front, the Indus flow change will be far more vulnerable to climate change and receding glaciers, whereas because of predominant precipitation contribution, the Yarlung Tsangbo–Brahmaputra and the Mekong would be relatively less vulnerable to glacial melt. It is not surprising that the Chinese will pitch for greater dam constructions on these rivers and maximise electricity generation.

With extensive river development projects being planned in Tibet, the scale of environmental destruction has been unprecedented in the last six decades. Evidence suggests that lithium and copper mining activities by Chinese state-owned companies in Tibet has led to a high level of pollution in the rivers.[28] Likewise, excessive logging and dam-building activities along rivers have resulted in the destruction of forests, leading to frequent landslides and mudslides in the region, which can have a serious impact on a downstream country such as India. Caught up in making Tibet the world's largest hydropower generator, the Chinese leadership is brazenly ignoring their own law on National Regional Autonomy that "gives priority to the rational exploitation and utilisation of the natural resources that the local authorities are entitled to develop."[29]

China's Dams and Diversions

In the search for renewable electricity power, China has been constructing dams at a scale that is unprecedented in human history. As Chinese engineers build reservoir upon reservoir that turn the turbines and accelerate the promotion of a low-carbon economy, the negative downstream effects are ignored. Since the 1950s, China has built over 22,000 dams of more than 15-metresin height. China's promotion of large-scale water projects with classic slogans such as 'big diversions, big irrigation' continues. Unrelenting in its efforts to harness rivers and become carbon neutral by 2060, China, in March 2021 announced its plan to build the world's largest hydroelectricity dam on the Yarlung Tsangbo. The project conceives of 11hydropower stations, generating a capacity of 60 gigawatts of power – three times more than the Three Gorges.

It is interesting to observe President Xi Jinping's speech in the Boao Forum in April 2013. He asserted that "... while pursuing its own interests, a country should accommodate the legitimate concerns of others...We need to work vigorously to create more cooperation opportunities, upgrade cooperation, and deliver more development dividends to our people and contribute more to global growth."[30] It was a well-calibrated political message, emphasising on China being a benign power and respecting peaceful co-existence. In reality, however, its emphasis on sovereignty and territorial integrity is far more pronounced than mutual benefit on managing its transboundary waters. It is a conundrum that will define how China balances its domestic water needs with its 'good neighbour' policy.

As Xi made his softening-of-China speech, a few months earlier, the energy sector blueprint was released in January 2013. Far from restraining itself, Beijing outlined the need to construct more hydroelectricity dams on the Nu (Salween), Lancang (Mekong) and Yarlung river basins.[31] Many of these projects are in ecologically and seismically sensitive areas. The blueprint was a reassertion of an aggressive 'supply-side hydraulic' approach of increasing storage capacity, making water transfers and prospecting and extracting groundwater. This approach was the result of a combination of factors that include food and energy needs, plans to meet the low carbon-intensity goals of the 12th Five-Year Plan (2011–2015) and the intensive lobbying of dam builders and electricity companies.

In March 2021, China adopted the 14th Five-Year Plan (2021–2025). According to the plan, China's energy consumption per unit of GDP and carbon dioxide emissions per unit of GDP will be reduced by 13.5 per cent and 18 per cent respectively. It also aims to increase the share of non-fossil energy in total energy consumption to around 20 per cent. To achieve its 'climate pledge for 2030' and 'carbon neutrality for 2060', emphasis on hydropower projects will continue. The 14th Plan explicitly mentions, "...hydropower development on the lower reaches of the Yarlung-Tsangpo river",[32] but also states "systematic governance of mountains, rivers, forests, farmland, lakes and grasslands, and build a natural protected areas system..." and "strengthen ecological protection management for large rivers and important lakes and wetlands..."[33]

The Yarlung is only transboundary river mentioned in the plan and, in the same paragraph, it observes that there are "major water diversion and transfer efforts' for promoting 'construction of major projects that have strong foundations..."[34] Water in China is unequally distributed, leading planners to push ahead with invasive water-diversion plans going back to the idea of *Shou-tian,* or 'reverse flow', of the Tibetan rivers that was espoused in 1988. Chinese engineers, who are a leading voice in decision-making, firmly believe that the diversion of rivers into the water-scarce northern and western regions is crucial for growth and stability.

An example of China's capital-intensive water projects is the South-to-North Water Transfer Project from Tibet, which got under way in 2002, and is expected to take more than 50 years to complete – making it the world's largest transfer scheme ever. The project involves drawing 44.8 bcm of water from the southern rivers in Tibet and linking them to mainland China's four main rivers – the Yangtze, Yellow, Huaihe and Haihe – through three diversion route: the eastern, central and western.[35] The eastern and central routes are now functioning and the rivers that have been linked are within the territory of China, but the western route, which factors diverting transboundary rivers including the Yarlung Tsangbo–Brahmaputra at the 'Great Bend' is controversial and of direct concern to India. There are questions related to the technical, economic and seismic feasibility of the project, but it has not been shelved either. In fact, in May 2021, President Xi convened a symposium on

the follow-up development of the South-to-North Water Transfer Projects in Nanyang and articulated that "strong support of water resources is needed in the country's efforts to shape a nationwide unified market, boost smooth domestic circulation, and promote the coordinated development of the southern and northern regions."[36] He underlined that "the South-to-North Water Diversion Project is a backbone project for the allocation of the resources across different river basins and regions."[37]

Given China's uneven water distribution, its energy needs and its food requirements, it is difficult for the country's planners to not consider water diversion as an option. Upstream diversion of water is hugely scary for downstream riparian states and is regarded as a malignant act. Along with a series of dam constructions, the possible diversion of the Yarlung would be a double whammy for India. However, in the more immediate term, concerns over the dams and storage projects that China is pushing forward vigorously are greater.

About a decade ago, as part of China's 12th Five-Year Plan (2011-2015), a cascade of dams was proposed on the upper and middle reaches of the Yarlung, including a 640MW dam in Dagu, a 510MW dam in Zangmu, a 320MW dam at Jiexu. Only the Zangmu has since been operationalised, while the other three are in various stages of development. With the 14th Five-Year Plan (2021-2025), which gives greater emphasis to water development projects on the Yarlung, reports suggest that the state-owned hydropower company, PowerChina, has signed a strategic cooperation agreement with the Tibet Autonomous Region government to implement hydropower exploitation in the downstream of the Yarlung-Tsangbo River.[38] It will be for the first time that the downstream section of the Yarlung in Tibet will be tapped, with Chinese engineers claiming it to be a 'historic opportunity'. On the other hand, the leadership in Beijing is quite gung-ho over the prospects of dam building and projecting it to enhance China's efforts in dealing with climate change and reducing its reliance on coal.

For the Chinese, who are used to water projects on a gigantic scale, the capacity of the planned dams on the Yarlung is relatively 'small'. From an Indian perspective, however, these projects are sufficiently large to be storage dams, especially if the purpose is for flood control, as is on the Yarlung.[39]

Run-of-River (ROR) projects, as the Chinese planners officially describe them, can be misleading. The basic principle of ROR dams is to return the waters to the river after they passes through the turbines. But what if they are not returned? There is no mechanism to verify that they will be.

Given the political equation between the two countries, China could well maximise its upper riparian position. It suits Beijing to be ambiguous and not show enthusiasm towards formal arrangements on sharing design-related information. Chinese hydrologists explain that "the Brahmaputra has plenty of water; it won't make any difference to India."[40] Even the Indian Water Resource Ministry has stated, to allay unnecessary fears, that the Yarlung enters India (as the Siang in Arunachal) with 78 bcm of water and rises to 629 bcm when it enters Bangladesh.[41] On the question of the Yarlung diversion, the Central Water Commission has suggested "a 50 per cent reduction of the 31.25 bcm currently available in the non-monsoon season and a reduction of 50 per cent in power generation in the Upper Siang project."[42] The figures suggest that India's concerns are more about non-monsoonal, or dry season, flow. The solutions for Indian planners are essentially two-fold: build storage dams at various locations and effectively put in place flood mitigation programmes.

Strengthening Lower Riparian Cooperation

The geographical reality of China cannot be changed, but India's lower riparian position does not necessarily mean an acute disadvantage. For China, water is immensely strategic. Its internal stability depends a lot on steady water supply and it is unlikely that Beijing will compromise on this aspect. Given this reality, India has to view its downstream status rationally. Hydrological facts and objective data-based analysis will be important in its calculation, and not a generalised fear hypothesis. Informed science is a good starting point for India to build its capability and capacity on the Brahmaputra, and in the process, it can de-emphasise China as a hydro-hegemon. The reasons are explained below.

The Yarlung Tsangbo–Brahmaputra originates from the Angsi glacier in the Burang County of Tibet. The total length of the river, from the source to the mouth, is 2,880 km, of which 1,625 km is in Tibet, 918 km is in India

and the rest, 337 km, is in Bangladesh. On the face of it, since 56 per cent of the river flows in Chinese territory it can be easily mistaken that China controls a large share of the water. However, and this is an important fact, the volumetric of the Yarlung Tsangbo–Brahmaputra is not proportional to its length inside a country. The Yarlung is a trans-Himalayan river where the annual precipitation averages about 300 mm. Once it crosses the Himalayan crest line, the annual precipitation reaches about 2,000 mm.[43] Translated, this means that the Yarlung, when it reaches India's territory and becomes the Brahmaputra, swells and becomes mightier because of the heavy monsoon rain, spring water and the contribution of the fast-flowing tributaries – the Lohit, Dibang and Siang/Dihang. Peer-reviewed data clearly suggest that during both the lean and the peak flow, the total annual outflow of the Yarlung from China is significantly less than the Brahmaputra. This means that India has ample water on its side to develop and harness.

India needs to have more water development footprints in Arunachal Pradesh to enhance the economic growth in the region, particularly by building more water storage dams to mitigate dry season flow and thereby exerting down-riparian prior appropriation rights. It must not be forgotten that China's claim to the Arunachal Pradesh territory is also a claim to the vast amount of water flowing in the area. Greater economic integration in the border region is an effective way to neutralise Beijing's claim. Of course, the hydro projects in Arunachal Pradesh, apart from being scientifically sound and technologically robust, need to be framed in a cooperative and consultative manner with wider stakeholders and inter-provincial participation in the northeast of India, particularly with Assam, which is downstream to Arunachal Pradesh. It will be counterproductive for India to create upstream and downstream acrimony within its own territory.

Inland navigation is an important entry point to bolster basin-level cooperation and to harness the potential of the Brahmaputra Basin. This could possibly lead to major dividends, including economic growth, increasing employment and improving livelihoods. Other entry points are strengthening regional hydrological services for flood mitigation (including data sharing), and hydropower development and trade. The northeast part of India has approximately 1,800 km of potential waterways and navigation, which

unfortunately have been much ignored. With the current government's investment in inland waterways, the Brahmaputra National Waterway 2 would act as a critical economic corridor with direct access to Chittagong Port in Bangladesh and the Haldia Port in West Bengal, and boost trade with Southeast Asian countries. Bangladesh has over 24,000 km of rivers, rivulets and canals of which one-fourth are navigable during the monsoon and one-sixth during the dry periods. Signed in 2015, the India–Bangladesh Protocol on Inland Water Transit and Trade (PIWTT) allows for inland vessels of one country to transit through specified routes of the other, with each providing facilities of 'port of call'. This remains a stable framework to expand transit trade through Bangladesh and realign its long-term strategy with India.

There are other ways to pursue positive interactions on the Brahmaputra, exclusive of China. An important element of India's hydrodiplomacy would be to initiate a lower-riparian partnership stretching from the Ganga–Brahmaputra–Meghna (GBM) to the Thanlwin/Salween and Mekong basins. India's hydrodiplomacy has to ensure that the partnership is not seen as a counter-force or even as a pressure group by China, but rather, as a concerned alignment seeking to open channels of communication and transparency with Beijing on upstream usage based on the principles of 'equity' and 'no-harm'.[44] Sub-regional groupings, such as the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) and the BBIN initiative, can act as a catalyst. Whether it is tourism, culture, transport or communication, rivers can be a force multiplier. More than knee-jerk counter-responses, India needs to think of cohesive engagement. The Mekong Ganga Cooperation (MGC) and the government's recent initiatives to expand the areas of cooperation among member countries, which includes Thailand, Myanmar, Cambodia, Laos and Vietnam, are vital to the sustainability of India's Act East policy.

On the politico-diplomatic front, India needs to highlight the transboundary rivers with China as a core issue in bilateral discussions. This space is important to provide the political push for the two countries to think of mitigating risks and sharing benefits on the Yarlung Tsangbo–Brahmaputra and the Sutlej. India's downstream position increases its vulnerability to China, particularly in flood season. There are also huge concerns of natural disasters,

such as the glacial lake outburst flood that happened on the Pareechu River in 2005 and lead to enormous damage downstream in Himachal Pradesh.

China has always been reluctant to discuss water issues, but the onus is on India to frame the water agenda beyond the volumetric and bring larger environmental conventions, such as climate change, wetland protection and biodiversity, to the table. This will help in adding a fresh perspective to the existing MoUs that India has with China. Mechanisms for water cooperation have already been established and, for the time being, it is unrealistic to expect a treaty from Beijing.

As a middle riparian, it is important to change the perception in the neighbourhood that India is a 'water hegemon', as is often expressed by Pakistan and Bangladesh, and second, to draw China into the South Asian water equation through a multilateral-basin approach, thereby sensitising China to downstream concerns and upstream responsibilities. Hydrodiplomacy has to be well nuanced and not always framed in legalistic terms – but rather, with a view to managing China.

This has significant political value when dealing with China over Tibetan water resources. By raising the question, however contested it might be, that one country alone cannot be the claimant to the waters in Tibet, India creates the opportunity to articulate an ecological perspective and principles of resource conservation. By continuously emphasising on water resources in Tibet as a humanitarian issue, India draws international concerns and could possibly prompt China into a water dialogue with the downstream countries on ways to preserve and share the benefits of the Tibetan waters.[45]

Conclusion

China's water needs and India's concerns will remain a recurring theme in the two countries' relations. Rivers are deeply subjective in terms of where, what and how they are used. With no legally binding treaty, apart from the norms and principles as expressed in the 1966 Helsinki Rules on the Uses of the Waters of International Rivers and the 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses, rivers between the two countries remain largely without formal arrangements of distribution, except for the sharing of hydrological information. It is essential for India, as

a downstream riparian state to China, to bring water issues into the core of bilateral discussions, thereby allowing for lower riparian apprehensions and fears to be recognised and discussed. In the BBIN framework, Brahmaputra has to be seen as one of the three in the GBM river system, and not merely an issue between India and China. The potential in the Brahmaputra for development of agriculture and hydropower is substantial. Developing the water resources with a studied approach will help reduce water-related vulnerabilities that include floods, droughts and groundwater over abstraction. As the lead actor, India's strategic and policy initiatives on the Brahmaputra have to be balanced between pursuing a 'water dialogue' with China and an emphasis on a 'basin approach' with Bangladesh and Bhutan. Brahmaputra needs to be treated as strategic resource, requiring a clear enunciation of the desired goal and strategic outcomes.

Notes

1. Ministry of Jal Shakti, Government of India, "India-China Cooperation". http://jalshakti-dowr.gov.in/international-cooperation/bilateral-cooperation-with-neighbouring-countries/india-china-cooperation. Accessed on June 6, 2022.
2. Ibid.
3. Ibid
4. Ibid.
5. Information under RTI, "Implementation Plan: Provision of Hydrological Information of the Yarlung Zangbu/Brahmaputra River in Flood Season by China to India". https://www.mea.gov.in/Images/pdf/JHarsha.pdf. Accessed on June 3, 2022.
6. Ibid.
7. Antonio Gramsci, *Selections from the Prison Notebooks of Antonio Gramsci*, Quintin Hoare and Geoffrey Nowell-Smith (eds), trans, (New York: International Publishers), 1971, p. 170.
8. Cited from *United News of India* (UNI), August 18, 2017.
9. Mark Zeitoun and Jeroen Warner, "Hydro-hegemony – A Framework for Analysis of Trans-boundary Water Conflicts", *Water Policy*, 8, 2008, pp. 435–460; Uttam Kumar Sinha, "Examining China's Hydrobehaviour: Peaceful or Assertive?", *Strategic Analysis*, 36(1), 2012, pp. 41–56.
10. Cited in *Transboundary River Basins: Status and Trends*, vol. 3, Transboundary Waters Assessment Programme (TWAP), UNEP, 2016. www.geftwap.org/publications/river-basins-spm. Accessed on June 7, 2022.
11. Ibid.
12. Centre for Naval Analysis, "Water Resource Competition in the Brahmaputra River Basin". www.cna.org/archive/CNA_Files/pdf/cna-brahmaputra-study-2016.pdf. Accessed on June 7, 2022.
13. "International Cooperation on Transboundary Rivers between China and its Neighbouring Countries", Ministry of Water Resources, People's Republic of China, April 2015, p. 2. http://www.mwr.gov.cn/english/mainsubjects/201604/P020160406513798903048.pdf. Accessed

on June 6, 2022. Also see, the National Bureau of Statistics of the People's Republic of China. http://www.stats.gov.cn/. Accessed on June 6, 2022.

14. "International Cooperation on Transboundary Rivers between China and its Neighbouring Countries", Ministry of Water Resources, People's Republic of China, April 2015, p. 2. http://www.mwr.gov.cn/english/mainsubjects/201604/P020160406513798903048.pdf. Accessed on June 7, 2022.
15. Ibid.
16. Ministry of Water Resources, "Per Capita availability of Water", Government of India. http://pib.nic.in/newsite/PrintRelease.aspx?relid=119797. Accessed on June 7, 2022.
17. Sabita Kushal, "What Does Being 'Water Stressed' Mean for India and Her Neighbours?", *India Water Portal*, September 10, 2015. http://www.indiawaterportal.org/articles/what-does-being-water-stressed-mean-india-and-her-neighbours. Accessed on June 7, 2022.
18. Thayer Watkins, "The Control of the Huai River System in China", cited in Uttam Kumar Sinha, "India-China Relations: Of Reality and Rationality", *USI Journal*, vol. CXLVIII, no. 682, April–June, 2018, p. 202.
19. Karl Wittfogel, *Oriental Despotism: A Comparative Study of Power*, (New Haven: Yale University Press, 1957 (Reprint 1981)), p. 127.
20. Carole McGranahan, "Mao in Tibet Disguise: History, Ethnography, and Excess", *Journal of Ethnographic Theory*, vol. 2, no. 1, 2012, p. 214.
21. Cited in James Nickum, "The Status of the South to North Water Transfer Plans in China", United Nations Development Programme. http://hdr.undp:org/en/reports/global/hdr2006/papers/james_nickum_china_water_transfer.pdf. Accessed on June 5, 2022.
22. Brahma Chellaney, *Water: Asia's New Battleground*, (Washington, DC: Georgetown University Press, 2011), p. 182.
23. "Tibet Since 1951: Liberation, Development and Prosperity", State Council Information Office of the People's Republic of China, p. 3. http://english.www.gov.cn/archive/whitepaper/202105/21/content_WS60a724e7c6d0df57f98d9da2.html. Accessed on June 5, 2022.
24. Ibid., p. 6.
25. Ibid., p. 34.
26. Ibid., p. 35.
27. *The Himalayan Climate and Water Atlas*, ICIMOD, CICERO and GRID Publication, 2015, p. 21.
28. Zamlha Tempa Gyaltsen, "China's Sixty Years of Environmental Destruction in Tibet", Central Tibetan Authority, April 4, 2019. https://tibet.net/chinas-60-years-of-environmental-destruction-in-tibet/. Accessed on June 7, 2022.
29. Article 28 of Regional National Autonomy by the People's Republic of China. The law was adopted at the second session of the Sixth National People's Congress in May 1984 and amended at the 20th Meeting of the Standing Committee of the Ninth National People's Congress in February 2001. https://www.ilo.org/dyn/natlex/docs/ELECTRONIC/35194/124676/F2146249224/CHN35194%20ChnEng.pdf. Accessed on June 7, 2022.
30. Full text of Xi Jinping's speech at opening ceremony of Boao Forum, Xinhua, April 10, 2013. http://www.china.org.cn/business/Boao_Forum_2013/2013-04/10/content_28501562. htm. Accessed on June 7, 2022.
31. Li Jing, "Ban Lifted on Controversial Nu River Dam Projects", *South China Morning Post*, January 25, 2013. http://www.scmp.com/news/china/article/1135463/ban-lifted-controversial-nu-river-dam-projects. Accessed on June 7, 2022.

32. Text of the 14th Five-Year Plan of the People's Republic of China: Fostering High-Quality Development, p. 12. www.adb.org/sites/default/files/publication/705886/14th-five-year-plan-high-quality-development-prc.pdf. Accessed on June 21, 2022.
33. Ibid., p. 21.
34. Ibid., pp. 21–22.
35. "South-to-North Water Diversion Project", *Water Technology*. https://www.water-technology.net/projects/south_north/. Accessed on June 19, 2022.
36. "Xi Focus: Xi Convenes Symposium on Follow-up Development of China's Mega Water Diversion Project", *XinhuaNet*, May 14, 2021. http://www.xinhuanet.com/english/2021-05/14/c_139946207.htm. Accessed on June 19, 2022.
37. Ibid.
38. Ananth Krishnan, "China Hydropower Company Plans First Downstream Dam on Brahmaputra", *The Hindu*, November 29, 2020. https://www.thehindu.com/news/international/china-hydropower-company-plans-first-downstream-dam-on-brahmaputra/article33206687.ece. Accessed on June 1, 2022.
39. Himanshu Thakkar, "Chinese Checkers", *Hindustan Times*, February 12, 2013. https://www.hindustantimes.com/india/chinese-checkers/story-ofjMvqQbSP3V4smToM3ZcP.html. Accessed on June 13, 2022
40. Zhou Wei, "Divided Waters in India", *China Dialogue*, September 20, 2011. http://www.chinadialogue.net/article/show/single/en/4539-Divided-waters-in-China. Accessed on June 16, 2022.
41. Standing Committee on Water Resources (2009–2010), Fourth Report, August 2010, p. 43. http://wwfenvis.nic.in/files/Water%20Resources/Working%20of%20Brahmaputra%20Board.pdf. Accessed on June 14, 2022.
42. "Parched Tiger to Thirsty Dragon: No Concerns about Dams on Brahmaputra", *Water Politics*, February 8, 2011. http://www.waterpolitics.com/2011/02/08/parched-tiger-to-thirsty-dragon-no-concerns-about-dams-on-brahmaputra/. Accessed on June 14, 2022.
43. Jayanta Bandyopadhyay, Nilanjan Ghosh and Chandan Mahanta, *IRBM for Brahmaputra Sub-basin*, *ORF Monograph*, pp. 8–9. https://www.orfonline.org/wp-content/uploads/2016/10/Monograph_IRBM-for-Brahmaputra_Z-Final.pdf. Accessed on June 7, 2022.
44. The community of co-riparian states is an important principle in the waters of an international river. According to Salman M.A. Salman, "The basis...is that the entire river basin is an economic unit, and the rights over the waters of the entire river are vested in the collective body of the riparian states, or divided among them either by agreement or on the basis of proportionality. Clearly, this is an ideal principle that overlooks sovereignty and nationalism..." See, Salman M.A. Salman, "Helsinki Rules, the UN Watercourses Convention and the Berlin Rules: Perspective on International Water Law", *Water Resources Development*, vol. 23, no. 4, December 2007, p. 627.
45. Uttam Kumar Sinha, "Tibet's Watershed Challenge", *Washington Post*, July 14, 2010.

7

Inland Navigation: A Way Forward

At various stages in the history of the Indian sub-continent's economic growth have waterways helped create economic wealth. In probably the most authentic physical account of the Indian frontier, the *Imperial Gazetteer of India* (1909) describes the Brahmaputra Basin as the 'great highway' of the Himalayas from the plateau of Tibet to the plains of Assam. Like the Indus in the north-west, the bend of the Brahmaputra enfolds the Himalayas in the south-east and the *Gazetteer* noted, "This magnificent natural outlet of the glacier and snow-fed drainage of the north is still a matter of speculative interest to geographers, although enough of it is known to justify the expectation that it may yet be recognized as one of the world's highways." Romesh Dutt, the eminent economic historian had expressed, "Nature had provided India with great navigable rivers which had been the high roads of trade from ancient times. And the system of canals, fed by these rivers, would have suited the requirements of the people for cheaper with slower transit, and would have at the same time increased production, ensured harvests and averted famines." He went on to describe how during the British rule narrow commercial considerations prevented state's involvement in river navigation, while road and rail enjoyed continuous state support. Despite extension of the Assam–Bengal Railway from Guwahati to Tinsukia in 1902 and to Lumding and Dibru–Sadiya in 1903, 98 per cent of the weight of the trade was carried by the Brahmaputra in the Assam valley during the time.[1] With the partition and the ensuing

politics, the significance of inland waterways in development thinking remained much neglected in the region.

This is fundamentally changing now with the realisation that waterways can be a cost-efficient, environment-friendly mode of transport with huge potential to enable diversion of traffic from over-congested roads and railways. In the light of potential benefits, the 'rivers for navigation' approach is undergoing a profound rethinking in the South Asian region. In 2016, through an act of parliament, India designated 111 rivers as national waterways and signalled a strong stake in harnessing its network of rivers for inland navigation. Similarly, Bangladesh is developing a large number of waterways as a national priority. Some of them will connect with those in India to facilitate transboundary navigation. As the focus on inland waterways intensifies in the lower riparian countries, Bhutan and Nepal, both landlocked countries, are waiting with anticipation to be connected to seaports via these waterways.

Inland navigation is of course not without its challenges. In a region where water is predominantly used for irrigation and with high seasonal variation in rainfall along with higher levels of urbanisation, maintaining channels for navigation is inherently difficult. Frequent flooding during the monsoons makes inland navigation further arduous. However, if the policy directive is to maximise broader social, economic and environmental benefits, then inland navigation projects could not only support greater and faster economic growth but also lead to higher cooperation among the South Asian countries. Navigation channels on rivers as they flow and cut across the territorial boundaries in the region should be designed to become 'pathways for prosperity' by interfacing with the social and economic needs of riverine communities rather than being narrowly implemented for transportation utility by moving large containers from one river port to another. The emphasis on transboundary river cooperation cannot be less highlighted. For example, careful site selection and constructing of more storage dams in the upper reaches of the rivers could provide the twin benefits of flood management and adequate water flow for navigation in the downstream plains. Upstream–downstream cooperation on inland navigation is not unique as such arrangements are witnessed in several basins such as the Nile, the Amazon, the Rhine and the Danube with discernible social and economic benefits, including mechanisms to protect the environment and the ecology of rivers.

Actors Involved on the Brahmaputra

The Brahmaputra is probably the unruliest river in the region both in terms of its flow profile as well as non-existent bilateral or multilateral arrangements although limited cooperation exists on sharing hydrological data. The lack of institutional mechanisms to understand the complex features of the river and its interaction with the social and economic aspects of the region has made political cooperation difficult to achieve. If the Brahmaputra, with its peak discharge of 100,000 bcm/second flowing through the northeast region before becoming the Jamuna and the Meghna rivers in Bangladesh, is to become a stimulus for the integrated multimodal connectivity plans in the Bay of Bengal region then the logic of geography has to prevail over the irrationality of non-cooperation.

The Brahmaputra encompasses China, India and Bangladesh as the major riparian countries through which the river and its tributaries flow with Bhutan having interest in the wellbeing of the basin as well. Together the Brahmaputra Basin covers an expanse of 580,000 sq km, with China occupying roughly half of the basin area, India one-third and Bangladesh and Bhutan one-twelfth each. China, the upstream from where the Brahmaputra originates, is focussed on planned hydroelectricity dams, broadly emphasising its national aspiration for clean energy. Inland navigation on the Brahmaputra is not an objective for China unlike, for example, the Yangtse River, winding through nine provinces from east to west, which is regarded as an economic super-zone or more commonly as the 'golden waterway' that generates 40 per cent of China's GDP. China has the largest network of waterways and the highest inland waterways cargo movement (one tonne over one kilometre) in the world. It considers inland port infrastructure critical to its global trade growth and has targets to improve its waterways with calls for strengthening shipping capacity, expanding roadway and railway networks and building large-scale logistics centres. Even on the Mekong River, China plans to develop 500 tonne shipping navigation along the 630 km stretch of the river from Yunan province to Luang Prabang in Laos.

India, on the other hand, has 14,500 km declared inland waterways. As compared to other means of transport, inland waterways are the least capital-intensive and have relatively low infrastructure costs. They are best suited to

carry over-dimensional cargo (ODC). Despite such advantages, waterways trade in India constitutes less than 4 per cent of the total inland cargo movement. Post-independence, India's waterways development has been a case of out-of-sight-out-of-mind. There are about 116 rivers, apart from the 111 rivers identified, that can provide 35,000 km of navigable stretches. By overlooking these natural waterways, the logistics cost in India today runs very high at about 18 per cent. Comparatively, in China it is 8–10 per cent and 10–12 per cent in most European countries. Inland waterways transport is cost effective as compared to rail and road. In an age of environmentally sound approaches, trade on waterways leaves a small carbon footprint. Estimates suggest that 1 horsepower can carry 4,000 kg load in water but only 150 kg by road and 500 kg by rail.[2] One litre of fuel can move 105 tonne/km by inland waterways but only 85 tonne/km by rail and 24 tonne/km by road. Unlike China, India has a vision plan on the Brahmaputra called the National Waterways 2 (NW2) and is currently focused on the route from Dhubri to Sadiya in Assam.

The North East Region (NER) in India has many large and small rivers providing facilities for water transport 'especially in its plain parts and in flat river valley of the large rivers in hills'. There are 20 National Waterways including the Brahmaputra. Nineteen new national waterways were declared in the NER in April 2016. The Brahmaputra and the Barak were the lifelines for transportation of goods and people before road connectivity developed. During the colonial period, the Brahmaputra–Barak–Surma–Kushiyara river system was used for trade between the NER and Calcutta port. Without these rivers, the growth of tea industry would not have come about. The NER has about 1,800 km of river routes providing for inland navigation. River ports or terminals such as Sadiya, Dibrugarh, Disangmukh, Neamati, Tezpur, Pandu-Guwahati, Jogighopa and Dhubri exist on the Brahmaputra along with ferryghats.[3] The river Barak also has two ports at Karimganj and Badarpur along with ferry services at several places. Navigational potential is being explored in Gumti and Haora rivers of Tripura, Tizu River in Nagaland and Kaladan River in Mizoram.[4]

Bangladesh, the third important riparian actor on the Brahmaputra, has over 24,000 km of rivers, rivulets and canals of which one-fourth are navigable

during the monsoon and nearly one-sixth during the dry period. About 50 per cent of Bangladesh's cargo traffic moves through these waterways along with nearly one-quarter of all the passenger traffic. Most of the freight transported by waterways in Bangladesh is bulk cargo, including construction materials, petroleum products, fly-ash, fertilizers and food grains. There are over 22,000 registered vessels engaged in trade and passenger movement. In addition, there are more than 750,000 local or country boats for transport of goods and people. These are the lifeline for the poorest communities. Bangladesh is strongly emphasising on regional inland waterways transport with its Connectivity Project Phase 2. The focus of these initiatives will be largely on long-distance trade and transport, bulk cargo and connecting its seaports to India's National Waterways 1 and 2. Of the three riparian states on the Brahmaputra, inland waterways transport is particularly promising between India and Bangladesh. The protocol agreement between the two countries remains a stable framework for transit and trade. The waterways connectivity presents an opportunity to Bangladesh to sell its commodities, such as garments, pharmaceuticals and leather, to India, Bhutan and even Nepal. In return, landlocked Nepal and Bhutan can finally find access to the sea through downstream India and Bangladesh. The network of river connectivity clearly has the potential, in the regional context, to reduce both the logistic cost and fuel consumption in transportation while simultaneously stimulating economic growth. With a reworking of regional tariff structures and non-tariff barriers inflation can also be checked.

China, without over committing to any broad-based water development of the Brahmaputra, has from time to time expressed multilateral cooperation on river basins and cites its participation on the Mekong River Commission as an example. On the Brahmaputra, however, it remains resistant to multilateral arrangements or tripartite cooperation with India and Bangladesh. The bilateral approach with India and Bangladesh on the Brahmaputra continues to outline its engagement. Despite the Bangladesh, China, India and Myanmar (BCIM) forum for regional cooperation, China is wary of introducing the benefits of water sharing if not addressing the water concerns. For the time being, it seems that China's basin-wide participation and in particular, the navigational usability of the Brahmaputra remains a difficult proposition. But it may not be insurmountable, especially if India and

Bangladesh along with Bhutan's participation purposely focus on a win-win, non-zero-sum benefits of inland waterways on the Brahmaputra, possibly allowing for China, at a later stage, to participate in it for larger political dividends. In this context, therefore, the lower-riparian cooperation on the Brahmaputra is of greater value. With the Asian Development Bank (ADB) providing technical, advisory and financial support, sub-regional platforms such as the BIMSTEC, which has transport and communication as one of its14 sectors of cooperation, and the BBIN initiative to enable people and cargo movement across borders can act as catalysts for cooperation on inland waterways.

Enhancing Inland Waterways on the Brahmaputra

Having understood the overall benefits of inland waterways and having factored in the cooperating actors in the equation, the question of how to enhance the scope of the Brahmaputra waterways becomes pertinent. The Brahmaputra has enormous potential to capture the sub-regional and NER aspirations but before it is fully realised it has a serious challenge to overcome and that being ensuring that adequate water flows, particularly during the dry months.

Building storage dams in the upper reaches of the Brahmaputra Basin can provide multiple benefits notwithstanding the negative social and ecological impacts of building such structures. A cost-benefit analysis suggests that some of the negative impacts can be off-set by the positive gains. For one, the storage dams will result not only in perennial and reliable inland waterways transport but will also bring higher availability of water in the dry months for drinking water supplies, irrigation and industrial and commercial use. Second, it will enhance flood management capabilities, leading to lower social and economic costs of floods and third, with an all-season water transportation system the climate change mitigation efforts will be strengthened. It is estimated that for every tonne/km transportation on water greenhouse gas (GHG) emission is calculated to be 25 per cent of that of road. Fourth, development of water storage dams would require long-term planning, financial capabilities, sub-regional cooperation among the Brahmaputra-basin actors, such as Bangladesh and Bhutan, and above all, provincial or intra-state understanding in the north-eastern region. As a spin-off, the overall benefits and gains from inland waterways transport can encourage water use efficiency in the water sectors.

Significant water savings could further result in enhanced flow during the dry season.

Bangladesh is a cornerstone to enhancing inland waterways, and any plans to expand India's ambitious national waterways will have to include trade to and through Bangladesh. As mentioned in the previous chapter, the 2015 India–Bangladesh Protocol on Inland Water Transit and Trade (PIWTT), provides inland vessels to transit through specified routes with each country providing facilities of 'ports of call'. The same year the Agreement on Coastal Shipping was signed between India and Bangladesh, allowing goods to move by sea from eastern seaports of India to Chittagong Port. The following year, a vessel from Kolkata traversed Bangladesh to the north-eastern state of Tripura, highlighting the value of protocol routes in boosting the isolated markets of northeast India and allowing the region access to the industrial and market centres in India and Bangladesh. The 19th PIWTT Standing Committee meeting between the two countries in 2018 significantly improved the protocol routes with the inclusion of the Rupnarayan River (NW86) and expanded the number of 'ports of call' from five to six on each side by adding Kolaghatin in West Bengal and Chilmari in Bangladesh. Standard-operating procedures for movement of passengers and cruise vessels on inland routes were also agreed upon. Combining the services of the 1,620-km NW1 on the Ganga–Bhagirathi–Hooghly river system, the 891-km NW2 on the Brahmaputra between the towns of Dhubri on the Bangladesh border and Sadiya in Assam and the 71-km NW6 on the Aai River in Assam (through Bangladesh) will open up greater economic benefit in the region, benefiting the Indo–Gangetic plains,[5] Bangladesh and the north-eastern states, which suffer from huge logistic cost of essential supplies. Currently, Bangladesh sources less than 10 per cent of import from India, and less than 1 per cent of exports. A situation that will rapidly change for the better as navigational routes are further developed. Bhutan is also benefitting. For the first time in July 2019, using the Brahmaputra waterway from Dhubri in Assam to Narayanganj in Bangladesh, Bhutan was able to ship stone aggregates using India as a transit. The cargo was first transported by land routes from Phuentsholing in Bhutan to the Dhubri jetty, covering 160 km and thereon by ship to Narayanganj. The cargo capacity was 1,000 MT, which is equivalent to 70 trucks on road. The development

of Jogighopa in Assam as a logistics hub for movement of cargo to and from the north-eastern states and Bhutan gives fillip to the development of inland waterways on the Brahmaputra. Additionally, the Munshiganj river terminal in Bangladesh is being developed as a custom station to handle third-party export and import cargo.

Bangladesh has taken a decision to dredge its rivers, and it will be advantageous for India to extend dredging services to Bangladesh. In fact, dredging work on the Ashuganj–Zakiganj section on the Kushiyara River and the Sirajganj–Daikhowa section on the Jamuna has commenced with India providing 80 per cent of financial contribution. Once the work is complete, the river route, it is expected, will become navigable all year round for cargo vessels, boosting further the connectivity and economic gains in the region. Night navigation services for safe shipping and navigation between the Pandu–Silghat stretch of NW2 near the Bangladesh border has already been implemented, and systems and technologies such as the river navigation information system or the differential global positioning system that India has installed at various locations on the NW2 should be offered to Bangladesh. The technical and infrastructural advancement of the NW2 is driving hydrographic surveys and feasibility studies, many of them already completed, on a number of rivers meandering the north-eastern states. The total navigational length calculated is 1,213km of which the prominent ones connected to the Brahmaputra are the Subansiri (NW95), Dhansiri (NW31), Lohit (NW62), Aai (NW6), Beki (NW73), Dehing (NW30), Kopili (NW57) and Puthimari (NW82). The Aai and the Beki along with the Drangme Chhu or the Manas and the Mo Chhu or the Sankosh flow from Bhutan and empty into the Brahmaputra in Assam, while the Wang Chhu confluences with the Brahmaputra in Bangladesh after traversing through West Bengal. Given the recent traction in the bilateral relations, Bangladesh is seeking Indian investment in almost 100 special economic zones (SEZs). India correspondingly should take advantage of the proposal, particularly in constructing cargo terminals, which are in shortage in Bangladesh. Additionally, Bangladesh should strongly consider allowing Indian vessels to load/unload at all designated ports of call, a courtesy that India offers to Bangladeshi vessels, and adopt improved vessel standards.

For Assam, the development of the inland waterways transport cannot be more critical. A vast populace both urban and rural need transport facilities and rely on small ferry services for their daily activities and livelihood. There are, however, operational limitations to these services. The World Bank-funded Assam Inland Water Transport Project is a timely venture to help modernise the waterways transport services by building terminals, installing night navigational aids, connecting more areas and ensuring easy accessibility in all seasons. This has the potential to spur economic trade at one level and facilitate education and health services to the riverine communities at another level.

Inland navigation on the Brahmaputra shows immense opportunities for transboundary and regional cooperation including meeting local aspirations and needs. As a low-cost form of transport substantial savings will accrue, benefitting trade. Lesser energy in transportation will also help reduce carbon emissions, enabling India and Bangladesh to meet the global climate change mitigation-related challenges. The European Union was able to achieve its target of reduction in carbon emissions in the transport sector through the increased use of the short sea shipping technique. Innovations could be pursued in developing energy efficient shipping options such as natural gas and solar power, which has seen large-scale development. The solar sector in India has witnessed innovative technologies and production techniques, resulting in reduced production costs. The inland water transport could also make a strong case for pursuing environmental flows in rivers such that the requirements of adequate depth and width of the navigation channel is maintained. Clearly, there is a need to re-imagine river basin cooperation from mere division of waters to shifting the discourse to adding more value from rivers and then sharing the benefits. Substantial cooperation and coordination among different stakeholders within each of the Brahmaputra-basin countries will be required as will much consultation within various levels of governments. The social, environmental, economic and political advantages can help reframe the upper-lower riparian dynamics with no riparian actor having an overriding negotiating power.

Notes

1. *Harness: Tapping the River in The Restless River* (World Bank Group: Washington DC, 2021), p. 310.
2. Ibid.
3. Inland Waterways Authority of India. https://www.iwai.nic.in/departments/north-east-region-cell/introduction
4. Ibid.
5. Op. cit., 1, p. 312.

ANNEXURES

Annexures

Joint Statement on the meeting of the Ministers of Transport of Bangladesh, Bhutan, India, and Nepal on the Motor Vehicles Agreement

Thimpu
June 15, 2015

Preamble

We, the Minister of Road Transport and Bridges of Bangladesh, the Minister of Information and Communications of Bhutan, the Minister of Road Transport and Highways and Shipping of India, and the Minister of Physical Infrastructure and Transport of Nepal, (hereinafter referred to as "BBIN Transport Ministers"), met in Thimphu, Bhutan on the 15th of June 2015. We expressed our appreciation to the Honorable Minister of Information and Communications of Bhutan, His Excellency Lyonpo D.N. Dhungyel, for convening this Meeting, and for the gracious hospitality and excellent arrangements made for it. We were joined in our meeting by the Vice President of the Asian Development Bank, Mr. Wencai Zhang.

We recall the strong determination expressed by the Heads of State of Government of the South Asian Association for Regional Cooperation (hereinafter referred to as "SAARC"), at their Eighteenth Summit held in Kathmandu, Nepal on the 26th and 27th of November 2014, "to deepen regional integration for peace, stability and prosperity in South Asia by intensifying cooperation, inter alia, in trade, investment, finance, energy, security, infrastructure, connectivity and culture; and implementing projects, programmes and activities in a prioritized, result-oriented and time-bound manner." We further recall their renewed commitment to "substantially enhance regional connectivity in a seamless manner through building and upgrading roads, railways, waterways infrastructure, energy grids, communications and air links to ensure smooth cross-border flow of goods,

services, capital, technology and people," directing relevant authorities to initiate national, regional and sub-regional measures and necessary arrangements to this end.

We took note of the progress made in formulating and negotiating the Motor Vehicles Agreement for the Regulation of Passenger, Personal and Cargo Vehicular Traffic between the SAARC Member States (hereinafter referred to as "SAARC MVA"), but, at the same time, recognize the need to accelerate cross-border transport facilitation to deepen and hasten regional integration through sub-regional measures in line with the directive of our leaders as articulated in the Declaration of the Eighteenth SAARC Summit.

The BBIN Motor Vehicles Agreement: Finalization and Implementation

We endorsed and signed the Motor Vehicles Agreement for the Regulation of Passenger, Personal and Cargo Vehicular Traffic between Bangladesh, Bhutan, India, and Nepal (hereinafter referred to as "BBIN MVA"), which was drafted on the lines of the SAARC MVA. The finalization of the BBIN MVA would allow us to move forward, in an accelerated fashion, with implementation of land transport facilitation arrangements between and among our countries. This, in turn, would enable the exchange of traffic rights and ease cross-border movement of goods, vehicles, and people, thereby helping expand people-to-people contact, trade, and economic exchanges between our countries. We will endeavor to accelerate the preparatory steps for the effective and sustainable implementation of the BBIN MVA, starting with the formulation, negotiation, and finalization of the necessary legal instruments and operating procedures. We recognize that the BBIN MVA is a complementary instrument to the existing transport agreements or arrangements at the bilateral levels that the Contracting Parties will continue to honor. Implementation difficulties, if any, will be resolved based on provisions of the BBIN MVA.

We will endeavor to carry out a six-month work plan from July to December 2015 for the implementation of the BBIN MVA in accordance with the following activities and milestones:

Formalization of the BBIN MVA, including the Protocols in Annexures 1 and 2, by August 2015;

- Preparation of bilateral (and perhaps trilateral/quadrilateral) agreements/ protocols for implementation of the BBIN MVA, by July 2015;

- Negotiation and approval of bilateral (and perhaps trilateral/quadrilateral) agreements/ protocols, by September 2015;
- Installation of the prerequisites for implementing the approved agreements (e.g., IT systems, infrastructure, tracking, regulatory systems), by December 2015; and
- Staged implementation from October 2015.

We strongly encourage key officials of relevant ministries and agencies concerned in our respective countries to mainstream the relevant provisions of the BBIN MVA, and subsequent legal instruments into their operations. We instruct our Nodal Officials or National Land Transport Facilitation Committees to monitor the work plan, and bring to our immediate attention any issues that may arise in the course of its implementation. We acknowledge the technical and facilitating role played by the Asian Development Bank (ADB) in taking the BBIN MVA initiative this far and request ADB to continue providing much needed technical support and other related arrangements necessary to ensure the effective and efficient implementation of the work plan.

Priority Regional Road Connectivity Projects in the BBIN Countries

We are pleased with the progress of improving physical road connectivity between our countries. We note that the ADB-supported South Asia Sub-regional Economic Cooperation (hereinafter referred to as "SASEC") program is helping enhance interconnectivity between our four countries.

We recognize that our four countries comprise a dynamic sub-region, which requires efficient land transport connectivity between the concentrations of supply and demand, which are widely dispersed. We take note that 30 priority transport connectivity projects with an estimated total cost of over 8 billion US dollars have been identified, which will rehabilitate and upgrade remaining sections of trade and transport corridors in our four countries. These corridors and associated routes were determined based on analysis of patterns of regional and international trade.

We take note of the finding that transforming transport corridors into economic corridors could potentially increase intraregional trade within South Asia by almost 60% and with the rest of the world by over 30%. We acknowledge that apart from physical infrastructure, the development of economic corridors within and between our countries requires the implementation of policy and regulatory measures, including the BBIN MVA, which will help address the nonphysical

impediments to the seamless movement of goods vehicles and people between our four countries.

BBIN Friendship Motor Rally

We take note that the BBIN Friendship Motor Rally is planned to be held in October 2015 to highlight the sub-regional connectivity and the scope and opportunities for greater people-to-people contact and trade under the BBIN initiative. We have today flagged off the route survey for the Rally.

Acknowledgement and Endorsement

We express our appreciation and gratitude to the Royal Government of Bhutan for the warm hospitality and excellent arrangements made for this Meeting. We thank the Asian Development Bank for the substantial support they have extended to the Meeting of the BBIN Transport Ministers.

This Joint Statement of the Meeting of the Honorable Ministers of Transport of Bangladesh, Bhutan, India, and Nepal on the Motor Vehicles Agreement for the Regulation of Passenger, Personal and Cargo Vehicular Traffic Between Bangladesh, Bhutan, India, and Nepal was endorsed at Thimphu, Bhutan on 15 June 2015 by: His Excellency Mr. Obaidul Quader, Minister of Road Transport and Bridges, Bangladesh; His Excellency Lyonpo D.N. Dhungyel, Minister of Information and Communications, Bhutan; His Excellency Mr. Nitin Jairam Gadkari, Minister of Road Transport and Highways, and Shipping, India; and His Excellency Bimalendra Nidhi, Minister of Physical Infrastructure and Transport, Nepal.

Joint Press Release

The Second Joint Working Group (JWG) Meetings on Sub-Regional Cooperation between Bangladesh, Bhutan, India and Nepal (BBIN)

New Delhi
January 31, 2015

The second meetings of the JWGs on Sub-Regional Cooperation between Bangladesh, Bhutan, India and Nepal (BBIN) on Water Resources Management and Power/Hydropower and on Connectivity and Transit were held in New Delhi on 30-31 January 2015 in a friendly and cordial atmosphere. The Bangladesh delegation was led by Mr. Tareq Md. Ariful Islam, Director General (South Asia), Ministry of Foreign Affairs; the Bhutanese delegation by Dasho Yeshi Wangdi, Director General, Department of Hydropower and Power Systems, Ministry of Economic Affairs; the Nepalese delegation by Mr. Prakash Kumar Suvedi, Joint Secretary (South Asia), Ministry of Foreign Affairs; and the Indian delegation respectively by Mr. Abhay Thakur, Joint Secretary (North) and Ms. Sripriya Ranganathan, Joint Secretary (BM), Ministry of External Affairs. The participation by all the four countries for the first time in these JWGs was appreciated.

The delegations welcomed the opportunity to exchange views on various possibilities for cooperation at a sub-regional level for mutual benefit.

The JWG on Water Resources Management and Power/Hydropower reviewed the existing cooperation in this sector. It discussed the scope for power trade and inter-grid connectivity between the four countries as well as potential for closer cooperation in future power projects. It was agreed that joint efforts would be made to explore harnessing of water resources including hydropower and power from other sources available in the sub-region. It was also agreed to exchange lists of potential future hydropower/power projects to be undertaken jointly involving at least three countries on equitable basis. Exchange of experiences and best practices in other areas of power sector among the four countries was also discussed.

The JWG took stock of the existing bilateral arrangements between the four

countries on data sharing for flood forecasting and ways of improving the same. Possibility of exchanging best practices on basin wide water resources management and development was also discussed.

The JWG on Connectivity and Transit reviewed existing arrangements. It agreed on the significance of BBIN agreements to enable movement of motor vehicles and railways. The meeting exchanged ideas on potential cargo (both roads and railways) and bus routes, involving at least three countries in addition to the existing bilateral routes and also agreed to share suggestions in this regard. It was also decided to explore the possibility of using multi-modal transport to meet commercial as well as tourist needs.

The JWG deliberated on the need for trade facilitation at land border stations for effective sub-regional connectivity. It exchanged views on usefulness of sharing trade infrastructure at land border stations and harmonization of customs procedures.

The meetings also discussed about the terms of reference for both JWGs.

The next meeting of the JWGs would be held in the second half of 2015 in Bangladesh.

Joint Press Release

Third Joint Working Group (JWG) Meetings on Sub-Regional Cooperation between Bangladesh, Bhutan, India and Nepal (BBIN)

Dhaka
January 22, 2016

The third meetings of the JWGs on Sub-Regional Cooperation between Bangladesh, Bhutan, India and Nepal (BBIN) on Water Resources Management and Power/Hydropower and on Connectivity and Transit were held in Dhaka on 19-20 January 2016. The Bangladesh delegation was led by Mr. Tareq Md. Ariful Islam, Director General (South Asia), Ministry of Foreign Affairs; the Bhutanese delegation by Mr. Karma P Dorji, Director, Department of Hydropower and Power Systems, Ministry of Economic Affairs; the Nepalese delegation by Mr. Prakash Kumar Suvedi, Joint Secretary (South Asia), Ministry of Foreign Affairs; and the Indian delegation respectively by Mr. Abhay Thakur, Joint Secretary (North) and Ms. Sripriya Ranganathan, Joint Secretary (BM), Ministry of External Affairs. Discussions at the meeting were cordial, constructive and forward looking, with many new initiatives for deepening sub regional cooperation identified and deliberated upon.

The JWG on Water Resources Management and Power/Hydropower carried forward earlier discussions on scope for power trade and inter-grid connectivity cooperation in future power projects and water resources management between the four countries. Specific hydropower projects under BBIN framework that could be concretized on equitable basis were discussed.

It was decided that an Experts Group would be constituted for exchanging best practices in water resources management and on specifics of the identified projects, power trade, inter grid connectivity, flood forecasting and other areas of possible cooperation.

The JWG on Connectivity and Transit reviewed progress under the BBIN MVA and made recommendations relevant to this process.

It was agreed to commence discussion on the possibility of having a BBIN Rail Agreement drawing on the draft SAARC Regional Rail Agreement template. It was also agreed that land ports/ land customs stations crucial for sub regional trade and transit would be given priority attention by all four countries.

The next meeting of the JWGs would be held in the second half of 2016 in India.

Joint Press Release on the Meeting of Bangladesh, Bhutan, India and Nepal on the Motor Vehicles Agreement (BBIN MVA)

February 08, 2020

1. A meeting of Bangladesh, Bhutan, India and Nepal on the BBIN MVA was held at New Delhi on 08 Feb 2020. Representatives of Bhutan participated in the meeting in an observer capacity as decided by the Royal Government of Bhutan earlier. The Bangladesh delegation was led by Mr Mohammad Sarwar Mahmood, Director General (South Asia), Ministry of Foreign Affairs. The Nepalese delegation was led by Mr Gopal Prasad Sigdel, Joint Secretary, Ministry of Physical Infrastructure and Transport. The Indian delegation was led by Mr Vikram Doraiswami, Additional Secretary, Ministry of External Affairs. The Bhutanese observer team was led by Mr Pem Tshering, Legal Officer, Ministry of Information and Communications. The meeting was held to discuss the passenger and cargo Protocols that are to give effect to the Motor Vehicles Agreement (MVA) for the Regulation of Passenger, Personal and Cargo Vehicular Traffic between Bangladesh, Bhutan, India and Nepal, signed on 15 June 2015. This is the first meeting of the group since their meeting in Bengaluru in January 2018, when the two Protocols were last discussed.
2. Delegations recalled commitments made at the highest political level for implementation of the BBIN MVA and the importance of trade, economic cooperation and people-to-people contact, through enhanced regional connectivity, including through facilitation of regional cross-border road transport. Delegations expressed satisfaction over progress made by each country in internal consultations with their stake-holders for the Protocol for movement of Passengers. Delegations also discussed in detail various aspects of the draft Protocol for movement of cargo vehicles, discussing the existing draft text jointly for the first time. In this regard, the three delegations reaffirmed their understanding that the BBIN MVA safeguards the rights

and obligations of all parties under other international Agreements and bilateral agreements within the group, including those relating to landlocked countries.

3. The delegations also discussed a draft enabling MOU to be signed by Bangladesh, India and Nepal for implementation of the BBIN MVA by the three countries, bearing in mind the consent provided by the Royal Government of Bhutan for the entry into force of the MVA among Bangladesh, India and Nepal, without obligation to Bhutan, pending the completion by Bhutan of its internal procedures for ratification of the BBIN MVA. The delegations of Bangladesh, India and Nepal agreed to consider expediting the finalization of this MoU, expressing gratitude to Bhutan for offering its consent in this regard.
4. The meeting was held in a friendly and cordial atmosphere, with the delegations agreeing upon the need to expeditiously finalize the Passenger and Cargo Protocols for implementation of the BBIN MVA. The meeting agreed to endeavour to revert by May 2020 on the process of internal consultations by respective countries based on the discussions of the meeting.

Meeting of Bangladesh, Bhutan, India and Nepal Motor Vehicles Agreement (BBIN MVA)

New Delhi
March 08, 2022

A meeting of India, Bangladesh, and Nepal on the BBIN MVA was held at New Delhi on March 7-8, 2022. Bhutan participated in the meeting as an observer. The Indian delegation was led by Ms. Smita Pant, Joint Secretary, Ministry of External Affairs. Bangladesh delegation was led by Mr A.T.M. Rokebul Haque, Director General (South Asia), Ministry of Foreign Affairs. The Nepalese delegation was led by Mr. Keshab Kumar Sharma, Joint Secretary, Ministry of Physical Infrastructure and Transport. The Bhutanese observer team was led by Mr Thinley Norbu, First Secretary, Royal Bhutanese Embassy in New Delhi.

2. The meeting was held to discuss the Passenger and Cargo Protocols that are essential to operationalise the BBIN Motor Vehicles Agreement (MVA) for the Regulation of Passenger, Personal and Cargo Vehicular Traffic between Bangladesh, Bhutan, India and Nepal, signed on June 15, 2015. This is the first meeting of the group since the outbreak of the Covid-19 pandemic. The last meeting was held in February 2020 in New Delhi.

3. During the meeting an enabling MOU to be signed by India, Bangladesh and Nepal for implementation of the BBIN MVA by the three countries, pending ratification of the MVA by Bhutan was finalised. Recalling the commitments made at the highest level for implementation of the BBIN MVA, the delegations expressed their desire to sign the MoU at the earliest to give momentum to the implementation.

4. The countries emphasized the importance of operationalising the BBIN MVA expeditiously to enable seamless movement between them for facilitating trade and people-to-people contact. Operationalising the MVA by concluding the Passenger and the Cargo Protocol will help realise the full potential of trade and people to people connectivity between the BBIN countries by fostering greater sub-regional cooperation.

5. The delegates agreed on specific steps and timelines to expeditiously finalise the Passenger and Cargo Protocols for the implementation of the BBIN MVA. Asian Development Bank provided technical and knowledge support to the meeting.

12TH STANDING COMMITTEE ON WATER RESOURCES (2020-21)

SEVENTEENTH LOK SABHA

Ministry of Jal Shakti Department of Water Resources, River Development & Ganga Rejuvenation

CHAPTER XI

International Water Treaties in the field of Water Resource Management and Flood Control

A. COOPERATION WITH PAKISTAN

11.1 The Department of WR, RD & GR has informed the Committee that the Indus basin extends over an area of 11,65,500 km^2 and lies mainly in India and Pakistan with small area in Tibet and Afghanistan. Within India, the Indus basin lies in Jammu and Kashmir (J&K), Himachal Pradesh (HP), Punjab, Haryana and Rajasthan. The Indus system of rivers comprises of main Indus River, its five major left bank tributaries i.e. Jhelum, Chenab, Ravi, Beas and Sutlej (all passing through India) and a right bank tributary namely Kabul river which enters Pakistan through Afghanistan and does not pass through India. The mean annual flow of the Indus system of rivers is about 168 Million Acre-Feet (MAF) including flow from Kabul river. (1 MAF = 1233 MCM = 43.56 TMC) Three rivers namely Ravi, Beas and Sutlej together are known as Eastern Rivers while the rivers Chenab, Jhelum and Indus together are called Western rivers. Out of these six rivers, the Beas River flows within in the territory of India and the remaining rivers cross to Pakistan downstream at different places.

Indus Waters Treaty

11.2 According to the DoWR, RD & GR, the Indus Waters Treaty was a result from a dispute between India and Pakistan on sharing of the waters of Indus basin which was geographically divided at independence. The Treaty was signed on 19th September 1960 in Karachi after eight years of negotiations under the

aegis of the World Bank. The Treaty contains a preamble, twelve Articles and eight (A-H) lengthy Annexures. The Salient Provisions of the Treaty are as under

1. All the waters of the Eastern Rivers - Sutlej, Beas, and Ravi with average annual flow of around 33 Million Acre Feet (MAF) is allocated to India for unrestricted use while the waters of Western rivers - Indus, Jhelum, and Chenab with average annual flow of around 135 MAF is allocated largely to Pakistan.
2. However, India is permitted to use the waters of the Western Rivers for Domestic Use, Non-consumptive use, Agricultural use as specified in Annexure C, and generation of hydro-electric power. This right to generate hydroelectricity from Western rivers is unrestricted subject to the conditions for design and operation as specified in Annexure D of the Treaty. India can also create storages upto 3.6 MAF on Western rivers.
3. Any issue, when arises, is first discussed at Permanent Indus Commission for its resolution. If the Commission is unable to resolve the same, the matter of technical nature can be referred to a Neutral Expert by either Party. If the issue is of legal nature, the same can be referred to a Court of Arbitration either jointly by both the Parties or by a Neutral Expert.
4. There is no provision in the Treaty to stop construction of a project till issues are resolved. Only Court of Arbitration can impose such restrictions.
5. The territorial disputes cannot be raised by either Commissioner. Also, there is no option for unilateral exit or modification in the Treaty for either country.
6. This Treaty is bilateral and World Bank only has a limited procedural role limited to appointment of Neutral Expert or Court of Arbitration on request of the Parties.

Permanent Indus Commission

11.3 Under Article VIII of the Treaty, a Permanent Indus Commission (PIC) has been created as an institutional mechanism for implementing the Treaty. PIC comprises of a Commissioner for Indus Waters from each side. Unless otherwise decided by either Government for a particular matter, each Commissioner is the representative of his Government for all matters arising out of the Treaty. The Commission is required to meet regularly at least once a year, alternately in India and Pakistan, and at other times on request. So far, 115 meetings of the Commission have been held since signing of the Treaty in 1960. The last meeting of the Commission was held in August 2018 at Lahore. The next meeting, scheduled in March 2020 has been postponed in view of pandemic. The

Commission is also required to undertake periodical inspections of the Rivers for ascertaining the facts connected with the various developments and works on the Rivers. So far 119 tours on either side had been undertaken. The Commission submits its Annual Report to the respective Governments before 30 June every year.

11.4 On the question of utilization of waters of the Indus, Jhelum and Chinab Rivers, the representative of the Department of Water Resources, River Development and Ganga Rejuvenation during the course of oral evidence held on 17.11.2020 stated as follows:

> "Sir, we have Major Dams on these three rivers. Like Ranjit Sagar Dam is built around Pathankot on Ravi. Vyas has Pong Dam and Sutlej has Bhakra Nangal Dam. We also transfer water from Beas river to Satluj through tunnel and canal, which is Beas Satluj Link (BSL) Project. Similarly, we are also transferring water from Ravi to Vyas. Through these three projects we are able to use major water. Little by little, the flood season has downstream of these reservoirs, some additional water, which we cannot use, it flows towards Pakistan. Apart from this, some more of our projects are still in the planning stage, as soon as they come, there is a Ujh project on Ravi's tributary. There is a project called Shahpurkandi Dam Project, which is on Ravi itself and is downstream of this Ranjit Sagar Dam. There is a third project, which we have envisaged, the Ravi-Vyas link second, because our one link is already on Madhopur. These three projects, if they come, then the rest of the water is going, we will tap majority. A common claim that our water is going towards Pakistan, it is not so. Right now we are able to use major water of these three rivers".

He further stated as follows:

> "Sir, what you said, I would like to supplement a bit. As people feel that we have taken very little water in that 1960 treaty, much water went to Pakistan. There is topography and other things to use water, currently 40 percent of our country is in the North-East, but in the North East we do not use that water and that water floods Assam and others. The topography there is such, whether it is Jammu and Kashmir, Parts of Himachal Pradesh that it is not possible for us to use more water than this. Technically, it is also not feasible. That is one thing. Second, the effect that the best water utilization of any river system is seen in India is that of the Indus system. We use more than 95% of these three rivers. In today's day, we are not able to do interlinking of

river. There are at least two examples of successful interlinking, which he has mentioned. We also bring Vyas water in Sutlej and Ravi water. On a rainy day, there will be a little more water anywhere; some of that water goes to Pakistan. Secondly, our problem is that our canals, which are in Punjab and Rajasthan, are built much earlier, they are very old. The way they should be maintained and they should not be able to carry as much water as they should carry. One place is Harike Barrage. Two big canals take off of Harike barrage, one is called Rajasthan feeder and the other is Sirhind feeder. As of the capacity of both of them, in today's day we are not able to utilize even a third of its capacity. Due to this, we have to release that water from the barrage of Harike and finally that water goes towards Pakistan. To lining them both, a project is being funded by the Government of India. If that will be done, then we will be able to use a little more water from the Existing System itself. As he said that one on one, Shahpur Kandi already work is going on. The project was closed for four years, but has been revived in the year 2018. Now we are going to take cabinet approval of Ujh multipurpose project, so due to this, some more water will be used. We are able to make good use of this system of water, which is our share of water. Yes, it is necessary that we have not been able to make more of the three rivers on which we should build more hydro electric projects, because hydroelectric projects will also have to have viability. Today, the way in which resettlement, rehabilitation and the rest of the cost has increased, it is seen everywhere that there is technical feasibility, but there is no commercial viability, if we generate energy for 8-10 rupees. Then what will we do with that? These are some problems, otherwise we are using a lot of water in this system".

11.6 The Department in its written reply has informed the Committee that no storage on Western rivers has been created by India so far. Further, the estimated power potential from Western rivers is about 20000 MW. Twenty Nine run- of-the-river (RoR) hydroelectric projects of more than 1 MW aggregating to 3482 MW have been constructed on Western rivers in the State and Central sector.
11.7 It has further been stated that Indus Waters Treaty 1960 provides India, the right to develop Irrigated Cropped Area (ICA) of 9,12,477 acres through waters of Western rivers without creating any storage. Further ICA of 4,31,000 acres can be added after creation of conservation storage and release of a specified quantum of water into the river annually from the same, in accordance with the Treaty, thereby taking the potential ICA from Western rivers to 13,43,477 acres. As per

the latest data for the crop year 2019-20, the ICA developed by India on Western rivers is 7,59,859 acres.

Regular Hydrological Data Exchange under Indus Treaty

11.8 The Department have further apprised the Committee that Article VI(1) of the Indus Treaty provides for regular exchange of specified data relating to flow of the rivers, extractions / releases from reservoirs and withdrawal from all canals, including link canals. This data is transmitted monthly by each Party not later than three months after the end of the month to which they relate. It also provides for supply of such data at less frequent intervals on request by either Party for operational purposes. It also provides for supply of any hydrological data to the extent that these are available. This data is being exchanged regularly between both the Parties.

Flood Information

11.9 Except for the Beas river which flows entirely in India, all other rivers of Indus system flowing through India, namely Indus main, Jhelum, Chenab and Sutlej cross to Pakistan located downstream. Article IV(8) of the Treaty provides that "The use of the natural channels of the Rivers for the discharge of flood or other excess waters shall be free and not subject to limitation by either Party, and neither Party shall have any claim against the other in respect of any damage caused by such use. Each Party agrees to communicate to the other Party, as far in advance as practicable, any information it may have in regard to such extraordinary discharges of water from reservoirs and flood flows as may affect the other Party." Thus, the Treaty puts an obligation on India to supply the advance information in regard to such extraordinary discharges of water from reservoirs and flood flows as may affect Pakistan. During the flood season. The river flows and discharges from the reservoirs are monitored by this wing in coordination with Central Water Commission, Bhakra Beas Management Board and Government of Punjab. This information on extraordinary discharges of water from reservoirs and flood flows is supplied to Pakistan under Article IV(8) of the Treaty as and when such situation arises.

B. COOPERATION WITH CHINA

Memorandum of Understanding on Brahmaputra and Sutlej Rivers with China

11.10 The Committee have been informed by the Department of WR, RD & GR that recurrent floods in Brahmaputra Basin wreak havoc frequently and a

major flood in the year 2000 led to loss of many lives, infrastructure and other properties in India. A need was thus felt for trans-border cooperation for early warning system. Accordingly, a Memorandum of Understanding (MoU) was signed between India and China in January, 2002 for sharing of hydrological information of the Yaluzangbu/Brahmaputra River in flood season by China to India for the three stations on Yaluzangbu/Brahmaputra river viz Nugesha, Yangcun and Nuxia located in Tibet Autonomous Region (TAR). The main purpose of the MoU is flood control and disaster mitigation in downstream areas, mainly in Arunachal Pradesh, Assam and further down. The hydrological data include Water Level, Rainfall and Discharge. The period of data in this MoU was 1st June-15th October every year. The MoU was renewed in June, 2008, May, 2013 and June 2018 for another five years.

11.11 Another umbrella MoU on Brahmaputra was signed between India and China in October 2013, which inter alia increased the originally envisaged duration of data from 1st June- 15th October to 15th May-15th October. This umbrella MoU of 2013 further opens up other areas of co-operation in water sector and has no expiry period. In the year 2005, there was a breach of Parichu Lake in TAR which led to severe flooding of Sutlej river in India. This led to loss of lives and properties in Himachal Pradesh and further down in India. Thus, a need for trans-border cooperation for early warning system was also felt for Sutlej River (called Langqen Zangbo in China). Thus, a Memorandum of Understanding (MoU) with People's Republic of China was signed on April, 2005 with provision of hydrological information of the River Sutlej/Langqen Zangbo in Flood Season by China to India. Under this MoU, Chinese side provides hydrological information of Tsada station located on River Sutlej/Langqen Zangbo. The MoU has a validity of five years. The MoU was renewed in 2010 and November, 2015 for another five years.

Implementation Plans

11.12 The signing of MoU on Brahmaputra and Sutlej rivers with China is followed by the signing of Implementation Plans (IP). The IP gives the modalities regarding technical details of provision of hydrological information, data transmission method, cost settlement etc. The IP also provides details of the stations, frequency, type, duration and format of transmission of data to be supplied.

Expert Level Mechanism (ELM)

11.13 The Department of WR, RD & GR has stated that during the visit of Hon'ble President of the People's Republic of China in November, 2006, it was mutually agreed upon to set up an Expert Level Mechanism (ELM). ELM between India and China was thus established to discuss interaction and co-operation upon provision of hydrological data in flood season, emergency management and other issues regarding trans-border rivers as agreed between them. The ELM meetings are being held annually, alternately in India and China. ELM meetings inter alia discuss the following:

i. Discussions on transmission of data and data utilisation Report by Indian side.
ii. Unforeseen flood related events in Tibet Autonomous Region (TAR) and their impacts on Indian side.
iii. Any other mutually agreed item in the agenda which may include presentations by both the sides on flood related matters, hydropower development, opening of new station in TAR, technical exchanges etc.
iv. Site visits to water resources projects/works in the respective countries.

11.14 As regards sharing of hydrological data with China, the representative of Department of Water Resources, River Development and Ganga Rejuvenation during the oral evidence held on 17.11.2020 apprised the Committee as follows:

> *"Sir, this is the MoU. China is such a country with which we do not have much cooperation at the moment, but at least it is of data sharing and that is also on payment basis. Normally like where we are taking data, Nepal is not charging anything from us but China is charging for supplying this data to us. In Brahmaputra, we get data of three stations during flood season, that is, from 15th May to 15th October, we get data on water level, flow, and rainfall. Sir, MoU with China belongs to the Brahmaputra and Sutlej river. Yes, the work of data sharing is happening continuously. Both agreements are for five-five years and are being renewed continuously".*

11.15 When asked whether there is regular sharing of hydrological data by China with regard to rivers of Brahmaputra and Sutlej, the Department replied as under: "Except for the year 2017 (when no data was supplied) data is being supplied by Chinese side for both the rivers viz, Brahamputra and Sutlej as per the MoUs. Hydrological data (Water Level, Rainfall and Discharge) of Brahmaputra River for the three stations in Tibet Autonomous Region (TAR) viz. Nugesha, Yangcun

and Nuxia was supplied regularly during the period from 15th May to 15th October during the year 2020, twice a day (0800 hrs and 2000 hrs Chinese Time). Similarly, Hydrological data (Water Level, Rainfall and Discharge) of Sutlej River for the lone station in TAR i.e., Tsada was supplied regularly during the period from 1st June to 15th October for the year 2020, twice a day (0800 hrs and 2000 hrs Chinese Time)"

11.16 On being asked whether China has any proposal to build dams on Brahmaputra river, the Ministry of External Affairs in their written reply stated as follows:

> *"The 'Outline of the 12th Five Year Plan for National Economic and Social Development of the People's Republic of China' endorsed in March 2011 indicated that three hydropower projects on the main stream of Brahmaputra River in Tibet Autonomous Region were approved for implementation by the Chinese authorities. A hydropower project at Zangmu was declared fully operational by Chinese authorities in October 2015. Government carefully monitors all developments on the Brahmaputra River. As a lower riparian State with considerable established user rights to the waters of the trans-border rivers, Government has consistently conveyed its views and concerns to the Chinese authorities and has urged them to ensure that the interests of downstream States are not harmed by any activities in upstream areas. The Chinese side has conveyed to us on several occasions that they are only undertaking run-of-the-river hydropower projects which do not involve diversion of the waters of the Brahmaputra. Various issues relating to trans-border rivers are discussed with China under the ambit of an institutionalized Expert Level Mechanism which was established in 2006, as well as through diplomatic channels. We intend to remain engaged with China on the issue of trans-border rivers to safeguard our interests".*

C. COOPERATION WITH BHUTAN

Flood Forecasting Mechanism

11.17 The Ministry of External Affairs, Govt. of India had sponsored a "Comprehensive Scheme of hydro-meteorological and Flood forecasting network on rivers common to India and Bhutan" in the year 1955 for the purpose of flood warning measures in Bhutan. Under the scheme 19 nos. of rain gauge and 8 nos. of wireless stations were set up under the control of MEA. The stations were subsequently handed over to Royal Govt. of Bhutan. The network now consists

of 32 hydro-meteorological/ meteorological stations maintained by the Royal Government of Bhutan with funding from India. The data received from these stations are utilised in India by the Central Water Commission for formulating flood forecasts. A Joint Experts Team (JET) comprising of senior officials of India and Bhutan, reviews and monitors the assigned work of this Scheme as well as the release of funds to RGoB.

11.18 A Joint Group of Experts (JGE) on Flood Management has also been constituted for matters related to floods created by the rivers originating from Bhutan and coming to India. The JGE deliberates the probable causes and effects of the recurring floods and erosion in the southern foothills of Bhutan and adjoining plains in India and recommends to both the Governments appropriate and mutually acceptable remedial measures.

Technical Assistance

11.19 The Central Water Commission has established Bhutan Investigation Division (BID) at Phuentsholing, Bhutan for providing technical assistance for various matters including development of hydropower potential in Bhutan. BID has been involved in providing technical assistance for setting up of Gauge and Discharge sites and Wireless stations for Flood forecasting, Survey, Investigation & construction of mini/micro hydel schemes, river training works.

Interconnection with Neighbouring Countries

MINISTRY OF POWER, GOVERNMENT OF INDIA

India is centrally placed in South Asian region and with cross border interconnections with neighbouring countries, playing a major role in effective utilization of regional resources. Further, to facilitate import/ export of electricity between India and neighbouring countries, Ministry of Power, Govt. of India have issued the "Guidelines for Import/Export (Cross Border) of Electricity-2018" on 18th December, 2018. India have also developed expertise in high capacity high voltage transmission projects including AC 400kV and 765kV and HVDC systems. Presently, India is connected with Nepal, Bhutan, Bangladesh and Myanmar. Country wise details are as under:

India–Nepal

Nepal is interconnected with India at various places through 11kV, 33kV, 132kV and 220kV lines. For transfer of bulk power, interconnection between India and Nepal through Dhalkebar (Nepal) - Muzaffarpur (India) 400kV D/C transmission line has been constructed. A total of about 700 MW of power is being supplied to Nepal through these interconnections.

Further, 400kV D/C Gorakhpur (India) – Butwal (Nepal) line, 400kV D/C Dhalkebar (Nepal) – Sitamarhi (India) line, 132kV D/C Nanpara, Bihar (India) – Kohalpur (Nepal), stringing of second circuit of 132kV line Kataiya (India) – Kushaha (Nepal) and 132 kV Raxaul (India) – Parwanipur (Nepal) lines have been agreed.

India–Bhutan

India and Bhutan already are connected through various 400kV, 220kV and 132kV lines, mainly for import of about 2000 MW power from Tala HEP (1020MW), Chukha HEP (336MW), Kurichu HEP (60MW) and Mangdechu HEP (720 MW) in Bhutan to India.

Further, Punatsangchu-I (1200 MW) and Punatsangchu-II (1020 MW) HEPs

in Bhutan, are expected to be commissioned by 2024-25. The transmission system for transfer of this power from these projects to India is already in place. With the commissioning of these HEPs the power transfer between Bhutan and India would be enhanced to about 4200 MW.

India–Bangladesh

A high capacity interconnection between India and Bangladesh exists through Baharampur (India) – Bheramara (Bangladesh) 400kV D/C lines along with 2x500 MW HVDC back-to-back terminal at Bheramara. Another 400kV (operated at 132kV) interconnection exits between Surajmaninagar (Tripura) in India to Comilla in Bangladesh. These interconnections cumulatively facilitate transfer of power of the order of 1160MW to Bangladesh.

Further, to enable more intra-regional electricity trade, including competitively-priced power generated from Hydro-electric power projects in India, Nepal and Bhutan; development a 765kV Double Circuit cross-border electricity interconnection between Katihar (India), Parbotipur (Bangladesh) and Bornagar (India) was agreed in the India-Bangladesh Joint Statement during Official Visit of Prime Minister of Bangladesh to India.

(Ministry of Power, Government of India. https://powermin.gov.in/en/content/interconnection-neighbouring-countries (accessed on August 12, 2022).

Bibliography

Abas, N., Khan, N., Saleem, M. S., & Raza, M. H. (2019). Indus Water Treaty in the doldrums due to water–power nexus. *European Journal for Security Research*, *4*(2), 201-242.

Adeel, Z., Aslov, S., Maestu, J., & Unver, O. (2015). Water Cooperation–Views on Progress and the Way Forward. Hamilton, Canada: United Nations University Institute for Water. *Environment and Health (UNU-INWEH)*.

Adhikari, K. N. (2014). Conflict and cooperation on South Asian water resources. *IPRI J*, *14*(2), 45-62.

Akter, M. (2016). Conceptualizing environmental governance on the GBM basin. *Bandung*, *3*(1), 1-17.

Alatas, S.M. (2016). Tensions over the Yarlung Tsangpo-Brahmaputra: The Geopolitics of Sino-Indian Relations in the 21st Century. *Strategic Studies and International Relations Program, National University of Malaysia.*

Alfthan, B., Gupta, N., Gjerdi, H. L., Schoolmeester, T., Andresen, M., Jurek, M., & Agrawal, N. K. (2018). Outlook on climate change adaptation in the Hindu Kush Himalaya. *Mountain Adaptation Outlook Series. United Nations Environment Programme, GRID-Arendal and the International Centre for Integrated Mountain Development: Vienna, Arendal and Kathmandu, 96pp*.

Ali, S. H. (2013). Ecological cooperation in South Asia: the way forward. New America Foundation.

Alley, K. D., Hile, R., & Mitra, C. (2014). Visualizing hydropower across the Himalayas: Mapping in a time of regulatory decline. *HIMALAYA, the Journal of the Association for Nepal and Himalayan Studies*, *34*(2), 52-66.

Arefin, S., & Muhammad, T. (2019). History of River Management in South Asia: Economic and Environmental Perspective. *Available at SSRN 3638714*.

Arun, A., & Ritu, V. (2017). Natural resource governance at multiple scales in

the Hindu Kush Himalaya. *ICIMOD Working Paper*, (2017/4)

Asgarov, M. (2017). Fresh Water Needs of People: a Transboundary Challenge of a Legal Framework, *Bachelor Thesis, RIGA Graduate School of Law.*

Bandyopadhyay, J., & Ghosh, N. (2009). Holistic engineering and hydro-diplomacy in the Ganges-Brahmaputra-Meghna Basin. *Economic and Political Weekly*, 50-60.

Bandyopadhyay, J., & Ghosh, N. (2016). Hydro-political dynamics and environmental security in the Ganges-Brahmaputra-Meghna basin. Social Sciences, 24, 1-25.

Bandyopadhyay, J., Ghosh, N., & Mahanta, C. (2016). IRBM for Brahmaputra Sub-basin: Water Governance, Environmental Security, and Human Well-Being. *New Delhi: Observer Research Foundation. http://brahmaputrariversymposium.org/wp-content/uploads/2017/09/Monograph_ IRBM-for-Brahmaputra_Z-Final. pdf. Zugegriffen am*, *28*, 2019.

Bhaduri, A., & Barbier, E. B. (2008). International water transfer and sharing: the case of the Ganges River. Environment and Development Economics, 13(1), 29-51.

Bhardwaj, S. K. (2015). India's River Water Management and Its Implications on Bangladesh: Policies and Politics. *Journal of International Relations*, *6*(6), 88.

Björklund, G., Brismar, A., Ehlin, U., Falkenmark, M., Lundqvist, J., Rockström, J., & Swain, A. (2000). Water and Development in the Developing Countries, A Study Commissioned by the European Parliament. *Development Series, DEVE*, *100*.

Bourne, C. B. (1997). *International water law: selected writings of Professor Charles B. Bourne* (Vol. 1). Martinus Nijhoff Publishers.

Das, S. P. (2016). Interrogating South Asia's Hydro Politics. Available at: http://www.cuts-citee.org/pdf/Discussion_paper-Interrogating_South_Asias_Hydro_Politics.pdf

Falkenmark, M. (2000, August). Water security for multinational water systems–opportunity for development. In *Stockholm International Water Institute (SIWI) Seminar, Stockholm*.

Gain, A. K., & Giupponi, C. (2014). Impact of the Farakka Dam on thresholds of the hydrologic flow regime in the Lower Ganges River Basin (Bangladesh). *Water*, *6*(8), 2501-2518.

Grandi, M. (2016). Hydropolitics in Transboundary Water Management Conflict,

Cooperation and Governance along the Nile River. PhD Dissertation, Human Rights and Sustainability, Sant'Anna School of Advanced Studies Pisa (Italy)

Gunaratne, V.H. (2019), Hydro-politics in South Asia, BCIS Emerging Scholars Symposium 2019, Session II - Emerging Conflict Dynamics, Bangalore University, India.

Herrmann, P.R. (2018). Water Diplomacy, a Role for the European Union, *Thesis,* International Relations, European Affairs Curriculum, Alma Mater Studiorum – Università di Bologna Scuola di Scienze Politiche.

Hill, D. (2003). Water Sharing in the Indus Basin: A Peaceful, Sustainable Future is Possible. *Global Dialogue*, *15*(2), 27-33.

Hill, D. (2012). Alternative Institutional Arrangements: Managing Transboundary Water Resources in South Asia. *Harvard Asia Quarterly*, *14*(3).

Hill, D. P. (2015). Where hawks dwell on water and bankers build power poles: transboundary waters, environmental security and the frontiers of neo-liberalism. *Strategic Analysis*, *39*(6), 729-743.

Ho, S. (2014). River politics: China's policies in the Mekong and the Brahmaputra in comparative perspective. Journal of Contemporary China, 23(85), 1-20.

Ho, S. (2016). 'Big brother, little brothers': comparing China's and India's transboundary river policies. *Water Policy*, *18*(S1), 32-49.

Hu, F. (2011). China's Upstream Dilemma: A Catalyst for Transboundary Cooperation?, *Policy Brief* Water *International,* Number 10

Huda, M. S. (2017). Envisioning the future of cooperation on common rivers in South Asia: a cooperative security approach by Bangladesh and India to the Tipaimukh Dam. *Water international*, *42*(1), 54-72.

Huda, M. S. (2020). *Energy cooperation in south Asia: utilizing natural resources for peace and sustainable development*. Routledge.

Huda, M. S., & Ali, S. H. (2018). Environmental peacebuilding in South Asia: Establishing consensus on hydroelectric projects in the Ganges-Brahmaputra-Meghna (GBM) Basin. *Geoforum*, *96*, 160-171.

Huzen, K. B. (1993). The India Factor in Bangladesh Foreign Policy: The Constitution of Geopolitical Hegemony in South Asia.

India infrastructure report (2011). *India infrastructure report 2011: Water: Policy and performance for sustainable development*. Oxford University Press.

Intelligence Community Assessment, (2012). Global Water Security, *Office of the Director of National Intelligence*, ICA 2012-08, United States of America.

Islam, M. S. (2011). Water scarcity and conflict: A Bangladesh perspective. In *The Daily Star Monthly Magazine Forum* (Vol. 5, No. 6, p. 19).

Johnston, R., & Smakhtin, V. (2014). Hydrological modeling of large river basins: how much is enough?. *Water resources management*, *28*(10), 2695-2730.

Kadurugamuwa, N. (2014). Sharing of Trans-Boundary River Waters in South Asia; Geopolitics and Beyond.

Karim, S. (2020). Transboundary Water Cooperation between Bangladesh and India in the Ganges River Basin: Exploring a Benefit-sharing Approach.

Kattelus, M., Kummu, M., Keskinen, M., Salmivaara, A., & Varis, O. (2015). China's southbound transboundary river basins: A case of asymmetry. *Water International*, *40*(1), 113-138.

Khalequzzaman, M., Srivastava, P., & Faruque, F. (2004). The Indian River-linking Project: A Geologic, Ecological, and Socio-Economic Perspective. In *Proceedings of the International Conference on Regional Cooperation on Transboundary Rivers: Impacts of Indian River-linking Project. December* (pp. 17-19).

Khalid, A. R. M. Looking From Downstream-Tipaimukh Dam: A Transboundary Disaster in the Making.

Khalid, I. (2010). Trans-boundary water sharing issues: a case of South Asia. *Journal of Political studies*, *17*(2), 79.

Kliot, N., Shmueli, D., & Shamir, U. (2001). Institutions for management of transboundary water resources: their nature, characteristics and shortcomings. *Water Policy*, *3*(3), 229-255.

Klise, G. T., Neir, A. M., Campana, M. E., Ewing, A., Basak Vener, B., & Rieu-Clarke, A. (2009). Hydrovulnerability of West Asia. *UNEP: Hydropolitical Vulnerability and Resilience along International Waters-Asia, Nairobi*.

Lebel, L., Xu, J., Bastakoti, R. C., & Lamba, A. (2010). Pursuits of adaptiveness in the shared rivers of Monsoon Asia. *International Environmental Agreements: Politics, Law and Economics*, *10*(4), 355-375.

Liu, J., Dorjderem, A., Fu, J., Lei, X., & Macer, D. (2011). Water Ethics and Water Resource Management, Ethics and Climate Change in Asia and the Pacific (ECCAP) Project Working Group 14 Report. UNESCO Bangkok

Magsig, B. O. (2009). Introducing an analytical framework for water security: a platform for the refinement of international water law. *Journal of Water Law*, *20*(2-3), 61-69.

Manurkar, J., Dhanve, V., Bhoir, B., & Bobade, S. (2016). Case Study of Bhakra Nangal Dam, *Bachelor Thesis*, University of Mumbai, India.

McCracken, M. (2017). *Measuring transboundary water cooperation: options for Sustainable Development Goal Target 6.5*. Global Water Partnership (GWP).

Mirchandani, M. (2016). The Teesta water dispute: Geopolitics, myth and economics. *Observer Research Foundation*.

Mondal, S. H., & Islam, S. (2017). Chronological trends in maximum and minimum water flows of the Teesta River, Bangladesh, and its implications. *Jàmbá: Journal of Disaster Risk Studies*, *9*(1), 1-11.

Pai, N. (2008). Climate change and national security: Preparing India for new conflict scenarios. *Indian National Interest Policy Brief*, *1*, 1-9.

Pandey, P. (2011). Understanding Patterns of Water Conflicts: Social and Political Variables. *South Asian Survey*, *18*(1), 157-171.

Pandey, P. (2014). Bangladesh, India, and fifteen years of peace: future directions of the Ganges Treaty. *Asian Survey*, *54*(4), 651-673.

Parven, A., & Hasan, M. S. (2018). Trans-boundary water conflicts between Bangladesh and India: water governance practice for conflict resolution. *International Journal of Agricultural Research, Innovation and Technology*, *8*(1), 79-84.

Pathan,M.A.(2021). Water Resources of Pakistan: Aanlysia of source and solution. AcademiaLetters, Article2726. https://doi.org/10.20935/AL2726

Pulla, V., Ahmed, Z. S., & Pawar, M. (2018). Water and communities in South Asia: a case for regional cooperation. Space and Culture, India, 6(3), 23-40.

R Grafton, Q., Wyrwoll, P., White, C., & Allendes, D. (2014). *Global Water Issues and Insights*. ANU Press.

Rahaman, M. M. (2002). Bangladesh–from a country of flood to a country of water scarcity–sustainable perspectives for solution. *Ratio*, 2.

Rahaman, M. M. (2012). Water wars in 21st century: speculation or reality?. *International Journal of Sustainable Society*, *4*(1-2), 3-10.

Rahaman, M. M., & Varis, O. (2009, February). Integrated water management of the Brahmaputra basin: Perspectives and hope for regional development. In *Natural Resources Forum* (Vol. 33, No. 1, pp. 60-75). Oxford, UK: Blackwell Publishing Ltd.

Raj, A., Jhariya, M. K., Mahmud, A. A., & Mahmoud, S. (2020). Impact of Climate Change on Arctic Vegetation: A Review. *Annals of Ecology and Environmental Science*, *4*(2), 26-34.

Rasul, G. (2014). Why Eastern Himalayan countries should cooperate in transboundary water resource management. *Water Policy*, *16*(1), 19-38.

Rasul, G. (2015). Water for growth and development in the Ganges, Brahmaputra, and Meghna basins: an economic perspective. *International Journal of River Basin Management*, *13*(3), 387-400.

Rasul, G., Neupane, N., Hussain, A., & Pasakhala, B. (2021). Beyond hydropower: towards an integrated solution for water, energy and food security in South Asia. *International Journal of Water Resources Development*, *37*(3), 466-490.

Rieu-Clarke, A. (2015). Transboundary hydropower projects seen through the lens of three international legal regimes: Foreign investment, environmental protection and human rights. *International Journal of Water Governance*, *3*(1), 27-48.

Rieu-Clarke, A., Moynihan, R., & Magsig, B. O. (2012). UN Watercourses Convention: user's guide. IHP-HELP Centre for Water Law, Policy and Science (under the auspices of UNESCO).

Rotberg, F. R. F., & Swain, A. S. A. Natural Resources Natural Resources Security in South Asia: Security in South Asia: Nepal's Water Nepal's Water.

Salman, M. (2009). The World Bank policy for projects on international waterways: an historical and legal analysis (Vol. 4). Martinus Nijhoff Publishers.

Samaranayake, N., Limaye, S. P., & Wuthnow, J. (2018). Raging Waters: China, India, Bangladesh, and Brahmaputra River Politics. Marine Corps University Press.

Samaranayake, N., Limaye, S. P., & Wuthnow, J. (2018). *Raging Waters: China, India, Bangladesh, and Brahmaputra River Politics*. Marine Corps University Press.

Samaranayake, N., Limaye, S., & Wuthnow, J. (2016). Water resource competition in the Brahmaputra river basin.

Sharma, B. R., & Ambili, G.K. (2009). Hydro-geology and water resources of Indus-Gangetic Basin: comparative analysis of issues and opportunities. Annals of Arid Zone 48(3&4): 187-217

Sidhu, B. K. (2013). The Kishenganga Arbitration-Transboundary Water Resources Governance. *Environmental Policy and Law*, *43*(3), 147.

Singh, U. (2014). Blue Blooded Diplomacy: Lessons for India and China, *FPRC Journal* -40-2019 (4), ISSN 2277 – 2464

Sultana, F. (2004). Engendering a catastrophe: A gendered analysis of India's river linking project. *Regional cooperation on transboundary rivers: Impact of the Indian river-linking project*, 288-305.

Swain, A. (1996). *The environmental trap: the Ganges river diversion, Bangladeshi migration and conflicts in India*. Uppsala: Dept. of Peace and Conflict Research, Uppsala Univ.[Institutionen för freds-och konfliktforskning, Uppsala univ.].

Swain, A. (2012). Global climate change and challenges for international river agreements. *International Journal of Sustainable Society*, *4*(1-2), 72-87.

Taylor, G. F., Weinhold, M. R., Adams, S. B., Khatiwada, N. R., Bhattarai, T. N., & Shakya, S. (2014). Assessment of Water Resources Management & Freshwater Biodiversity in Nepal. United States Forest Service International Programs Office, Philanthropy Support Services (PSS) Inc. and Nepal Development Research Institute (NDRI).

Thomas, K. A. (2017). The river-border complex: a border-integrated approach to transboundary river governance illustrated by the Ganges River and Indo-Bangladeshi border. *Water International*, *42*(1), 34-53.

Togni, F. (n.d.) Individual Assignment: Water grabbing in Himalayan Asia: the conflict over the Yarlung-Zangbo/Brahmaputra river between China and India. Avaliable at: https://www.academia.edu/download/37903583/Water_grabbing_ in_ Himalayan_Asia_the_conflict_over_the_Brahmaputra_river_between_China__India_and_Bangladesh..pdf

Upadhyay, S. N., & Gaudel, P. (2017). The adoption of the declaration of the principles on the Grand Ethiopian Renaissance Dam and lessons for South Asia. Hydro Nepal: Journal of Water, Energy and Environment, 21, 17-24.

Upadhyay, S. N., & Gaudel, P. (2018). Water resources development in Nepal: myths and realities. *Hydro Nepal: Journal of Water, Energy and Environment*, *23*, 22-29.

Vaidya, R. A., & Karki, M. B. (2018). Sustainable Management and Regional Cooperation for Himalayan Waters. In Informing Water Policies in South Asia (pp. 270-291). Routledge India.

Vaidya, R. A., & Sharma, E. (Eds.). (2014). *Research insights on climate and water in the Hindu Kush Himalayas*. International Centre for Integrated Mountain Development.

Wilson, A. M., Gladfelter, S., Williams, M. W., Shahi, S., Baral, P., Armstrong, R., & Racoviteanu, A. (2017). High Asia: the international dynamics of climate change and water security. *The Journal of Asian Studies*, *76*(2), 457-480.

Wolf, A. (2002). Conflict and cooperation along international waterways. *Conflict prevention and Resolution in Water Systems*, 185-200.

World Water Council (2004). Proceedings of the Workshop on Water and Politics:

Understanding the Role of Politics in Water Management, Marseille, February 26-27.

World Water Week in Stockholm (2006). Beyond the River – Sharing Benefits and Responsibilities, Stockholm International Water Institute, SIWI.

Wouters, P., & Chen, H. (2013). China's 'soft-path'to transboundary water cooperation examined in the light of two UN global water conventions–exploring the 'Chinese way'. *Water Law 22,* 229-247.

Xie, L., & Jia, S. (2017). Diplomatic water cooperation: the case of Sino-India dispute over Brahmaputra. *International Environmental Agreements: Politics, Law and Economics*, *17*(5), 677-694.

Xie, L., & Jia, S. (2017). Diplomatic water cooperation: the case of Sino-India dispute over Brahmaputra. *International Environmental Agreements: Politics, Law and Economics*, *17*(5), 677-694.

Yasuda, Y., Aich, D., Hill, D., Huntjens, P., & Swain, A. (2017). Transboundary water cooperation over the Brahmaputra River: Legal political economy analysis of current and future potential cooperation. The Hague Institute for Global Justice: The Hague, The Netherlands.

Yasuda, Y., Hill, D., Aich, D., Huntjens, P., & Swain, A. (2018). Multi-track water diplomacy: current and potential future cooperation over the Brahmaputra River Basin. *Water International*, *43*(5), 642-664.

Zhang, H. (2016). Sino Indian water disputes: the coming water wars? *Wiley Interdisciplinary Reviews: Water*, *3*(2), 155-166.

Zhang, H. (2016). Sino Indian water disputes: the coming water wars? *Wiley Interdisciplinary Reviews: Water*, *3*(2), 155-166.

Zolin, N. (2004). The new Geopolitics of water in the Himalayas And the case of the Brahmaputra river, *Thesis, Master's Degree Programme.* D.M. 270/2004

Zolin, N. (2015). The Geopolitics of water in the Himalayas (Bachelor's thesis, Università Ca'Foscari Venezia).

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