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An Analysis of the Role of Politics in Water Governance in the Brahmaputra Basin

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CHAPTER 1: INTRODUCTION

Water has attracted attention as a policy concern for a number of years. Access to water has been recognized as a human right, whilst its scarcity and distribution is deemed as one of the major causes of risk in the 21st century (Woodhouse & Muller, 2017). The focus of many businesses and governments is on taking steps to ensure water security, often defined as "the reliable availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies" (Grey & Sadoff, 2007, p. 547-548). Concerns regarding water security have intensified as a result of climate change, which is likely to increase competition over water resources, as well as cause a reduction in global water availability. Due to rapid population growth, pollution due to economic growth, and changes in precipitation, winds, and temperatures due to climate change, water is becoming more and more of a contested resource (Al Radif, 1999). As water becomes more contested around the world, its management and governance has become increasingly important, both within and between countries (Lautze, De Silva, Giordano & Sanford, 2011). As water governance is an academic field that is closely linked to numerous other (sub-)fields, including geography, regionalism, political and environmental science, nuanced research in this field could aid the furthering of academic research in other related fields.

The Brahmaputra is one of the largest rivers in the world, located in Southeast Asia. As millions of people rely on this river, the governing of this river in a way that allows them continued access is vital. The Brahmaputra is located in an area that is likely to be heavily impacted by climate change. The river springs from the Himalayas, which are expected to start melting at a higher rate, leading to short-term increases but long-term decreases of water flow. In the downstream areas of the basin, temperature increases and floods as a result of higher rates of precipitation are expected (*Ray et al., 2015*). Next to this, the river's riparian countries are rapidly developing economically. In light of these rapid changes, access to and protection from water is likely to become an issue in the near future. Therefore, an assessment of the ways in which the Brahmaputra river is governed is important. This thesis shall aim to do so by focussing on the role of politics in water governance, as well as the impact politics has on equity in water access. The research question of this thesis is therefore as follows; How can a focus on the role of politics in water governance be used to improve equity in water access? This question will be answered by analysing a case study, giving rise to the following sub-question; How does politics impact water governance in the Brahmaputra basin?

In order to answer this question, this thesis will first provide a short overview of the Brahmaputra basin. This is followed by an overview of the development of the concept of water governance, together with a critique on current discussions. This is followed by an analysis of the governance of the Brahmaputra basin, for which an analysis method put forward by the Water Governance chair group at the IHE Delft Institute for Water Education will be used. This analysis method aims to re-centre politics in discussions on water governance through three distributions, those of water and risk, voice and authority, and knowledge and expertise. This theory will be expanded upon later. This analysis will be followed by a discussion, in which the implications of the role of politics will be discussed. Lastly, this thesis will end with a conclusion.

CHAPTER 2: LITERATURE REVIEW

THE BRAHMAPUTRA RIVER BASIN

The Brahmaputra river, also known as the Yarlung Zangbo/Tsangpo in Chinese, flows from the Tibetan plateau and ends in the Bay of Bengal in Bangladesh. The river starts north of the Himalayas, at 5000m altitude, and is joined by a number of tributaries (SaciWATERs, 2016). In China, it is joined by five tributary rivers. After flowing through the Great Bend, and entering Assam, India, the river is joined by the Dibang, Lohit, and Subansiri tributaries (Ray *et al.*, 2015). It is here that the river gets the name Brahmaputra. In Bangladesh the river is first joined by the Tista river, and later by the Ganges and Meghna river, which gives rise to the term Ganges-Brahmaputra-Meghna (GBM) river system, used to refer to the three main rivers of this region (Ray *et al.*, 2015). Bhutan has four tributary rivers that feed into the Brahmaputra river, namely the Amochu, Wang Chu, Sonkosh, and Manas (Rahaman & Varis, 2009). The Brahmaputra empties in the Bay of Bengal. Its basin consists of parts of China, India, Bhutan, and Bangladesh, although the main arm of the river does not flow through Bhutan. The riparian countries of the Brahmaputra basin can be seen in Figure 1.

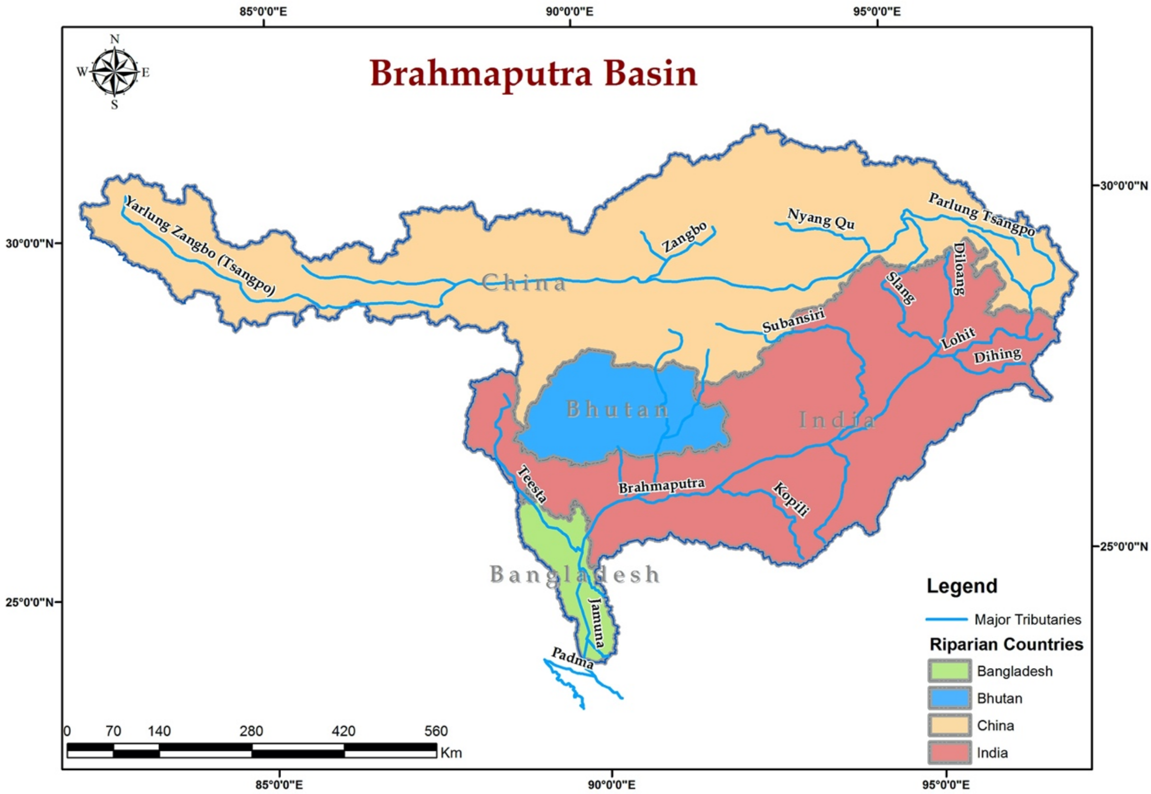

Figure 1: The Brahmaputra basin and riparian countries (SaciWATERS, 2016).

The Brahmaputra river is just under 3000 kilometres long, with a basin of around 575000 square kilometres (Rahaman & Varis, 2009). Together with the closely-linked Ganges and Meghna basins, the Brahmaputra basin is one of the most densely-populated basins in the world (Ray *et al*., 2015). Over 100 million people live in the basin, and many more outside that rely on the river's flow (Rahaman & Varis, 2009). The upstream parts of the basin, namely in China and Bhutan, have a high hydropower potential (Ray *et al*., 2015). The river is known as the highest river in the world, with an average altitude of around 4000m (Rahaman & Varis).

THE CONCEPT OF 'WATER GOVERNANCE'

Governance encompasses all processes, laws, regulations, and institutions in relation to decision-making processes in any specific field (Rogers & Hall, 2003). As it relates to government policies, as well as market forces and civil society, any form of governance is inherently political. This also means that what constitutes good governance, whether that be efficiency, democracy, accountability, or sustainability, is dependent on political forces, making governance a broad term (Rogers & Hall, 2003). In decision-making on natural resources, management and governance are difficult to separate, and are sometimes used interchangeably (Gain & Schwab, 2012). Within the international field of water politics, the concept of water governance has undergone significant changes, and its implementation remains imperfect. Terms such as 'sustainable water management', 'integrated water resources management (IWRM)', 'water management', and 'water governance' are used to refer to the same thing by some, and distinctly different things by others (Gain & Schwab, 2012). Among scholarly literature, there seems to be a consensus about the importance of governing water, but a lack of clarity regarding what the concept of water governance entails or what it should aim to achieve. This chapter traces the origins and development of water governance, and explains critical water scholars' current issues with the concept.

HISTORY OF WATER GOVERNANCE

1970S + 1980S – EFFICIENCY AND AVAILABILITY OPTIMIZATION

In the early years of academic writings on water control, there was no clear distinction between water governance and water management. Terms such as 'water control' and 'water management' were used without being clearly defined, and the focus of literature was on the optimization of water resource distribution (Ismayilov, 1980). Water was primarily analysed as a resource that was needed for food production at this time, with increased efficiency and availability being main drivers (Ismayilov, 1980). The optimization of these two fields could be calculated, meaning that there was a correct way to control water in order to maximize food productions. This control of water was largely organized around state provision (Miranda, Hordijk

& Molina, 2011). At the same time, awareness of the implications of approaching water management in such a way was increasing, most notably water quality deterioration and loss of biodiversity (de Jong, van Rooy & Hosper, 1995). As the potential issues with a fixed stock of water and an increase in its use were being recognized, the UN called a Water Conference in 1977. This meeting looked at international water policy options and institutions, discussing how they “can best be adapted to the needs of individual countries and be made responsive to current and future demands for food, energy, improved health and sanitation and pollution management” (FAO, 1977, p. 79). The control of water through these policies and institutions remained very sectoral at this time, with little interconnectivity between different economic sectors or government levels (de Jong *et al.,* 1995). This resulted in water policies that were beneficial in one area, but proved detrimental in others. To combat this, water resource plans focussed on multi-objective optimization were being proposed, which were cost-benefit analyses of a range of different fields, including energy production, water quality, environmental protection, and cost minimization (Simonović & Miloradov, 1985). Over time, with economic expansion and population growth, the pressure on water kept increasing.

1990S – IWRM AND CLIMATE AWARENESS

Many assessments of the impacts of climate change were conducted in the 1990s, which led to an influx of academic articles that were written about water scarcity and the need for improved use and safeguarding of water resources (Lonergan & Kavanagh, 1991). Water scarcity issues were largely attributed to climate change, in the forms of fluctuating precipitation rates and temperatures, as well as increases in demands, due to migratory movements, population growth, and economic expansion (Lonergan & Kavanagh, 1991). As more awareness of issues of water scarcity highlighted the interconnectedness of different water issues, the sectoral approach to water made room for Integrated Water Resources Management, also known as IWRM (de Jong *et al.,* 1995). In its essence, IWRM means the blending of elements of the natural system and the human system (GWP, 2000). Management of the natural system includes freshwater and coastal management, water quantity and quality, and upstream and downstream water management (GWP, 2000). The human system includes policy development, consumption choices, and stakeholder participation (GWP, 2000). It is based on the notion that water is a natural resource, integral to an ecosystem, as well as a social and economic good (Al Radif, 1999). The term was first formally introduced in 1992, at the International Conference on Water and the Environment in Dublin, as part of what is known as the Dublin Principles. With this, the focus started shifting from controlling water resources to caring for them, and water was seen as a system, together with its surrounding lands and ecosystems (de Jong *et al.,* 1995). In 1996 the Global Water Partnership (GWP) was established by the United Nations Development Programme (UNDP), the World Bank, and the Swedish International Development Agency (SIDA). The main goal of the GWP was to improve and coordinate IWRM efforts around the world (Lautze et al., 2011). With the increased popularity of IWRM, the focus of controlling water started to move beyond technical implementations, aimed at increasing water availability, and management strategies focussed on the economic values of water (Lonergan & Kavanagh, 1991). Articles discussing water scarcity and the emergence of a potential water crisis, pushed forward IWRM as the best environmental governance response (Uitto, 1997). In the early years following its inception and subsequent rise to popularity, IWRM functioned as an overarching concept, encompassing elements of both water governance and water management (Lautze *et al.,* 2011). IWRM remains a popular and widely used paradigm within water management. It is a part of the United Nations' Sustainable Development Goals (SDG's). SDG 6, clean water and sanitation, includes the implementation of integrated water resource management at all levels by 2030, including transboundary basins (UN, n.d.).

2000S – EXPLORATION OF WATER GOVERNANCE

The early 2000's were marked by the emergence of the idea of a global water system, of which the physics, chemistry, biology, and socio-economics could be measured and expressed in global-scale models (Vörösmarty, Pahl-Wostl, Bunn, & Lawford, 2013). This approach represented a clear move away from the smaller-scale, sectoral approach that was very prominent in the 1970's and 1980's. The first explicit connection between governance and water can be traced back to the Second

World Water Forum in the Hague in 2000, where a call was made for “governing water wisely to ensure good governance, so that the involvement of the public and the interests of all stakeholders are included in the management of water resources” (Rogers & Hall, 2003, p. 15). Following this, water governance was swiftly identified as an area of priority action at the International Conference on Freshwater (Lautze *et al.,* 2011). This increased attention for water governance highlights the shift within the field of water studies from infrastructure focussed on optimization and availability, to the institutional, financial, and organizational arrangements that control the flows of water (Zwarteveen *et al*., 2017). The GWP established the most prominent definition of water governance, “the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society” (Rogers & Hall, 2003, p. 16).

Next to its definition of water governance, the GWP also created a list of 12 characteristics that reflect good water governance. These 12 characteristics are open, transparent, participative, accountable, effective, coherent, efficient, communicative, equitable, integrative, sustainable, and ethical (Rogers & Hall, 2003). Other studies discussed good governance as a combination of accountability, participatory processes, transparency, and decentralized decision-making (Gain & Schwab, 2012). These features are, however, difficult to assess, as indicators are difficult to find and some features of good governance are based on competing notions. The GWP’s 12 characterics show that the lines between water governance and water management remain blurry, as a number of these characteristics go beyond the definition of water governance that the GWP provided. Water governance can be seen as the processes and institutions through which decisions related to water are made, meaning that characteristics such as sustainable, effective, and equitable go beyond that, as they are concerned with the quality of water resources outcomes instead of the decision-making process (Lautze *et al.*, 2011). These characteristics are more aligned with water management, the application of measures to control water resources (Lautze *et al.,* 2011). Water governance is more about the ways in which decisions pertaining to water are made than the decisions themselves (Batchelor, 2007). Different scholars have made frameworks to analyse the quality of water governance based on a number of dimensions, including state and non-state actors, multi-level integration, and modes of governance (Gain &

Schwab, 2012). There have also been those who assessed the quality of water governance by making use of popular governance indicators, such as Freedom House, in order to provide an objective framework that can be applied to water governance globally, in line with the shift towards global analyses in water sciences.

The creation of a shared conceptualization of water governance has proven to be difficult, due to differences in the understanding of 'governance', as well as in 'water' (Castro, 2007). Governance to some is a set of administrative and technical measures to enforce policies, whereas to others the focus is on debate, democratic participation, and societal development (Castro, 2007). Simultaneously water is regarded by some as a primarily economic resource, which can be controlled and measured using market systems, whereas for others it is a natural resource which is in need of technical protections (Castro, 2007). Social scientists are likely to look at how (good) governance is defined, in what words, and by who, with less attention for technical or economic parameters (Miranda *et al.,* 2011). This means that whichever epistemic field has the upper hand in the conceptualization of (good) water governance has a large impact on the actual way water is subsequently governed. As water governance covers decision-making processes, the field is profoundly political (Batchelor, 2007). This political nature makes water governance, and governance as a whole, very subject to definitions which are consistent with one specific political viewpoint. Next to differences in principles with regards to governance, institutional cultures and backgrounds of actors that influence their value of water have an influence on their conceptualization of good water governance (Miranda *et al.,* 2011). Water governance descriptions and applications more often focus on prescribing what water governance should be, as opposed to describing what it is (Batchelor, 2007).

RECONCEPTUALIZATION OF WATER GOVERNANCE

The more global approach to water allowed for more research on climate impacts, no longer limited to political boundaries, as well as trans-national water privatization, trade of virtual water in other commodities, and large-scale pollution (Vörösmarty et al., 2013). In spite of the fact that there was little shared understanding of what water governance entailed or how it worked, calls for its improvement around the world kept being made. Studies highlighted that many of the global issues with water were a result of failing governance, although the conditions of governance failures differed across countries. These conditions thus also required different solutions, which is in sharp contrast to the strategy of applying idealized principles of water governance based on technological notions, without assessing the performance of these governance approaches in specific situations (Vörösmarty et al., 2013). In mainstream water policy discussions, the conceptualization of water governance ended up being very idealistic, focussed more on how water governance should be, and largely devoid of its political nature (Castro, 2007). In recent years scholars have called for a reconceptualization of water governance, as the lack of consensus on the term is hampering any improvements to the actual governance of water resources. One group of such scholars is the Water Governance chair group from the IHE Delft Institute for Water. This group introduced a framework which attempts to improve debates on how governance should happen, by first understanding how it actually occurs, by recentring the political dimensions of governance. Zwarteveen et al. criticize the ways in which the idea of good governance is promoted as a neutral title for improvements to the governing of water, as it actually encompasses a distinct set of policy reforms, including competition in markets, reduction of the role of the state, and decentralization of administration (2017). Their framework calls for the recognition of equity as a central concern of water governance debates, as the declining qualities and quantities of water, together with the increased frequency of floods and droughts, will affect different groups of people differently (Zwarteveen *et al.,* 2017). This framework will be used in this thesis' analysis of water governance in the Brahmaputra basin, and will thus be further expanded upon in the next chapter, which is the methodology.

CHAPTER 3: METHODOLOGY

This research is focussed on the ways politics influences water governance, by looking at the ways water is actually being governed instead of how dominant water governance narratives say water governance should look. The Brahmaputra river basin was used as the case study, as research addressing the state of water governance across the basin has thus far been lacking, in spite of the fact that this basin is one of the largest in the world, and a vital source of water for millions of people across four countries (Rahaman & Varis, 2009; Ray *et al.,* 2015). As mentioned in the introduction, the analysis method created by IHE Delft Institute for Water Education's Water Governance chair group was used for this thesis. This analysis method is based on the notion that the apoliticality of mainstream water governance discussions is limiting the analytical strength of the term, and that refocussing on politics could offer options to improve equity in water access. The analysis method poses that in order to improve the utility of water governance to actually describe and understand processes of governing, a number of things should be recognized. It is important to look at the ways the term is used, by who, and for what goals (Zwarteveen *et al.,* 2017). Secondly, the relation between knowing and analysing water governance and actually governing water should be recognized (Zwarteveen *et al*., 2017). One's idea on what governance approach is best has an influence on the knowledge one creates regarding water governance. Lastly, discussions on water governance should not be limited to analyses that are limited to the perspective of those who are in charge of governing, but should also include those who interact with water (Zwarteveen *et al.,* 2017). These three points resulted in a framework for the study of water governance which is anchored in distributions, namely those of water and risk, those of voice and authority, and those of knowledge and expertise. The Water Governance chair group defined water governance as "the practices of coordination and decision making between different actors around contested water distributions" (Zwarteveen *et al*., 2017, p. 3), recognizing the political nature of these practices and the use of these distributions for the concept of equity in water governance. Equity as a concept is not easy to quantify, as it is value laden and relative to who makes use of it. This does not mean that the concept is unusable, but rather that its use needs some clarification. Merriam-Webster defines equity as "justice according to natural law or right. Specifically, freedom from bias or favouritism" (n.d.). In this analysis, the focus was on social equity, which looks at the differences in access to, control over, and use of water across different social groups, as well as spatial equity, which takes into account the impacts of spatial area on the access to water (Phansalkar, 2007). Making use of the three distributions, this thesis' analysis aimed to create an overview of the many ways in which politics plays a central role in determining how water is governed in the Brahmaputra basin.

As the Brahmaputra basin spans across four states, and the relations between politics and governance are complicated and ever-changing, this analysis did not attempt to provide a complete and exhaustive picture of all the influences of politics. Instead, four of the most important contemporary water issues in this basin were used to illustrate the ways politics influences decision-making, and the implications of this influence. The four issues are water quantity, water quality, fishing communities, and hydropower projects (Strang, 2020). The distributions of water, risk, voice, authority, knowledge, and expertise in the Brahmaputra were analysed using these four issues. In order to do so, a wide array of secondary sources was used, primarily in the form of academic articles. These secondary sources were supplemented with a number of primary sources, in the form of newspaper articles and government documents. As water governance is an interdisciplinary field, the sources selected for this case study were also interdisciplinary. In order to achieve this, sources from a wide variety of fields of study were selected, including geography, economics, politics, engineering, hydrology, climate change, and development studies. The majority of sources used in the analysis were collected through Google Scholar, as well as the search engines of academic articles, with ScienceDirect being the main one.

CHAPTER 4: RESULTS

DISTRIBUTION OF WATER AND RISK

When it comes to the distribution of water, it is important to look at the consequences of water distributions, as well as the laws and norms that are in place to justify certain levels of water access (Zwarteveen *et al.,* 2017). This means that, next to mapping the actual way water flows in an area, an analysis should also include why and by who the decisions were made that caused water to flow in this particular way.

The distribution of risk includes how the use of water in one area affects possibilities for use in other areas, as well as the laws in place that create and distribute this risk across an area (Zwarteveen *et al*., 2017). Use of water here includes hydropower dams, upstream pollution, and groundwater salinization, among others.

Looking at these two facets allows for a clearer picture of how water is experienced by a population, and why it is experienced this way. If one is to make a case for water governance improvements, it is important to clearly understand how regulations impact the uses and risks of water. Studies on water security show that both Southern China, as well as South and Southeast Asia, are characterized as water insecure, suffering from low investment in information, institutions, and infrastructure, whilst simultaneously being hydrologically complex (Grey *et al.,* 2013).

In order to get a picture of the way water and risk are distributed across a more specific space, a combination of concrete hydrological data, as well as social, economic, and political analysis are needed (Grey *et al.,* 2013). In the case of the Brahmaputra, both remain lacking, likely resulting, at least partly, from the lack of cooperative institutional and policy regimes in the basin (Grey *et al.,* 2013). Especially data from China remains difficult to come by. This lack of cooperation means little information on basin-wide climate, stream flow, agricultural production, trade, and natural hazards (Ray *et al.,* 2015).

DISTRIBUTION OF WATER

The water resources in the Brahmaputra basin are not distributed evenly across the four basin countries. China has a little over half of the basin area, as well as almost half of the annual runoff, the volume of water flowing down the river per year. In terms of population, however, only 1.6% of people living in the basin live in China, with the vast majority living in India and Bangladesh. A number of the borders in the Brahmaputra basin are disputed and difficult to place, which results in different measures of basin areas, population sizes, and runoff. Figure 2 combines the data from a few different studies to create an overview of the basin and its population distribution.

Country	Basin area (10^3 km^2)	Annual Runoff (km^3)	Population (million)	Length of river (km)
China	293	307.1	1.8	1627
Bhutan	38.4	71.6	0.8	0
India	195	158.6	52.4	1130
Bangladesh	47	124.4	56.8	240
Total	573.4	661.7	111.8	2997

Figure 2: Per country distribution of Brahmaputra basin area and population (Rahaman & Varis, 2009; Bhattarai, 2009; Feng, Wang & Liu, 2019)

Communities in the Brahmaputra basin mostly live off of agriculture, ranging from rice and wheat to papayas, mangos, bamboo, and tea (Ray *et al.,* 2015). In spite of this, there is little data with regards to agricultural water usage in the basin. Figure 3 shows a preliminary study of projected agricultural water usage, based on data provided by the Indian Department of Statistics, the Tibet Statistical Yearbook, the Bangladesh Ministry of Agriculture, and the National Statistics Bureau of Bhutan. Data from Bhutan was not added to the model, as agricultural production was very small.

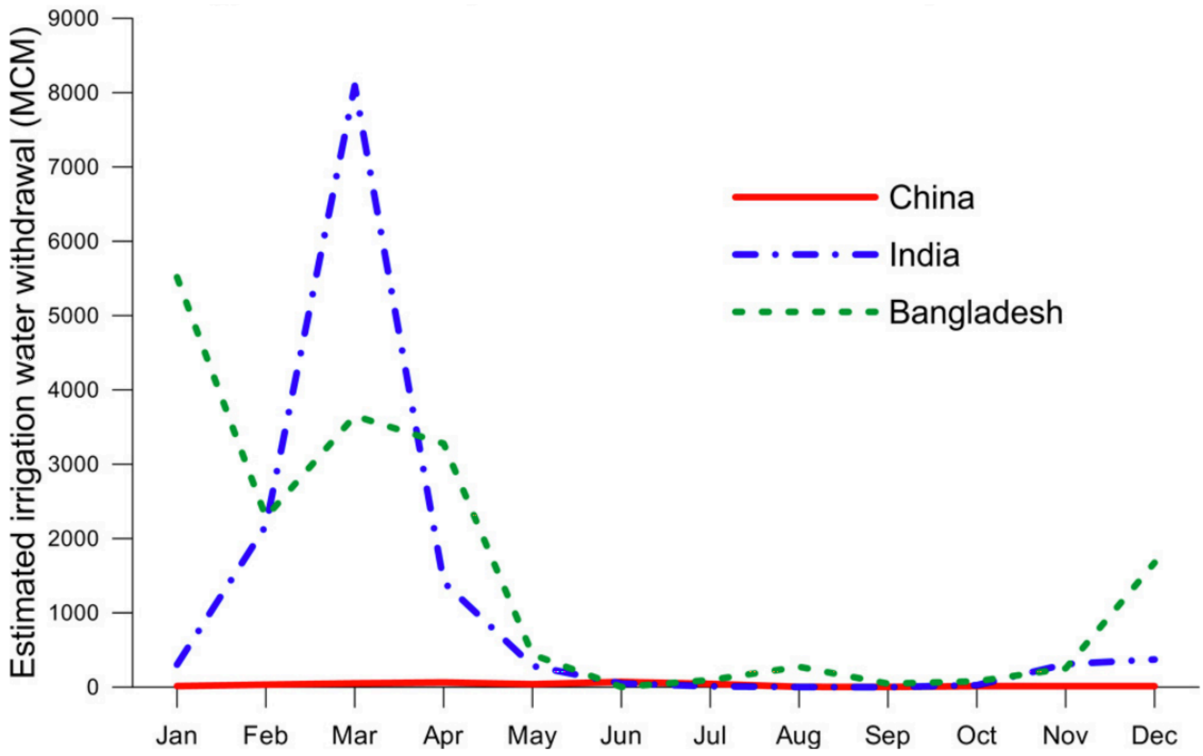

Figure 3: Seasonal variation in irrigation water requirement per county in the Brahmaputra basin, expressed in million cubic metres (Ray *et al.,* 2015)

Figure 3 shows that Bangladesh uses the most water in the basin, as rice is in its early stages of cultivation during the winter, and requires high levels of irrigation. It also shows that during the monsoon period, between June and October, there is little to no need for further irrigation water. The rainfall between June and September accounts for 60-70% of the total annual rainfall (Ray *et al*., 2015). During this same period, the flow of the river measured in Bangladesh is seven times higher than it is in the lowest months, highlighting the high level of seasonal variability in the basin (Ray *et al*., 2015). The irrigation water requirement modelled in figure 3 was subsequently modelled in comparison to the available water in the Brahmaputra river at three different stations, Yangcun (China), Pandu (Assam, India), and Bahadurabad (Bangladesh). This comparison can be seen in Figure 4.

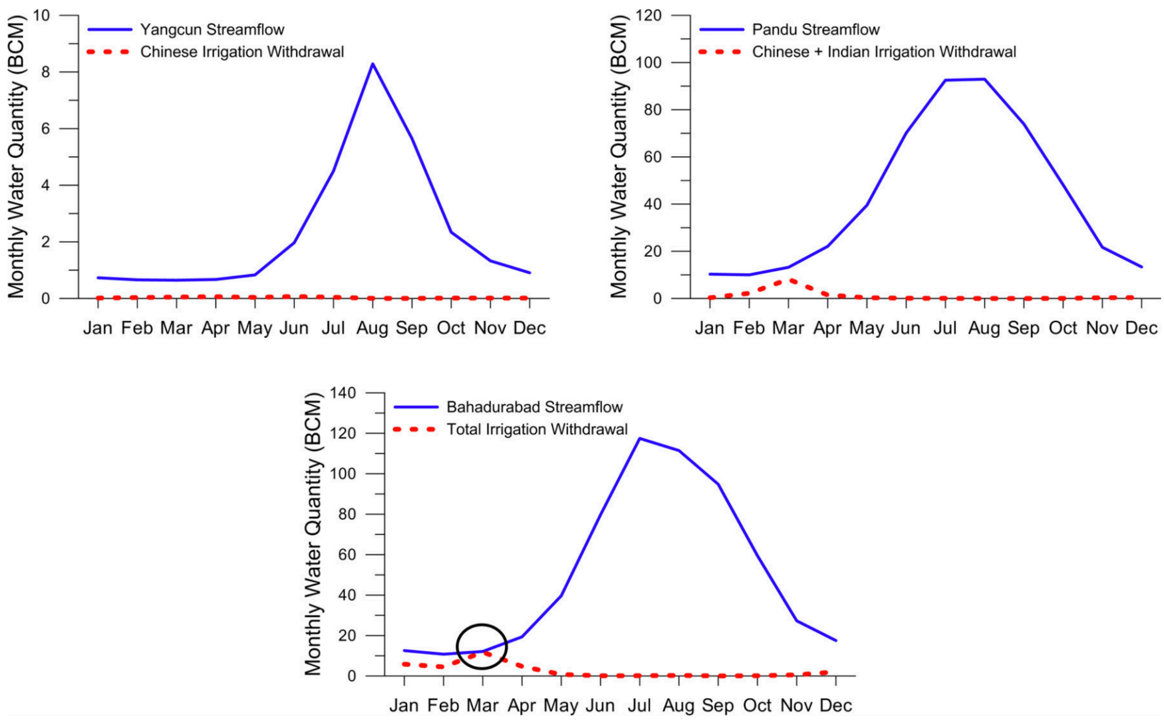

Figure 4: Basin-wide irrigation water requirements relative to total available water along 3 parts of the Brahmaputra river, expressed in billion cubic metres (Ray *et al.,* 2015).

This analysis shows that, with the exception of total irrigation withdrawal in the basin relative to the streamflow in Bangladesh in March, surface water is generally unlikely to be limited in the basin. This data is tentative, however, as there was only one Chinese climate point available to add to this analysis. Furthermore, this analysis is based on projected water needs based on statistical data from the riparian countries' governments, meaning that the actual water needs could differ. Lastly, this analysis only shows agricultural water needs, meaning that water needs for other purposes should be added to the withdrawal modelled here.

DISTRIBUTIONS OF RISK

RISK THROUGH WATER QUALITY

Rivers are instrumental in draining the water from upland areas, including rainfall, municipal and industrial waste, and agricultural runoff. The three main sources of river water pollution are domestic water usage, industrial usage, and agricultural usage (Kotoky & Sarma, 2017). Water quality is not objective, as acceptable qualities are socially defined and dependent on the intended use of the water. Water quality has a direct impact on people's health, and also determines how well-suited particular bodies of water are for particular purposes (Kotoky & Sarma, 2017).

There are many parameters used to assess water quality, but they can mainly be sorted into three categories. (1) Physical parameters, which include the temperature, colour, and taste of water, (2) chemical parameters, which include pH, oxygen levels, heavy metals, among others, and (3) biological parameters, which include the levels of bacteria, algae, and viruses present in the water (Omer, 2019). One of the most common water quality assessments is known as the water quality index (WQI). A WQI combines a number of water quality parameters to provide one number to express overall water quality, in order to make discussions on water quality more accessible to the public (Kotoky & Sarma, 2017). Next to a WQI, the presence of heavy metals is also often used to indicate water quality, as many of them are fatally poisonous or cause chronic diseases in people (Omer, 2019). The rate of heavy metals in water is strongly correlated with WQI parameters, such as specific pH levels and rates of Na+ (Jadhav *et al., 2015*).

Along the Brahmaputra, no continual basin-wide water-quality-measuring system is in place currently. There are a number of quality assessment, focussing mainly on the chemical composition of the river and the potential sources of contaminants. By comparing studies on water quality, one can gain a clearer picture of the areas of the basin in which the contamination of water is high, which can be used to understand the ways in which the risks posed by water contamination are spread throughout the area and its peoples. Risk is most commonly expressed as a function of vulnerability to a hazard (IPCC, 2014). This means that any analysis of the distribution of risks needs information on the level of vulnerability of people living in an area, through their proximity to water or their reliance on water for their livelihood, as well as the type of hazard they face, whether that be a natural hazard or a socio-political one. In this case, water pollution can be seen as the hazard. Vulnerability is further divided into sensitivity to a hazard and adaptive capacity, how well a community can respond to a hazard (IPCC, 2014). This means that whilst the hazard of pollutants is mostly bio-chemical, the extent to which said hazard then poses a risk to people is highly social, and dependent on the ways people in the basin interact with water.

WATER QUALITY AS A HAZARD

Water studies in the Tibetan part of the basin have shown slightly elevated levels of heavy metals in the water, with arsenic (As), a highly poisonous one, being the most prominent one (Huang *et al.,* 2011). These elevated levels, together with other deviations from global averages, in the form of an alkaline pH and higher rates of Na+ and Cl-, were the result of naturally-occurring phenomena, such as bedrock weathering and the presence of salt water lakes (Huang *et al.,* 2011). The assessment concluded that these differences were negligible, and that “the watercourse can in general be considered relatively pristine” (Huang *et al.,* 2011, p. 8). There was little evidence to suggest that anthropogenic activities, including agriculture, mining, and damming projects were affecting water quality in a significant way on the Tibetan plateau. With that being said, the area is undergoing rapid development as a result of an improved railway connection, and is therefore facing increased pollution through industrial development, tourism, and agriculture (Huang *et al.,* 2011).

A study in India’s Assam region made use of a WQI to assess the pollution levels of the Brahmaputra in this area. When the WQI of the Brahmaputra in Assam was calculated, the river scored 61.71 (Kotoky & Sarma, 2017). This score classifies the Brahmaputra as a class IV river, which is polluted (Kotoky & Sarma, 2017). The scoring system for the WQI and the implications for different usages can be found in Figure 5.

Usage	10	20	30	40	50	60	70	80	90	100	WQI
General	Very Polluted						Slightly Polluted		Clean		
Water Class	V				IV		III		II	I	
Public WS	Not acceptable				Doubtful		Necessary Treatment Becoming More Expensive		Minor Purification Required	Purification Not Required	
Recreation	Not Acceptable	Obvious Pollution Appearing		Only for Boating	Doubtful For water contact	Becoming polluted, still need bacteria count		Acceptable for all sports			
Fish Shellfish Wildlife	Not Acceptable			Course fish only	Handy fish only	Doubtful for sensitive fish	Marginal for trout		Acceptable for all sports		
Irrigation	Not Acceptable			Obvious pollution appearing	Acceptable						
Treated Water Transportation	Not Acceptable		Acceptable								
Usages	10	20	30	40	50	60	70	80	90	100	WQI

Figure 5: Water Quality Index classification and implications per water usage (Kotoky & Sarma, 2017).

As can be seen in Figure 5, a score of 61.71 means that although the water can still safely be used for irrigation, pollution is likely to have a negative impact on the more sensitive fish in the river, and the Brahmaputra cannot be classified as a safe source of drinking water or other recreational purposes. A study using the same WQI was conducted in the North of Bangladesh. Measurements in the Mymensingh district showed a WQI score of 57.58, which, once again, places the water of the Brahmaputra river in the IV class (Muyen, Rashedujjaman & Rahman, 2016).

Parts of groundwater resources in Assam are contaminated with heavy metals. The WHO has established that the limit of As in ground water is at 10 ppb (parts per billion). In 16 of the 20 measuring sites in Assam, the level of As exceeded this limit, with the highest level of contamination being 352 ppb, highlighting the severity of As pollution in some parts of Assam (Nath *et al.,* 2018). The distribution of As in Assam can be seen in Figure 6.

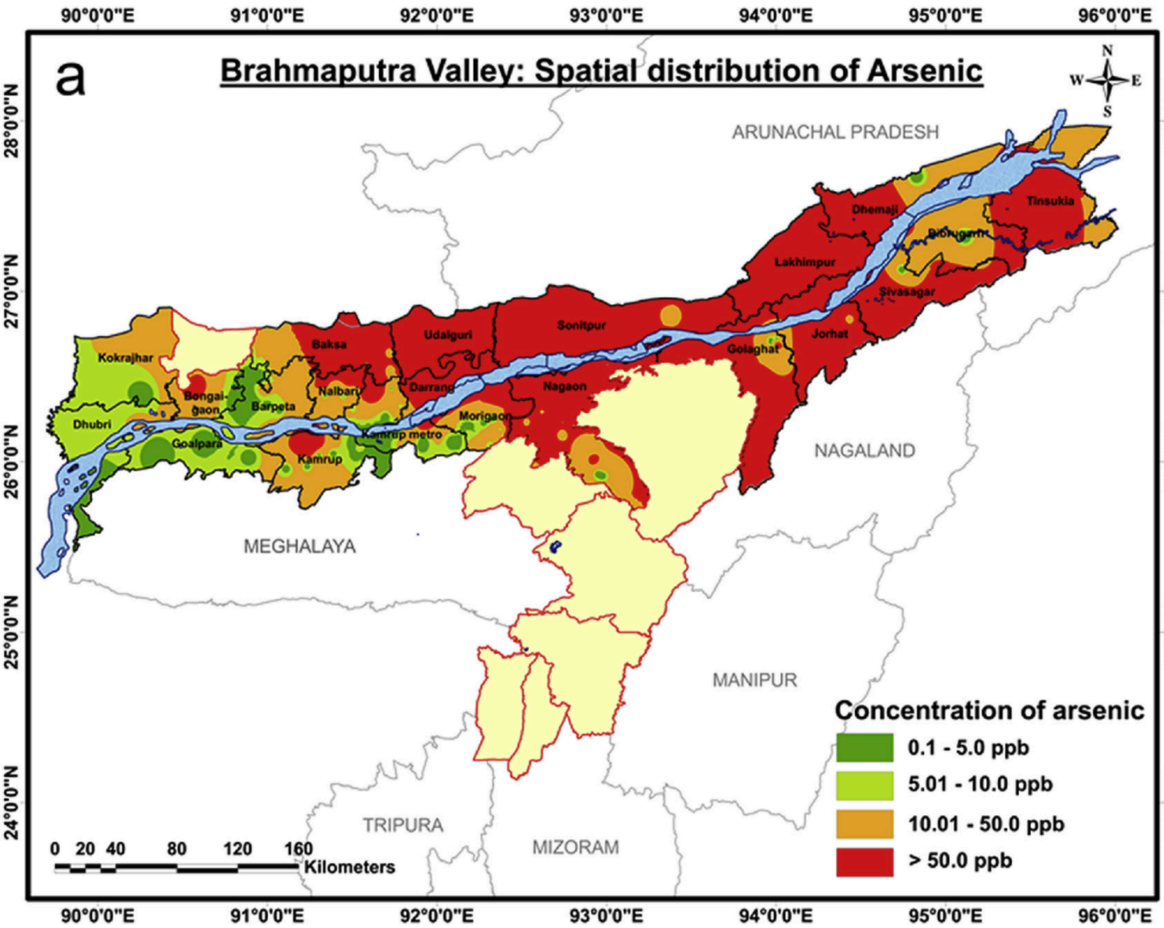

Figure 6: Distribution of groundwater Arsenic (As) in the Brahmaputra Valley in Assam, expressed in parts per billion (ppb) (Nath *et al.,* 2018).

As is highly toxic and using contaminated water for food preparation, drinking, or irrigation can expose people to its harmful consequences (WHO, 2018). Exposure can lead to a number of medical issues, including skin lesions, diabetes, increased deaths in youth, and cancer (WHO, 2018).

Like the pollution on the Tibetan plateau, the majority of As pollution is attributed to geogenic factors, as a result of volcanic rocks near the great bend, and sulphide rocks high in As coming from the Himalaya's (Nath *et al.,* 2018). There are, however, clear indicators that certain polluters cause increased levels of heavy metals in bodies of water. Higher levels of As and fluoride correlate with high levels of other polluters, such as Na+, as well as alkaline pH and high salt levels. These other polluters are, at least in part, the direct result of human behaviour. A study on one of the Brahmaputra's tributary rivers in Assam revealed that the test sites close to densely-populated areas scored almost twice as poorly on a WQI as those in less densely-populated areas (Bora & Goswami, 2017). The levels of oxygen in the water are low, which is usually a sign of high levels of organic pollution, often in the forms of pesticides, fertilizers, and industrial chemicals (Bora & Goswami, 2017). This means that industrial and municipal pollution exacerbates the issue of As and fluoride pollution (Jadhav *et al*., 2015).

VULNERABILITY TO POLLUTION

Although the qualities of the water flowing through certain parts of the Brahmaputra basin are measured, there is little follow-up regarding the specific ways in which these water qualities then impact the people living and working in the basin. The entire Brahmaputra basin can be seen as a reservoir for groundwater, leaving Assam with water directly from the river, as well as from aquifers which get supplied by tributary rivers and rainfalls. As studies have shown, however, both the Brahmaputra river as well as the groundwater is contaminated in many areas of Assam. Assam is India's largest North-Eastern state. Although the state has been developing in recent years, it lags behind the national average in terms of urbanisation and literacy rate. In terms of economic growth, Assam is ahead of national averages, with a growth rate of over 15% in 2014, highlighting the state's rapid economic expansion (Nayak & Panda, 2016).

Guwahati, Assam's largest city, has expanded rapidly, which has resulted in inadequate drainage facilities and increased sewage and waste (Borah *et al.,* 2020). Domestic sewage and municipal and industrial waste end up in the river Bharalu, either through municipal drains or through storm water runoff as a result of wastelands that are out in the open (Borah *et al.,* 2020). Although Guwahati city does not use the Bharalu river, which is a tributary of the Brahmaputra, as a source for drinking water, this contaminated water is used for a multitude of purposes further down the river. Furthermore, the contaminated water is likely to also contaminate the groundwater reserves around the Guwahati area. Groundwater aquifers are used as the main source of drinking water for the majority of those living in the Brahmaputra basin (Nath *et al.,* 2018). The availability of usable surface water is decreasing in Assam as a result of urban and industrial pollution, both from within Assam and from areas upstream. These include hydropower schemes in China and Arunachal

Pradesh, as well as large tourism projects along the banks of the Brahmaputra (Nayak & Panda, 2016).

As groundwater remains a vital source of water, with households accessing it through tube well and dug wells, the Indian government has been working on improving groundwater quality monitoring and drinking water supply coverage (DDWS, n.d.). The they have initiated a Rural Drinking Water Programme (NRDWP), which aims at creating safe drinking water sources for rural habitations through Piped Water Supply Schemes (PWSS) and Spot Source Water Supply Schemes (SSWSS) (DDWS, n.d.). In many urban areas in Assam, PWSS are major sources of water. What can be seen is that municipal boards in these areas distribute access to these treated sources of water primarily to those who pay taxes for these facilities (Gupta, 2004). The implementation of these NRDWP projects remains lacking, as many of the water supply schemes are implemented way behind schedule, and of those that are implemented almost 30% are no longer in working condition (Hindustan Times, 2010; The Sentinel, 2020). The largest numbers of failing water supply schemes can be found in the poorest districts of Assam (Nair *et al.,* 2013; The Sentinel, 2017). For many in more rural parts, which either did not get any supply schemes, or poorly-maintained ones, self-dug ponds or wells and community-managed tanks are sources of water, which are not treated for heavy metals or other pollutants (Gupta, 2004).

Around 60% of Assam's population is engaged in agriculture. Those engaged in agriculture are vulnerable to water pollution, as high rates of heavy metals or salts in water have negative impacts on soil properties and crop quality (Nayak & Panda, 2016). Poor farmers and fishermen in Assam use water from the Brahmaputra for all sorts of activities, including bathing, travel, caring for animals, and sanitation (Nayak & Panda, 2016). Only 5.8% of households in the rural parts of Assam have access to tap water from a treated source (DDWS, n.d.). Estimations have shown that the presence of As in Assam's water resources is putting more than 8 million people at risk of As contamination (Choudhury & Mahanta, 2018). The Department of Drinking Water and Sanitation clarifies that PWSS is adopted to cover a large population, and when there is a need for water treatment (DDWS, n.d.). SSWSS is for small populations and treats water minimally or not at all, it is mostly focussed on installing hand pumps and wells (DDWS, n.d.). This means, however, that small populations are highly unlikely to get intensive water treatments, even when their water source needs it. People living in the more remote and rural areas of Assam are missing out on the schemes that are put in place by India's government (Bezbaruah, 2021). Government efforts are further constrained by numerous factors, with weak cost recovery being a major issue in the most rural areas (DDWS, n.d.).

Many of those who are most dependent on the Brahmaputra for their water also tend to have low literacy rates, poor physical and health infrastructure, as well as uncertain livelihoods (Nayak & Panda, 2016). Tentative government assessments have shown that Assam's most marginalized communities, including lower castes, disabled people, women, and tea garden communities are most likely to be missed by public, private, and civil society efforts (DDWS, n.d.). Poor quality water resources in Assam have resulted in dysentery and hepatitis-A outbreaks of epidemic proportions (Gupta, 2004). The low levels of education and literacy in rural villages makes treatment of As-contaminated water difficult. Many villagers do not know about the dangers, as there has been a lack of public awareness campaigns (The Sentinel, 2016). As a result of this lack of public awareness, PWSS systems are managed poorly, leading to leakage, contamination, and unreliable flow. There is a lack of community ownership over the care for these PWSS, which is due, in large part, to the lack of awareness of the importance of the treatment of Assam's water resources (Choudhury & Mahanta, 2018). Non-profit organisations such as Gramya Vikash Mancha work with rural communities to protect them from As poisoning. They provide communities with treatment systems that can provide communities with more than 4000 litres of As-free water a day (Bezbaruah, 2021).

DISTRIBUTION OF VOICE AND AUTHORITY

After looking at the ways water and risk are distributed, and the reasons as to why they are distributed in this way, it is important to look at the ways the control over water is organized and steered (Zwarteveen et al., 2017). This means looking at how authority over water-related decisions is distributed in society, and who has the voice to provide input in decision-making. Numerous actors with varying backgrounds, types of expertise, and degrees of influence interact in the environment in which decisions regarding water distributions are made.

Negotiations regarding control over water are not limited to formally designated domains of water governance, and focussing only on government-based water laws can sometimes stand in the way of equitable water governance (Zwarteveen et al., 2017). Negotiations are also influenced by social hierarchies and identities, and water governance decisions are embedded in routine ways of interacting with water, outside of official channels (Zwarteveen et al., 2017). Exploring who has authority and who has a voice, in both formal and informal settings, allows for a better picture of how water is governed.

VOICE AND AUTHORITY REGARDING FISHERIES

In Bangladesh, around 12 million people are part-time or full-time fishermen, regarded as one of the most vulnerable groups in Bangladesh (Kabir, Adhikary, Hossain & Minar, 2012). Studies have shown that those living in isolated fishing communities make around 70% less money than the national average of Bangladesh (Kabir *et al.,* 2012). The Old Brahmaputra River, one of the arms of the Brahmaputra in Bangladesh, has a depth of 3.5 metres in the dry season, which increases to around 15 metres in the monsoon season (Ahmed, Rahman, Bunting & Brugere, 2013). Fishers come to the river during the monsoon and just after the monsoon, as the concentration of fish is high then. More than 75% of the fishermen living along the Old Brahmaputra are illiterate, and only very few of them have a secondary education (Kabir *et al.,* 2012). They have drinking water facilities, but poor sanitary facilities and housing, no electricity, and they are often dependent on village doctors with little understanding of medical science (Kabir *et al.,* 2012). The area's capital city, Mymensingh, is a major source of human encroachment and river pollution through municipal sewage and household waste, leading to a 20% reduction in aquatic biodiversity (Ahmed *et al.,* 2013). Fish catch has been steadily declining in Bangladesh, as a result of overfishing, industrialization, climate change, and environmental degradation (Ahmed *et al.,* 2013).

Previous policies of the Bangladeshi government have been focussed on maintaining capture fisheries whilst conserving biodiversity, in order to increase fish production (Ahmed *et al.,* 2013). The policies have had only limited success, as they do not take all socio-economic aspects of small-scale fisheries into account, the ways in which they provide food, income, and livelihoods for small communities (Ahmed *et al.,* 2013). When local fishers in the Old Brahmaputra were interviewed, they highlighted the ways in which small-scale fishing can contribute to poverty reduction, as the price of fish is going up as a result of population growth and a gap between supply and demand (Ahmed *et al.,* 2013). As small-scale fishery has the potential to reduce poverty, the government of Bangladesh has been working to improve the ways in which decisions regarding fisheries are made.

Since the 1990s, Bangladesh's Fisheries department has introduced a number of programmes to increase productivity, including nurseries, fish sanctuaries, and community-based fisheries management (CBFM) (DoF, 2019). These CBFM projects were introduced to around 23000 fishing households between 2001 and 2006. The idea is that the community shares responsibility for making and enforcing the resource management rules, together with academia, government, and civil society (Mustafa, 2020). This method is utilized more often in recent years, as it is said to promote sustainability and equity next to increased productivity (Mustafa, 2020). With the support of NGOs, fishing communities establish community-based organizations (CBOs) (Mustafa, 2020). CBFM supports the formation of formal and informal fisheries institutions. Formal institutions include community organizations set by the Department of Fisheries together with local government institutions. The informal institutions focus on promoting unity among fishers, sharing of traditional practices and knowledge, and exploring the power dynamics in fishing communities (Hossain & Rabby, 2019).

The impacts of CBFM have been mixed. Many reports have been positive, citing increased biodiversity, increased financial strength and improvements to livelihoods of fishers (Mustafa, 2020). Studies on the impacts of these CBFM programmes on the social capital of participants showed that community-based approaches led to more participation, rule compliance, conflict resolution, knowledge, and information exchange (Islam & Yew, 2013). There have also been signs, however, that these CBOs get taken over by local politics, pushing the poorest and least powerful in the community to the wayside (Mustafa, 2020). The formal institutions' ideas for fishery management are oftentimes controlled by the rich and powerful in communities (Hossain & Rabby, 2019).

Permanent waterbodies are government property in Bangladesh, and they get leased out to fishers, often backed by powerful leaseholders (Valbo-Jørgensen & Thompson, 2007). Property rights are poorly defined, due to changing water characteristics in wet and dry seasons, full-time and part-time fishers, types of gear and fish, and state regulations (Islam & Yew, 2013). These leases for fishing rights tend to go to elites with a lot of social power, who then in turn get to determine who has access to waters (Islam & Yew, 2013). Community-based management arrangements tend to be controlled by influential people looking for financial gains in the form of subsidies and profits (Valbo-Jørgensen & Thompson, 2007). Those who are in control over more resources, such as financial capital or land, have more power to influence rules set by CBOs (Hossain & Rabby, 2019).

Local fishers can serve as an important source of information to improve the river's ecosystem, as well as decrease the vulnerability of local communities (Ahmed *et al.,* 2013). So far, this has happened only partly, due to a top-down approach from the Bangladeshi government and an educational and societal gap between fishing communities and formal and informal spaces discussing water governance (Ahmed *et al.,* 2013). NGOs involved in CBFM produced newsletters, TV talk shows, and other forms of audio-visual material to improve communities' conflict-solving abilities, enforcement of fishery rules, as well as leadership and accounting (Islam & Yew, 2013). However, as mentioned before, 75% of the fishermen living along the Old Brahmaputra are illiterate. Next to this, most have no electricity, and thus no access to TV or radio (Kabir *et al.,* 2012). These factors, combined with the notion that those with more money have more of a say in CBOs means that, for now, the poorest of the poor are not able to have their voices heard in Bangladesh' management of fisheries, even though the government is promoting community-based approaches.

DISTRIBUTIONS OF KNOWLEDGE AND EXPERTISE

As in many other spaces, within the field of water governance there is an interaction between power and knowledge. This means that those with power are able to frame and interpret reality in such a way that benefits their interests, which in turn means that the knowledge and ways of governing water produced using this framing of reality reinforces existing systems of power (Zwarteveen *et al*., 2017). It is important to look at which knowledges are used more than others, and which interests they serve. Scientific knowledge is influenced by its creators and place of origin, which needs to be taken into account when looking at the influence of water expertise on governance decisions (Zwarteveen *et al*., 2017). Knowledge can be seen as an understanding of reality based on an interpretation of generated information. The mechanisms to generate information, including resources, skills, and instruments, are subject to biases, meaning that the description and subsequent explanation of reality is always influenced by who is formulating it, and who it is formulated for (Usón, Henríquez & Dame, 2017). In the fields of environmental governance as well as sustainable development, the absence of politics can be seen in a lack of exploration of who makes decisions, and for whose benefits (Huber & Joshi, 2015). When speaking of governing a river, or developing it for ecological or economic benefits to society, there is little room for discussions of what sort of nature one is trying to create or preserve, and whether these benefits will be seen as benefits for all of society (Huber & Joshi, 2015).

HYDROPOWER IN INDIA

India and China are Asia's largest recipients of the UN's Clean Development Mechanism, a scheme to fund projects aimed at reducing greenhouse gas emissions (Ahlers, Budds, Joshi, Merme & Zwarteveen, 2015). Hydropower projects are the second-largest type of project receiving financing. The field of hydropower development is one that is characterized by depoliticization attempts, with a focus on techno-economic rationality (Huber & Joshi, 2015). Hydropower is framed as a green grow strategy, with a disregard for context-specific interactions between people and their environment in the areas where these hydropower projects are to be constructed (Huber & Joshi, 2015). The dominant narrative is that hydropower is affordable, reliable, and a clean alterative to fossil fuel.

Within India, hydropower dams are presented first and foremost as economic projects that will help meet the energy demands of India's rapidly growing economy (Ahlers *et al.,* 2015). India's rapid development has drastically increased the power consumption, which can explain the Indian government's willingness to tap into previously untouched energy sources, such as the Brahmaputra with its high hydropower potential (Erlewein, 2013). Hydropower projects have low recurring costs, low carbon emissions, and a high power output. For individual states with a high potential, such as Arunachal Pradesh and Sikkim, building dams on the Brahmaputra can serve as a way for the state to increase revenue (Erlewein, 2013). In 2000 the World Commission of Dams put out a controversial report which talked about the ways in which, although dams can bring substantial benefits, "the failure to account for the consequences of large dams for downstream livelihoods have led to the impoverishment and suffering of millions" (World Commission on Dams, 2000, p. xxxi). This report was received poorly in India, with the government's response being a total denunciation of the finding of this report (Baruah, 2012). In India, water governance is a state responsibility, but hydropower projects do need to pass a host of federal clearances, including an Environmental Impact Assessment (EIA) (Choudhury, 2010).

HYDROPOWER DEVELOPMENT IN ARUNACHAL PRADESH

The Brahmaputra basin has around 30% of India's total hydropower potential. The vast majority of this potential can be found in Arunachal Pradesh, and has remained largely unused (World Bank, 2007). In 2003, the Indian government launched a plan that was intended to add 50000 MW of energy through hydropower development, intended to increase the share of electricity generated by hydropower dams from 25% to 40% (Erlewein, 2013). The Central Electricity Authority has made plans to construct over 150 large hydropower projects, as well as 900 smaller ones throughout the North-Eastern region of India, with the majority of these projects being in Arunachal Pradesh and Sikkim (Chowdhury & Kipgen, 2013). Figure 7 shows the spread of these proposed hydropower dams throughout Arunachal Pradesh.

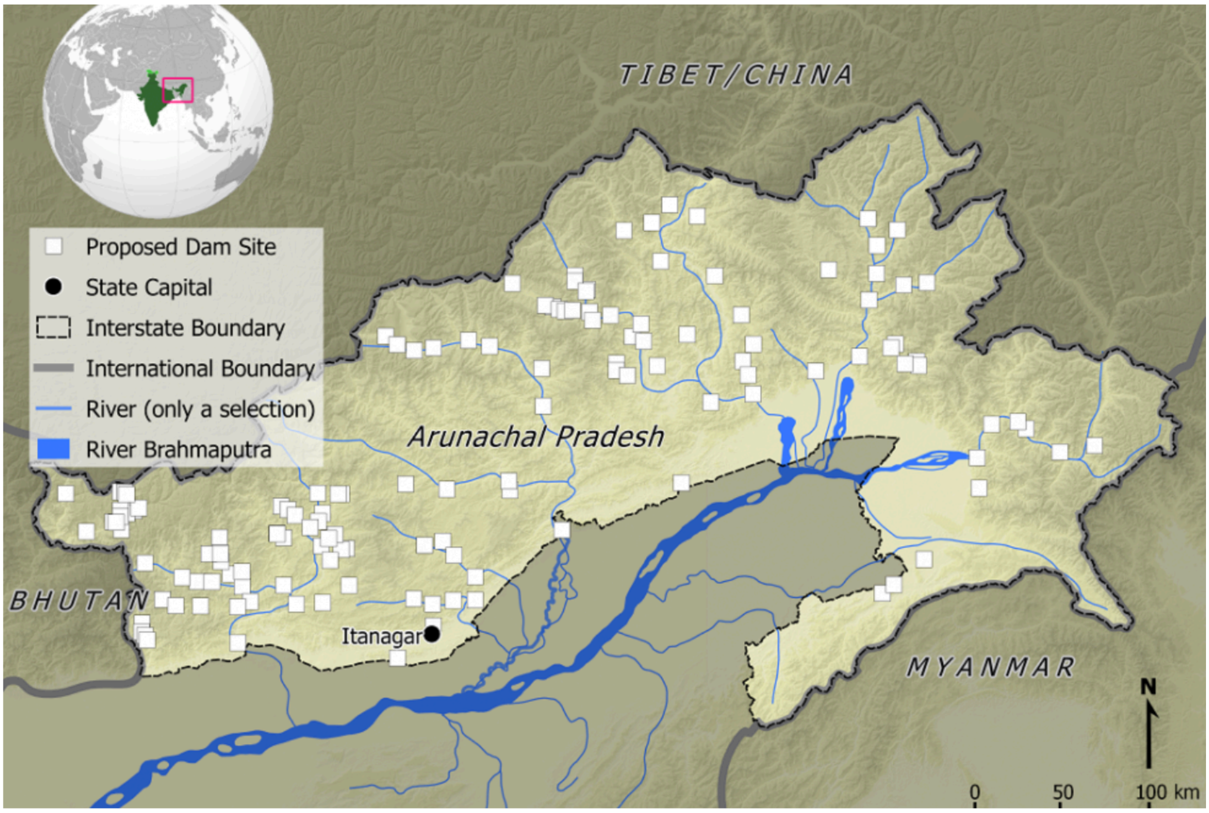

Figure 7: Proposed hydropower dams in Arunachal Pradesh, based on data from the Department of Hydropower Development (Ete, 2014)

Arunachal Pradesh' government has signed more than 100 Memorandum of Agreement's (MoA's) with construction companies for the development of hydropower projects, with some projects having been subjected to India's quality check system, as well as the EIA (Chowdhury & Kipgen, 2013). Arunachal Pradesh is a tribal majority state, meaning that the state is mostly made up of small tribal communities who live on the land they work off, which results in a deep connection to their resources (World Bank, 2007). This is coupled with a lack of clarity with regards to land and water ownership. Land classifications in Arunachal Pradesh are not clear, but indigenous communities do enjoy riparian usufruct rights, meaning that they are allowed to make use of rivers so long as they do not impair or alter them (Chowdhury & Kipgen, 2013). The mountains and valleys in Arunachal Pradesh, together with the rivers that flow through them, are under the possession of tribes and clans (Ete, 2014). The state government has no records that identify these claims of ownership in the area. As local communities operate under the knowledge that they own the lands and rivers they live with, the state and national governments have no authority to make decisions with regards to those lands and rivers (Ete, 2014). This means that the MoA's given to companies are seen as illegitimate, an idea that was further solidified by the state government's lack of transparency in giving out these MoA's. This lack of faith in the government's actions meant that subsequent EIA measurements, such as water assessments and geological drilling were interpreted by local communities as the government trespassing on private property. This could be seen as an employment of EIA guidelines to establish legitimate state government control over these areas inhabited by tribes. Next to this, the EIA is also employed in other ways.

INDIA AND THE EIA

EIA in India came into being as a result of external pressures, namely from the UN Conference on Human Environment and the subsequent National Committee on Environmental Planning (Choudhury, 2010). It needs to be completed for the construction of major development projects. Hydropower projects are required to obtain an Environmental Clearance (EC) from the central Ministry of Environment and Forests (MoEF). The basis for this EC is the EIA reports. Although the implementation of mandatory EIA reports has been deemed as a positive for the integration of environmental considerations in development processes, there are those who criticize the EIA, from its limited impact to its levels of public participation (Erlewein, 2013). The EIA is presented as an apolitical, scientific tool which can correctly anticipate environmental and social impacts of development projects (Choudhury, 2010). For this, a set of assumptions are made, including how accurately the EIA identifies baseline situations as well as all socio-environmental impacts (Choudhury, 2010). However, as there is a constitutive relationship between those that hold power and the knowledge generated using scientific tool, it is likely that the EIA is skewed in some way in favour of those who have created it.

In 1994 the EIA became official legislation under India's Environmental Protection Act, but amendments since then have reduced its powers. The amended 2006 EIA requires only an assessment of the direct impacts of an individual project, with no attention for cumulative effects of multiple projects (Erlewein, 2013). The EIA in India is focussed on technical assessments, with little to no input from local communities (Baruah, 2012). Next to this, the Ministry of Finance also proposed the "streamlining" of public hearings and a time limit for an EC, after which development projects would be deemed to have been cleared (Choudhury, 2010). Lastly, changes to the EIA made it so that only the local people directly affected by development projects would be allowed to attend public hearings (Choudhury, 2010). The MoEF has created a 10-kilometre radius cut-off point around hydropower projects, meaning that communities living outside this radius cannot claim they are stakeholders in the project (Ete, 2014). This thus means that those living further upstream or downstream from a project cannot attend public hearings, although the EIA is framed as being open to public input. Environmental groups, as well as local communities, have argued that this cut-off point is random and not in accordance with hydrology, as flow-of-river alterations do not simply stop affecting communities once they live more that 10 kilometres away from it. The impacts of the EIA and its framing and phrasing can be seen in the Lower Subansiri Hydropower project, one of the largest hydropower projects in India.

THE LOWER SUBANSIRI PROJECT

The Lower Subansiri hydropower project is located on the border between Arunachal Pradesh and Assam (Dutta & Sarma, 2012). For the Lower Subansiri, the initial EIA was carried out in 2001, and after a set of public discussions and an expert appraisal committee, the MoEF gave the project an EC subject to certain conditions (Choudhury, 2010). This meant that developers were requested to perform additional studies, but simultaneously implied that the project should and would proceed.

Dutta & Sarma state that "no sufficient and detailed study was done in the entire downstream during the preparation of the report" (2012, p. 2955), as studies assessing the river's health, impacts on endangered species, fish diversity, and options for mitigation were not adequately addressed. Next to this, the official EIA only focussed on dam impacts up to a distance of 7 km away from the dam site, whilst the Subansiri river flows 130 km through Assam before joining the Brahmaputra (Dutta & Sarma, 2012). A group of regional experts on engineering, geology, zoology, and other related fields, were asked to assess the downstream impacts of the Lower Subansiri Hydropower project. This report was finished in 2010, and called for expensive changes to the design and site of the dam, as the location in which the dam was set to be built was geologically and seismologically too sensitive (Baruah, 2012). A World Bank report on development in Northeast India states that "despite the seismicity of the region, there is a growing consensus among engineers that the physical and engineering constraints to development of hydropower can be overcome" (World Bank, 2007, p.60). The World Bank's website states that this report has come about at the request of the Indian Government. This shows a difference in interpretation of the security of the dam site, dependent on who is asked to assess it, and what their interests are. Next to this, the regional expert report had paid more extensive attention to the potential impacts of construction on the communities living along the rest of the Subansiri river, instead of only focussing on the first 7 km. Their assessment showed that the lives of rural villagers would be negatively impacted, namely through riverbank erosion and flood damages as a result of the dam. The NHPC, the National Hydroelectric Power Corporation in charge of the project, took the regional experts' assessment and stated that this showed that even without a dam project people face many hardships in the area, and that dams would bring with them many opportunities for local villagers (Baruah, 2012). They did not address critiques of their report, but stated that the site and design of the dam had been approved by the highest specialized government agencies.

These factors show that although the EIA is presented as an objective, apolitical tool to measure the impacts of hydropower development, there are biases with regards to which data is included and how it is measured, as well as the ways in which data is subsequently presented to the public. The EIA is designed by the Indian government, and is designed in such a way that it will not stand in the way of desired hydropower development in Arunachal Pradesh. Despite extensive criticism, the Lower Subansiri hydropower project is still listed as completely cleared in the

Brahmaputra Board's annual reports, having cleared the EIA, and a set of Detailed Project Reports (DPRs) (Brahmaputra Board, 2019). The completion of the Lower Subansiri, together with other dams in the state, fit into a wider action plan to establish India's user rights on the Brahmaputra and its tributaries in Arunachal Pradesh (Samaranayake, Limaye, & Wuthnow, 2016). Indian officials have repeatedly linked India's riparian rights to the Brahmaputra to dam building. Arunachal Pradesh is a disputed territory, as China also claims ownership, and the belief in the Indian government is that increasing hydropower development along the Brahmaputra in this state will further solidify India's hold on the region (Xie & Jia, 2017).

CHAPTER 5: DISCUSSION

The main point that came up repeatedly during the analysis of the state of water governance in the Brahmaputra basin was a lack of research and measurements. Multiple scholars have already pointed out that the Brahmaputra basin is one that is both underdeveloped and under-researched, especially when compared to the other major basins in the area, namely the Ganges, Indus, and Meghna (Ray *et al.*, 2015; Bhattarai, 2009). In the case of the distribution of water an assessment of water availability should include some form of mapping an area's water flow, as well as an exploration of the norms and laws in place that cause this particular flow. There are two main factors in the Brahmaputra basin that limit this mapping.

Firstly, the lack of measuring points on waterflow and climate fluctuations, as well as the unwillingness, especially on China's part, to share measured data. This could be seen in the irrigation water study presented in the analysis, which had to make use of incomplete water flow and climate data. A tool named CROPWAT was used, which calculates water usage per crop based on a number of characteristics, including planting date, climate in planting area, and soil type. For this study, there was only one climate measurement point available for the entire Tibetan part of the Brahmaputra basin's agricultural water usage. This sort of data could be used to improve the access to water in the region, through cooperative measures or changes in legislation. This shows that deliberate, insufficient measuring along the

Brahmaputra river, and the refusal to share data, hampers further research into the ways the river is used and experienced by people, and thus how it should be governed to improve equity. What can be inferred from the distribution of water is that basin-wide, the area is much more likely to be severely impacted by a water overabundance than a shortage.

Secondly, the ways in which peoples make use of the river have, thus far, been underexplored. Although agriculture is one of the main sources of employment in the basin, and also one of the main water usages, other socio-cultural or economic interactions with the river have not been addressed in discussions of water usage. There is, for instance, the annual Pushkaram Brahmaputra festival in Assam, which has been rapidly growing in recent years, but is not mentioned in any academic paper on the river (Venkataramanan, 2019). This Pushkaram festival intends to revive the reverence of river bodies, and could thus influence the ways people interact with the Brahmaputra and its tributaries. The role rivers can play in social and cultural interactions in an area have been explored in other parts of the world, but in this basin they have not (Schillinger & Lycett, 2019). This has resulted in an unclear picture of how the river is actually being used, and by who.

These two factors make determining the state of water availability for people in the basin difficult. This, subsequently, makes any sort of tangible plans for improving equity through water governance in the area almost impossible. Next to these issues in determining water availability in the basin, there is little to no transparency with regards to the laws in place influencing the flow of the river, at least not translated into English and available in spaces open to the public. The lack of attention for socio-cultural uses of water, as well as the lack of measuring stations and research, are deliberate and political choices. The role politics plays in the prevention of more extensive data acquisition on which to base water governance decisions deserves attention, as it impacts attempts to improve access to water.

When it comes to the distribution of risk, the focus was on water quality. Although numerous water quality assessments have been conducted across the Brahmaputra basin, many of these assessments were making use of different parameters, which could weaken the comparability of assessments across the basin. The study conducted on the Tibetan Plateau, for instance, focussed on major ions, trace elements, and nutrients, and stated that the condition of the water was relatively pristine, but did not clarify adequately what was meant with pristine. Across all studies conducted in the basin there are mentions of WHO guidelines and global averages, but there is little clarification as to which elevated levels should be cause for concern and which are negligible. This highlights the highly technical and chemical focus of the field of water quality assessment, in which the focus lies on the quality of water in comparison to global averages, instead of the quality of water relative to the ways in which people in the area make use of it. This is where the second aspect of risk comes in. Although it is possible to get a general overview of water pollution as a hazard in the Brahmaputra basin, it is still very difficult to pinpoint the ways in which people are vulnerable to this hazard, as studies on people's interactions with the water are few and far between. This shows that, in similar fashion to the distribution of water, the lack of clear information on the ways water is accessed and used limits the abilities to determine the extent to which water pollution is a risk to people. It comes perhaps as no surprise that it is those that are poorest, furthest removed from cities, and most vulnerable to water pollution that remain the most underrepresented in water quality impact assessments.

India's NRDWP does show that those in charge of governing water in the basin are aware of the hazard that water pollution poses to people. In cities, the PWSS are focussed primarily on areas where tax-payers live. In the more rural areas, PWSS are swapped for SSWSS. However, as SSWSS offer fewer protections against dangerous water pollutants, since they do not have the same filtering capabilities as PWSS, this essentially means that only densely populated areas get filtered water. These measures reveal the stance the government is taking in their approach to this issue, which is primarily economic. Assam's government even admitted that economic constraints were some of their main issues with getting its entire population access to clean water. Recognizing the economically-centred approach the Assam state government is taking to these programmes aimed at improving water quality is important, as it simultaneously reveals who is falling through the cracks. This in turn could be used to alter water governance in such a way that in future water quality programmes these people are provided for, improving equity.

In the instance of the distribution of voice and authority, with the focus on fishing communities in Bangladesh, there was some awareness amongst the Bangladeshi government that some form of community participation could improve the care for the river. The situation in fishing communities in Bangladesh supports the notion presented by the Water Governance chair group's framework that negotiations regarding water control should not be focussed only formally government-designated domains, as many of the attempts to better include local fishers in decision-making processes occur outside of these domains. Although the Old Brahmaputra is only one of the many tributary rivers in the Brahmaputra basin, the fishermen living along this river are characteristic of fishing communities throughout the basin, especially in North-East India and other parts of Bangladesh. Low literacy rates, male-dominated hierarchical structures, and simplistic infrastructure and fishing equipment are features of many fishing communities throughout the basin (Dutta & Dutta, 2013).

Bangladesh's government's willingness to support the introduction of CBFM programmes highlights a level of acknowledgement of the importance of input from locals living with the river. Even within these programmes, however, it is clear that increasing or at least maintaining fish productivity was the primary goals, and that community-based approaches were simply seen as one way of securing said productivity. Although there was some acknowledgement of the socio-cultural dimensions of CBFM, such as the sharing of traditional knowledge and the promotion of unity, economic dimensions remained the primary focus. This focus can be seen in the subsequent assessments of CBFM programmes. The assessments that focussed on the aspects the government finds most important, such as rule compliance, biodiversity, and financial strength, find that the programmes have been working well. Assessments that do include socio-cultural dimensions find issues with the programmes. The economically-focussed attitude towards the functioning of CBFM programmes led many of them to fall victim to the same kind of power politics that government domains suffer from, once again resulting in an approach to fisheries that does not include all socio-economic factors. For many of the poorest villagers, CBFM merely replicated the political dynamics that are present in formal water governance domains on a much smaller scale. Those with money are in charge of decision-making, something which is further exacerbated by educational gaps between fishers, intensified by NGOs and government's poor attempts at reaching Bangladesh's most marginalized fishing communities.

The analysis of CBFM programmes in Bangladesh supports the notion that much of the mainstream discussions on water governance are dominated by technical and economic discourses, as most of the limited scholarly research on fisheries in the region is focussed on economic fluctuations in the price of fish in the region, and the level of sophistication and efficiency of fishing practises employed. Other aspects of the life of indigenous fishing communities and their ways of interacting with the river, primarily the cultural aspects, do not receive the same kind of academic and subsequently policy attention. An example of this is Bheta fishing, which is an indigenous fishing method that is part of the cultural heritage of tribal communities in Arunachal Pradesh (Dutta & Dutta, 2013). Despite the importance of this fishing method for local communities, no mention of this method is made in any of Arunachal Pradesh's official fishery assessments. Similarly, in the community-based fisheries management projects in Bangladesh, the focus is on making resource management more efficient and sustainable, with no mention of the cultural basis of many traditional fishing methods across the entire Brahmaputra basin.

The distribution of knowledge and expertise is focussed on the relationship between power and knowledge, on which water governance decisions are based. In the case of hydropower, there are two main frames in use, hydropower as a green growth strategy, or as an environmental hazard. In most cases, a country's approach to dam development is characterized by a combination of these two frames, as hydropower is a multifaceted issue (Ahlers *et al.,* 2015). The environmental costs are always relative to specific dam sites, and economic and energy opportunities are dependent on what the alternatives are. Next to this, hydropower construction opens up debates on land ownership, population replacement, as well as equity and sustainability.

In the case of India, the approach characterizing hydropower as a good investment has the upper hand, which can be inferred from the government's rejection of the research presented by the WCD. This positive approach towards dams, together with a rejection of the WCD's recommendations of more inclusive decision-making and greater recognition of environmental impacts (World

Commission on Dams, 2000), in turn impacts the design and functioning of India’s EIA. The EIA is officially an apolitical tool that is used to assess both environmental and social impacts of (hydropower) development projects. There are, however, very deliberate facets of the EIA that impact the results of this assessment. This is not to say that those in charge of the EIA have purposefully designed it in a way to get desired results, but rather that the knowledge generated by the EIA cannot be seen separate from the systems that formulate and alter it. The first formal introduction of the EIA came as a result of international pressures, and in the years since then amendments have reduced its abilities to create an inclusive overview of the ways hydropower dams impact local populations. By making it more difficult for local communities to have their voices heard by banning them from public discussions, a technical tool presented as an unbiased impact assessment has become very clearly coloured by those who designed it. The brief case study of the Lower Subansiri dam project showed that the projected impacts of the dam vary widely depending on which experts are asked to compile a report, and the measurements they use to write up said reports. Local experts highlighted numerous ways in which the dam and its impact assessment were falling short, including issues with the dam site and a limited downstream impact assessment. Those in charge of the dam, however, noted that the dam has passed through all of India’s legal requirements, highlighting the way in which this deliberate design of the EIA serves to legitimize the construction of those hydropower projects the national and state governments want to see in Arunachal Pradesh.

The end result of the way the EIA is designed is that the extent of the environmental impacts remains underreported, as issues with aquatic biodiversity, groundwater supplies and changes in sediment load with far-reaching impacts on local farmers are either inadequately assessed, or not assessed at all. This EIA design has made it easier for hydropower projects to receive an EC. This is in line with the Indian government, as is evident from Arunachal Pradesh’ more than 100 MoA for hydropower projects. The recognition that the knowledge produced by the EIA should not be seen as separate from the political apparatus that has designed it can lead to a more critical approach to water governance decisions that are made on the basis of this knowledge.

It is important to note here that the four issues discussed here are used to exemplify the theory's distributions, and the role of politics within them. This does not mean that for each of these issues only one type of distribution is important, as it was written in this thesis' analysis. Instead, most major water governance issues could and should be looked at from a number of these distributions. When discussing water quality, for instance, next to the distribution of risk in decision-making on this, the distribution of knowledge and expertise here is important as well. As was briefly touched upon, there are numerous ways to assess the quality of water. The parameters one chooses to measure the quality of water are likely impacted, even implicitly, by one's background and desired use for water. Zoologists are likely to look at the suitability for water to support aquatic life and fish, whereas economists will look at the water's utilization for industries or agriculture. Similarly, when talking about the ways in which those living in the poorest and most remote areas are the least likely to get adequate water filtering systems, it is subsequently also valuable to look at the ways in which these people are able to have their voices heard in water governance decision-making, if at all. Poverty, poor infrastructure and education, as well as distance from more populated areas are likely to make participation in decision-making processes more difficult across river basins, not just in the instance of Bangladeshi CBFM programmes. In this thesis, only one distribution was analysed per water issue, primarily for the sake of clarity of argument, but it is important to stress that these distributions and their implications overlap in many instances.

A second thing to keep in mind is that this research was conducted by only one person. In the framework put forward by the Water Governance chair group from the IHE Delft Institute for Water they make the case that an analysis that combines different academic backgrounds is preferable, as it forces scholars to look critically at their own views and approaches. It is this lack of interdisciplinarity in water governance writing that gave rise to their framework in the first place, as a focus on economic incentives and technical and engineering solutions to water governance issues resulted in a lack of attention for the role of politics. Further explorations of the role of politics in water governance processes, whether in the Brahmaputra basin or in other basins around the world, could therefore benefit from a multidisciplinary research team.

CHAPTER 6: CONCLUSION

This thesis made use of a transnational case study to highlight the influence of politics on water governance, for the purpose of improving the utility of the concept of water governance in discussions of water access and diplomacy. The analysis has revealed that the impact of politics in the governing of the Brahmaputra is extensive and multifaceted. In all four major water issues addressed in this thesis clear political decisions could be identified that had an impact on the way water was subsequently being governed. In the case of water quantity, the political decisions to either share or not share measurements and data on people's interactions with water have an impact on ideas of where water should flow. As for water quality, political decisions were made as to who would be protected against water pollutants, and in which ways. In the case of voice and authority in decision-making, the ways in which the CBFM programmes were designed and assessed were based on political decisions about who should be able to have their voices heard. Lastly, in terms of power and knowledge in hydropower development, the impacts assessments are designed in a way that was based on the political decisions and aspirations of those who created them. Water governance is a field that is closely related to numerous other fields of study, and improving the nuance in water governance discussions will aid other research fields, such as politics, climate change, economics, and development studies. Real, tangible water governance decisions are being based on the data, knowledge, interactions, and representation influenced by political decisions. Therefore, addressing these political decisions could allow for a water governance that takes into account the interactions with water of more people in the Brahmaputra basin, not just those who have more political sway, which would help to improve social equity.

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