UNDERSTANDING THE COSTS OF NON-COOPERATION IN THE GANGES-BRAHMAPUTRA-MEGHNA (GBM) BASIN

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About this report

This report, commissioned by the Transboundary Rivers of South Asia (TROSA) program and prepared by the UNESCO Chair on International Water Cooperation at Uppsala University, analyzes various costs of non-cooperation in the Ganges-Brahmaputra-Meghna (GBM) basins.

About TROSA

TROSA is a regional water governance program funded by the Government of Sweden and managed by Oxfam. It works with riverine communities in the GBM and Salween basins to strengthen and promote more human rights-based and inclusive water resources governance.

About the UNESCO Chair on International Water Cooperation

The first UNESCO Chair on International Water Cooperation was established at Uppsala University in 2016. Prof Ashok Swain, Professor at Uppsala University's Department of Peace and Conflict Research and Director of the Research School on International Water Cooperation, was appointed the new UNESCO Chair. The task of the chair holder is to promote research and teaching on international water management and water governance issues and to facilitate collaboration within and outside Uppsala University.

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LIST OF ABBREVIATIONS/ACRONYMS

BCM – Billion Cubic Metres

BD – Brahmaputra Dialogue

BIMSTEC – Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation

BPDB – Bangladesh Power Development Board

BRIDGE – Building River Dialogue and Governance

CUSEC – Cubic Feet Per Second

GBM – Ganges-Brahmaputra-Meghna

GSBA – Ganges Strategic Basin Assessment

ICPDR – International Commission for the Protection of the Danube River

IHA – International Hydropower Association

IPCC – Intergovernmental Panel on Climate Change

IWAI – Inland Waterways Authority of India

LMC – Lancang-Mekong Cooperation

MoU – Memorandum of Understanding

MOWR – Ministry of Water Resources

MRC - Mekong River Commission

NDTV – New Delhi Television Limited

ORASECOM - Orange-Senqu River Commission

PMO – Prime Minister's Office

PPP – Public-Private Partnerships

SaciWATERs – South Asian Consortium for Interdisciplinary Water Studies

SADC – Southern African Development Community

SDG – Sustainable Development Goals

SFG – Strategic Foresight Group

UN – United Nations

UNDP – United Nations Development Programme

UNECE – United Nations Economic Commission for Europe

UNESCO/IHP – United Nations Educational, Scientific and Cultural Organisation's International Hydrological Program

WWAP – World Water Assessment Program

WWF – World Wildlife Fund

ZAMCOM – Zambezi Watercourse Commission

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EXECUTIVE SUMMARY

For the five riparian countries, i.e., Bangladesh, Bhutan, China, India, and Nepal, of the Ganges-Brahmaputra-Meghna (GBM) basin, these three rivers and their tributaries and distributaries play a crucial role in their socio-economic development. Not only are these rivers the primary source of water supply in the region but also, they support the region's agricultural production, trade, commerce, and navigation, are a source of rich aquatic supply, sustain diverse flora and fauna, bear huge hydropower potential, and work as a lifeline for millions of people by aiding their livelihoods.

Despite being rich in freshwater resources, the GBM basin is one of the poorest regions in the world, where the riparian states are facing unprecedented challenges to meet their citizens' water, energy, and food demands. The growing population associated with increased economic activities, industrialisation, and urbanisation have already amplified the need for water manifold, putting tremendous pressure on the basin's freshwater resources. While the demand for water is increasing, its availability and quality are gradually decreasing, fuelling competition among the riparian states who already have divergent interests. The state of transboundary water cooperation in the basin is very limited. A lack of collaborative arrangements and unilateral exploitation of the basin's freshwater resources have made transboundary water management a contested issue, catalysing disputes, and leading to regular conflicts. Non-cooperation among the riparian countries has led to high costs, which has also impeded the riparian states' ability to realise the full potential of the basin's resources, threatening its future socio-economic progress and stability.

It is, therefore, crucial for the riparian countries to comprehend the cost of non-cooperation by assessing the basin's full potential and the missed opportunities that collaborative arrangements and joint actions could accomplish. Further delay in addressing the reasons behind limited or non-cooperation will risk intensifying the already deteriorated water situation and increase tensions among the riparian states. Lingering in identifying the lost opportunities of cooperation would hinder the region's developmental prospects and its social and environmental sustainability.

Given this, the study, commissioned by the Transboundary Rivers of South Asia (TROSA) program, attempts to understand the costs of non-cooperation in the GBM basin and identify the potential options to facilitate cooperation so improvements could be implemented in transboundary water management and integrated water governance. Exploring the usage of water across different sectors in which riparian countries could cooperate and their potential cooperation benefits, the report assesses the cost of non-cooperation at the transboundary level. By summarising the cost of non-cooperation and possible options for improvements, the study seeks to influence policymakers in the riparian countries of the GBM basin, water management practitioners as well as academics in making a case for meaningful and substantial transboundary water cooperation at the basin-wide level and contribute to improving overall water governance.

THE COSTS OF NON-COOPERATION

The study identifies nine types of costs resulting from non-cooperation in four different sectors, i.e., water, energy, food, and environment. These costs are:

a. Adverse Impact on the Flow Regime of the Rivers & Water Availability
b. Deteriorating Water Quality & Associated Health Hazards
c. Higher Transportation Costs Due to Lack of Water Connectivity
d. Reduction of Agricultural Productivity & Output
e. Reduction in Fisheries
f. Increased Environmental Stress & Degradation of Ecosystem
g. Adverse Impact of Climate Change
h. Untapped Hydropower Potential, Higher Energy Price & Energy Insecurity
i. Loss of Life & Livelihoods Due to Natural Disasters

By exploring the difference between the potential benefits that could be accrued from cooperation in the four sectors mentioned above and the current state of cooperation, the study assesses the unrealised opportunities and suboptimal resource utilisation due to non-cooperation.

It is incredibly challenging and, to some extent, almost impossible to comprehensively quantify and monetise all the types of costs described and analysed here. Drawing upon different reports and published work, the study has attempted to make a very conservative rough estimate of the costs due to non-cooperation in the GBM basin. During the time 1976 to 1993, due to the lack of adequate cooperative arrangements in the Ganges basin between Bangladesh and India at Farakka, the average annual financial loss for Bangladesh was approximately US$ 186.59 million, which was around 0.6 per cent of the country's GDP at that time. Considering the economic loss of 0.6 per cent of the country's current GDP, the annual loss of non-cooperation for Bangladesh would be approximately US$ 2,125.48 million. Besides, the annual loss to Bangladesh due to annual flood events is about US$ 2,463.17 million. For Bhutan, India, and Nepal, the yearly loss of floods is estimated at around US$ 54.65 million, US$ 7,471.82 million, and US$ 143.34 million, respectively. In the energy sector, due to non-cooperation, Nepal and Bhutan are deprived of estimated annual economic benefits ranging from US$ 105 million to US$ 1,840 million under different scenarios from the development of hydropower generation projects. Furthermore, in the environmental sector, especially in the case of the Sundarbans, it has been estimated that the cost of environmental damage associated with the degradation of the ecosystem and the loss of biodiversity would be approximately US$ 107 million per year. Considering that cooperation among the riparian states of the GBM basin could significantly reduce these types of costs, the aggregate annual cost of non-cooperation in the GBM basin adds up to nearly US$ 14,205.46 million (approximately US$ 14.2 billion).

FACILITATING COOPERATION IN THE GBM BASIN

The costs of non-cooperation in the GBM, as the study discovers, is already high, which will increase in the future if no action is taken. Maintaining the status quo would further augment the existing vulnerabilities and emerging risks associated with the water, energy, food, and environmental security of the region. The study proposes three broad areas of intervention to facilitate cooperation in the basin.

Change in Policy Outlook and Decision-Making Process: One of the crucial changes needed in the policy outlook is promoting a sub-basin-wide multilateral water management approach. Considering China's apathy to be involved in any basin-wide multilateral water cooperation, the riparian states of the GBM basin need to explore a sub-basin-based approach by bringing together Bangladesh, Bhutan, India, and Nepal on a common river management framework, like the lower riparian countries of the Mekong region. Another vital policy outlook is communication and engagement, and there is no denying the importance of formal communication among the riparian countries in order to promote cooperation. Nonetheless, considering the environment of suspicion and lack of trust in the GBM basin, the riparian states need to encourage multitrack water engagement in the form of Track-1.5, Track-2 and Track-3 diplomacy, next to Track-1 formal diplomacy. In this regard, the riparian countries need to involve NGOs, CSOs, academia, think tanks and research organisations in the water governance framework. In addition, it is equally important to engage third parties and the private sector in transboundary water governance. While the riparian states could learn from the good examples of third-party engagement in other river basins like Indus, Senegal, Lake Ohrid etc., there are opportunities for the riparian states to engage the private sector through PPP that could help finance different collaborative water development projects in the basin. Another crucial aspect of the policy outlook is the need for comprehensive data and information exchange protocol. In addition to that, the riparian states need to invest in research and development, not only to promote hydrological modelling and combined hydrological data assessment but also to develop enabling technologies, which could help to ensure efficient supply and demand management in the water sector, thus contributing substantially to water governance in the GBM basin.

Development of Institutional Arrangements: The most pressing need in the case of institutional arrangements regarding transboundary cooperation is developing a river basin organisation to manage water-related issues. Learning from the good examples of other river basin organisations worldwide, like MRC in the Mekong, ORASECOM in Senegal, ICPDR in the Danube, ICPR in the Rhine, etc., the riparian states need to take the initiative to develop a robust river basin organisation. Besides, the riparian states need to utilise the existing regional and sub-regional cooperative arrangements, like BCIM, BIMSTEC, BBIN, to move forward with the discussion of collaborative water management. To strengthen institutional arrangement, it is also crucial for the riparian countries to promote multidimensional capacity building involving human resources as well as national and other institutions engaged with transboundary water management.

Promotion of Benefit-Sharing: Volumetric allocation of water is still the dominant arrangement of water cooperation in the GBM basin, which does not allow the riparian countries to exploit the synergies among the sectors like water, energy, food, and environment and reduce the negative externalities. One promising strategy to promote benefit sharing in the GBM basin could be the joint development of multipurpose storage dams in the upper catchment. That will allow the riparian states to store excess water during the monsoon, regulating floods during the peak time, and increase river flow in the dry period. Other additional benefits from multipurpose dams include generating hydropower and maintaining adequate water flow for navigation. However, the riparian countries need to carefully assess the environmental and societal risk of any infrastructural development projects in order to reduce their adverse impact and ensure a win-win outcome for all the stakeholders.

There is no denying that the GBM basin offers numerous opportunities and multiple benefits to the riparian states to continue their socio-economic development, meet their water, energy, and food demands and safeguard the environment. The long history of non-cooperation has already hampered the development potential of the GBM basin's riparian states as well as their water, energy, food, and environmental security. Increasing population and inequitable growth in the basin, and global climate change have added further to growing insecurity in these sectors. For the sake of the region's future progress, it is necessary that the GBM basin countries need to change the status quo and facilitate multilateral cooperation for the best possible use of their shared water resources.

1. INTRODUCTION

Water, a crucial but finite natural resource on earth, is facing tremendous pressure at present. Population growth, coupled with increased economic activities and rapid industrialisation in recent decades, has increased the demand for water manifold. While the availability, accessibility, and quality of water are on the decline, its ever-increasing demand has made water resources management a major concern in the present-day world, a failure on which might jeopardise the sustainability of human civilisation, surrounding biodiversity, and the ecosystem. In addition, climate change is looming large, exacerbating the already worsened water situation worldwide (IPCC 2007, 2010, 2018; Pandey, 2011; Phillips et al. 2006; UNESCO, UN-Water, 2020; WWAP, 2015). Climatic changes have also led to increased intensity and frequency of water-borne disasters like droughts and floods in different world regions (Eriksson et al. 2009, Shrestha and Aryal, 2011). What is more, nearly half of the global freshwater resources are shared by two or more states, making its management even more complicated, and in many cases, conflict-ridden (Leb 2009; Sinha 2016; Wolf & Hamner 2000; Wolf et al. 2003). In fact, the world's 310 international river basins are becoming some of the most prominent sources of tension and conflict nowadays, threatening water security, along with peace and stability of the concerned region. More than ever before, the world has reached a situation where cooperation over water resources has become inevitable to address the water-related challenges and ensure water security for all.

The Himalayas is the birthplace of some of the world's critically important rivers, including the Ganges-Brahmaputra-Meghna (GBM). These rivers and their tributaries and distributaries are the primary sources of water supply to many South Asian countries, including the riparian states of the GBM basin, namely Bangladesh, Bhutan, India and Nepal, and a part of China (Tibet). As far as the freshwater flow volume is concerned, the GBM river system is the largest, originating in the Himalayas (Immerzeel et al. 2010) and the third largest globally, only overtaken by the Amazon River and the Congo River systems. By making a connection between the Himalayas and the Bay of Bengal, this massive river system, endowed with freshwater resources, fertile agricultural land, hydropower potential, rich aquatic supply and diverse flora and fauna, works as a lifeline for the entire region, supporting the life and livelihood of nearly 670 million people along with its diverse biodiversity and vibrant ecosystem (Whitehead, 2018). The basin also plays a significant role in shaping the socio-economic and cultural architecture of the whole GBM region.

1.1 Understanding the Challenges

Despite being rich in water resources, the GBM basin, with the largest population density globally, is one of the world's poorest regions (Amjath-Babu et al., 2019). With an annual population growth of approximately 1.04 per cent, the region is already hosting over 10 per cent of the global population (World Bank, 2021). The economy of the riparian states has been growing at an average rate of over 6 per cent per year in the last decade (until the COVID-19 pandemic). The demographic change associated with the region's continuing growth and developmental activities is increasing water demand alarmingly along with demand for food and energy (Hanasz, 2014; Rasul et al., 2019). The stress on the GBM basin's freshwater resources is intensifying day by day, putting tremendous pressure on the riparian states to ensure their access to those resources. To make things worse, the availability of freshwater resources in the basin is declining. It has been predicted that the basin will face a depletion of almost 275 billion cubic metres (BCM) of annual renewable water in the next 20 years (SFG, 2011). By 2030, China alone will face a yearly water shortage of about 50-100 BCM, while India will see a reduction of its surplus water to 200-260 BCM (SFG, 2011). Freshwater availability will also shrink in many parts of Bangladesh (Rahman et al., 2017). Declining freshwater resources and skyrocketing demands mean water will become a major point of friction within and among the riparian states, including its stakeholders, be it local, national, or regional. It would not be an exaggeration to say that, by all accounts - water, more than any other natural resources—is likely to spark future conflicts in the GBM basin (Chellaney, 2011).

Moreover, increased human activities, fuelled by industrialisation, urbanisation, deforestation, unregulated mining, etc., are not only putting tremendous pressure on the basin's available freshwater resources but also impacting the river morphology and surrounding ecosystem (IUCN, Bridge, 2018; Rasul, 2016). Water pollution, especially from untreated industrial and domestic waste, is another major concern in the basin. These negative impacts emanating from anthropogenic activities are severely affecting human life, biodiversity, and the ecosystem of the GBM basin.

On top of that, climate change associated with global warming and sea-level rise have brought added tension and profound uncertainties to the already stressed water situation in the GBM basin—a region, which has already been identified as one of the most vulnerable areas in the world in the face of climate change (IUCN, Bridge, 2018). The basin's climate pattern and water environment are projected to change substantially due to global warming (Aamer and White, 2018; Islam et al., 2017; Nepal et al., 2021; Swain, 2018). For instance, in the last couple of decades, many parts of China and northeast India have observed a decline in annual rainfall (Chellaney, 2011; Choudhury et al., 2019). At the same time, many parts of the GBM basin have experienced unusual and heavy rainfalls during the monsoon period (Zolin 2015). With increasing temperatures and erratic precipitation, less water will be available during the summertime when water demand, especially for irrigation, is high. This will aggravate the drought situation in the region. In the monsoon season, the rivers would experience devasting floods more than ever before. Furthermore, climate change will have a substantial long-term impact on the average run-off of the river system, along with an influence on the variability of river flows, mainly due to the rapid melting of glaciers and erratic rainfall patterns, which will affect the hydro-morphology of the entire river system. This will ultimately create additional challenges for the GBM riparian countries to effectively operate the basin's resources in the coming days (Islam et al., 2017; Swain 2012, 2018).

The mounting impact of the water crisis along with climate change poses a massive challenge to food production in the region. According to SFG (2011), by 2050, both China and India would face a 30-50 per cent drop in the yield of their primary cereal production, i.e., wheat and rice, whereas the demand for food would go up by at least 20 per cent. Henceforth, these countries would have to depend on external sources to import food, which can be as high as 200-300 million tons of rice and wheat, to meet their internal demand (SFG, 2011). This will drastically increase their food dependency and increase food insecurity. Any threat to food production vis-a-vis food security will directly manifest itself in the whole GBM region's economy along with its future peace and stability.

What is more, with one of the lowest per capita electricity consumptions in the world, many of the riparian states of the GBM basin are struggling to meet their energy needs and experiencing a shortage of electricity supply (Rasul, 2014; Timilsina et al., 2015; Vaidya et al., 2021; World Bank, 2009). For instance, the per capita electricity consumption in Bangladesh, Nepal, and India in 2019 was 489 KWh, 189 KWh, 1,009 KWh, respectively, whereas the global average was 3,358 KWh (Our World in Data, 2020). Many people in the basin still do not have electricity access, and many have to depend on energy sources that are not environmentally sustainable to meet their energy needs. About 400 million Indians do not have a reliable electricity supply (Rahaman and Hossain, 2020; Sargsyan et al., 2011). Most rural Nepal has no access to electricity or a limited power generation capacity through an off-grid system. The situation worsens during the dry season when less water is available in the river, and the country faces 9 to 12 hours of load shedding that can be as high as 16 hours a day (ICIMOD, 2019; Timilsina et al., 2015). People living in Nepal's urban centres also suffer from chronic load-shedding and unstable power supply, especially during the dry winter seasons (Ogino et al., 2019). Bangladesh also faces power outages, especially during the summertime when the demand is exceedingly high—against the electricity demand of approximately 14,000 MW, the country's peak electricity generation varies between 10,000 to 12,500 MW (Bpdb.gov.bd., 2021; Ichord, Jr., 2020). Without an alternative, countries like India and Bangladesh are likely to become more dependent on higher-cost environmentally unsustainable energy sources to meet their future electricity demands.

Besides that, the GBM flows through countries experiencing bilateral and internal suspicion, mistrust, and political tension (Barua, 2018; Barua and Vij, 2018; IUCN BRIDGE, 2018; Samaranayake, 2016). Competition amongst countries centred around access and utilisation of freshwater resources is dominant in the region, often restricting riparian countries' ability to properly develop and manage the basin's resources (Zolin 2015). Despite the transboundary nature of the GBM that passes through several countries, there are only a few water-sharing agreements among the riparian states, which are mostly bilateral in nature (Pandey, 2020; Samaranayake, 2016). The countries have been engaged in unilateral exploitation of shared resources that has led to political tension and several conflicts, not only with other riparian countries in the basin but also with their affected population in their own countries (Rasul, 2015). This has contributed to the sub-optimal development of the basin's freshwater resources and impeded the region's socio-economic progress.

These looming concerns in the basin, along with its existing challenges, demand strong cooperation and collaborative actions among the riparian states. Unfortunately, the current transboundary water relations among the basin states are marred by limited cooperation, fragmented approaches and unilateral actions dominated by political realism and lack of commitments, often producing a "zero-sum outcome", posing a threat to the growth potential of the region, its water-energy-food security along with its political stability (Rasul, 2014; Zolin 2015). Collaborative water resource management remains a far cry in the region, increasing the possibility of conflict. Mutual suspicions and reluctance to cooperate are hampering timely approaches to the collective action to address not only water-related challenges but also its food, energy, environmental and climate-related issues. In fact, guaranteeing energy, water, and food security for the ever-increasing population and safeguarding the biodiversity and ecosystem has now become one of the biggest challenges for the riparian states of the GBM basin.

1.2 Rationale of the Study

There is no denying that the GBM basin's rich resources have the potential to navigate the economic growth and social development in the region that could elevate the living standards of millions of its poor people in addition to securing their water, energy, food demands, and protect the environment. Through collaborative efforts, it can be expected that the shared resources of the basin could be optimally exploited, and benefits generated from those initiatives could be equitably shared. To do so, comprehending the potential benefits of cooperation and the outcome of non-cooperation is crucial. Policymakers and water management practitioners often could not always fully perceive the cost of missed opportunities for cooperation, which are not often appropriately communicated in the public sphere (Pohl et al., 2017). Delay in tackling the reasons behind the non-cooperation in the GBM basin will risk intensifying the already worsened water security situation and the existing tensions among the riparian states. Lingering in identifying the lost opportunities of cooperation would hinder the region's developmental prospects and its social and environmental sustainability. Therefore, it is of paramount importance for riparian states to understand the cost of non-cooperation in the GBM basin.

1.3 Aim, Objectives & Scope of the Study

Given the backdrop, the present study has been commissioned by the Transboundary Rivers of South Asia (TROSA) program of Oxfam, to understand the cost of non-cooperation in the GBM region and identify the possible options so as improvements could be made in transboundary water management and integrated water governance to move forward with the development activities in the region along with addressing its water-energy-food-related insecurities. By exploring different usage of freshwater in a basin and the areas in which riparian countries of the GBM basin can cooperate along with their potential cooperation benefits, the report makes a cost assessment of non-cooperation at the transboundary level. By recapitulating the cost of non-cooperation and potential options for improvements, the report seeks to encourage policymakers in the riparian countries of the

GBM basin, water management practitioners as well as academics in making a case for meaningful and substantial transboundary water cooperation at the basin-wide level and contribute to improving overall water governance.

1.4 Analytical Approach

Every country has its own national interest and political agenda when it comes to the utilisation and the governance of a river basin's resources and takes advantage of its available benefits. But, in a shared river basin that crosses national boundaries, there are conflicting interests and competing national agendas among the riparian countries, especially to secure and maximise access to those available resources. In such a scenario, some sort of cooperative arrangements among the riparian countries are needed to realise the potential benefits and avoid conflicts. According to Sadoff and Grey (2005), the riparian countries will cooperate only if it serves their interest and national agenda. Convergence among the national agendas and the common interests of the riparian countries work as incentives for them to cooperate. And it is expected that greater cooperation will lead to better management and development of the river itself, reinforcing cooperation in the basin (Sadoff and Grey 2002; UNECE 2015).

There is no universal way to define transboundary water cooperation. The operational definition for this report has been adopted from the work of Zartman (2008) and McCraken (2017) that reads, "Transboundary water cooperation is a process by which states take collaborative efforts to utilise a basin's freshwater resources in an efficient, equitable and sustainable way to achieve a common interest that produces mutual benefits, which would otherwise not be available with unilateral action. In addition to generating mutual benefits for the riparian countries, transboundary water cooperation also works as a catalyst for peace and security, focusing on solving or mitigating disagreements and conflicts among the riparian states (Swain, 2012; Adeel et al. 2015). Based on the criteria developed by United Nations Educational, Scientific, and Cultural Organisation's International Hydrological Program (UNESCO/IHP) and the United Nations Economic Commission for Europe's (UNECE), cooperation in a shared basin can be assessed based on:

i. The presence of a joint body, commission, or mechanism for cooperation

ii. Existence of formal agreements

iii. Regular formal communication (at least once in a year) at the political or technical level

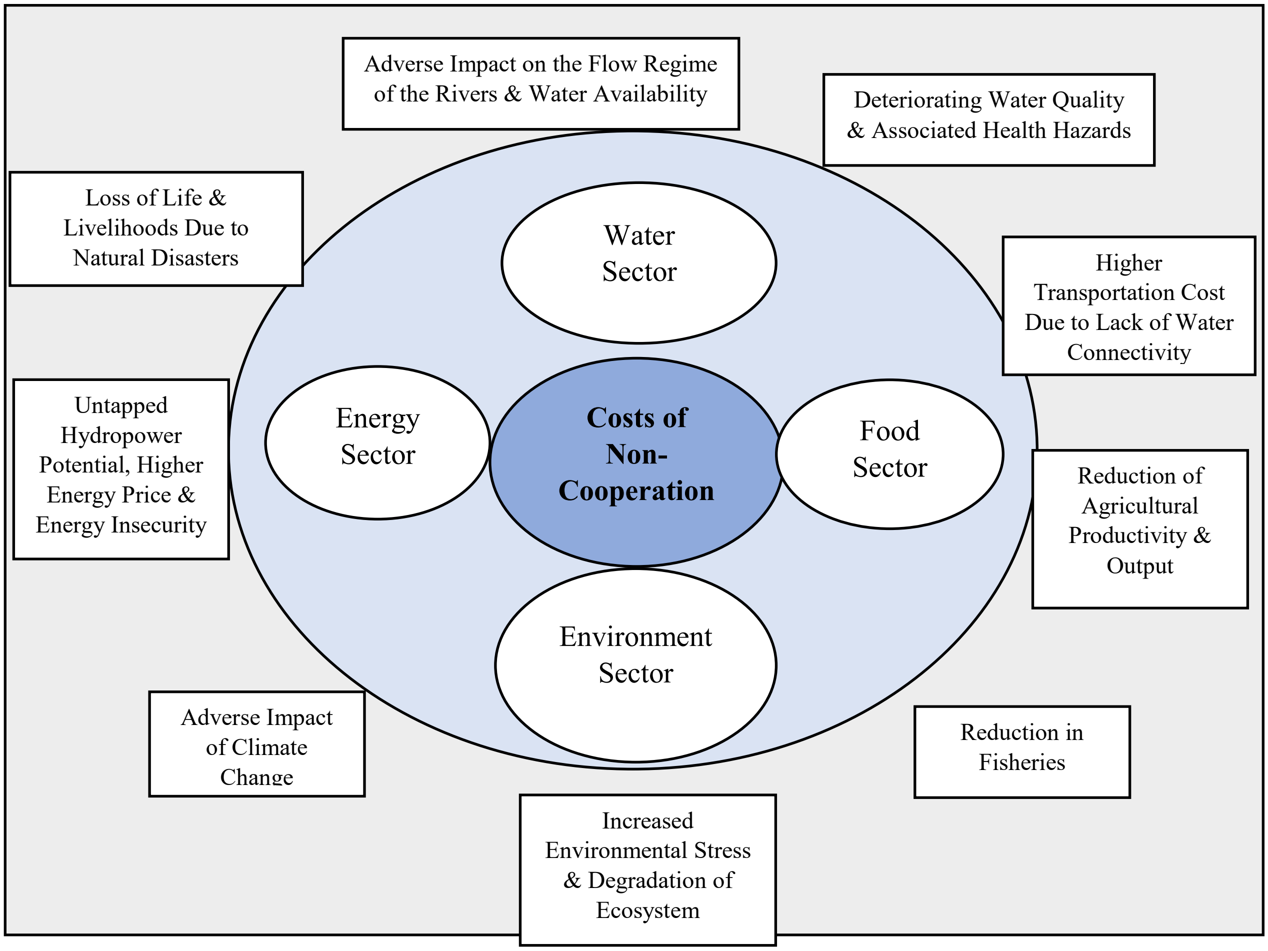
iv. Establishing of a joint or coordinated management plan or objectives

v. Regular exchange of data and information (Klimes et al., 2019; McCraken, 2017; UN-Water, 2020)

When it comes to the utilisation of a basin's freshwater resources, there are conflicting demands not only among national stakeholders but also among different sectors. Rivers are crucial not only for water supplies but also for other purposes like food production, energy generation, navigation, etc., along with their various ecosystem services. The biodiversity of the surroundings also largely depends on the resources of the basin. So, the multiple and competing use for water, energy and food from a basin's freshwater resources mean there are important synergies and trade-offs that need to be considered to maximise the benefits and minimise conflict. Besides, to achieve long-term sustainability of cooperation on transboundary river water resources, it is important to carefully assess the interlinkages between these different sectors as well (Weitz et al. 2014).

Therefore, looking at water cooperation from a water-energy-food-environment perspective could help understand the wider implications of cooperation and how non-cooperation in one sector affects the others, which is crucial to broaden the scope of interventions. But the question to ponder upon is what types of cost the riparian states in the GBM basin would incur due to non-cooperation taking a holistic water-energy-food-environment perspective. The figure below details the most important types of costs applicable for the GBM basin. It should be noted that the list is not exhaustive, and there are other costs as well, but the report will limit its scope within this list.

Figure 01: Different Types of Costs Resulting from to Non-cooperation



The report will discuss the costs of non-cooperation in the GBM basin by looking at each of the sectors and identifying the difference between the potential cooperation and the current state of cooperation, highlighting the unrealised gains that could have been accrued from cooperative arrangements among the riparian states.

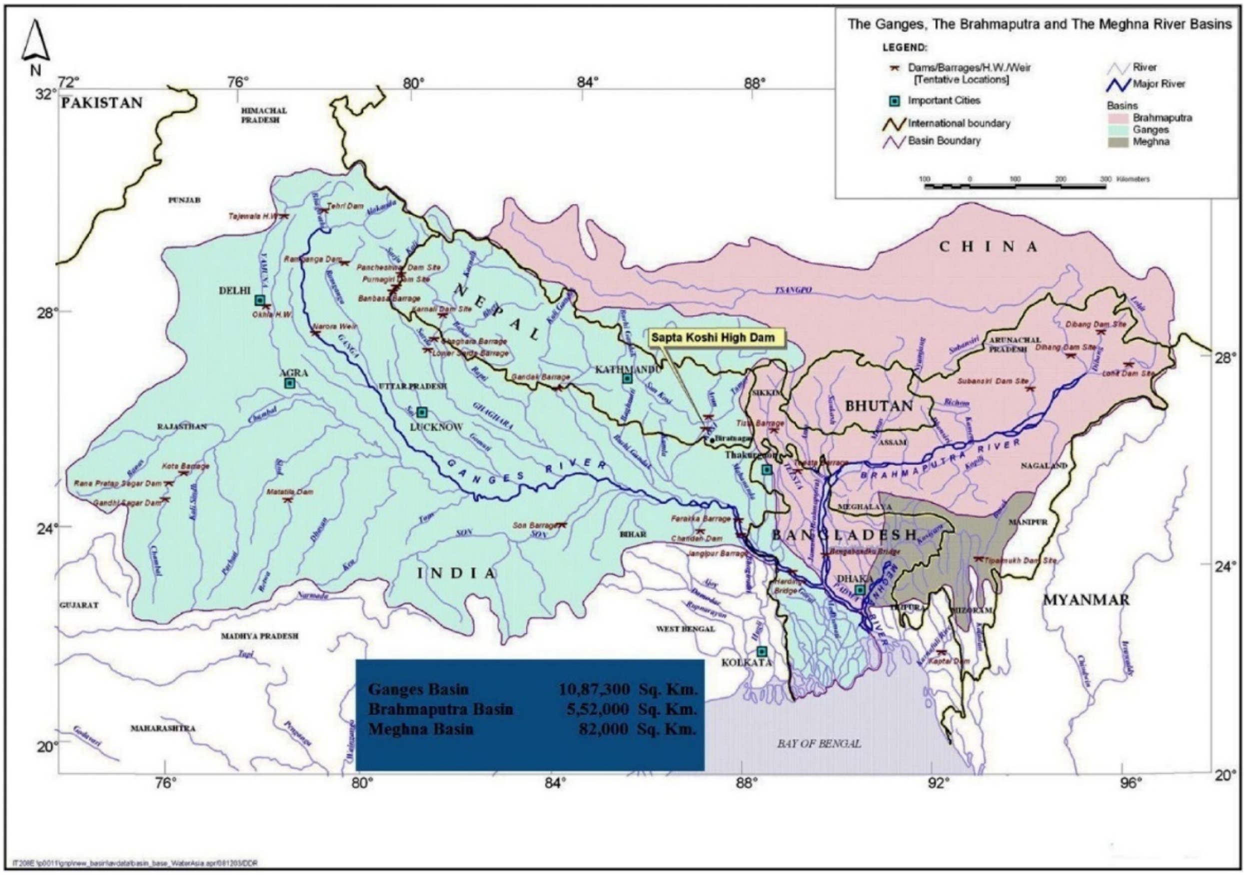
1.5 Structure of the Report

- The report commences with a brief **Introductory Section**. It provides the background, highlights the challenges of the GBM basin, discusses the rationale, aim and objectives of the study and sheds light on the analytical approach.
- **Section two** incorporates a brief description of the GBM basin, its geophysical and hydrological characteristics, and socio-economic significance. The section also highlights the current state of conflict and cooperation in the GBM basin among the riparian states.
- **Section three** examines the cost of non-cooperation in the GBM basin. By identifying the potential benefits that the basin offers and the gains that can be accrued by mutual cooperation, the section demonstrates the missed opportunities to optimally maximise benefits in different sectors and how non-cooperation affects the socio-economic development of the respective countries and its significance for the region as a whole.
- **Section four** explores the potential options to facilitate cooperation in the region. It demonstrates how the cost can be reduced, cooperation can be sustained, and a wide variety of benefits unleashed.
- **Section five** concludes the report by summarising the findings of the study.

2. THE GANGES-BRAHMAPUTRA-MEGHNA RIVER BASIN

The GBM river system originates in the Himalayan Mountain range and empties into the Bay of Bengal. In their entire journey, the three rivers, along with their tributaries and distributaries, pass through five countries—namely Bangladesh, Bhutan, India, Nepal, and China (Tibet). Though these three rivers have a common destination, they pose specific distinct characteristics and flow through vastly different regions for most parts of their journey to the sea. In addition to their individual significance, each one of the rivers has tributaries that are also important by themselves in socio-economic and political terms, as well as in terms of their resources and utilisation. Many of these tributaries are transboundary in nature and cut across national boundaries (Ahmad et al. 2001; Biswas and Uitto 2001; Biswas 2008). Without a clear understanding of the basin's geophysical and hydrological characteristics, socio-economic and demographic attributes, as well as the mutual relationship among the riparian states, the discussion on the cost of non-cooperation would be difficult. This section will briefly explain those important attributes of the GBM basin.

Figure 02: The Ganges-Brahmaputra-Meghna Basin



Source: Joint River Commission Bangladesh.

2.1 Geophysical & Hydrological Characteristics

The GBM river basin spans over a total area of just over 1.7 million square km, covering parts of five riparian states as mentioned above. Table 01 shows the distribution of the basin area among the riparian countries. India hosts the largest catchment area of the GBM basin. Among the five riparian states, Nepal is entirely in the Ganges basin, whereas Bhutan is placed entirely in the Brahmaputra basin. Bangladesh is located at the bottom of the basin and holds only 7 per cent of the catchment area.

Table 01: Ganges-Brahmaputra-Meghna Basin Area Distribution

Basin	Area	Countries Included	Area of the Country in the Basin (km2)	As % of Total Area of the Basin	As % of Total Area of the Country
Ganges	1,087,300	India	860,000	79	26
		China	33,500	3	0.3

		Nepal	147,500	14	100
		Bangladesh	46,300	4	32
		Bhutan	-	-	
Brahmaputra	543,400	India	195,000	36	6
		China	270,900	50	3
		Nepal	-	-	-
		Bangladesh	39,100	7	27
		Bhutan	38,400	7	100
Meghna	82,000	India	47,000	57	1
		China			
		Nepal			
		Bangladesh	35,100	43	24
		Bhutan	-	-	-
Total	1,712,700	India	1,102,000	64	33
		China	304,400	18	3
		Nepal	147,500	8	100
		Bangladesh	120,400	7	83
		Bhutan	38,400	3	100

Source: *Joint Rivers Commission Bangladesh, cited in FAO, 2011.*

Regarding the freshwater resources of the GBM basin, the basin area is regarded as a water-rich region. The yearly average water flow in the GBM region is approximately 1,350 billion cubic metres (BCM), of which the Brahmaputra is responsible for nearly half of the discharge. The 165.4 BCM Brahmaputra water flows to India from China annually, 78 BCM from Bhutan to India, and finally, 537.2 BCM comes to Bangladesh from India. In the case of the Ganges River, annually, 12 BCM water flows from China to Nepal. 210.2 BCM flows to India from Nepal, and 525 BCM flows to Bangladesh from India (Rasul, 2015). Yearly, 48.4 BCM flow of the Meghna River comes to Bangladesh from India (FAO, 2012). In contrast to the annual average water availability of 269,000 m^3/km^2 for the world, the water availability in the GBM region is nearly three times higher - 771,400 m^3/km^2. Besides, the basin has an annually replenishable groundwater resource of about 230 BCM (Biswas, 2008; Rasul, 2015).

Despite being a water-rich region, the GBM basin has a strong seasonal water variability and asymmetric climatology, posing a significant challenge to its efficient planning and management (Bandyopadhyay 1995; Papa et al., 2012; 2015). The water regime of the basin is primarily monsoon driven, and water is abundant during the four months of monsoon from June to September, when the basin receives about 84 per cent of its annual rainfall. Around 80 per cent of the annual river flow generates during these four months. However, water is scarce in the dry season that spans around November to June. The lack of rainfall during the dry period and excess water in the monsoon creates a drought-flood scenario in the region. While monsoon-induced floods caused immense suffering to life and livelihoods, the insufficient water in the non-monsoon period hampers irrigation and navigation, along with affecting the environmental flow of the rivers (Rasul, 2015).

Table 02: Salient Features of the Ganges-Brahmaputra-Meghna Basin

Parameters	Ganges	Brahmaputra	Meghna
Annual average flow rate (m3/s)	11,000	19,600	-
Range of flow rate	< 1,000-70,000	< 8,000-100,000	-
Total renewable water resources (BCM)	525	585.6	48.4
Potentially usable water resources (BCM)	386.5	77.9	10.2
Per capita water availability (m^3)	1039	11,782	-
Water withdrawals (BCM)	266.8	9.9	2.4
Sown area (million hectare)	44.99	3.50	0.94
Irrigated area (million hectare)	22.41	0.85	0.22
Water resources developed (%)	44	11	15
Surface storage potential (BCM)	94.35	52.94	-
Hydropower potential (million kW)	96	206	2.04

Source: *Bhuiyan and Hossain, 2006; Pandey, 2020; Rasul, 2015; Swain, 2018.*

2.2 Socio-economic & Demographic Characteristics of the Basin

The GBM basin, one of the most highly populated floodplains in the world, is currently home to approximately 670 million people, which is nearly 8-9 per cent of the global population (Whitehead 2018). At the same time, this basin is one of the poorest regions on earth, inhabiting 40 per cent of the world's poor people who are primarily dependent on rain-fed agriculture and subsistence living (Akanda, 2012). What is more, the region is experiencing immense population growth. Population density is exceedingly high in a large part of the basin. By maintaining the status quo of current development trends, population growth and management of resources, poverty will become even more pervasive and prevalent in the future. Most of the riparian countries in the basin are performing poorly in different social indicators and rank between 129 and 142 (Table 02) in human development indices, especially in the areas like health, education, child mortality, nutrition, access to safe drinking water, sanitation, etc. (UNDP, 2020). The countries have a low life expectancy and high birth rates. Infant and maternal mortality rates are also much higher compared to developed countries globally (UNDP, 2020).

The economic activities of the region are highly dependent on the freshwater resources from the GBM basin. The primary source of livelihoods, i.e., agriculture, fishery, forestry, and livestock rearing, cannot survive without the resources from the basin. Agriculture contributes nearly one-third of the GDP of the riparian countries and is responsible for almost two-thirds of employment. Food security in the region is also directly related to the availability of freshwater resources, as primary staple foods of the region, i.e., wheat and rice, need a huge amount of water to cultivate. Agriculture accounts for more than 90 per cent of the freshwater withdrawal in the region (see Table 03). In addition to supporting irrigation for agricultural activities, the GBM basin supports transportation, inland navigation, and fisheries as well as energy generation (Rasul 2015; 2019). So, the standard of life, opportunities of livelihoods, and economic potential of the basin depend on the freshwater resources, which also works as the main driver for the region's socio-economic development and helps the riparian states to achieve energy, water, and food security for their citizens. To understand the challenges in the socio-economic sphere and have a clear understanding of the socio-economic characteristics of the basin, Table 03 provides a brief overview of the key socio-economic characteristics of the GBM basin riparian countries.

Table 03: Key Socioeconomic Characteristics & Resources of the Riparian Countries of the GBM Basin

Indicators	Bangladesh	Bhutan	China	India	Nepal
Population (2019)[1]	163.05 million	0.763 million	1,397.715 million	1,366.417 million	28.608 million
GDP (2019)[2]	US$ 302.571 billion	US$ 2.530 billion	US$ 14,279.937 billion	US$ 2,868.929 billion	US$ 30.641 billion

GDP growth (2019)[3]	8.2%	5.5%	5.9%	4.2%	7.0%
GDP per capita (2019)[4]	US$ 1,855.7	US$ 3,316.2	US$ 10,216.6	US$ 2,099.6	US$ 1,071.1
Population in extreme poverty (US$ 1.90 per day)[5]	14.8% (2016)	1.5% (2017)	0.7% (2015)	21.2% (2011)	15% (2010)
HDI ranking (2019)[6]	133	129	85	131	142
Total water withdrawal (2017)[7]	35.87 billion m^3/year	0.338 billion m^3/year	598.1 billion m^3/year	761 billion m^3/year	9.497 billion m^3/year
Total renewable water resources (2017)[8]	1,227 billion m^3/year	78 billion m^3/year	2,840 billion m^3/year	1,911 billion m^3/year	210.2 billion m^3/year
Total renewable water resources per capita (2017)[9]	7,684 m^3/inhab/yr	10,4619 m^3/inhab/yr	1,955 m^3/inhab/yr	1,427 m^3/inhab/yr	7,607 m^3/inhab/yr
Water dependency ratio (2017)[10]	91.44%	0%	0.96%	30.52	5.71%
Water Stress (2017)[11]	5.72%	1.41%	43.22%	66.49%	8.31%
Agricultural water withdrawal as % of total water withdrawal[12]	87.82%	94.08%	64.41%	90.41%	98.14%
Energy production (2018)[13]	33.64 Mtoe	-	2,562.14 Mtoe	573.56 Mtoe	10.38 Mtoe

Primary energy consumption (2016)[14]	373 TWh	25 TWh	35,264 TWh	8,352 TWh	47 TWh
Energy consumption (per capita) (2016)[15]	2,361 KWh	33,586 KWh	24,938 KWh	6,306 KWh	1,721 KWh
Hydropower generation (2019)[16]	0.82 TWh	6.61 TWh	1,302.1 TWh	161.74 TWh	5.33 TWh
Share of electricity production from hydropower (2019)[17]	1.03%	99.97%	17.77%	11.74%	98.27%

Source: *[1 2 3 4 5]World Bank, [6] UNDP, [7 8 9 10 11 12]FAO:AQUASTAT, [13]IEA, [14 15 16 17]ourworldindata.*

2.3 The State of Cooperation in the GBM Basin & Current Trends

Transboundary water cooperation among the riparian states in the GBM basin is overwhelmingly dominated by bilateral modes of cooperation. A deep understanding of the mutual water relations among the riparian countries is of paramount importance to get a holistic picture of the state of cooperation among the riparian states and future directions. Since, the report focuses on energy, food, and the environment sectors, along with water, some discussions have been made on cooperation by those sectors.

2.3.1 Bangladesh-India Water Relations

The transboundary water relations between Bangladesh and India are overshadowed by a bitter and protracted disagreement over sharing of common rivers' water. The origin of the conflicts can be traced back to the 1960s when India started constructing the Farakka barrage on the Ganges, 18km upstream from the Bangladesh border. Both countries signed a five-year agreement in 1977 for sharing the Ganges water, which was followed by two MoUs in 1982 and 1985. The decreasing dry-season water flow and opposing views on improving the situation caused a stalemate between the countries in achieving a long-term water-sharing agreement. However, in December 1996, Bangladesh and India managed to sign the Ganges River water-sharing agreement for thirty years, which will expire in 2026.

Teesta, a tributary of the Jamuna River (Brahmaputra), has now become the main bone of contention between Bangladesh and India. Bangladesh and India had signed an ad hoc agreement in 1983 that allocated 75 per cent of the waters of the river, with 39 per cent to India and 36 per cent to Bangladesh, while 25 per cent remained unallocated for later decisions. The agreement expired in 1985, and since then, both Bangladesh and India have been negotiating to strike a deal over the increasingly scarce water of the Teesta River. In 2011, India agreed to share 37.5 per cent of Teesta waters while retaining 42.5 per cent of the waters during the lean season between December and March. However, the deal never went through due to strong opposition from the Indian state of West Bengal. From there on, there have been several attempts by the political leadership to reach an agreement; unfortunately, efforts remain futile due to the politics in West Bengal. The Teesta issue was discussed during the most recent visit of the Indian Prime Minister to Bangladesh in March 2021, but still, no progress has been made (PMO, 2021).

At the Brahmaputra basin, India shares water level and rainfall data with Bangladesh. Besides, initiatives can be seen to enhance cooperation in the basin through informal channels like the "Brahmaputra Dialogue" (BD), initiated by the South Asian Consortium for Interdisciplinary Water Studies (SaciWATERs). Started as a bilateral dialogue platform between Bangladesh and India to work towards a basin-level management framework in order to cooperate on the Brahmaputra, the project eventually became a multilateral platform including all the riparian countries involving actors from track 3, 2, and 1.5 from countries in China, India, Bhutan, and Bangladesh. The BD project is the only continuous Track 1.5 dialogue initiative sharing various insights on the complexities of the Brahmaputra River (Vij et al., 2019; Vij, 2020).

The Meghna River is known as the Barak River in India. India's plan to develop a hydropower dam at Tipaimukh raised controversy with its neighbour Bangladesh in this sub-basin. The dam is to be constructed 500 metres downstream from the confluence of the Barak and Tuivai Rivers in Manipur over the Barak River, which enters Bangladesh below the location of the proposed dam. The main objective of the Tipaimukh dam project is to generate 1500 MW hydropower and flood control on 2,039 square kilometres of area for the planned development of the Indian state of Manipur. Experts stressed the adverse impact of the proposed dam on the flow of the river, as well as on agriculture and fisheries (HPA, 2013). India also faced opposition inside its territory against this dam due to the fear of displacement of 60,000 people in the state of Manipur and its negative impact on the environment. In July 2013, the Forest Advisory Committee of India's Ministry of Environment and Forest rejected the proposed dam's forest clearance, forcing further delays of the project work. (Swain 2018)

In the recent past, on 05 October 2019, Bangladesh and India signed an MoU that allowed India to withdraw 1.82 cusecs (cubic feet per second) of water from the Feni River, which originates in the South Tripura district and flows through Sabroom town before entering Bangladesh (Sarkar, 2019). Besides, both countries are working on concluding the Framework of an Interim Agreement on sharing of waters of another six transboundary rivers, namely, Khowai, Gumti, Manu, Muhuri, Dharla, and Dudhkumar (PMO, 2021).

In addition to the water sector, Bangladesh and India have also been collaborating in the energy sector; the Joint Working Group (JWG)/Joint Steering Committee (JSC) on power provides an institutional framework for the cross-border trade of electricity. The former is now exporting 1,160 MW of power from the latter (MEA, 2021).

These two countries also have a Protocol for Inland Water Trade and Transit to facilitate waterways connectivity. This protocol is renewed biannually. In 2020, both countries renewed this protocol by adding five more ports of call and two inland water transit routes. This will improve the connectivity of Tripura and adjoining states with the economic centres of India and Bangladesh, along with helping the remote areas of both the riparian states.

2.3.2 Nepal-India Water Relations

When it comes to Nepal-India water cooperation in the GBM basin, the former is the upper riparian country for four major rivers, namely Karnali, Mahakali, Gandak, and Kosi, which are especially important for the water flow of the Ganges River. Nepal and India started cooperating over freshwater resources in 1920 when the latter was under British colonial rule (Shah, 2001). Since then, both countries have agreed on several mutually cooperative agreements regarding the utilisation of freshwater resources, namely the Sarada Agreement (1920), Kosi Agreement (1954), Gandak Agreement (1959), Mahakali Treaty (1996) etc. A Nepal-India Joint Committee on Water Resources, headed by each country's water resources secretary, has been set up to promote high-level coordination for implementing various water-related agreements (Hanasz 2014). In the latest development, during the Nepalese prime minister's visit to India in April 2018, both India and Nepal agreed to cooperate on inland waterways connectivity. They have also decided to discuss establishing a bilateral institutional mechanism based on the assessment and inputs of technical scoping missions comprising officials of both nations separately (Bagale, 2020).

In the transboundary water cooperation between India and Nepal, energy trading agreements play a crucial role. The foundation for power exchange between these counties was laid with the signing of two river agreements for Koshi and Gandaki in the 1950s. Currently, there are three power-sharing arrangements between India and Nepal, namely the Koshi Treaty, the Border Town Power Exchange, and the Mahakali Treaty (Parikh et al, 2016). Governments of both countries are also jointly discussing developing the Pancheswar project (5,600 MW), Saptakoshi (3,330 MW), Karnali (10,800 MW), and Naumure (225 MW). Project Development Agreements (PDAs) for the following projects have been signed: a) 900 MW Upper Karnali with GMR India b) 900 MW Arun-3 with SJVNL. The PDAs in the pipeline are a)

600 MW Upper Marsyangdi – GMR b) 750 MW West Seti – CWE (Three Gorges) c) 880 MW Tamakosi III (SN Power) (Parikh et al, 2016).

However, the bilateral water agreements signed by Nepal and India have been perceived by the Nepalese as being favourable to India. Many Nepalese have considered these treaties as historical injustices, creating significant impediments to broader cooperation in the areas of trade and defence (Huda and Ali 2018).

2.3.3 Bhutan-India Water Relations

India's water relations with Bhutan are in stark contrast to the former's occasionally troubled relationship with two of its neighbours, Bangladesh, and Nepal. The relations between these two riparian states of the GBM basin is based on cooperation by harnessing freshwater resources, especially in generating hydroelectricity (Hanasz 2014). Reciprocity and confidence emanating from the mutually beneficial cooperative mechanism on hydropower generation have been the foundation for a solid and stable bilateral relationship between the two countries. Bhutan's abundance of freshwater resources and its unique topography contribute to its favourable hydropower generation capacity. As of 2019, Bhutan has at least five operational hydropower facilities, a number of small and mini hydroelectric generators with a total of 2,326 MW installed capacity, along with several potential sites in development (IHA, 2020; Schmidt, 2020). Bhutan's hydropower sector has been developed with foreign aid, primarily from India, where the latter has funded four hydropower projects, including the 36MW Chukha hydropower project, 60MW Kurichhu hydropower project, 1,020MW Tala hydropower project, and the 720MW Mangdechu hydropower project (Ranjan, 2020). India is also the largest customer of Bhutanese hydropower, importing 1200 MW of electricity annually (Kumar, 2018). In July 2017, Bhutan and India signed a joint MoU with Bangladesh to develop a 1,125MW Dorjilung hydropower project. The major cost of the project is supposed to be provided by Bangladesh to import its electricity. In June 2020, Bhutan and India signed their first-ever Joint Venture Hydroelectric Project located at the Kholongchhu River in Trashiyangtse district in eastern Bhutan to produce 600MW electricity (The New Indian Express, 2020).

The beneficial outcome and the win-win cooperation between Bhutan and India is an illustration of how freshwater resources in a transboundary river basin can be managed by the riparian states that positively impact the quality of the living standard of people living in both countries. The successful cooperation between these two in hydropower generation has also led to further collaboration in other areas like the environment, flood mitigation, and riverbank erosion by creating the "Joint Group of Experts on Flood Management" and the "Comprehensive Scheme for Establishment of Hydro-Meteorological and Flood Forecasting Network". The larger benefit of this mutually agreed cooperation framework can help to bring a conducive atmosphere for regional cooperation and the enhancement of peace and stability in the region. However, there is a growing section in Bhutan, which is critical of

India-funded hydropower projects because of increasing foreign debt and environmental destruction.

2.3.4 China-India Water Relations

The water relations between the two large riparian states of the GBM basin, i.e., India and China, is largely undefined. Though, in the Brahmaputra basin, some cooperative mechanisms exist between these two states, many new conflicts are on the rise due to diverse development trajectories pursued by both countries and the existing mistrust and suspicion between the two. Since 2000, China has prioritised the development of the Tibetan area, through which the upper reaches of the Brahmaputra River flow. This has resulted in the building of several large hydropower projects upstream. The country has planned to divert 200 BCM water from the Brahmaputra to its water-scarce regions in the north under its South-North Water Transfer scheme. These development activities have become a major concern for the lower riparian countries—India and Bangladesh—and a potential source of conflict in the future (Akter 2016; Patranobis, 2017). The Intelligence Community Assessment Report, conducted by the US Office of the Director of National Intelligence also forecasted that the Brahmaputra River basin will experience discord among the riparian states over the developments of water projects through 2040 (Office of the Director of National Intelligence, 2012).

China and India signed their first MoU in 2002, for five years upon provision of providing hydrological information on the Yarlung Zangbo/Brahmaputra River during the flood season to India by China, which has been renewed further since then. As per this MoU, China collects flood season hydrological data in the remote location upstream of the Brahmaputra River and provides that data to India. Another MoU was signed in October 2013 to strengthen cooperation on trans-border rivers, in which the scope of the provision of hydrological information of three hydrological stations was also enhanced (MOWR, n.d.; Swain, 2018). China stopped providing information following the 73-day-long stand-off between Chinese and Indian troops at Doklam over the Chinese military's plans to build a road close to India's Chicken Neck corridor connecting the North-Eastern states. Later, in June 2018, China's Ministry of Water Resources and India's Ministry of Water Resources, River Development and Ganga Rejuvenation inked an MoU for sharing hydrological information of the Brahmaputra River in flood season by China to India (Bhuyan, 2018). Despite these small developments, and due to the worsening of bilateral relations, India remains seriously concerned over China's dam-building activities on the upstream and its possible water diversion from the Brahmaputra River (Swain, 2018).

2.3.5 The State of Cooperation

Section 1.4 of the report details five criteria, i.e., the presence of a joint body, commission, or mechanism for cooperation; existence of a formal agreement; regular formal communication (at least once in a year) at the political or technical level; establishment of a joint or coordinated management plan or objectives; and regular exchange of data and information, to assess cooperation in a shared river basin. This analytical lens has been used to understand the current state of water cooperation in the GBM basin.

Cooperative Arrangement Criteria	State of Cooperation
Presence of a Joint body, Commission or Mechanism for Cooperation	The GBM region is a basin without a river basin organisation to manage water-related issues. At best, some bilateral organisations, like the Bangladesh-India Joint River Commission (JRC), Nepal-India Joint Committee on Water Resources, etc., exist to look after transboundary water issues. Nevertheless, these institutions lack robustness and appropriate jurisdiction to manage water on a basin-wide level.
Existence of Formal Agreements	Formal agreements regarding water cooperation do exist in the GBM basin. Unfortunately, most of them are bilateral in nature. For instance, Bangladesh and India have a water-sharing agreement in the Ganges signed in 1996. Apart from that, both countries have signed different MoUs on water cooperation, energy trade, conservation of the Sundarbans, etc. But the implementation of those formal agreements is not satisfactory. Nepal and India also have agreed on a number of mutually cooperative agreements regarding the utilisation of freshwater resources, like the Sarada Agreement (1920), Kosi Agreement (1954), Gandak Agreement (1959), and the Mahakali Treaty (1996). However, there is a strong feeling among the Nepalese people that Nepal has been deprived of their fair share of water resources from these agreements. In the case of India and Nepal, both countries have an MoU on the sharing of hydrological data of the Brahmaputra and Sutlej River. Nepal also has a transit and transportation agreement with China. But, even after five years of signing the agreement, both countries have yet to develop even the standard operating procedure (SOP) of its implementation.
Regular Formal Communication (At Least Once a Year) at the Political or Technical Level	At the political level, riparian states of the GBM basin exchange high-level visits. Bangladesh and India exchange regular official visits where water-related issues remain one of the top agendas. At the technical level, both countries also share regular visits. However, the official

	institution to maintain water relations between these two countries, i.e., JRC, has failed to organise ministerial-level meetings since 2010. Nepal and Bhutan also exchange high-level political visits with India. In 2018, in a prime-minister-level visit of Nepal to India, both parties agreed on inland water connectivity.
Establishment of a Joint or Coordinated Management Plan or Objectives	There are some occasions where riparian countries are collaborating bilaterally on joint management of freshwater resources. Bangladesh and India are currently working on concluding the Framework of an Interim Agreement on sharing waters of six transboundary rivers. They also have a Protocol for Inland Water Trade and Transit to facilitate waterways connectivity. Joint management plans can be observed in the energy sector between Bangladesh and India, Nepal and India, and also Bhutan and India.
Regular Exchange of Data & Information	India shares water level and rainfall data with Bangladesh for different rivers, including the Ganges, Brahmaputra, Teesta, and Barak. China has been providing data of the Brahmaputra River to India and Bangladesh under a signed MoU. However, there is no protocol to share year-round hydrological data in the GBM basin among the riparian countries. Besides, data sharing also depends on the state of the bilateral relationships between the states. Following the 73-day Doklam stand-off between China and India, the former stopped sharing data with the latter for a time.

3. THE COST OF NON-COOPERATION IN THE GBM BASIN

At present, the state of transboundary water cooperation among the riparian states of the GBM basin is minimal. The freshwater resources of the basin are already under severe stress. Lack of cooperation has impacted not only the water sector but also other sectors like food, energy, climate, etc., due to their interconnectedness and interdependency, resulting in socio-political, economic, environmental, and climatic backlash. The following section will present a detailed discussion on the cost of non-cooperation in different sectors. The discussion accounts for the current state of cooperation in various areas and the potential benefits in different sectors and highlights the missed opportunities that could be gained if there had been cooperation among the basin states.

3.1 Water Sector

Transboundary management of water in the GBM basin is one of the biggest challenges for riparian countries. Freshwater resources in the basin are already under stress due to various anthropogenic and natural causes mentioned earlier. Lack of cooperation among the riparian countries primarily affects both the quality and quantity of freshwater resources.

3.1.1 Adverse Impact on the Flow Regime of the Rivers & Water Availability

In line with the demographic change in the riparian states of the GBM basin, the demand for water for multiple purposes like domestics, industrial, environmental has already increased manifold and will skyrocket in the years ahead. For instance, India will experience almost doubled water demand from 890 million m^3 in 2006 to 1.4 trillion cubic m^3 of water by 2050 (Akter, 2015). In Bangladesh, the annual domestic water demand is estimated at 2,716 million m^3. It has been projected that the demand will increase by 50 per cent by the year 2030 and 99 per cent by 2050. The commercial and industrial water requirement, which was 79.3 million m^3 in 2011, will also see an increase of 125 per cent and 340 per cent by the years 2030 and 2050, respectively (Islam et al., 2017). Nepal and Bhutan receive high rainfall but still face difficulties in providing water per demand, mainly due to high temporal and spatial variations in water availability and growing water needs (Nepal et al., 2021). Table 04 shows how water usage has increased among the riparian states of the GBM basin in the last 40 years.

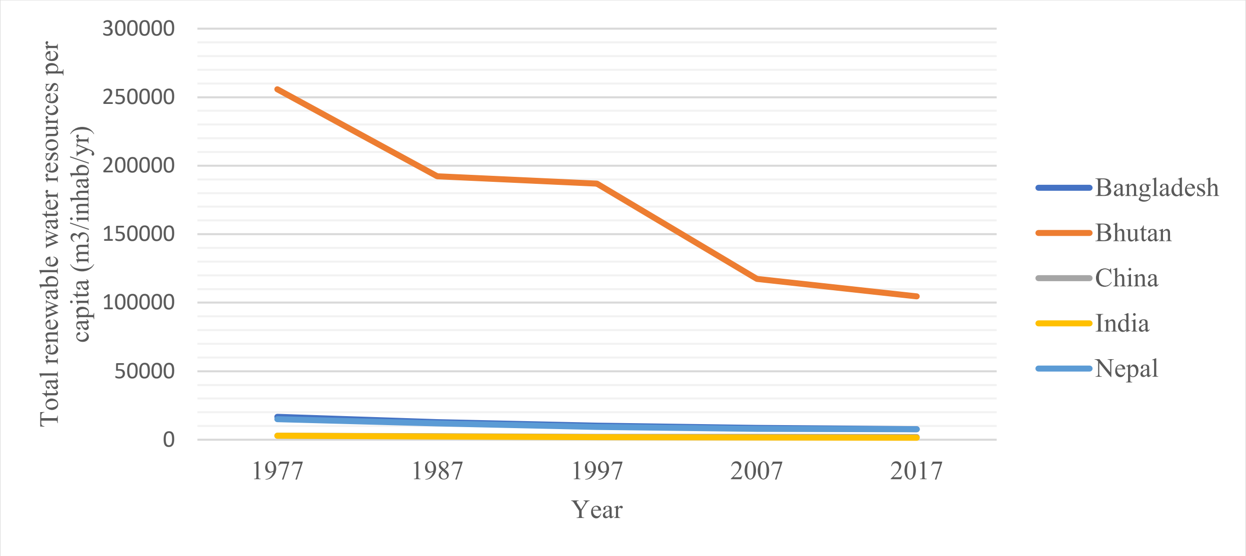
Table 04: Total Water Withdrawal (10^9 m^3/year)

	1997	2007	2017
Bangladesh	-	-	35.87
Bhutan	-	-	0.338
China	539.3	571.3	598.1
India	577.3	715.8	761
Nepal	-	9.497	9.497

Source: *FAO: AQUASTAT.*

While the demand for water is increasing, the availability of water in the basin is experiencing a gradual decline. It is worth mentioning that compared to the population that is residing in the basin, the availability of freshwater is limited. For example, despite having 17 per cent of the global population, India has to depend only on 4.3 per cent of global freshwater resources. China also faces a similar dire condition. With 18 per cent of the world's population, the country has to count on only 6.7 per cent of global freshwater resources (Zolin, 2015). What is more, renewable freshwater resources in the basin have already fallen drastically in the last couple of decades. Figure 03 clearly shows how per capita water availability has declined over the years (Table 04 has the more detailed illustration of the decline of per capita renewable freshwater resources).

Figure 03: Falling Per Capita Water Availability in the GBM Basin



Source: *FAO: AQUASTAT.*

Table 05: Total Renewable Freshwater Resources per capita (m^3)

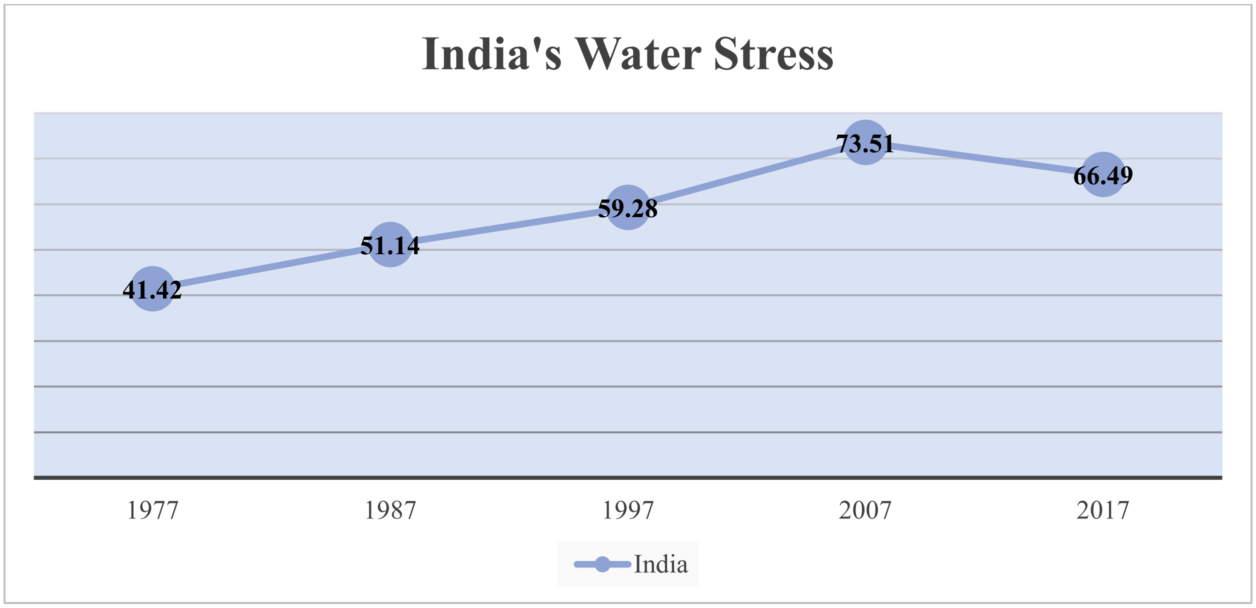
	1977	1987	1997	2007	2017
Bangladesh	16,703	12,826	10,212	8,601	7,684
Bhutan	255,770	192,186	186,817	117,315	104,619
China	2,899	2,488	2,201	2,064	1,955
India	2,929	2,331	1,909	1,615	1,427
Nepal	14,984	11,927	9,307	7,697	7,607

Source: *FAO: AQUASTAT.*

Among the riparian countries, India has already reached a water-stressed situation, closely followed by China. Figure 03 shows how India's level of water stress has increased over the years. 33 per cent of India's GBM basin land area is now in a severe water stress situation (Babel and Wahid, 2011). There are predictions that India's per capita water availability will dip down further to 1,465 m3 by 2025 and 1,235 m3 by 2050 (The Hindu Business Line, 2019). And, as per the "Water Stress Index", a country with a per capita water availability under 1,700 m3 is considered a "water-stressed" country, and if the availability further goes below 1,000 m3, the country is termed as "water-scarce" country (White, 2012).

According to the Indian government's official think-tank, NITI Ayog's report in 2018, the demand for potable water in the country will outstrip its supply by 2030 (Koshy, 2018). Considering the status quo of non-cooperation being maintained in the GBM basin, India will face a severe challenge to ensure water security within its territory in the future.

Figure 04: India's Level of Water Stress (Freshwater Withdrawal as a Proportion of Available Freshwater Resources) Over the Years

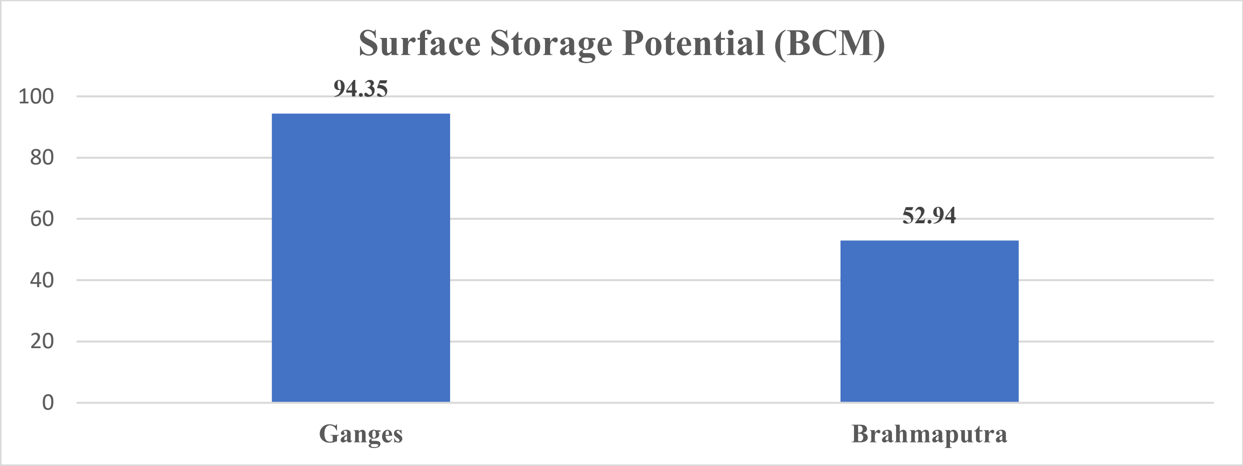


Source: *Generated from World Bank data.*

Though the situation is not that dire in other GBM riparian states compared to India and China, Figure 03 clearly illustrates how per capita renewable water resources are declining day by day. If the current trend of non-cooperation persists, almost all the countries in the basin will have a severe shortfall of water in the coming days, especially in the dry season, that will have adverse not only on the life and livelihoods of people but also on business, inland navigation, and the environment.

Seasonal variability of the water in the GBM basin demands storing excess water to meet year-round water requirements. Both the Ganges and the Brahmaputra have an enormous potential of surface storage capacity (see Figure 05). The building of multipurpose storage dams could exploit that potential by reserving excess monsoon water of the wet period that could later be released to increase the dry season water flow. The World Bank (2014) commissioned a study highlighting the high potential of multipurpose storage dams for restoring and distributing monsoon-season water in the basin. Due to the lack of cooperation on the idea of storage facilities, the monsoon water flows of the GBM basin (yearly average water flow in the GBM basin is approximately 1,350 BCM, the lion share of which is available during the monsoon) mostly drain into the Bay of Bengal without being properly utilised. Eighteen storage facilities were identified in Northeast India by the Brahmaputra Master Plan of India, 1986, with five of them having a total of 80 BCM storing capacity. Another large storage site with a gross capacity of 15 BCM was identified in the Meghna basin, which could also store monsoon water (Rasul, 2015). Bhutan and Nepal also have immense potential to reserve monsoon water by building large storage facilities. Thirty potential reservoir sites were identified in Nepal, among which nine were classified as large (greater than 5 BCM), with an aggregate gross storage capacity of 110 BCM. It is predicted that the dry season (January–May) water flow of the Ganges River can be substantially increased by seven large storage dams in Nepal (Rasul, 2015). These storage facilities could drastically improve the water availability in the region to a great extent, especially in the dry period. However, due to the absence of any collaboration among the basin states, there has not been any progress in this regard so far.

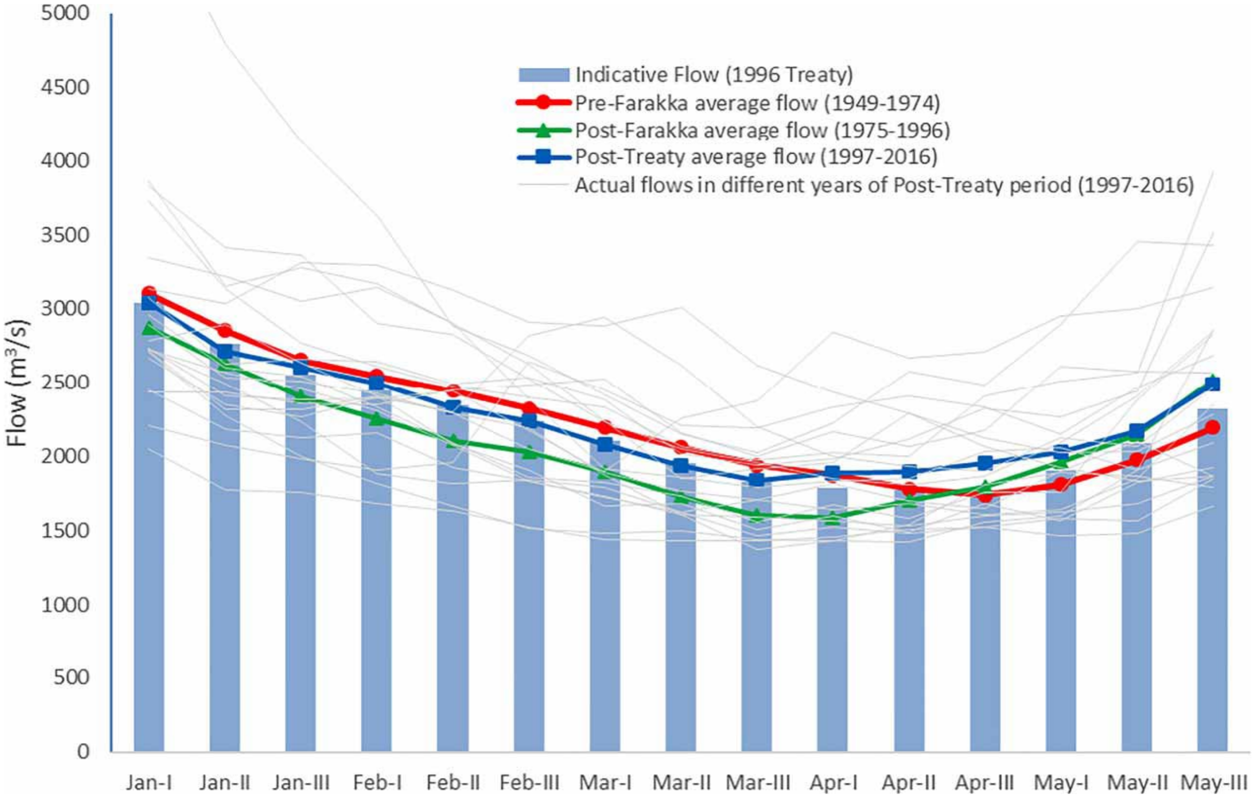
Figure 05: Surface Storage Potential of the Ganges-Brahmaputra River System



Source: *Rasul, 2015.*

Another area of concern affected by non-cooperation is unilateral water diversion projects. At the downstream of the GBM basin, freshwater availability largely depends on upstream water intervention projects. Unilateral water infrastructure development and water diversion projects by the upstream countries without proper coordination with the downstream riparian states have severely impacted the flow regime of the major rivers of the basin and their natural resource systems, thus affecting the basin's water and food security. For instance, the dry season Ganges flow significantly declined when India started operating its Farakka barrage in 1975 (see Figure 06). It took both Bangladesh and India nearly 30 years to produce a long-term cooperative agreement regarding the sharing of Ganges water that was signed in 1996.

Figure 06: Comparison of the Average Dry Season (Jan–May) Flows of the Ganges at Farakka during Pre-Farakka (1949–1974), Post-Farakka (1975–1996), Post-Ganges Treaty (1997–2016) Periods and the Actual Yearly Flows During Post-Ganges Treaty (1997–2016) period.



Source: *Rahman et al., 2019.*

However, during the time 1976 to 1993, due to the lack of proper cooperative arrangements in the Ganges basin between Bangladesh and India at Farakka, the consolidated financial losses of Bangladesh was approximately BDT 113,240 million, which was roughly US$ 3,171.99 million (1991 price index, considering 1 US$ = 35.70 BDT) (Department of the Treasury, n.d.; Swain, 1996). This means that, due to a lack of cooperation from 1976 to 1993, the annual average financial loss for Bangladesh was approximately BDT 6,661.18 million (approximately US$ 186.59 million), which was around 0.6 per cent of the country's GDP at that time (World Bank, n.d.). Considering the economic loss of 0.6 per cent of the current GDP, the annual loss of non-cooperation would be approximately BDT 180,663.88 million (approximately US$ 2,125.48 million, considering 1 US$ = 85 BDT in 2021) (BBS, 2021; Worlddata.info, n.d.).

Table 06: Financial Loss Due to Lack of Cooperation in the Ganges Basin for Bangladesh

Item	Financial Loss in Million BDT (1991 price index)
Agricultural	37,000
Fisheries	63,000
Forestry	9,900
Industry	1,150
Public health	1,180
Navigation	560
Dredging	560
(G. K. Intake channel and Gorai Intake Channel)	450
Total	113,240

Source: *Swain, 1996.*

Another prime example of unilateral hydrological structures and their adverse impact on the flow of the river is on the Teesta River, a tributary to the Brahmaputra. Since the state government of West Bengal, India, commissioned the Teesta Barrage Project in 1976, seven hydropower stations have been built to date on the Teesta River and its tributaries (Rahman et al., 2020). The Indian government also built Gazoldoba Barrage in India in 1987, which was followed by another barrage constructed by the Bangladesh government in Lalmonnirhat district in 1990. Unfortunately, due to the lack of adequate water, there remains a huge gap between the potential benefits and actual benefits that have been gained so far. The situation illustrates how unilateral actions, river intervention projects, and non-cooperation among the stakeholders have impacted the river flow and hydrological regime of the rivers.

3.1.2 Deteriorating Water Quality & Associated Health Hazards

Another worrisome issue for the entire GBM basin is the deteriorating water quality, i.e., the presence of various pollutants like oils, heavy metals, microbes, fertilisers, pesticides, herbicides, excess amount of nutrients, etc. The annual volume of wastewater discharge in the GBM basin is 92 billion m3 per year (Babel and Wahid, 2008). Unsustainable water usage, along with unplanned urbanisation, rapid industrialisation, and other socio-economic activities, in the basin are mainly responsible for producing massive amounts of wastewater and polluting the basin's freshwater resources. Millions of people in the basin, especially in India, Bangladesh, and Nepal, do not have access to clean water and suffer from a lack of safe drinking water (see Table 07). In addition, an enormous number of people do not have safely managed sanitation facilities either.

Table 07: Population Without Access to an Improved Water Source & Safe-drinking Water in the GBM Basin

Country	Number of people Without Access to an Improved Water Source (in million) (2015)[1]	Total Population Without Access to Safe Drinking Water (2017)[2]
Bangladesh	20.47	13.09%
Bhutan	0	0%
China	63.31	4.5%
India	77.3	5.9%
Nepal	2.27	8.4%

Source: *[1] WHO/UNICEF, cited in https://ourworldindata.org/water-access; [2] FAO:AQUASTAT.*

As a result, in the GBM basin, a sizeable number of the morbidity is related to impure or contaminated water usage (FAO, 2011). For instance, 21 per cent of India's disease outbreaks are water-borne (Zolin, 2015). In the absence of a holistic approach to monitoring water quality and joint initiatives to address the water pollution problem, the situation is getting worse day by day. Lack of cooperative arrangements in conserving the water quality implies several significant health risks arising from the use of low-quality water, contaminated water flow, untreated sewage, industrial wastewater, and use of toxic pesticides/herbicides from agricultural fields. For instance, in the Ganges River, around 1.3 billion litres of raw sewage is directly dumped into the river in India every day. In addition, approximately 260 million litres of industrial waste, mostly untreated, are discharged in the river annually; pollution also transpired from the use of fertilisers and pesticides, and six million tons of fertilisers along with nine thousand tons of pesticides are used annually within the river basin that basically ends up in the river (Babel and Wahid, 2011). Polluted water increases the incidences of water-borne diseases; thus, augmenting expenses related to treatment and forcing the riparian states to make additional investments in the health care sector. The death rate from unsafe water sources is also extremely high among the riparian countries of the basin (see Table 08). Research findings have shown that hydroclimatic extremes, like floods and droughts, along with the reduction in freshwater flow in the GBM basin, contribute to the spread of water-borne diseases, like cholera, in the basin's downstream states, such as Bangladesh (Akanda, 2012). What is more, degraded water quality can also become a source of conflict among the riparian countries (Pandey, 2011).

Table 08: Mortality Related to the Use of Unsafe Water Sources

Country	Death rate from unsafe water sources (deaths per 100,000) in 2017	Share of deaths from unsafe water sources in 2017
Bangladesh	25.29	2.86%
Bhutan	16.63	2.03%
China	0.32	0.04%
India	67.46	5.75%
Nepal	52.71	4.89%

Source: IHME, Global Burden of Diseases, cited in https://ourworldindata.org/water-access.

What is more, all the riparian states in the GBM basin have been experiencing high economic growth (at least until the COVID-19 pandemic) associated with increased industrial activities. It is to be noted that industry heavily relies on water for all stages of manufacturing and production. Nearly 70 per cent of the industrial waste produced in the GBM basin is dumped in the river system untreated (Babel and Wahid, 2008). An increase in industrial activities implies a high discharge of toxic substances, heavy metals, toxic sludges, and other pollutants in the waterways. The absence of coordinated effort, a lack of joint monitoring, and no strong regulatory measures would severely hamper the quality of water resources of the basin, posing a grave threat to the public health safety of the riparian countries.

3.1.3 Loss of Life & Livelihoods Due to Disasters

The GBM region is one of the global disaster hotspots (Haque and Nicholls, 2018; UNESCAP, 2019). The region is highly vulnerable to multiple natural hazards, among which water-borne disasters are the most prominent. Every year, all riparian states of the basin have to withstand the worst of hydrological disaster, especially floods, from moderate to severe intensity. Floods are the primary source of economic damage from disasters in the region, as well as one of the major causes of deaths (see Table 09). For instance, the 2007 flooding incidence in the GBM basin affected approximately thirteen million people and caused economic damage of more than a billion dollars (Huda and Alli, 2018). In the last decade, over 135 million people in the GBM basin were affected by flooding, which was also responsible for around US$ 57 billion worth of economic damage (EM-DAT Public, n.d.). In addition,, a total number of 18,710 people die in Bangladesh, India, and Nepal due to flood disasters (EM-DAT Public, n.d.). The main concern is that the frequency and intensity of flooding, along with other disasters, have increased manifold in the last couple of decades due to the adverse impact of climate change (Swain, 2018, Islam 2017). During the wet seasons, a large part of the GBM region is now experiencing devastating floods more than ever before, taking a heavy toll on the life, infrastructure, and livelihoods of the people living in the area. Absence of a coordinated disaster management arrangement can be largely blamed for greater flooding risks in the region along with increased flood damage.

While it is not possible to totally prevent floods, the damage associated with them can be reduced through joint initiatives by the GBM riparian states. One effective way in this regard is managing floods on a basin-wide level. Unilateral action in managing floods by one riparian state without taking into consideration the entire basin is counterproductive and severely affects the hydro-morpho-dynamics of the river. Unfortunately, cooperation in disaster management on a basin-wide level is extremely limited in the GBM region. Limited cooperation in the form of data exchange exists bilaterally, which is not enough, especially for flood forecasting with adequate lead time. A lack of basin-wide comprehensive disaster management arrangements among the GBM riparian countries is also hurting the national disaster management programs in respective states and increasing disaster-related costs and damages. Table 09 reveals the flood-related deaths and damages, which are remarkably high.

Table 09: Flood Disaster-Related Deaths & Damage in the GBM Basin

Country / Indicators	Flood Occurrence (WRI) (ranges from 0-5, where 0 is lowest and 5 is highest)[1]	Total Number of People Affected by Floods (2010-2020)[2]	Total Number of People Dying in Floods (2010-2020)[3]	Total Estimated Damages (in US$) from Flood Disasters (2010-2020)[4]	Average Annual Loss by Floods (million US$)[5]	Hazard Contributing to Annual Average Loss (Flood)[6]
Bangladesh	4.9	35,204,678	910	1,605,713,000	2,463.17	79.9%
Bhutan	4.7	-	-	-	54.65	87.3%
India	3.9	98,983,372	16,040	55,288,413,000	7,471.82	76.1%
Nepal	4.5	2,142,312	1,771	941,671,000	143.34	82.9%

Source: *[1] FAO:AQUASTAT; [2 3 4] EM-DAT; [5 6] Preventionweb.*

3.1.4 Higher Transportation Cost Due to Lack of Water Connectivity

Since time immemorial, the GBM river basin and its principal tributaries have been a crucial connectivity route for business, trade, and transportation. These rivers offer natural and century-old navigation channels connecting various parts of the GBM basin and have played a crucial role in the region's socio-economic development. During British rule, the river transportation in the Brahmaputra stretched from the Bay of Bengal to all the way up to Tejpur and Dibrugarh in Assam (Gyawali, 2016). In the case of the Ganges River basin, river transportation was extended deep into the United Provinces (present-day Uttar Pradesh) (Gyawali, 2016).

However, in recent years, the scope of inland transportation and water transit in the basin has been severely curtailed, primarily due to various reasons like lack of partnership among the riparian states, numerous water diversion projects in the upstream and arbitrarily built water infrastructure, reduction of water flow in the river, etc. In the last couple of decades, Bangladesh has lost almost 15,6000 km of inland waterways, which now stretch barely 5,968 km. The route is further reduced to 3,865 km during the lean period, mainly due to insufficient water flow in the river (Hasan et al., 2018). India has only 14,500 km of inland waterways and navigation routes, but the full potential of the country's inland transportation is yet to be realised (IWAI, 2016).

The full potential for inland water transportation in the GBM basin is enormous. The development of this sector is crucial from energy economics and efficiency perspectives, which is calculated based on the amount of cargo weight a one horse-power engine can move (Gyawali, 2016). As per the calculation of the author (Gyawali, 2016), it is 150kg for trucks on the road; for the railway, the weight is 500 kg. But, in the case of inland water transportation, it is 4,000kg. Calculated in terms of energy, inland water transportation uses up to 230 MJ/1000 tons-km. The consumption nearly doubles (430 MJ/1000 tons-km) for rail transportation and four times (920 MJ/1000 ton-km) for trucks on the road. Since energy is considered a key contributor to transportation costs, efficiency in energy consumption entails cost efficiency in the transportation sector (IBRD/World Bank, 2011).

Besides, inland water transportation is crucial for Nepal, Bhutan, and Northeast India, as their economic development is substantially hindered due to their landlocked positions. These landlocked countries and areas mostly depend on road transportation for their trade and commerce, which is expensive as well as time-consuming (Rasul et al., 2019). They could have direct sea access by using the GBM river basin's waterways, thus facilitating their trade and commerce. Besides, compared to other modes of transportation, water transport is cost-effective. For instance, in Nepal, road transportation is ten times costlier than water transportation. Despite that, the country mainly depends on road transportation to transport freight, where only 130,000 tons of goods are transported annually via its river system (see Table 10) (Rasul, 2015). The cost to transport 100,000 tons of freight from Kolkata to Kathmandu by road is approximately US$ 943,000, while it would cost nearly ten times less (US$ 96,000) if the freight were transported by water (Rasul, 2014).

Table 10: Cost & Trading Time to Export & Import a Container

Country	Export		Import	
	Time (days)	Cost (US$ per container)	Time (days)	Cost (US$ per container)
Bangladesh	28	1,281	33	1,515
Bhutan	38	2,230	37	2,330
India	17	1,332	21	1,462
Nepal	40	2,545	39	2,650
Global average	21.5	1,559	24	1,877

Source: *World Bank (2018), cited in Rasul et al. (2019).*

Inland water transportation is comparatively a cleaner option to transport freight and manage logistics, emitting less $CO2$ per ton-km, compared to other modes of transportations like rail or road (IBRD/World Bank, 2011). Based on a report (CE Delft, 2008) in the Netherlands, for inland water transportation, the carbon emission varies from 25 gr CO2/ton-km to 70 gr CO2/ ton-km while carbon emission of lorry and trucks on roads are approximately 60 gr CO2/ton-km to 125 gr CO2/ton-km and rail transportation (diesel) is approximately 25 gr CO2/ton-km to 70 gr CO2/ ton-km (IBRD/World Bank, 2011). Therefore, developing the IWT sector will allow the riparian states of the basin to protect the environment by reducing their carbon emissions from transportation. According to Rasul et al. (2019), cargo passing through Birgunj into Nepal in 2008/2009 was 406,275 tons; transporting this same amount of cargo through the water instead of the road would reduce carbon emissions by approximately 60,000 tons.

3.2 Energy Sector

The GBM basin has the potential to promote growth and development in the entire region through collaborative partnerships among the riparian states in different water-related projects. Unfortunately, non-cooperation among the co-riparian countries has caused low water use efficiency and discontinuation of various hydro projects with tremendous potential for the region's economic progress and social development. Hydropower generation is one among many instances from which basin states are deprived of substantial benefits due to a lack of cooperation.

3.2.1 Untapped Hydropower Potential, Higher Energy Price & Energy Insecurity

Energy is considered the lifeline for modern development. Access to clean and cheap energy is presently considered a necessary condition for a country’s economic growth, industrialisation as well as human development, improving socio-economic conditions, and poverty alleviation. For the last couple of decades, the riparian countries of the GBM basin have been experiencing accelerated economic growth, rapid industrialisation, and urbanisation. The region's annual average GDP growth rate is 6 per cent per capita. It has been predicted the region will also maintain this impressive growth rate in the future. Access to an uninterrupted and sustainable energy supply would be instrumental in maintaining that high growth rate as energy access is critical for economic activities.

Energy demand has already skyrocketed in the region, creating a gap between demand and supply. For instance, the demand for electricity in NE India was 9,298.73 GWh in 2010, which is predicted to reach 35,982.49 GWh by 2030. The electricity demand of Nepal will be 15,000 GWh by 2025. In the case of Bangladesh, the electricity demand will grow by 10 per cent per annum (SFG, 2011). According to the Bangladeshi government projection, the demand will be 52 GW in 2041 compared to the installed capacity of 20 GW in 2019 (GOB, 2016). From the analysis of Rahaman and Hossain (2020), the gap between the demand for electricity and the generation capacity of Bangladesh in 2025, 2030 and 2035 would be 31.4 GW, 50.3 GW and 71.5 GW. So, securing a long-term sustainable energy supply has been and would become a major challenge for the riparian states. What is more, countries like India, China, and Bangladesh heavily depend on fossil fuels to meet their energy requirements and have to count on energy imports (see Table 11), which are as high as 34 per cent of their total energy use. 70 per cent of electricity generated in India comes from coal, which is one of the most carbon-intensive energy sources, responsible for severe environmental pollution (Clientearth.org., 2020; Rahaman and Hossain, 2020).

Table 11: Current Energy Situation in the GBM Basin

Country	Bangladesh	Bhutan	China	India	Nepal
Share of primary energy comes from renewables (2020)[1]	0.64%	-	14.86%	8.96%	-
Share of primary energy from fossil fuels (2019)[2]	99.36%	-	85.14%	91.04%	-
Share of electricity produced from renewables (2020)[3]	1.40%	100%	29.02%	22.22%	100%
Share of electricity produced from fossil fuels (2020)[4]	98.60%	0%	66. 17%	74.46%	0%

Population without access to electricity (2019)[5]	7.8%	0%	0%	2.2%	10.1%
Per capita electricity consumption (2020)[6]	488 KWh	8,664 KWh (2019)	5,297 KWh	972 KWh	189 KWh (2019)
Energy imports (% of energy use) (2014)[7]	17	-	15	34	17
Value lost due to electrical outage (% of sales)[7]	5.5 (2013)	3.7 (2015)	-	3.7 (2014)	17.0 (2013)

Source: *[1 2 3 4 6] ourworldindata; [5 7] World Bank; [8] USAID, 2016.*

The GBM river system and its tributaries and distributaries have huge potential for hydropower generation (Amjath-Babu et al., 2019; Rahaman and Hossain, 2020; Rasul, 2015; Rasul et al., 2019). For instance, Nepal's theoretical hydropower generation potential is 83,280 MW, with economically feasibility at 40,000 MW; however, until 2019, the country had 1,127 MW of installed capacity (IHA, 2019a). India's hydropower potential is estimated at 149,000 MW; the country has already harnessed 50,071 MW from installed capacity and is now the fifth-largest hydropower producer by capacity (IHA, 2019b). Bhutan's hydropower potential is 30,000 MW, among which the economically feasible is 23,760 MW. As of 2019, the country had 2,326 MW of actual installed hydropower capacity (IHA, 2019c). So, in total, the entire GBM basin has more than 200,000 MW of hydropower potential. Table 12 shows the hydropower potential of the riparian states of the GBM basin and their actual installed capacity.

Table 12: Hydropower Potential & (%) Exploited by the Riparian States of the GBM Basin

Country	Bangladesh	Bhutan	India	Nepal
Total hydropower potential (MW)	800	30,000	149,000	83,280
Economically feasible potential (MW)	n/a	23,760	84,000	40,000

Actual installed hydropower capacity (MW)	230	2,326	50,071	1,127
Currently exploited (% of total potential)	28.75	7.75	33.6	1.35
Currently exploited (% of economically feasible potential)	n/a	9.79	59.6	2.82

Source: *International Hydropower Association; Rasul, 2015.*

It appears that the riparian states have only harnessed less than one-fourth of their hydropower potential to date, in contrast to developed countries, like Switzerland, Norway, Sweden, Japan, where they have materialised nearly 70 per cent, 68 per cent, 68 per cent and 56 per cent of their hydropower potential respectively (Biswas 2008; IHA 2020). Some impediments to materialise hydropower potential in the basin include insufficient financial resources, limited technical ability, lack of grid connectivity and support infrastructure, absence of forward-looking policy outlook, alongside the risk of single buyers. Riparian states, namely Nepal and Bhutan, do not have the required technology and investment to build mega hydropower projects. Besides, they also need collaboration agreements with the neighbouring countries and proper infrastructural facilities, including regional grid connectivity, to sell the surplus hydropower. India is already involved with both Bhutan and Nepal in different hydropower projects. Though India's partnership with Bhutan is considered somewhat of a good example of a collaborative arrangement to garner benefit from shared water sources, there is a belief in Nepal that the country has been deprived by India and treated unfairly under the past water treaties (Swain, 2018). Besides, India is also facing increasing opposition from environmental groups and affected communities within Nepal against its water development projects. The country has also failed to undertake its recently planned dam projects like Pancheswar on time, pushing Nepal to explore Chinese investment and collaboration to develop its freshwater resources for the last ten years. However, India's opposition to China's increasing influence in its perceived area of influence has made it difficult for China to collaborate with Nepal in its water development project successfully. The lack of a collaborative mindset has resulted in a zero-sum outcome for the riparian states in the basin.

The lack of cooperation in tapping hydropower potential means lost opportunities to accrue multiple benefits, like ensuring low-carbon energy supply, facilitating clean energy transition, reducing carbon emissions, supporting economic growth, and alleviating poverty, etc. Considering the global average, harnessing hydropower is still cheaper than other alternative energy sources (Vaidya et al., 2021). Besides, hydropower is a relatively environmentally friendly energy source that could reduce carbon emissions. Without alternative clean energy sources, the C02 emissions from power generation in the GBM riparian countries would increase manifold in the future (Table 12). So, hydropower generation and inter-grid connectivity and power trade could assist the riparian states in contributing to mitigating global warming by making the energy sector transition to a low-carbon energy source. At present, Bhutan offsets nearly 4.4 million tons of C02e through exporting hydropower to its neighbours (Parikh et al., 2016). The country has the potential to offset up to 22.4 million tons of C02e per year by 2025 by exporting electricity in the region produced from its clean hydroelectricity projects (Parikh et al., 2016). What is more, hydropower development could boost the region's economic progress and catalyse industrialisation. For instance, Nepal could gain US$ 5 billion from the hydropower development only from the Koshi basin alone (World Bank, 2014). A recent study (Amjath-Banu et al., 2019) conducted on the Koshi River basin also reveals an estimated benefit of US$ 2.3 billion per year against the yearly cost of US$ 0.68 billion. Another study conducted by Wijayatunga and Fernando (2015) estimated annual economic benefits ranging from US$ 105 million to US$ 1,840 million under different scenarios from the development of hydropower generation projects in Bhutan and Nepal. According to Pandey (2020), for approximately US$ 85 million in costs, six ongoing and planned power trade projects in the basin would generate benefits worth US$ 2,549 million.

It also needs to be kept in mind that energy generated from hydropower is not bankable, and if not developed, the resource is lost forever, so does the potential benefit, which could be used for development purposes in the region. Therefore, untapped hydroelectricity potential is not only a missed opportunity to utilise invaluable freshwater resources; but also, a lost chance for the riparian states to contribute to climate change mitigation, along with meeting their energy demands.

Table 13: CO_2 Emissions Forecast from Power Generation (Million tons of CO_2)

Country	2030	2040
Bangladesh	161	265
Bhutan	0	0
India	1,856	2,667
Nepal	0	0

Source: *Timilsina et al., 2015.*

3.3 Food Sector

3.3.1 Reduction of Agricultural Productivity & Output

One of the crucial drivers of the GBM basin's food security is agriculture, which also accounts for nearly 12 to 24 per cent of the riparian countries' GDP. They produce food not only for internal consumption but also earn a good amount of foreign exchange by exporting crops and livestock products (see Table 14). Besides, in the case of employment generation, this sector employs almost half of the basin's population. For instance, in Nepal, around 72 per cent of the labour force is employed in the agricultural sector. The share is as high as nearly 57 per cent in Bhutan, and 43 per cent in India (see Table 15). That illustrates how important this sector is for the economy of the GBM basin as well as its food security.

Table 14: Agriculture Statistics in the GBM Basin

Indicators	Bangladesh	Bhutan	China	India	Nepal
Agricultural production (crops and livestock) (Tons) (2019)[1]	141,024,415	701,002	-	1,549,319,125	32,601,158
Agricultural products (crops and livestock products) export (Tons) (2019)[2]	644,682	68,084	-	40,155,495	619,076
Agricultural products (crops and livestock products) export value (US$ 1000) (2019)[3]	555,088	31,149	-	33,657,504	427,380
Agriculture (value added % of GDP) (2019)[4]	12.7	15.8	24.3	7.1	16
Share of the labour force employed in agriculture (2017)[5]	39.07%	56.78%	71.74%	17.51%	42.74%

Source: *[1 2 3] Data generated from FAOSTAT; [3] World Bank; [4] World Bank, cited in ourworldindata.*

Agriculture in the GBM region is highly dependent on water from the main rivers and their tributaries and distributaries. This sector accounts for more than 90 per cent of water withdrawal in Bhutan, India, and Nepal, and 87 per cent of water withdrawal in Bangladesh (see Table 15). The main staple foods in the region, i.e., rice and wheat, need a massive amount of water, which can be as high as 1000 tons to produce only one ton of grain and largely depends on irrigation during the lean period (Rasul, 2015). The entire basin is already one of the intensively irrigated areas globally, incorporating around 35.1 million hectares of area equipped for irrigation, among which India shares 82.2 per cent of the area. 14.0 per cent is in Bangladesh, 3.3 per cent in Nepal, 0.4 per cent in China, and 0.1 per cent lies in Bhutan (FAO, 2011).

Table 15: Agricultural Water Withdrawal in the GBM Basin

Indicators	Bangladesh	Bhutan	China	India	Nepal
Agricultural water withdrawal (10^9 m3/year) (2017)[3]	31.5	0.318	385.2	688	9.32
Agricultural water withdrawal as % of total water withdrawal (%)[4]	87.82	94.08	64.4	90.41	98.14

Source: *FAO: AQUASTAT.*

Since the agricultural sector is responsible for the lion's share of water withdrawal in most riparian states of the GBM basin, reduction of available water in the river system, specifically during the dry period, would severely threaten the respective country's effort to attain self-sufficiency in food together with their economy. Suboptimal regional water governance has already threatened the agricultural productivity in the region, which would further be aggravated significantly by the adverse impact of climate change and the growing competition for water by the riparian states. There is no denying that the demand for food will increase manifold concurrent with the region's ever-increasing population (see Table 16). It has been predicted that, by 2050, the population of all the riparian states except China will increase by more than 15 per cent compared to 2019. India alone would have nearly 1.64 billion people by that time to feed. It is highly unlikely for the countries in the GBM basin that additional land could be brought under cultivation for more food production, as land is very scarce in the region. Therefore, the only option for the riparian states would be the intensification of agriculture that will also require the expansion of irrigation facilities, consumptive use of water. All these would increase the competition among the riparian states for water and put tremendous pressure on the available freshwater resources.

Table 16: Population Related Statistics in the GBM Basin

Indicators	Bangladesh	Bhutan	India	China	Nepal
Population (2019)[1]	163.05 million	0.763 million	1,397.715 million	1,366.417 million	28.608 million
Population Projection (2050)[2]	192.57 million	.904 million	1.64 billion	1.4 billion	35.32 million
% Increase	18.10	18.48	17.33	2.48	23.46

Source: *[1] World Bank; [2] UNDP, cited in ourworldindata.*

Increased competition and lack of cooperation in the water sector means less water from the river would be available for agriculture. That being so, crop production would be hampered due to the shortage of irrigation water, depletion of soil moisture, lowering of the groundwater table, and intrusion of saline water, all of which are already prevalent in many parts of the GBM basin. In such a situation, the upstream countries might exploit their position to partly counterbalance the increasing pressures over water by withdrawing more water from the basin, resulting in less water being available for the downstream countries and increasing their vulnerability. Countries like Bangladesh would be at even more at risk due to insufficient water to meet their irrigation needs, which will further weaken the cooperative atmosphere in the basin.

Limited water availability also affects the salinisation of water and soil in downstream regions, further hampering the potential of agricultural productivity of the countries located there. The intrusion of saline water through estuaries is mainly regulated by the flow and velocity of freshwater from the upstream, strength of the tides, and turbulence in the river. If the flow of the water is reduced, the saline water starts advancing inland. This is the most severe impact of upstream water flow reduction. Bangladesh is one of the worst affected countries by this problem. The entire southern part of the country is highly exposed to the tidal influences of the Bay of Bengal and vulnerable to salinity problems. Hence, an increase in salinity, both in surface water and groundwater, would have a severe bearing on the agricultural productivity, fish habitat, forestry, and industry of the country. In the case of Farakka Barrage water diversion that was responsible for the reduction of the Ganges River flow, there was severe adverse impact recorded in the southwestern region of Bangladesh due to increased salinity (Bhuiyan and Hossain, 2006; Gain and Guipponi, 2014; Hassan, 2019; Rahman and Rahaman, 2018). That resulted in exceeding the crop tolerance limit in the area due to incomplete leaching by floodwater and rainfalls. The deteriorated soil condition has resulted in a significant decrease in crop yield in the region. Due to increased groundwater abstraction, agricultural drought conditions also prevailed in the area, taking a heavy toll on agricultural production and caused a massive economic loss. According to one study, the annual damage in the agricultural sector alone was worth US$ 600 million (Khan 1996). The potential loss would be much higher if the same thing happened in the Brahmaputra and

Meghna basins, which might permanently damage the ecosystem and biodiversity of the highly productive freshwater wetlands of the region, resulting in an ecological disaster, gravely hampering the food security of the region.

Any reduction in food production would have severe consequences in the region. In the context of water scarcity vis-à-vis food insecurity, the countries in the basin would be forced to organise additional imports of food from water-rich countries to meet their internal demand, increasing the cost of the country's total imports. There is a huge possibility that future food insecurity might be accompanied by a flashpoint of tension that could lead to renewed conflict centred around water among the riparian states.

3.3.2 Reduction in Fisheries

Fisheries remains a vital sector right after agriculture as far as food security is concerned. The industry provides 60 per cent of animal protein in Bangladesh and nearly 13 per cent of animal protein in India (Barik, 2017; Bogard et al., 2015). This sector also has enormous potential for economic development in the GBM region by providing employment and income as well as nutrition, especially to the people who have limited scope of earnings.

Despite that, this sector is facing a tremendous challenge in recent years. Though fish production has increased manifold, in-land open water fisheries resources have been depleting gradually in the GBM region (Shamsuzzaman et al., 2020). According to World Bank data, 227 fish species are now threatened in India. In China, the number is 136, and in Bangladesh, it is 29 (see Table 17). The main reasons behind that are biodiversity loss in the wetland ecosystem of the basin, severe water pollution, environmental degradation, and lack of water flow in the river; many of which are the outcome of unilateral water diversion upstream of the GBM basin and lack of cooperation in joint management of freshwater resources. Lowering the water level by numerous water interventions has distressed fish species directly, mainly because of loss of habitat and prevention of regular fish migration pathways. Case in point, the Ganges River water diversion has caused a substantial reduction of Hilsa and Carp species, along with a total of 109 Gangetic species. More concerning is how many water infrastructures have already been proposed and approved in the upper catches of the basin, which would further endanger the fish species.

Table 17: Fish Species Threatened in the GBM Basin

Country	Fish species threatened (2018)
Bangladesh	29
Bhutan	3
China	136
India	227
Nepal	7

Source: *Data generated from World Bank*.

Non-cooperation among the co-riparian in the basin severely limits the scope for the riparian states to reap the full benefit of the fisheries sector. The basin currently has a vast number of undernourished people. The number is as high as 14.4 per cent of the entire population in India and 14.1 per cent of the population of Bangladesh (see Table 18). Nurturing of the fisheries sector could help to reduce that number. Additionally, the loss of open water inland fisheries has a direct impact on employment. Many fishers in both India and Bangladesh have lost their livelihoods due to the reduction of catches and have moved to other areas in search of survival.

Table 18: Prevalence of Undernourishment in the GBM Basin

Country	Prevalence of undernourishment (3-year average) % (2017)
Bangladesh	14.1
Bhutan	-
China	8.6
India	14.4
Nepal	6

Source: *FAO:AQUASTAT.*

Another area affected by limited cooperation is the Hilsa economy. Hilsa production is particularly important for Bangladesh and accounts for 11 per cent of the total catch of fish produced each year (IIED, 2016). The economy associated with it is also important since the livelihood of approximately 287,000 fishers depend directly on Hilsa fishing, and around 2–2.5 million people engage in the Hilsa production supply chain–processing, transportation, marketing, and other post-harvest activities (IIED, 2016; Porras et al., 2017). Hilsa is also popular in India, especially in West Bengal, where it is considered a delicacy. However, the international trade of Hilsa is heavily regulated. Bangladesh lifted the Hilsa fish export ban in 2018. The country issued special permission to export 1,450 tons in 2020. Considering the economic significance of the Hilsa economy, cooperation between Bangladesh and India, specifically West Bengal, in this regard will not only economically benefit both countries but also open the possibility of improving "fish diplomacy" between Bangladesh and West Bengal, which might be able to build trust between the Bangladeshi government and the government of West Bengal (Swain, 2018).

3.4 Environment & Climate Sector

3.4.1 Increased Environmental Stress & Degradation of Ecosystem

The GBM basin is well-known for its biodiversity and ecosystem functions, for which freshwater of the river is crucial. Unfortunately, this entire biodiversity and ecosystem are now threatened. The lack of consideration towards ecosystem requirements has put tremendous stress on the existing flora and fauna along with their habitat, hampering their smooth functioning and survival.

Water scarcity, lack of adequate water flow in the river, depletion of groundwater, increased salinity in water and soil, and lack of moisture in the root zone have already affected many parts of the GBM basin, especially the countries located downstream. The adverse impact of environmental degradation means loss of employment and economic benefit from the resources. For instance, increasing salinity intrusion in the southwest coastal areas of Bangladesh has already wreaked havoc on the country's local environment vis-à-vis socioeconomic conditions. Lack of coordinated effort by the riparian states to preserve the GBM basin's environment further degenerates the situation.

One of the critical ecologically sensitive areas in the GBM basin is the Sundarbans, the largest single block of mangrove forest on earth, located at the Ganges delta. With nearly 10,000 square kilometres, the forest stretched over the southwestern part of Bangladesh and the south-eastern part of India. 60 per cent of the forest, comprising 6,017 square kilometres, is located in Bangladesh, and the remaining 3.983 square kilometres is on the Indian side (Rahman and Novera, 2018). Nearly 22 per cent of the forest is covered by water bodies like rivers, creeks, canals, etc., making it highly dependent on the freshwater resources of the Ganges River basin.

The Sundarbans is of significant importance for both Bangladesh and India, not only due to its support of a wide variety of flora and fauna and its providence of numerous ecosystem services, but also its sheer contribution to the employment of some 500,000 to 600,000 people for at least half the year (Islam, 2017). Besides, the forest works as a buffer zone in protecting the coastal regions of Bangladesh and India from the devastating cyclonic storm surges and flooding from the Bay of Bengal. Considering its ecological significance for the world, the Sundarbans has been recognised as a "UNESCO World Heritage Site" and a "RAMSAR" site.

In recent times, the ecological sustainability of Sundarbans has been severely threatened. Unilateral water intervention and water diversion projects in the upstream of the GBM basin, like the Farakka barrage, has significantly reduced the freshwater flow in the Ganges distributaries like Gorai, Kobadak, Mathabhanga, Chandana, and other rivers, hampering the forest's ecological balance and increasing salinity in both surface and groundwater along with nearby land areas (Nishat and Chowdhury, 2019; Rahman and Novera, 2018; Rahman, Navera and Bose, 2019). The result of excess salinity is damage to vegetation, specifically the Sundari (Heritiera fomes) trees that cannot tolerate high salinity and produce nearly 60 per cent of the commercial timber of the area, reduction of agricultural productivity, forestry, and fishery, and a change in Sundarbans's sustainable landscape. It has been estimated that the cost of environmental damage associated with the degradation of the ecosystem and the loss of biodiversity in the Sundarbans area is approximately US$ 107 million per year (Krishnan, 2015).

What is more, this mangrove forest is highly vulnerable to the adverse impact of climate change and subsequent sea-level rise (Islam, 2017; Loucks et al., 2009; Nishat and Chowdhury, 2019). Recent satellite images have already discovered that the Sundarbans has already lost approximately 4 per cent of its land area due to land erosion in the last few years (Krishnan, 2015). Nishat and Chowdhury (2019) have predicted that freshwater mangroves might be totally replaced by saline water mangroves by 2050 due to climate change, along with a decrease in the total area under true mangroves and a significant loss of biodiversity. According to a World Bank prediction (World Bank, cited in Nishat and Chowdhury, 2019), a 10 cm sea-level rise will inundate at least 15 per cent of the Sundarbans, and the total forest might be inundated if there is a 60 cm sea-level rise (see Table 19). As a result of climate change, sea-level rise would be a severe concern for the Sundarbans, posing a threat to the long-term persistence of this precious forest and its vast biodiversity and ecosystem. Unfortunately, coordinated efforts to save the Sundarbans is highly limited in the basin.

Table 16: Impact of Sea-Level Rise on the Sundarbans

Sea-Level Rise (cm)	Inundated Area of the Sundarbans
10	15%
25	40%
45	75%
60	100%

Source: World Bank, cited in Nishat and Chowdhury, 2019.

3.4.2 Adverse Impact of Climate Change

Riparian countries in the GBM basin are widely recognised as extremely vulnerable countries in the face of climate change. Bangladesh ranked 7th and Nepal 10th in the Long-Term Climate Risk Index (2000-2019), in which India also ranked 20th among 180 countries in the world (Eckstein, Künzel, and Schäfer, 2021). Countries in the region have already started experiencing a change in climatic conditions, which is expected to become much worse in the near future. According to Masood et al. (2014), by the end of the 21st century, the entire GBM basin is projected to be warmer by 3°C. The temperature of the Brahmaputra basin will increase by 3.2 °C; the Ganges basin will see a 2.9°C increase, and the Meghna basin 2.6°C. The mean precipitation is also projected to be changed by +14.0, +10.4, and +15.2 per cent. The changes of mean runoff are predicted to be +14, +15, and +18 per cent in the Brahmaputra, Ganges, and Meghna basin, respectively. According to Islam et al. (2017), the monsoon precipitation is predicted to increase by 0.64 and 1.40 mm per day, while winter precipitation might decrease by 0.05 mm per day during the time 2011 to 2041, compared to the baseline period. Annual runoff in the region is also predicted to increase by 7 to 12 per cent by the year 2050.

Change in evaporation and temperature would adversely affect the precipitation and ice-melting pattern, hence raise the variability of the water flow, and alter the quality and quantity of the GBM basin's freshwater resources. Some of the adverse impacts of the changes include, but are not limited to, the occurrence of heavier rains, changes in the spatial and temporal distribution of rainfall, higher runoff generation, low groundwater recharge, melting of glaciers, changes in evaporative demands, and water use patterns in agriculture, etc. (FAO, 2011; Islam et al., 2017, Rahman et al., 2020). The uneven distribution of freshwater resources and its spatial-temporal variability is already a major concern in the GBM basin. The basin receives the lion's share of its annual flow during the four months of the monsoon period. Therefore, the mismatch between water demand and the seasonal supply of water in the basin is common. Since the monsoon flow will increase due to the impact of climate change, that would result in more frequent, devastating floods. Increased uncertainty of water availability would also pose significant challenges to the region's overall agricultural productivity. The outcome of these changes would be severe disruption of the food supply chain, stalled economic development, loss of life and property, and degradation of the basin's biodiversity and ecosystem. The Asian Development Bank (2014) commissioned study predicted that the countries like Bangladesh, Bhutan, India, and Nepal, along with Sri Lanka and the Maldives, would suffer an economic loss of approximately 1.8 per cent of their aggregate annual GDP by the year 2050 from climate change, which could be as high as 8.8 per cent by 2100, if the status quo is maintained. In the case of Bangladesh, the mean economic loss of climate change under different scenario would be 2 per cent to 9 per cent.

Yet another devastating impact of climate change is sea-level rise, to which some of the riparian states are highly vulnerable. According to Islam et al. (2017), a one metre sea-level rise will inundate 5,763 square kilometres in India. In the case of a 45-cm sea-level rise, 35 million people will be displaced from 20 coastal regions in Bangladesh. The impact of sea-level rise will not be confined within the coastal regions; rather, it will cause tremendous socio-political and security-related problems and destabilise the entire basin.

Respective countries of the basin do have their own policies and measures to tackle climate change. However, the sectoral policies and plans adopted by different countries are not robust enough to cope with climate change's adverse impact and lacks integration across cross-cutting issues that require mutual collaboration. Without a coordinated effort by all the riparian states to optimise the sectoral approaches, it will not be possible to tackle the menace of climate change in the region (Swain, 2011). It is widely accepted that data generated in one country could significantly reduce disaster impact in other countries. Unfortunately, data sharing among the co-riparian countries is minimal. Any climate change adaptation and mitigation measures involving the GBM basin need to consider a basin-wide approach to minimise any unintended consequence to other countries. Being unable to recognise these interdependencies could lead to more economic damage in the future. Collaboration is also needed to ensure continuous and sustainable access to freshwater resources for expanding agricultural production and providing clean energy in the face of growing climate uncertainty, which would be critical for warranting water, food, and energy security in the region.

3.5 The Estimated Aggregate Annual Cost of Non-Cooperation

It is incredibly challenging and, to some extent, almost impossible to comprehensively quantify and monetise all types of costs described and analysed here. Drawing upon different reports and published work, the study has attempted to make a very conservative rough estimate of the cost due to non-cooperation in the GBM basin. During the time 1976 to 1993, due to the lack of adequate cooperative arrangements in the Ganges basin between Bangladesh and India at Farakka, the average annual financial loss for Bangladesh was approximately US$ 186.59 million, which was around 0.6 per cent of the country's GDP at that time. Considering the economic loss of 0.6 per cent of the country's current GDP, the annual loss of non-cooperation for Bangladesh would be approximately US$ 2,125.48 million. Besides, the annual loss of Bangladesh due to annual flood events is about US$ 2,463.17 million. For Bhutan, India, and Nepal, the yearly loss of floods is estimated at around US$ 54.65 million, US$ 7,471.82 million, and US$ 143.34 million, respectively. In the energy sector, due to non-cooperation, Nepal and Bhutan are deprived of estimated annual economic benefits ranging from US$ 105 million to US$ 1,840 million under different scenarios from the development of hydropower generation projects. Furthermore, in the environmental sector, especially in the case of the Sundarbans, it has been estimated that the cost of environmental damage associated with the degradation of the ecosystem and the loss of biodiversity would be approximately US$ 107 million per year. Considering that cooperation among the riparian states of the GBM basin could significantly reduce these types of costs, the aggregate annual cost of non-cooperation in the GBM basin adds up to nearly US$ 14,205.46 million (approximately US$ 14.2 billion).

4. FACILITATING COOPERATION IN THE GBM BASIN

The cost of non-cooperation in the GBM is already remarkably high, which would degenerate in the future if no action were taken. Maintaining the status quo would augment the existing vulnerabilities and emerging risks emanating from population expansion, unsustainable economic growth, unilateral infrastructure development, and the adverse impact of climate change. If ignored, the existing non-cooperative atmosphere would have a tremendously negative impact on the economic potential of the basin along with its water-energy-food-environment security, which in turn could adversely affect the peace and stability of the entire region.

To reduce the non-cooperation cost and facilitate cooperation, this study identifies three areas of consideration, i.e.,

i. Shift in policy outlook and decision-making processes
ii. Development of institutional arrangements
iii. Promotion of benefit sharing

A major shift is needed in the policy outlook of the riparian states and the decision-making process to maximise synergies and reduce negative externalities among the water, energy, food, and environment sectors. Additionally, to strengthen the collaborative framework and create a cooperative atmosphere, the current institutional arrangements need to be better developed so as to create a conducive atmosphere for cooperation. Furthermore, the riparian states need to shift their focus primarily from volumetric distribution of water to sharing of multiple benefits derived from multifaceted utilisation of freshwater resources that would create additional opportunities and foster an enabling environment for reinforced cooperation.

4.1 Change in Policy Outlook & Decision-Making Process

4.1.1 Promoting Sub-Basin-wide Multilateral Water Management Approach

The GBM basin represents a complex geophysical, hydrological, and geopolitical system comprising a whole gamut of compound issues related to the water, energy, food, and environment sectors. Earlier attempts, which were mainly bilateral in nature, have shown their limited ability to address the water-related challenges, often resulting in mistrust and suspicion among the riparian states. Therefore, a basin-wide multilateral water management strategy incorporating the co-riparian countries is needed to improve the situation and solve any complex water issues.

The absence of China's interest in the upstream of Brahmaputra (Yarlung Zangbo) in the past had given India a free hand to dominate the basin. However, in recent years, China has not only engaged in building dams in the upstream Brahmaputra, but it has also been very actively engaged in water development projects in Nepal, Bangladesh, and even in Bhutan. As the experiences from the Mekong River suggest, China is not likely to take part in any water-sharing agreement with India or other countries in the basin. Looking realistically, China was also one of only three countries to vote against the UN Convention of Non-Navigational Uses of International Watercourse in 1997 at the UN General Assembly. In 2020-2021, at a number of UN Security Council meetings, while discussing the dam dispute between Ethiopia and Egypt, China has made it abundantly clear about its adherence to the principle of upstream riparian's right to develop its freshwater resources. China has little economic or political incentive to come into an agreement to manage the Brahmaputra River within a basin-based framework. Thus, it will be wise to explore a sub-basin-based approach and bring together Bangladesh, Bhutan, Nepal, and India on a common river management framework, like the lower riparian countries of Mekong, Thailand, Laos, Cambodia, and Vietnam have done since 1995.

There is no doubt that there are many significant hurdles to even develop working and effective cooperation among these four lower basin countries. The primary problem is India's established approach in the region to address water sharing issues bilaterally. India is yet to see benefit in discarding the policy of bilateralism and adopting a multilateral approach. Since Nepal, Bhutan, and Bangladesh are not geographically contiguous, they also lack a common agenda on which sector(s) to cooperate on the shared river system.

Thus, a starting point for introducing a comprehensive sub-basin-wide multilateral water management approach could be revisiting the national water policies of the respective riparian countries. There is no denying that national water policies do have a crucial bearing on transboundary water cooperation. National policies need to have a basin-wide perspective that would enable effective benefit-sharing among all the riparian states and promote taking actions deemed beneficial for the entire basin. In both the National Water Plan (Government of Nepal, 2005) and the Water Resource Strategy of Nepal (Government of Nepal, 2002), the provision of integrated river basin management has been acknowledged, highlighting the importance of a holistic and systematic approach to water management. The National Water Policy of Bangladesh (Government of Bangladesh, 1999) also recognises a basin-wide perspective of water resource management, stressing the importance of taking the entire river basin as a unit of development. Since the powerful actors of the basin, like India, often tend to follow a bilateral transboundary water management strategy, other riparian countries need to persuade them in order to revisit their national policies. For example, Article 13 of the Indian Water Policy (Government of India, 2012) has prioritised the bilateral negotiation approach while dealing with international agreements in a shared river basin. It is, therefore, essential to acknowledge the importance of complementarities of a shared basin in national water policies, along with national priorities that would create a conducive environment to cooperate at a basin-wide level. The integrated basin-wide management approach could reverse the existing disagreements and antagonism into cooperation and partnership, thus promoting balanced development in the region.

4.1.2 Facilitating Multi-track Diplomacy & Informal Communication

Mutual suspicion and lack of trust among the riparian states are significant concerns in the GBM basin, limiting the scope of cooperation. To improve the situation, support the trust and confidence-building process, and maintain good relations and reciprocity among the stakeholders, regular communication and exchange of views become a top priority that would enable the opening of different communication channels. Due to a lack of institutionalised cooperation, state-level communication in the form of Track-1 diplomacy is often relied upon in the GBM basin. More opportunities for informal interactions among riparian states via Track-2 and Track-3 channels along with Track-1.5 diplomacy could improve stakeholder's participation in the management process and support the regular exchange of communication and dialogue in this regard. This will allow academia, non-governmental organisations (NGOs), civil society organisations (CSOs), social activists, water experts, the scientific community, and technological and policy institutions to work closely through informal discussions and meetings, thus helping to address the trust issue. It is worth mentioning that many CSOs are active in the riparian states of the GBM basin, working on water-related issues. These organisations have the potential to facilitate transboundary water cooperation by engaging different stakeholders and the local community. They could promote informal and formal knowledge sharing, facilitate decision-making and support implementation frameworks by assisting the respective governments of the GBM basin states, thus working as a catalyst for cooperation (IUCN BRIDGE, 2018). Therefore, it is important to engage and support the CSOs in GBM water management. Additionally, the riparian countries could expand dialogue by relying on their think tanks by arranging meetings, conferences, workshops, roundtables, etc. Regular interaction with focused discussion will allow the riparian states to resolve some of the challenges and deadlocks. This will also help to improve people-to-people communication, crucial to facilitating cooperation, especially in the case when negotiation is stalled due to the presence of conflicting interests and limitations of formal Track-1 diplomacy.

While aiming for strong and institutionalised cooperation among the countries of the lower basin, there is also a need for regular communication and exchange of information and ideas with upstream China. Thus, the existing platforms like Brahmaputra Dialogue (BD) could be supported in this respect, which could facilitate positive opportunities for formal basin-wide stakeholder interactions through an informal setting. BD is already bringing together the concerned stakeholders from the riparian states and allowing them to effectively participate in the negotiation process. The existing gap between the scientific community, water experts and policymakers could be bridged through these initiatives.

4.1.3 Engaging Third Parties & the Private Sector

The involvement of a third party in the negotiation process can also be an effective tool in addressing the trust issue and facilitate cooperation. There are many good examples of third-party mediation in facilitating water cooperation around the globe, like the World Bank's involvement in the Indus Water Treaty, integrating Guinea into the Organisation for the Development of Senegal, bridging the gap between Albania and Macedonia in the Lake Ohrid watershed, Southern African Development Community (SADC)'s role on the Zambezi and Orange-Senque water negotiations, East African Community's contribution in Lake Victoria sub-basin, etc. Besides, they can also effectively take part in the negotiation of agreements along with mediating disputes between and among the riparian states, or at least initiate the official dialogue, based on which further progress can be made.

Engagement of the private sector is also crucial in the development of transboundary water management, which can bring large investment in the water sector, and could facilitate technology transfer along with increasing awareness. For instance, since 2006, Coca-Cola has been involved with UNDP, working across Europe, the Arab region, and Asia in helping communities to gain access to freshwater resources and sanitation and water for productive use. Under the campaign "Every Drop Matters", the projects are promoting a sustainable, cost-effective, and replicable way of managing water. The CEO Water Mandate, a UN Global Compact initiative, is mobilising business leaders to address global water challenges and promote Sustainable Development Goals (SDGs) through corporate water stewardship, in partnership with the UN, governments, civil society organisations, and other stakeholders. Private sector involvement is also important for the energy sector, which can facilitate the power grid integration in the GBM basin. The governments of the riparian states need to collaborate in developing private sector engagement strategies, including public-private partnerships (PPPs), that could help to finance hydroelectric projects and sharing of electricity.

4.1.4 Developing Comprehensive Data & Information Exchange Protocols

Data and information sharing related to hydrometeorology, the physical environmental, flood, drought, and other disasters, and development of water projects in the sub-basin are crucial to identify the full breadth of potential cooperation and eliminate possible miscommunication and confusion. Regular exchange of information is essential to build trust and operationalise integrated water resource management in the basin, which usually reflects the goodwill of the riparian states and facilitates a confidence-building process among the countries in the sub-basin.

There is a trend in the GBM basin to securitise water issues and classify important hydrological data, which severely hampers the cooperative atmosphere and limits the scope for joint water management. The current data-sharing protocols are also extremely limited. For instance, China shares hydrological data of Brahmaputra with India from 15 May until 15 October (NDTV, 2020). At present, there is no year around data sharing mechanism between these two countries. Besides, access to information regarding upper riparian countries' different water development projects are also limited. The lack of data exchange, especially on upstream water project-related data, limits the scope of water utilisation for the downstream countries due to negative externalities and often yields suspicion and mistrust among the riparian states.

Hence, there should be a comprehensive protocol of data sharing in the lower GBM basin, allowing the sharing of a wide variety of information and data among the riparian states. Data sharing should not be confined within the monsoon season; instead, hydrological data should be shared year-round. The upper riparian countries also need to expand access to information regarding their water development projects to reduce any misperception and improve the trust and confidence of the lower riparian countries of the basin.

4.1.5 Facilitating Investment in Research & Development (R&D)

There is no alternative to continuous improvement in R&D to address the existing and emerging challenges in the GBM basin. At present, this R&D sector is very much neglected. Attention is needed on joint assessment and collaborative studies which are crucial for developing water infrastructure in the basin, promoting integrated water resource management, and increasing water use efficiency, etc. It is also important to promote hydrological modelling and combined hydrological data assessments to foresee the future challenges that might jeopardise cooperation in the basin. There have been numerous instances worldwide where international bodies collaborate with riparian countries to conduct joint water assessments, scientific studies, and river basin analysis to sustainably develop water management plans and projects and reduce the negative externalities. For instance, the United Nations Economic Commission for Europe (UNECE) Water Convention is conducting water assessments with the stakeholders of the Sava River basin, helping the International Sava River Basin Commission to prepare water management plans and promote intersectoral coordination. The World Wildlife Fund (WWF) assisted studies are supporting the Zambezi Watercourse Commission (ZAMCOM) and the dam operators to maintain the environmental flow of the river and protect the river ecosystem (Adeel et al., 2015).

Another vital aspect of R&D is developing enabling technologies, which could help ensure efficient supply and demand management in the water sector, thus contributing substantially to conflict resolution among the riparian states of the GBM basin. Technology has been used in various parts of the world as an enabler of conflict management. The huge supply and demand gap of water is one of the major concerns in the basin, often deteriorating the relations between the riparian states, sometimes resulting in conflict. Advanced technologies pertaining to water supply can help increase the availability of usable water by enabling water conservation and introducing efficiency in its distribution and usage. High investment in the R&D sector needs to be arranged to develop such water technologies like rainwater harvesting, conserving, and reusing water technology, wastewater prevention and treatment, etc., at a commercial and large scale, along with advanced technologies for storage of monsoon water under joint ventures to tackle the issue of freshwater scarcity in the basin, especially during the dry season. At the same time, it will be judicious for the four riparian states in the sub-basin to build partnerships with the countries currently at the forefront of R&D in order to share and transfer advanced water management technology.

4.2 Development of Institutional Arrangements

4.2.1 Introducing a Robust River Basin Organisation

The GBM system is a basin without a river basin organisation to manage water-related issues. At best, some bilateral organisations, like the Bangladesh-India Joint River Commission (JRC), Nepal-India Joint Committee on Water Resources, etc., exist to look after transboundary water issues. Nevertheless, these institutions lack robustness and appropriate jurisdiction to manage water on a basin-wide level. Therefore, for the efficient and competent management of the GBM river basin that would promote cooperation, it is of paramount importance to have an independent river basin organisation incorporating every co-riparian country. The organisation must have the capability and proper jurisdiction to make decisions independently and take actions without any pressure from the political governments. A robust river basin organisation would have the capacity to coordinate, monitor, manage, implement water management protocols, and develop and enforce management standards, thus promoting balanced development in the basin, facilitating equitable distribution of the basin's resources and building and maintaining trust and engagement among the riparian parties. Its roles and responsibilities should be clearly defined, ideally laid out in Rules of Procedures to ensure its effectiveness, reduce any possible miscommunication among the stakeholders or eliminate any ambiguity.

The RBO would also navigate the riparian countries to develop large water projects at appropriate sites with minimal negative externalities that would increase the projects' acceptability among the local community. This would also help ensure comprehensive solutions to the existing problems that cannot be solved bilaterally. The organisation would also enable the riparian states to deal with emerging challenges that would require joint actions involving all the actors. This would further promote interaction amongst the co-riparian countries and allow local stakeholders to participate in the basin's development process.

As previously described in this section, it might be challenging to include China in a basin-based institutionalised framework. The Mekong River Commission (MRC), and countries in the GBM basin can study and emulate existing river basin organisations around the globe: the Orange-Senqu River Commission (ORASECOM), the International Commission for the Protection of the Danube River (ICPDR), The International Commission for the Protection of the Rhine (ICPR), SADC Protocol on Shared Watercourse Systems, and the Amazon Cooperation Treaty Organisation (Fowler and Swain, 2021). Thus, the riparian countries of the basin can learn from the Mekong model and build a sub-basin-based river organisation like the Mekong River Commission and, at the same time, keep the platform available for regular meetings and exchange of information with upstream China.

4.2.2 Utilising Existing Regional & Sub-regional Cooperative Platforms

The riparian states of the GBM basin need to exploit other existing regional or sub-regional cooperation arrangements that can foster transboundary water cooperation. The riparian countries are already members of different regional and sub-regional initiatives like Bangladesh China India Myanmar Forum for Regional Cooperation (BCIM), The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) and Bangladesh Bhutan India Nepal (BBIN) initiative. BCIM incorporates three of the riparian countries of the Brahmaputra basin. One of the focus areas of the BCIM is the joint exploration and development of minerals, water, and other natural resources. This multilateral platform has the potential to facilitate cooperation in the Brahmaputra basin. These platforms incorporate the riparian states of the GBM basin and could be a viable option to move forward with discussions on joint water management. Since these cooperative initiatives have different agendas in addition to water management, they could play a crucial role in promoting benefit-sharing among the riparian countries.

4.2.3 Promoting Multi-dimensional Capacity Building

Lack of institutional, human, technological and infrastructural capacity is one of the biggest obstacles for effective water cooperation (Adeel et al., 2015). Therefore, it is of paramount importance to increase human capacity, along with strengthening national and other institutions involved with transboundary water management. Strengthening human capacities could include, but are not limited to, the ability to assess water-related data, conduct integrated impact assessments, the ability to monitor, regulate and have oversight on water-related projects, evaluate negative externalities and the adverse impact of water intervention activities. In the case of institutional capacity building, priority needs to be given to the ability to prepare, coordinate, monitor, implement, evaluate, inspect water management activities. This also includes the capacity building of think tanks and research organisations to conduct water assessment and research.

4.3 Promotion of Benefit-Sharing

The GBM basin incorporates a complex web of stakeholders from five different countries with varied interests and needs. The basin is not only an essential source of water for millions of people but also contributes significantly to the food and energy needs by supporting agriculture, aquaculture, and hydropower generation, etc. Numerous opportunities exist in the basin to utilise its abundant freshwater resources. It is, therefore, essential for the riparian states to acknowledge and understand the multiple benefits that are available in the basin and make every effort to effectively share those benefits by going beyond water, which can work as an incentive for the riparian states to cooperate further.

The current mode of cooperation, which is primarily based on the volumetric allocation of water, does not allow the riparian states of the GBM basin to make any concession on water negotiations, thus often producing a zero-sum outcome. If the riparian countries could realise the common interest and understand that benefits gained from cooperation are much higher than anticipated costs, they would be more motivated to cooperate. There are numerous instances around the globe where benefit-sharing facilitates cooperation among the riparian states. Under the Greater Mekong Subregion Program, sharing of benefits allows China to become more cooperative with other riparian states (Lee, 2014). The program focuses on a number of benefits that can be availed through transboundary water cooperation, in which the benefits could be categorised into food (agriculture and fisheries), energy (coal and hydropower opportunities), minerals (coal, limestone and strategic elements such as uranium), regulation of climate and hydrology (flood and erosion control), and opportunities for diversification of economic activities (ecotourism development and inland navigation) (Sinha et al., 2018). This can be a model for potential cooperation in the GBM basin. In addition, under the Lancang-Mekong Cooperation (LMC), which is also based on a multilateral mechanism, the riparian countries have put in place a multi-faceted and wide-ranging cooperation framework that is based on the benefit-sharing principle. Following the "3+5 cooperation framework" that includes three pillars of cooperation: political and security issues, economic and sustainable development, and social, cultural and people-to-people exchanges, and five key priority areas: agriculture and poverty reduction, water resources, cross-border economic cooperation, connectivity, and production capacity, the LMC has been working to facilitate collaboration among the riparian states that would benefit the people of the region (Lmcchina.org, 2017). Cooperation in the Senegal River Basin has helped the riparian states reap benefits in the energy sector by jointly developing hydroelectric dams, which was based on collective responsibility and ownership. Thus, shifting the focus from volume-based water sharing to water negotiations based on benefit-sharing would allow the riparian states to enjoy multiple benefits from the shared basin.

One among many potential options of benefit sharing in the GBM could be developing multipurpose storage dams in the GBM basin's upper catchment area. Water scarcity in the dry season is the prime cause of discontent among the co-riparian countries. Multipurpose storage dam projects will not only provide the opportunity to store excess monsoon water during the wet season, which can help increase the river flow in the dry period but also provide additional benefits like generating hydropower, regulating flood flow as well as maintaining adequate water flow for navigation. This will also enable the riparian states to lower their overall carbon emissions by harnessing a comparatively environment-friendly energy option - hydropower. Cooperation on the development of multipurpose dam projects will allow the riparian states of the basin to maximise benefits from the basin's freshwater resources while minimising various types of costs. For instance, Rasul et al. (2019) have discussed in detail how multipurpose water use in the Koshi River basin can generate different benefits like hydropower, irrigation, flood moderation, navigation, and dry season water augmentation. Therefore, the riparian countries need to evaluate the good examples of other river basins such as the Southern African Power Pool, and the Greater Mekong Regional Electrical Interconnection System, etc., that would assist benefit-sharing through cross-border interconnections and regional power exchange.

Another potential area in which the riparian countries could share benefits is navigation, a "non-consumptive" way of water utilisation. Developed jointly, inland water transportation using the GBM waterways would allow the riparian states like Nepal and Bhutan, as well as India's north-eastern region, to attain much-needed access to the sea, thus benefitting their economies, opening new opportunities for tourism, trade, and commerce, and fostering multimodal connectivity in the region.

However, it is crucial to assess the risks (both environmental and societal) associated with infrastructural development, especially in the development of multipurpose storage dams and hydropower generation, along with the negative costs in order to reap the full benefit of cooperation. Negative externalities, especially for the local community, like displacement of people, submergence of land, disturbance on sediment flow, risk of dam outburst, and river flow regulation must be considered before embarking on large multipurpose dam projects. The guidelines prepared by the IHA on sustainability factors should be followed to mitigate such risks. Collaborative projects developed under the benefit-sharing principle would only produce a win-win outcome for all stakeholders if embarked upon in a sustainable manner, maintaining proper environmental regulations. At the same time, countries should not become bogged down with past accounts of mistrust and discontent, thereby losing the fresh opportunity of cooperation. The GBM basin offers numerous benefits and opportunities, and the riparian states need to make a smart and practical approach to embrace such opportunities to reinforce cooperation in the basin.

5. CONCLUSION

For the countries located in the GBM basin, securing access to freshwater resources is deeply connected with their water, energy, and food security, along with their socio-economic development potential and the region's environmental sustainability. The riparian states need collaborative efforts to optimally utilise the basin's resources and exploit the available benefits.

Nevertheless, the state of cooperation centred around transboundary water among the riparian states of the basin is limited, marred by political realism, mutual suspicion, and mistrust, often producing a "zero-sum outcome" to collaborative initiatives. The present study takes an exploratory approach to understand the cost of non-cooperation in the GBM basin. By exploring potential benefits that could be accrued from cooperation in four different sectors, i.e., water, energy, food and environment, and the current state of limited cooperation, the study assesses the missed opportunities due to non-cooperation and its associated cost. While doing so, the study first shed light on the geophysical, hydrological, socio-economic characteristics of the GBM basin in order to depict a clear picture of the GBM basin's hydrological and socio-economic scenario together with its available resources. Based on the five criteria to evaluate cooperative arrangements in a shared basin, i.e., the presence of a joint body, commission or mechanism for cooperation; the existence of a formal agreement; regular formal communication (at least once in a year) at the political or technical level; establishment of a joint or coordinated management plan or objectives; and regular exchange of data and information, the study demonstrates that the state of cooperation among the riparian states of the basin is limited.

The study identifies nine types of costs - adverse impact on the flow regime of the rivers and water availability; deteriorating water quality and associated health hazards; loss of life and livelihoods due to natural disasters; higher transportation costs due to lack of water connectivity; untapped hydropower potential, higher energy prices and energy insecurity; reduction of agricultural productivity and output; reduction of fish catches; increased environmental stress and degradation of the ecosystem; and adverse impact of climate change - in water, energy, food and the environment sectors, which are directly and indirectly related to limited or no cooperation in the basin. In seeking to promote cooperation in the basin, the study identifies three areas of consideration: change in the policy outlook; development of institutional arrangements; and promotion of benefit sharing.

One of the crucial changes needed in the policy outlook is promoting a sub-basin-wide multilateral water management approach. Considering China's apathy to involvement in any basin-wide multilateral water cooperation, the riparian states of the GBM basin need to explore a sub-basin-based approach by bringing together Bangladesh, Bhutan, India, and Nepal on a common river management framework, like the lower riparian countries of Mekong region. A starting point for introducing a comprehensive sub-basin-wide multilateral water management approach could be revisiting the national water policies of the respective riparian countries to develop complementarities and a basin-wide water management perspective. Another vital policy outlook is communication and engagement, and there is no denying the importance of formal communication among the riparian countries in order to promote cooperation. Nonetheless, considering the environment of suspicion and the lack of trust in the GBM basin, the riparian states need to encourage multitrack water engagement in the form of Track-1.5, Track-2 and Track-3 diplomacy, in addition to Track-1 formal diplomacy. In this regard, NGOs, CSOs, academia, think tanks and research organisations can play a crucial role. In addition, it is equally important to engage third parties and the private sector in transboundary water governance. While the riparian states could learn from the good examples of third-party engagement in other river basins like Indus, Senegal, Lake Ohrid etc., there are opportunities for the riparian states to engage the private sector through PPP that could help finance different collaborative water development projects in the basin. Another crucial aspect of change in the policy outlook is the need for comprehensive data and information exchange protocols. Additionally, the riparian states need to invest in research and development, not only to promote hydrological modelling, and combined hydrological data assessments but also to develop enabling technologies, which could help ensure efficient supply and demand management in the water sector, thus contributing substantially to water governance in the GBM basin.

The most pressing need for institutional arrangements in regard to cooperation is developing a river basin organisation to manage water-related issues. Learning from the good examples of other river basin organisations worldwide, like MRC in the Mekong, ORASECOM in Senegal, ICPDR in the Danube, ICPR in the Rhine, etc., the riparian states need to take the initiative to develop a robust river basin organisation. Besides, the riparian states need to utilise existing regional and sub-regional cooperative arrangements, like BCIM, BIMSTEC, BBIN, to move forward with the discussion of collaborative water management. To strengthen the institutional arrangement, it is also crucial for the riparian countries to promote multidimensional capacity building involving human resources as well as national and other institutions engaged with transboundary water management.

Finally, the third area to consider for facilitating cooperation is benefit sharing. Volumetric allocation of water is still the dominant arrangement of water cooperation in the GBM basin, which does not allow the riparian countries to exploit the synergies among the sectors like water, energy, food, and the environment and reduce the negative externalities. One promising strategy to promote benefit sharing is the joint development of multipurpose storage dams in the upper catchment of the GBM basin. That will allow the riparian states to store excess water during the monsoon, regulating floods during the peak time, and increase river flow in the dry period. Other additional benefits from multipurpose dams include generating hydropower and maintaining adequate water flow for navigation. However, the riparian countries need to carefully assess the environmental and societal risk of any infrastructural development projects in order to reduce their adverse impact and ensure a win-win outcome for all the stakeholders.

In conclusion, there is no denying that the GBM basin offers numerous opportunities and multiple benefits to the riparian states to meet their water, energy, and food demands, and protect the environment. The long history of non-cooperation has already hampered the sustainable development potential of the GBM basin's riparian states. For the sake of the region's future progress, it is high time for the basin countries to change the status quo and facilitate multilateral cooperation for the best possible use of their shared water resources.

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