

Dams, Development and the Future of Sino-Indian Hydro-Politics

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Abstract

China and India's miraculous economic growth has improved the livelihoods of millions of people but has increased demand for already scarce water resources in the region. The hydro-political relationship between the two states is unique due to China's hold of the Tibetan Plateau, which houses nearly all major riverheads in the region. China's unwillingness to cooperate with their downstream neighbors has become cause for concern, especially for India's growing economy and population. Water, most obviously crucial for public health, is also a key input for all energy production, making it imperative to the continued development of both states. This study holistically analyzes key economic policy changes enacted by both states in the late 20th century that encouraged their rapid economic growth and proceeds to quantitatively assess the associated changes in energy and water demand. This analysis is supported by modern water scarcity data and contextualized through the lens of the geopolitics of Tibet. Utilizing Fearon's rationalist framework, I analyze the key sources of conflict as incomplete information and commitment problems exacerbated by the indivisible nature of the Tibet's resources. The interconnections between these sources make finding a comprehensive solution difficult. I suggest that domestic water and energy efficiency improvements and codified data sharing agreements can foment short-term cooperation between the nations. This thesis ultimately establishes a link between China and India's globalization-led development and the associated change in energy and water demand in order to determine the actions necessary to avoid international conflict and ensure long-term water and energy security for both states.

I. Introduction

The phrase “water is life” has been circulated and translated throughout the world for decades. The phrase, though simple, evokes the absolutely irrefutable and unquantifiable value of water. Most obviously we need water to satisfy our thirst and cultivate crops, but as the world rapidly developed, water became a crucial economic input for many industries.¹ From textile production to steel smelting, water is an irreplaceable production input. Basic economic principles tell us that in order to capture returns to scale, the total production input must increase.² Water is not only crucial to the production of goods as an input, but also plays an increasingly crucial role in energy production as well.³ Throughout our historical development water has played a key role in all aspects of life and the 21st century is no exception. More than ever before, water is becoming a global issue that demands attention as impacts of climate change, pollution and increased consumption exacerbate existing issues of water scarcity.

Among the world’s emerging water antagonisms, one in particular necessitates immediate attention. China and India’s miraculous economic growth since the late 20th has changed the livelihoods of hundreds of millions of people.⁴ As the two most populous countries in the world, China and India must consider and mitigate prevailing issues related to increased domestic consumption of natural resources.

¹ Thompson, B. (2017). Water as a Public Commodity. *Asian Journal of WTO and International Health Law and Policy*, 12(2), 247–263. <https://doi.org/10.3366/ajicl.2011.0005>

² Silberston, A. (1972). Economies of Scale in Theory and Practice. *The Economic Journal*, 82. Retrieved from <https://www.jstor.org/stable/pdf/2229943.pdf>

³ Yu Qiu, G., Li, W., Li, L., Zhang, Q., & Yang, Y. (2014). Water and Energy Nexus in China: Current Situation and Future Perspective in Energy Industry, Water Industry and Agriculture. <https://doi.org/10.4172/2090-4541.1000138>

⁴ Barry, N. (1993). Deng Xiaoping: The Economist. *The China Quarterly*, (135), 491–514. Retrieved from <https://about.jstor.org/terms>

An influx of foreign money flowed into China's borders as the Chinese Communist Party (CCP) eased its economic oversight in the early 1980s,⁵ and as a result, the country's industrial and consumption-related water demands changed.⁶ Both production-related demand (agriculture and industry) as well as consumption-related demand (urban and rural households) have increased since the 1980s.⁷ These rising demands have mandated the CCP undertake massive infrastructural projects to irrigate water from the water-rich provinces of the south to the water-scarce provinces of the north.⁸ How China chooses to mitigate its increased water consumption will directly impact its regional neighbors—most importantly, its regional rival India.

China's water consumption changes are crucial to regional hydro-politics due its control of the Tibetan Plateau. Touted as "Asia's water tower," the Tibetan Plateau is home to ten major riverheads that provide water to 50% of the world's population.⁹ If China pursues water projects upstream in Tibet, their downstream neighbors could be heavily impacted. As China encounters continued water scarcity issues, the CCP will have greater incentive to pursue water projects involving the waters of the Tibetan Plateau.¹⁰ The region as a whole, from Bangladesh to Vietnam, is experiencing remarkable economic growth. But economic development carries a

⁵ Ibid.

⁶ Shalizi, Z. (2008). Water and Urbanization. In *China Urbanizes: Consequences, Strategies and Policies*. Washington DC: The World Bank. Retrieved from http://www.un.org/waterforlifedecade/swm_cities_zaragoza_2010/pdf/03_water_and_urbanisation.pdf

⁷ Yu Qiu, G., Li, W., Li, L., Zhang, Q., & Yang, Y. (2014). Water and Energy Nexus in China: Current Situation and Future Perspective in Energy Industry, Water Industry and Agriculture. <https://doi.org/10.4172/2090-4541.1000138>

⁸ Shahid, Y., & Saich, T. (2008). *China Urbanizes: Consequences, Strategies, and Policies*. The World Bank/International Bank for Reconstruction and Development. Retrieved from <https://openknowledge.worldbank.org/bitstream/handle/10986/6337/424850PUB0ISBN101OFFICIAL0USE0ONLY1.pdf?sequence=1&isAllowed=y>

⁹ Pomeranz, K. (2013). Asia's Unstable Water Tower: The Politics, Economics, and Ecology of Himalayan Water Projects. *Asia Policy*, 10(16), 4–10. <https://doi.org/10.1353/asp.2013.0023>

¹⁰ Ibid.

heavy burden on natural resources, namely water. As these nations develop their water demands will also increase, deeming water-sharing a pressing international issue.

India and China's water relationship is of particularly high concern. As two of the largest nations in the world in terms of population and economic output, the outcome of hydro-political disputes is a globally meaningful issue. Though China's economic and population growth has slowed over time, the country's consumption needs are still steadily increasing.¹¹ India, conversely, is about a decade behind China in terms of economic development. India's economy and population has been growing rapidly since the early 1990s and shows no sign of slowing.¹² As India continues to capture its developmental potential, its water needs will change.¹³ India is already experiencing water shortages throughout the country and risks retarding its economic growth if long-term water access is not ensured.¹⁴ India and China alike are becoming increasingly incentivized to capitalize on their domestic water sources; but due to the geography of the region and the importance of the Tibetan Plateau, their pursuit of domestic satiation has international implications. The Tibet Plateau acts as the meeting point for Sino-Indian economic, political and security related issues. Without proper attention, the Sino-Indian hydro-political issue will continue to fester and increase its likelihood of escalation into conflict.

The hydro-political issues brewing in the region have attracted large amounts of academic and public attention. Growing concern for future "water wars" has made the Sino-Indian water situation highly politicized¹⁵ because of the economic importance of adequate water

¹¹ FAO. 2016. AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO).

¹² Ibid.

¹³ Bhatnagar, M. (2009). Reconsidering the Indus Waters Treaty. *Tulane Environmental Law Journal*, 22, 271–461.

¹⁴ Ibid.

¹⁵ Chellaney, *Brahma China's New War Front: Natural Resource as a Political Tool*, (Times of India, 2013)

access for the public and private spheres grows domestically in India and China alike.¹⁶ India risks forfeiting its economic rise if its needs are not met. Institutions like the United Nations and World Bank have historically played a key role in brokering bilateral water agreements,¹⁷ but China's uncooperative nature in regard to water treaties obstructs any potential treaty. The multifaceted value of water makes it a particularly hard resource to manage. But as economic and urban development spreads throughout Southeast Asia demand for water will become an increasingly pressing and global issue that will demand sustainable management.¹⁸

This thesis aims to link the globalization-led economic development of India and China beginning in the late 20th century to the prevailing regional water issues today in order to discuss potential escalation and methods for de-escalation. The thesis distinguishes itself in its attempt to combine historical, political and economic analysis to understand the complexity of these issues bilaterally. Water issues in India and China have been studied independently, but a critical connection between their economic development narratives to modern bilateral water issues is necessary to understand the full potential for conflict and cooperation.

I will be utilizing an interdisciplinary method of analysis to establish and discuss the issue at hand. The first section details the development narratives of India and China by utilizing statistical data combined with qualitative policy analysis to demonstrate the process of rapid development of each state. The second section aims to demonstrate how the development narrative established in the preceding section has impacted water and energy consumption

¹⁶ Yu Qiu, G., Li, W., Li, L., Zhang, Q., & Yang, Y. (2014). Water and Energy Nexus in China: Current Situation and Future Perspective in Energy Industry, Water Industry and Agriculture. <https://doi.org/10.4172/2090-4541.1000138>

¹⁷Bhatnagar, M. (2009). Reconsidering the Indus Waters Treaty. *Tulane Environmental Law Journal*, 22, 271–461. Radosevich, G. E., & Olson, D. C. (1999). Existing and Emerging Basin Arrangements in Asia: Mekong River Commission Case Study. *The World Bank*, 1–30.

¹⁸ Thompson, B. (2017). Water as a Public Commodity. *Asian Journal of WTO and International Health Law and Policy*, 12(2), 247–263. <https://doi.org/10.3366/ajicl.2011.0005>

through a holistic analyzation of the data. The third section will explain the geopolitical relationship through an analysis of the territorial value of Tibet. The final section will utilize a rational choice framework to discuss the potential for conflict versus cooperation. Ultimately, I conclude that although escalation to conflict is a very real possibility, domestic and bilateral actions can help assuage problems of incomplete information, credible commitment and indivisibility to foment long-term cooperation between India and China.

II. China and India's Miraculous Development

China and India are both in the process of rapid development, albeit at different stages. China experienced rapid economic growth beginning in the early 1980s and has since transformed as a nation. India is in the midst of rapid development with over a 7% GDP average growth between 2010 and 2018.¹⁹ Both countries utilized similar strategies like decreased bureaucratization and industrial regulation as well as the encouragement of private enterprise ownership in order to lift themselves from the low-income country bracket. Though the countries utilized similar ideologies for their policy changes, they ultimately aimed to encourage the growth of different sectors. Whereas China aimed to increase its manufacturing capacity, India poured its resources into the development of their service industry.

2.1: China 1980 to Today: Key Policy Changes and Their Impact

After Mao Zedong's death in 1976, the CCP began to relax its hawkish governing style.²⁰ China's era of fast paced economic development was spearheaded by Deng Xiaoping who

¹⁹ World Bank. "Average GDP Growth Rate India (annual %)" *World Development Indicators*, The World Bank Group, 2017, data.worldbank.org/indicator/EN.ATM.CO2E.PC.

²⁰ Barry, N. (1993). Deng Xiaoping: The Economist. *The China Quarterly*, (135), 491–514. Retrieved from <https://about.jstor.org/terms>

focused on pragmatic and practical policy, rather than Maoist ideology. Deng ushered in a period of relaxed CCP economic policy that allowed foreign money to flow into China, increase personal wealth and improve the livelihoods of millions of people. Chinese economic reform began at the CCP's Third Plenary Session in 1978. This meeting shifted the CCP's economic policy to focus on market openness, the adoption of foreign advanced technologies and the encouragement of scientific and technological development in China. These major shifts in economic policy jump-started China's rapid economic growth and importance to the world market. These decisions altered China's role in the global market and gained it a seat at the economic table.

The overarching theme of 1980s policy changes was relaxation. By relaxing its authority, the CCP gave the Chinese economy room to grow. The 1980s also marked a shift in the strategy of policy changes themselves. The CCP recognized that overzealous and impractically massive economic reforms were unsustainable and instead began implementing policy incrementally.²¹ The most impactful changes encouraged by Deng were renewed emphasis on science and technology, allowance of individual wealth and encouragement of foreign investment.

2.1.2: Emphasis on Science, Technology and Education

Among the most important policy changes brought by Deng Xiaoping was his explicit belief in the value of science and technology. Deng Xiaoping recognized the importance of increasing production to improve the livelihoods of Chinese citizens and grow the economy. In order to increase production, scientific and technological capabilities would have to be improved.

²¹ Ibid.

Prior to his rise to power, the Chinese education system had become highly politicized and lacked creative purpose.²² In order to encourage innovation, Deng Xiaoping relaxed the education system to allow more political freedom. Deng needed to depoliticize education and allow greater creative liberation in order to encourage the innovation needed to compete in the global market. Increasing the importance of education was a means to reaching this economic goal. By adopting technologies from abroad and encouraging the innovation of new practices, the CCP was able to increase productivity in agriculture and industry.²³

2.1.2: Rise of Wealth

Though Deng Xiaoping maintained a strong appraisal of equity during his reign as party chairman, he also recognized the importance of allowing the accumulation of some personal wealth to encourage economic growth. To accomplish this aim, the CCP had to grant more liberty to the agricultural sector and thus established household responsibility systems (HRS). The HRS system distinguished itself in two ways: (1) the CCP began allowing farmers to privately sell their crops in small markets and (2) the CCP allowed resource ownership through land leases given to rural households.²⁴ By giving families individual responsibility for their farming output and encouraging private market participation, millions of households lifted themselves out of poverty and increase the overall productivity of the sector.

Following the increase in agricultural productivity, large amounts of rural labor were now available. This HRS policy was widely successful and in 1984 the CCP announced the policy's

²² Barry, N. (1993). Deng Xiaoping: The Economist. *The China Quarterly*, (135), 491–514. Retrieved from <https://about.jstor.org/terms>

²³ Cheremukhin, A., Golosov, M., Guriev, S., & Tsyvinski, A. (2015). *The Economy of People's Republic of China from 1953* (No. 21397). Cambridge, MA.

²⁴ Ibid.

extension to the whole economy, including the budding urban industry.²⁵ The CCP introduced two major policy reforms to the state-owned industrial sector: (1) a dual-pricing system meant to encourage the rise of the planned and non-planned economy and (2) a contract management responsibility system (CMRS) that allowed enterprises to retain more profit and increase wages.²⁶ These policy changes were also widely successful and in the mid 1990s, the CCP began allowing limited privatization of industries. In time the importance of state-owned enterprises decreased, ushering in the rise of privately-owned industries and the influx of foreign investment that ultimately led to huge increases in industrial production.²⁷

Between 1978 and 2012, the majority of China's GDP growth was attributed the expansion of non-agricultural sectors.²⁸ Agriculture lost its importance to the Chinese economy due the CCP's goal of increasing the urban industrial sector. Throughout the 1980s, investments in agricultural infrastructure were redirected to urban infrastructure and policy increasingly focused on urban centers.

But the CCP did not simply change the internal organization of China's economy. It also facilitated China's entrance into the world market through a new "open door" economic policy. This goal was accomplished through the establishment of Special Economic Zones (SEZs). SEZs were "designated geographical spaces where special policies and measure support specific economic functions" located along the Chinese coast to encourage foreign investments and leverage their geographic advantage. Different SEZs held different functions but all sought to

²⁵ Tisdell, C. (2008). *Thirty Years of Economic Reform and Openness in China: Retrospect and Prospect* (No. 51). Brisbane. Retrieved from https://ageconsearch.umn.edu/record/90620/files/WP_51.pdf

²⁶ Cheremukhin, A., Golosov, M., Guriev, S., & Tsyvinski, A. (2015). *The Economy of People's Republic of China from 1953* (No. 21397). Cambridge, MA.

²⁷ Ibid.

²⁸ Ibid.

encourage foreign investment by providing some sort of propriety advantage. These advantages included free trade areas, industry parks and bonded zones.²⁹

2.1.3: Impact in China Today

China's modern economic growth has been called miraculous, and rightly so. In less than 50 years China recovered from the deadliest famine in history and emerged as an economic powerhouse. Today, China acts as the US's greatest competitor and as a linchpin in the global market. Demonstrated by Figure 1, China did not experience linear economic growth, but rather a more sudden jumpstart. Beginning in the mid 1990s China's GDP per Capita rapidly rose and so did its power in the global market. This was due in large part the policy reforms enacted by the Chinese Communist Party (CCP) throughout the late 20th century to modernize China and facilitate economic growth. Looking back, these reforms have lifted millions of Chinese citizens out of poverty and have vastly altered the quality of life for the average Chinese.

²⁹ *Chinese Special Economic*. (n.d.). Retrieved from [https://www.worldbank.org/content/dam/Worldbank/Event/Africa/Investing in Africa Forum/2015/investing-in-africa-forum-chinas-special-economic-zone.pdf](https://www.worldbank.org/content/dam/Worldbank/Event/Africa/Investing%20in%20Africa%20Forum/2015/investing-in-africa-forum-chinas-special-economic-zone.pdf)

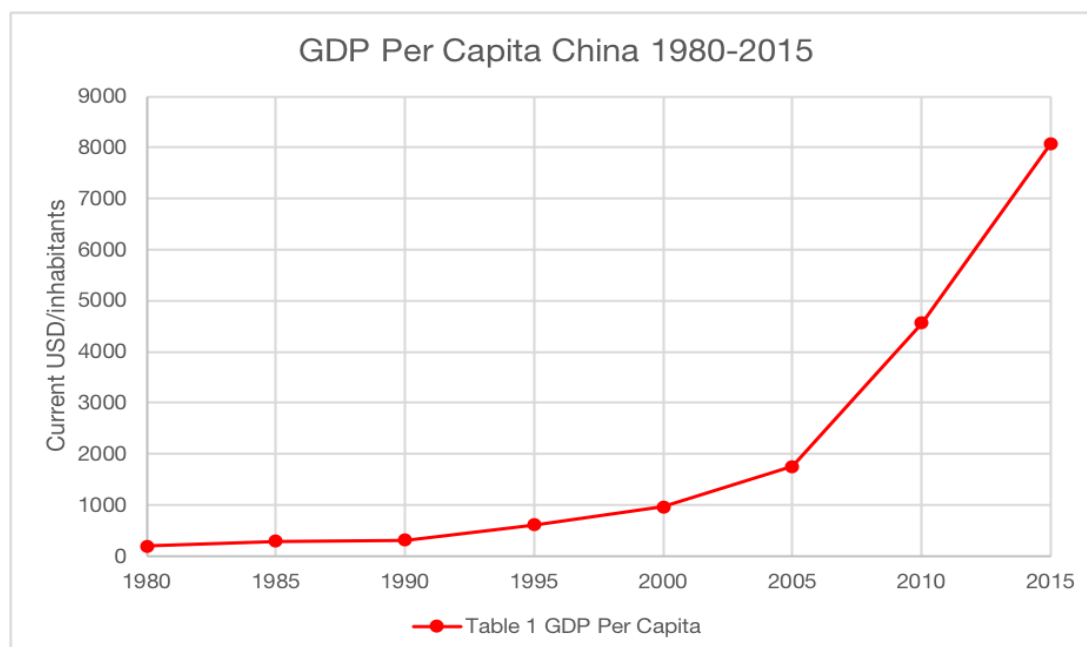


Figure 1: China GDP Per Capita 1975-2015

Source: AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO) 2016

China did not just change economically; it changed demographically. The Chinese population has increased significantly since the mid 1970s, growing approximately 32%.³⁰ But China's population has not only changed in sheer numbers, it has also changed in geographic distribution. The economic growth captured by China encouraged the rapid urbanization of its cities as the CCP increasingly invested in urban industrial development.³¹ Between 1980 and 2015 nearly 300 million rural Chinese citizens migrated into cities and some projections estimate that over 60% of the Chinese population will live in urban areas by 2020.³²

The rapid urbanization in China is part of the prevailing international trend of the economic importance of cities. Unlike other rapidly urbanizing countries, China's stringent

³⁰China, Zhongguo tong ji xin xi zi xun fu wu zhong xin, International Centre for the Advancement of Science & Technology, and University of Illinois at Chicago. 2018. *China statistical yearbook*. Hong Kong: International Centre for the Advancement of Science & Technology.

³¹ Cheremukhin, A., Golosov, M., Guriev, S., & Tsyvinski, A. (2015). *The Economy of People's Republic of China from 1953* (No. 21397). Cambridge, MA.

³² Yusuf, S., & Saich, A. (Eds.). (2008). *China Urbanizes*. The World Bank. <https://doi.org/10.1596/978-0-8213-7211-1>

internal migration ensured that the employment needs of growing industries are met without the rise of slums. Controlling the rural to urban migration was crucial to the CCP because “urban employment opportunities and the median urban wage will determine living standards in cities”³³. As urban industries rapidly grew, the CCP began allowing more rural to urban migration to ensure that employment needs were met.

2.2: India 1990 and Beyond: Key Policy Changes and Their Impact

Since the late 1990s, India’s economy and population has experienced drastic yet volatile growth. Unlike China’s gradual and incremental process of increased trade openness and decreased bureaucratization, India’s groundbreaking economic growth can largely be attributed to a series of policy reforms enacted in 1991. After a balance of payments crisis in the late 1980s caused by import substitution economic strategy, India began following export-led economic development methods that mirrored those of China. This method, similar to Deng’s policies in China, subordinated the alleviation of poverty and decreased the role of the state in order to create the best environment for economic growth in the international market. Understanding the similarity of policy utilized by both states provides a good basis for future projections of Indian growth.

The delay in policy reformation as compared to China explains the staggered economic growth between the two nations. In the years to come, India may follow the same rapid growth path as China which will have massive impacts on the natural resource needs of the country. Similar to its neighbor to the north, India changed its economic policy to encourage Foreign Direct Investment through decreased regulation, shrinking of the public sector and a switch to a

³³ Ibid.

floating exchange rate system. The key difference between China and India's growth, however, is the sector of focus. Whereas China made huge attempts to increase their industrial productivity, India utilized its advantage to build its service sector.³⁴

2.2.1: Removing Industrial Regulations

In order to encourage economic growth via export-led industrialization, India needed to reduce regulations to encourage international investment. The Indian government recognized its advantage as a massive and largely untapped market and therefore changed regulation to encourage economic interest by major international economic players. Tariffs played a major role in encouraging new international interest. In 1991 tariffs were reduced from an average of 100% to approximately 30%.³⁵ The Indian government also eliminated almost all quota ratios that inhibited international companies from capitalizing on the Indian market.

The Indian government also began streamlining the industrial process through the elimination of the tedious and overly bureaucratic licensing system. The removal of licensing allowed larger, more efficient plants to enter the previously protected small-scale sectors³⁶. The streamlining of the industrial investment system also eased the process of foreign investment, encouraging large amount of foreign investment in these newly opened sectors.

The decreasing in licensing points to the decreasing role of the government in planning the economy. By allowing the economy to be more independently regulated, the Indian government could allow the overall productivity of the private sector to increase. The decrease of licensing can also be seen as a relaxation of government oversight.

³⁴ Kumar, U., & Subramanian, A. (2011). *India's Growth in the 2000s: Four Facts*. Washington DC.

³⁵ Agarwal, M., & Whalley, J. (2013). *The 1991 Reforms, Indian Economic Growth, and Social Progress* (No. 19024). Cambridge, MA. Retrieved from <https://www.nber.org/papers/w19024.pdf>

³⁶ Ibid.

2.2.2: *The Rise of the Service Sector*

A major shift in Indian economic policy in the 1990s is the abandonment of a fixed exchange rate and the increase of available capital flows in the country. The switch from a fixed to a floating rate system allowed Indian exports to be more competitive in market through the devaluation of Indian currency³⁷. The devaluation of the Rupee not only made manufactured goods more competitive but also encouraged the rise of the Indian service sector. India's service sector experienced an astounding 85.3% increase in GDP share between 1974-1982 and 2001-2010, a indicator of water's increased importance. Within that sector, the most remarkable growth is in phone an internet related services which increased over 500% between 1980 and 2010.³⁸

2.2.3: *Today and Beyond*

The Indian government has experienced rapid economic growth for nearly three decades³⁹ due in large part to its increased integration with the international market. Figure 2 demonstrates the sharp rise in GDP per capita beginning in the mid 1990s. Prior to 1997, Indian GDP per capita remained fairly stable. The sharp increase in GDP per Capita can be largely attributed to the 1991 policy changes outlined above. While the changes in India's GDP thus far are remarkable, they are far from over. Projections from PricewaterhouseCoopers Global's (PwC) predict that India will become the world's second largest economy, following China, by 2050⁴⁰.

³⁷ Ibid.

³⁸ Kumar, U., & Subramanian, A. (2011). *India's Growth in the 2000s: Four Facts*. Washington DC.

³⁹ AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO) 2016

⁴⁰ Audino, H., Clarry, R., & Hawksworth, J. (2017). *The Long View How Will the Global Economic Order Change by 2050?* London. Retrieved from www.pwc.com

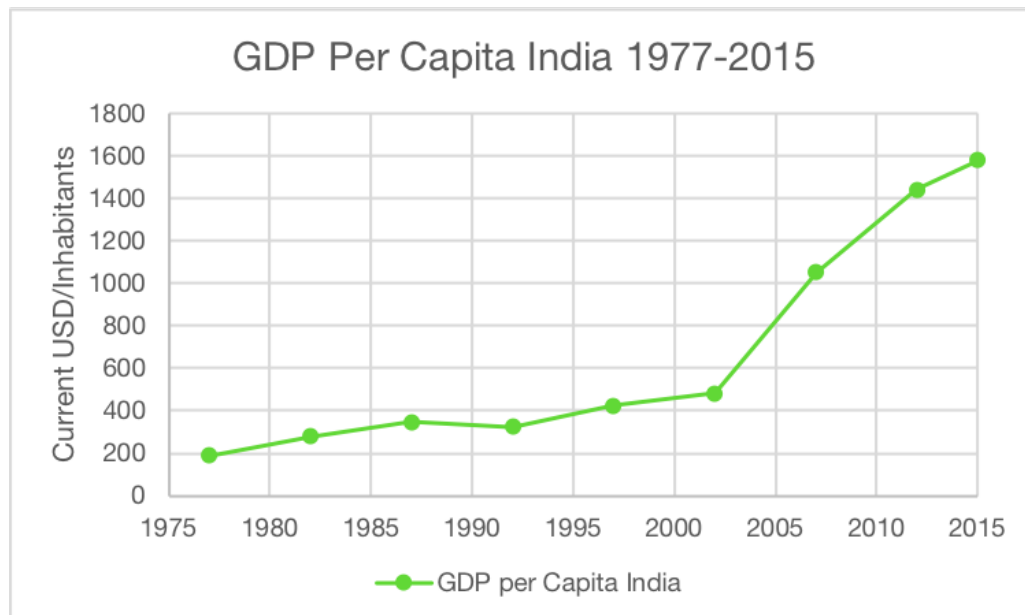


Figure 2: GDP per Capita India 1977-2015

Source: AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO) 2016

Similar to China, India's population has rapidly grown since the 1970s. However, unlike China, India lacks the political capability to control its population to the same extent. Though the average fertility rate in India has decreased from 5.19 in 1975 to 2.32 in 2016, the Indian population is still expected to outgrow China's by 2024^{41,42}. Figure 3 demonstrates India and China's population convergence and India's impending rise over China. Increases to overall average life expectancy globally makes the rapidly growing population of India ever more concerning.

⁴¹ World Bank. "Fertility Rate, total (births per woman) India" *World Development Indicators*, The World Bank Group, 2017, data.worldbank.org/indicator/EN.ATM.CO2E.PC.

⁴² Audino, H., Clarry, R., & Hawksworth, J. (2017). *The Long View How Will the Global Economic Order Change by 2050?* London. Retrieved from www.pwc.com

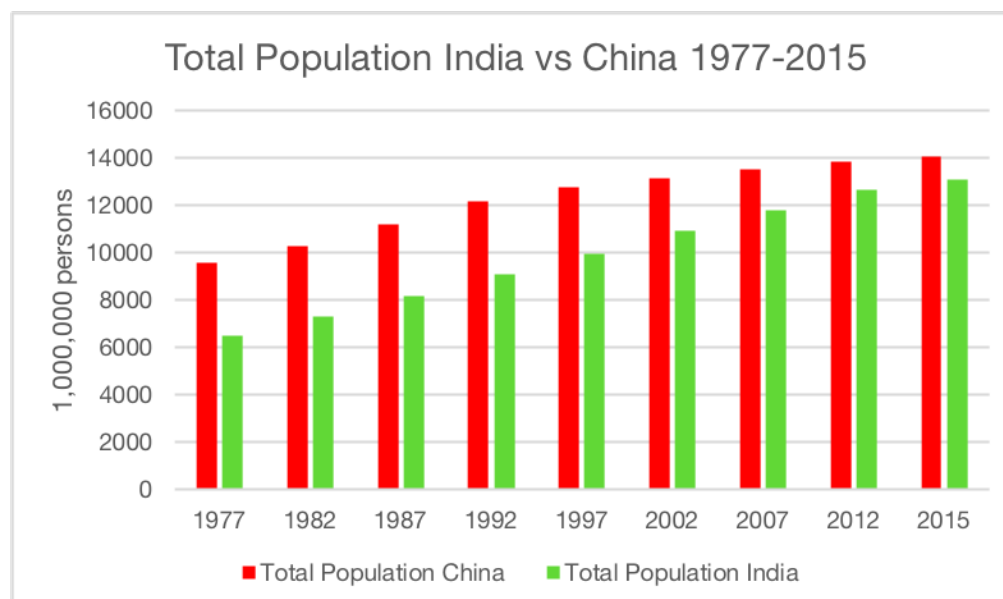


Figure 3: Total Population India vs China 1977-2015

Source: AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO) 2016

In India, the proportion of the urban to rural population is also growing, similarly to China. But without a strict internal migration policy like China, India is plagued by massive slum development in their urban centers. India is also struggling with the same lack infrastructural development to mitigate the issues associated with rapid urbanization. These issues will only be exasperated in time as India's urban population is projected to nearly double by 2050, with 400 million rural migrants flooding to major cities⁴³.

III. Impact on Water and Energy Consumption

3.1: The Water-Energy Nexus

The obvious humanitarian and agricultural value of water cannot be understated nor neglected, but the importance of water to these two emerging powerhouses reaches much further.

⁴³ United Nations, Department of Economic and Social Affairs, Population Division (2014). World Urbanization Prospects: The 2014 Revision, Highlights (ST/ESA/SER.A/352)

Both China and India heavily rely on water for energy production. As these countries continue to grow in terms of population and economy size, they will need more energy to ensure their prolonged success.

The water energy nexus describes the intimate relationship between energy and water. A report from the *Journal of Fundamentals of Renewable Energy and Applications* explains, “Water is needed to generate energy. Energy is required to deliver, clean and evaporate water. Thus, there are extensive linkages between water and energy use. Meanwhile, both resources may limit the other, especially in the context of urbanization and industrialization as well as climate change”.⁴⁴

Water can be understood as a key input to all energy production such as hydropower, coal and natural gas. Regardless of the energy sources China and India will choose to pursue in the future, water will be needed for the energy production process. Water can is then a limiting factor to energy production and thus a developmental hazard for both states. The needs to produce energy is incentive for India and China to attempt to secure as much water as they can to ensure their growth. After establishing the inextricable relationship between the two, one can examine the potential hazards of the rapid development of these two massive states.

3.2: Energy Demand Changes

The development of India and China alike have altered their respective domestic energy demands. In order to sustain their development, both countries are reliant on their ability to continuously increase their energy production to meet demand.

⁴⁴ Yu Qiu, G., Li, W., Li, L., Zhang, Q., & Yang, Y. (2014). Water and Energy Nexus in China: Current Situation and Future Perspective in Energy Industry, Water Industry and Agriculture. <https://doi.org/10.4172/2090-4541.1000138>

3.2.1 China

China's energy needs have grown astronomically since in the late 1970s. Figure 4 demonstrates that total production of energy has risen fairly uniformly long with GDP per Capita. The uniformity of the trend suggests that as a country's economy grows, so does its energy demand. The basics of economies of scale explains that in order to increase returns to investment, total output must increase. In order to increase output, one must also increase total input. Energy is a key industrial input and its adequate access is crucial for the growth of the sector. Figure 5 demonstrates the astonishing rise in industrial energy demand beginning from the 1990s.

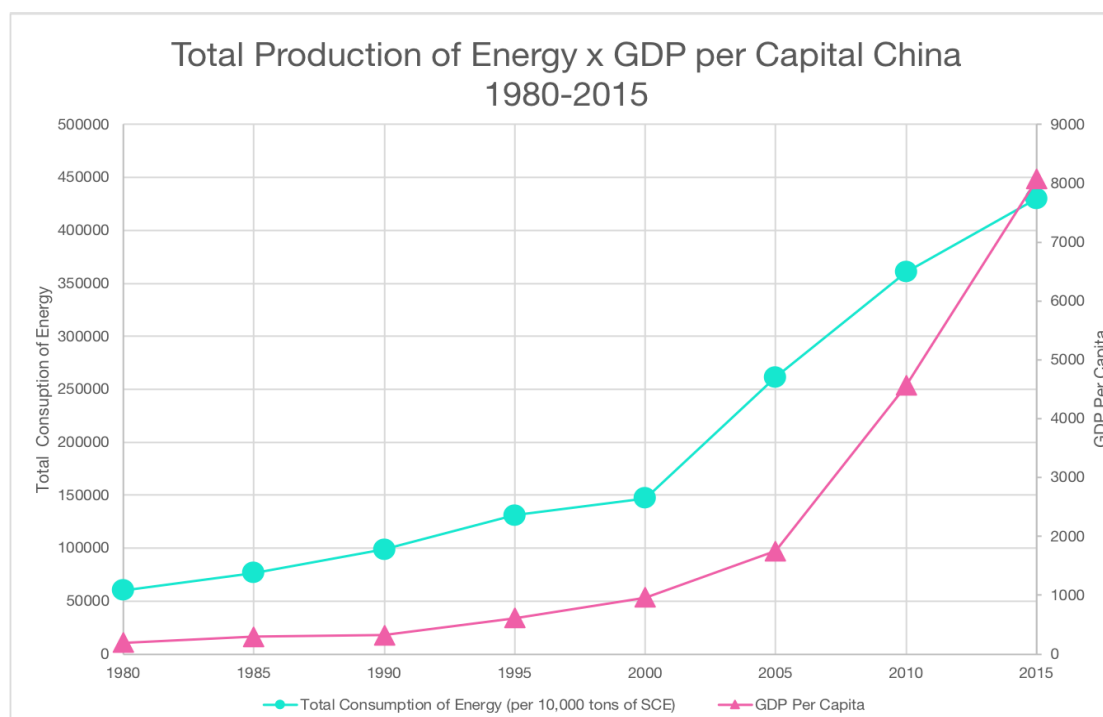


Figure 4: Total Production of Energy x GDP per Capita China 1977-2015

Source: 2018. China statistical yearbook.

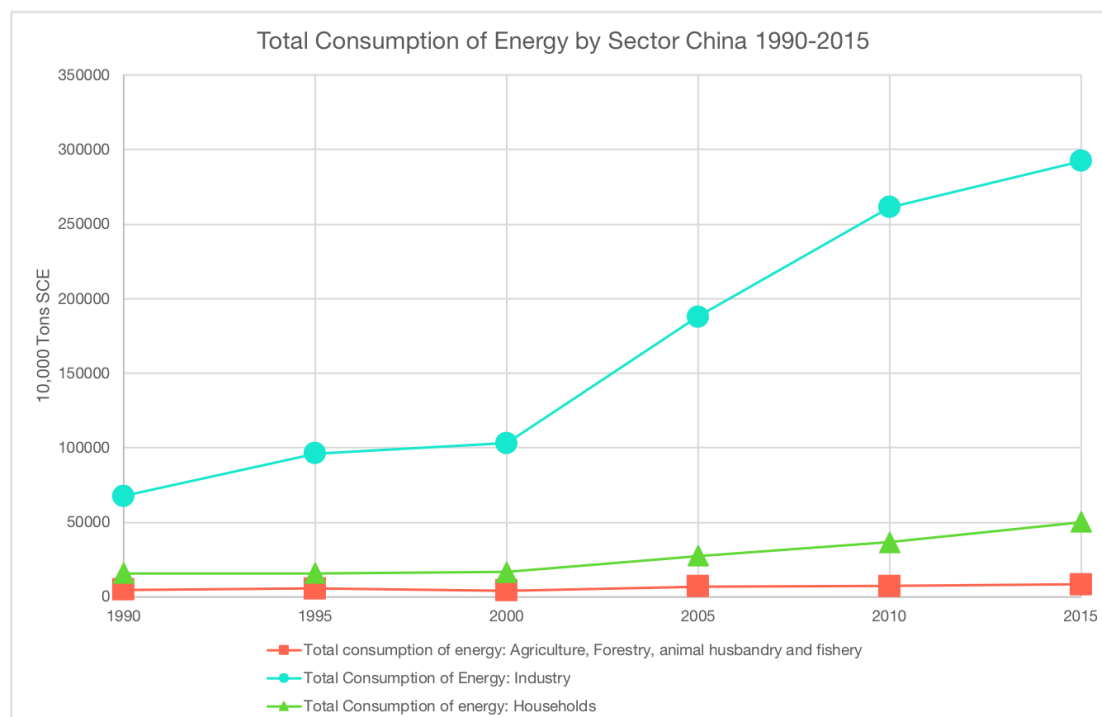


Figure 5: Total Consumption of Energy by Sector China 1990-2015

Source: Chinese Statistical Yearbook 2017

While the industrial sector has most evidently experienced the sharpest changes in energy consumption, the energy consumption patterns demonstrated by Figure 5 of household and agriculture also point to some interesting trends. Though the population has grown, and the average diet has become more energy and water intensive with economic development,⁴⁵ the amount of energy needed to fuel the agricultural sector has stayed fairly stagnant. Further, another interesting trend highlighted by Figure 5, is the rise in household consumption of energy. The increased amount of energy being used by municipalities could be interpreted as a symptom of urbanization pointing to a concerning trend between energy demands and urbanization. As China continues to urbanize, the increased energy need from individual municipal households will only continue to strain China's energy resources.

⁴⁵ Pomeranz, K. (2013). Asia's Unstable Water Tower: The Politics, Economics, and Ecology of Himalayan Water Projects. *Asia Policy*, 10(16), 4–10. <https://doi.org/10.1353/asp.2013.0023>

Overall, the astonishing growth of energy consumption and production in China is cause for concern, especially when considering the sector-based demand changes. A major driver of the increased demand for energy has been the industrial sector; but increased household energy use is also cause for concern. Though China's industries have largely matured and therefore are not expected to increase their energy demands at such an alarming rate, these trends point to a precarious future for China's rapidly growing southern neighbor.

3.2.2: India

India, like China, has experienced a sharp rise in total energy demand coinciding with its rapid economic development. Figure 6 demonstrates that similar to China, energy consumption demand can be positively correlated with a rise in GDP per capita. Even with the high population growth the country has sustained in the last 30 years, the amount of electricity use per capita has sharply risen. This speaks to the severity of electric demand changes in the country brought about by its development. Not only does the country need more energy to simply sustain its growing population, but each individual in the population is consuming 550% more electricity in 2015 as compared to 1975.

When considering the path that China's energy demands followed throughout its rapid economic development, the increasing need for electricity in India warns of a similar trend to be followed. As Indian cities continue to grow, the country will have to find ways to supply their urban centers with the energy they need.

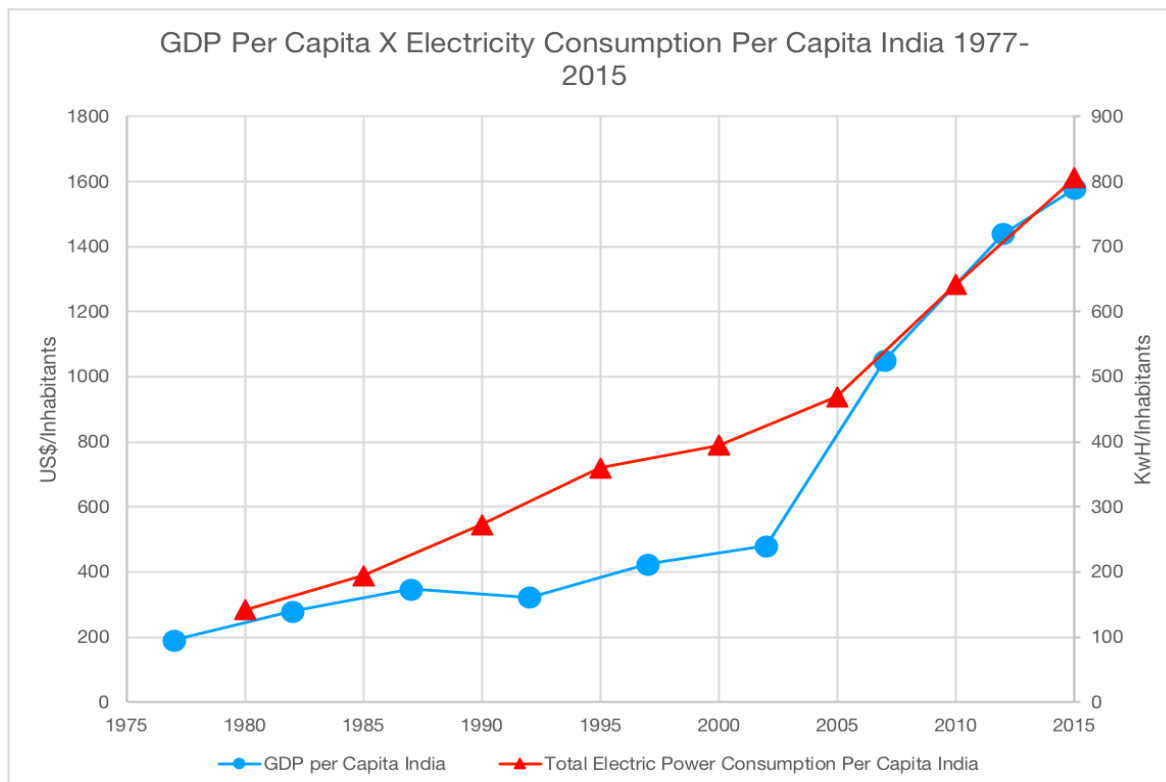


Figure 6: GDP Per Capita x Electricity Consumption per Capita India 1977-2015

*Source: AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO) 2016
World Bank. India World Development Indicators, The World Bank Group, 2017*

3.3: Water Demand Changes

3.3.1: China

China's development has evidently altered its energy needs. The increase in energy need coupled with the overall development of the public and private sphere of the country strains already scarce water resources. Economic development has only increased China's total water and energy needs.

Figure 7 demonstrates the close link between population growth and water needs. China's population has grown by nearly 500 million people since 1975, and therefore an increased demand for water is logical. What this graph is unable to demonstrate, however, is how population growth itself is not the sole driver of increased water withdrawal. Figure 8 shows the

fairly constant water per capita availability in China between 1977 and 2015 and the decreasing need for water in agriculture. This signals that the increased demand for water is not solely attributed to sustention of food and water demands of the population, but also to support the demands of the ever-industrializing landscape. Recalling the energy-water nexus, one can understand that the increased demand for energy, driven by the rise of the industrial sector and growth of cities, has heavily impacted the water demands of the nation.

Rises in municipal and industrial demand explain the consistency of the agricultural sector's water demands. Figure 9 demonstrates the sector-based demand for water over time. While agricultural needs have slowly decreased, municipal and industrial demand has increased considerably. Industrial water needs increased nearly 300% in the last four decades. When considering the rise in industrial energy demand outlined in Figure 5, a sharp rise in industrial demand water demand is understandable. Similarly, China's municipal water demand has also increased by an astonishing 1,173%. As outlined previously, China has rapidly urbanized since the late 1970s, the water demand generated from that rapid urbanization has impacted water demand.

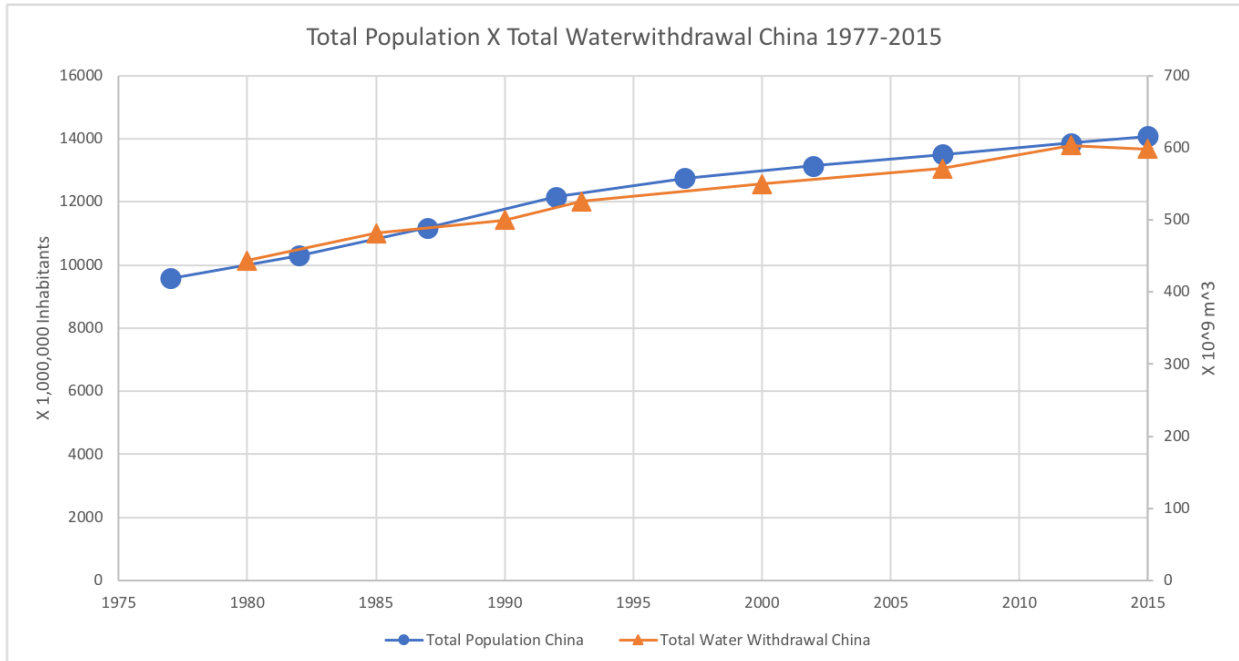


Figure 7: Total Population x Total Water Withdrawal China 1975-2015
 Source: AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO) 2016

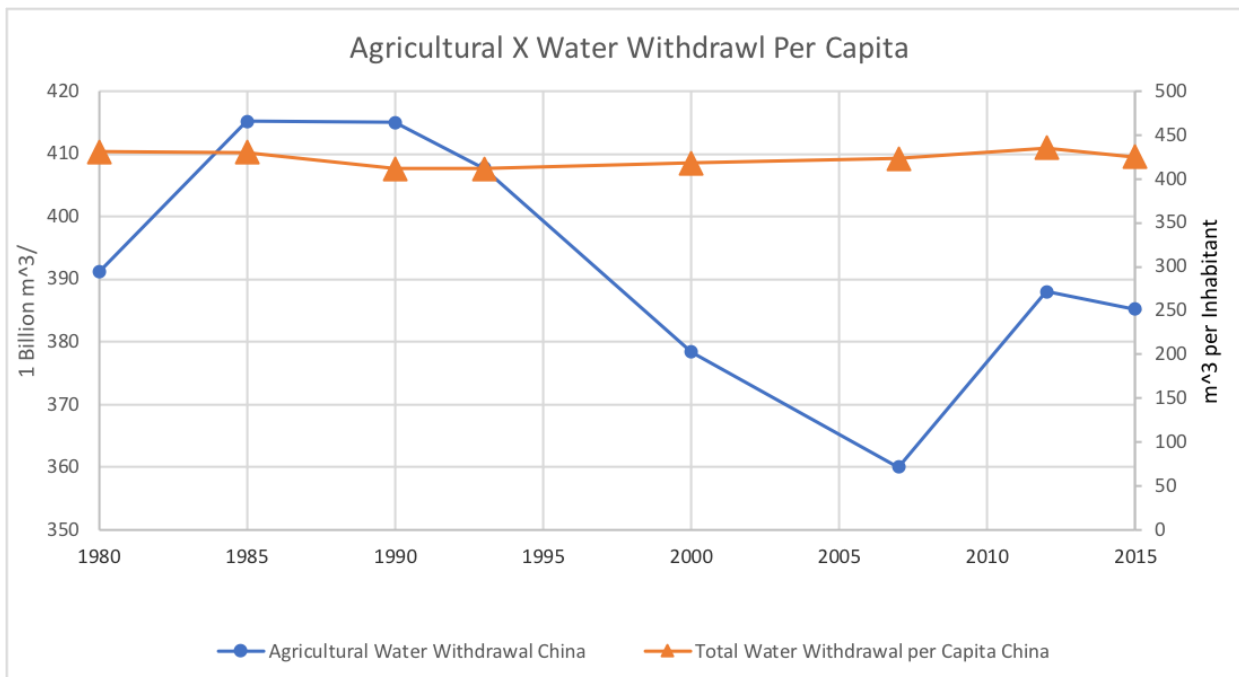


Figure 8: Agricultural Water Withdrawal vs Water Withdrawal per Capita China 1980-2015
 Source: AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO) 2016

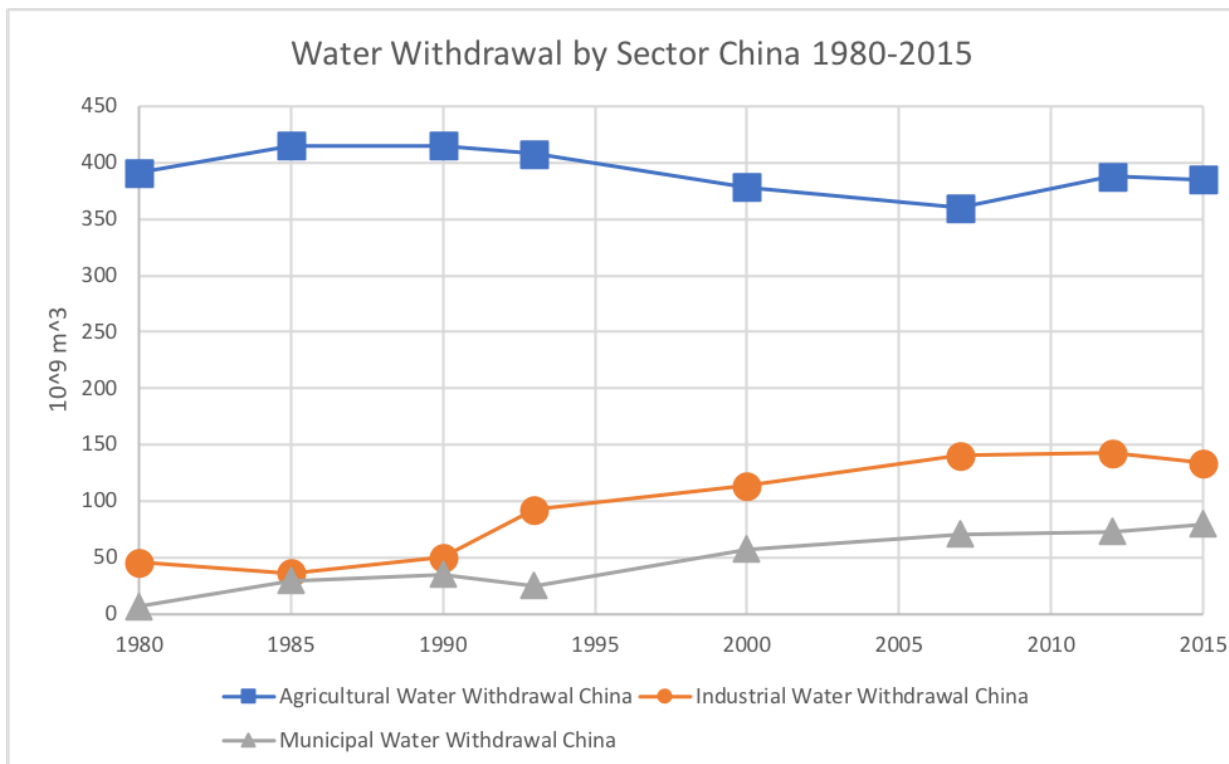


Figure 9: Water Withdrawal by Sector China 1980-2015

Source: AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO) 2016

3.3.2: India

Considering the commonalities between India and China, the data depicting a sharp increase in water demand in China may be concerning considering India's developmental trajectory. Figure 10 demonstrates that similarly to China, India's change in total water withdrawal over time appears to be strongly correlated with the overall increase in population. Unlike China however, India's rise in water demand is largely attributed to agricultural demand. This difference is understandable based on India's developmental strategy. Whereas China largely benefited from the rise of their industrial sector, India developed its service sector instead. India's problem distinguishes itself from that of China because the agricultural needs of the rapidly growing population is a main driver of increasing water demand.

It should be noted, however, that these water data end in 2010, very close to India's GDP boom. It may still be too soon to tell how much the industrial and municipal water demands will

change considering the massive increase in GDP between 2007 and 2015. This could explain the seemingly negligible rise in industrial and municipal water demand demonstrated in Figure 11.

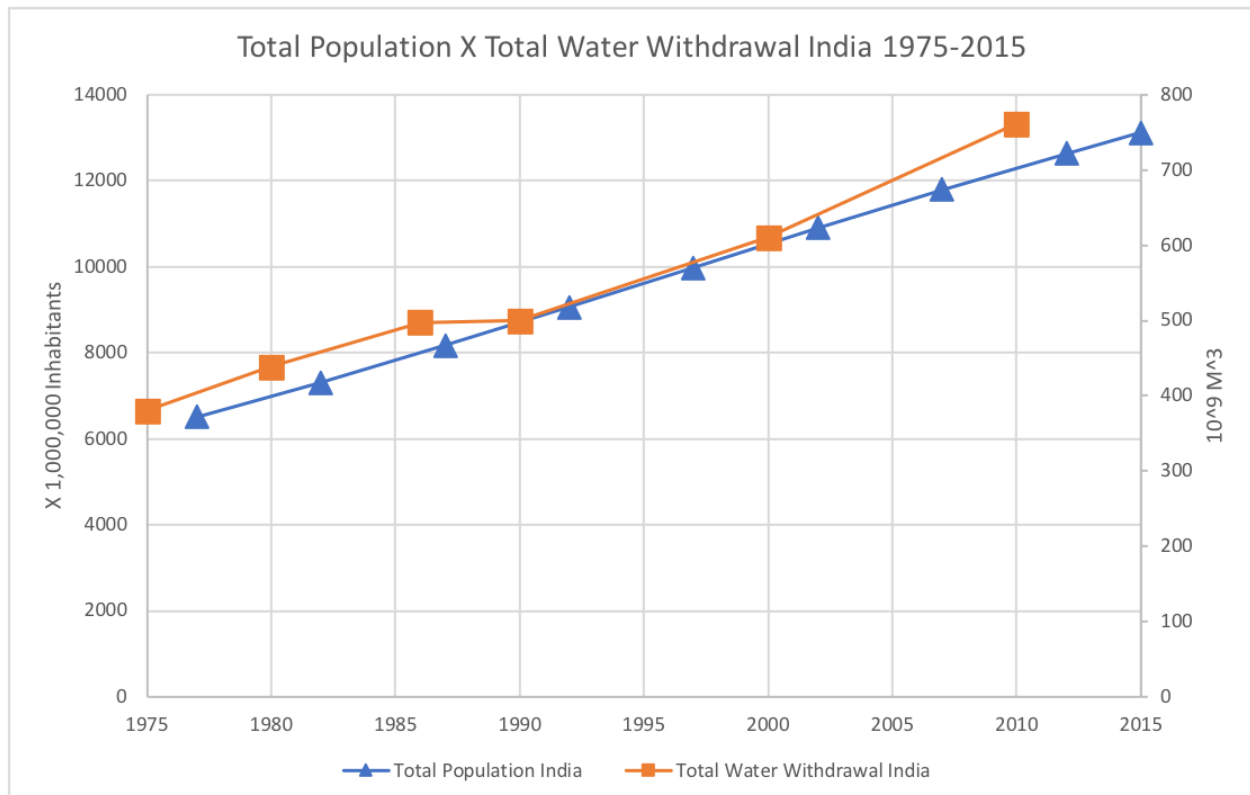


Figure 10: Total Population X Total Water Withdrawal India 1975-2015

Source: AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO) 2016

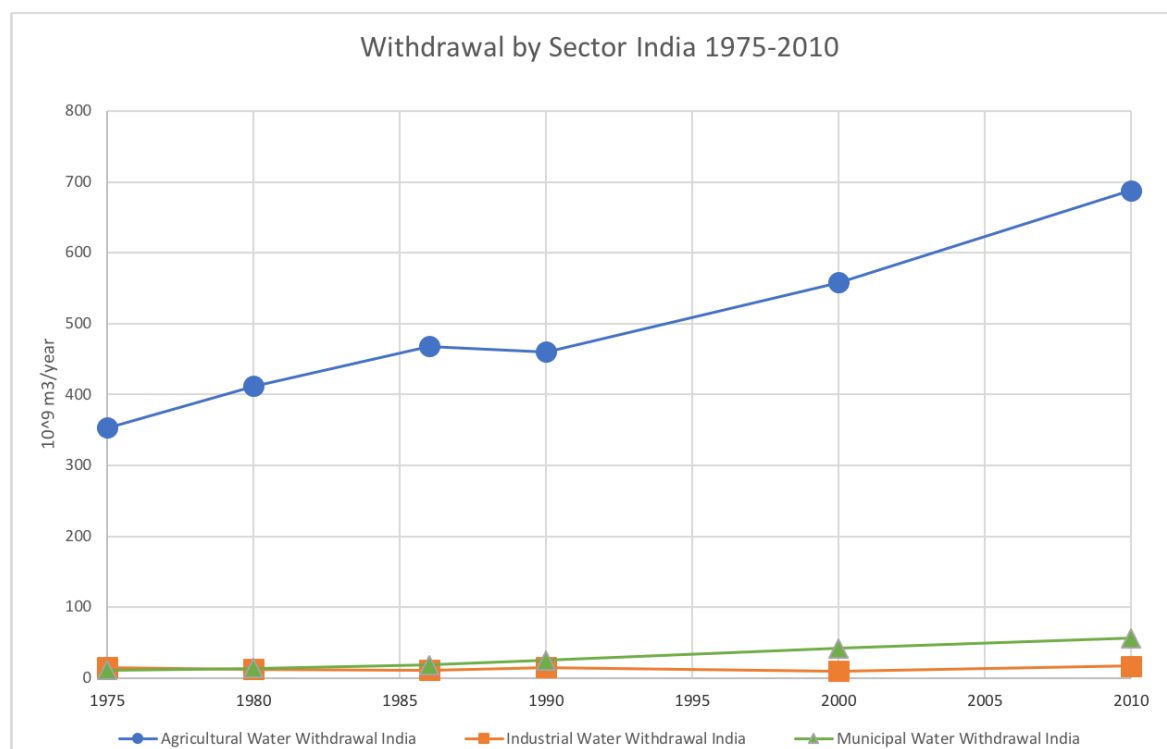


Figure 11: Sector Based Water Withdrawal

Source: AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO) 2016

3.4 Increasing Water Scarcity in China

China is already water scarce. The average water per capita availability is one-third of the world average and the available water flow per capita is second to India for the lowest in the world.⁴⁶ The already low amounts of water flowing in these countries is exacerbated by their growing populations and developmental needs.

A key issue in China's water scarcity is its uneven distribution. The vast majority of China's water is located in the southwestern provinces but more than half of China's population is located in the northeastern region of the country. The whole of northern China is categorized as water scarce, as it only houses 14% of China's available water sources.⁴⁷ The northern and coastal

⁴⁶ Shalizi, Z. (2008). Water and Urbanization. In *China Urbanizes: Consequences, Strategies and Policies*. Washington DC: The World Bank. Retrieved from http://www.un.org/waterforlifedecade/swm_cities_zaragoza_2010/pdf/03_water_and_urbanisation.pdf

⁴⁷ Ibid.

regions of China are booming urban economic zones, it is imperative for China to ensure sufficient water access in order to guarantee continued economic stability.

China's water scarcity issues are worsened by generally poor management. The CCP relaxed its centralized control over the Chinese state in order to allow the economy to grow. This disjointed management, however, makes creating and implementing policy difficult.⁴⁸ Water is managed at three levels in China, each with their own interests in regard to water.⁴⁹ The mismanagement of water and lack of consistency with policy information threatens the ecological viability and long-term sustainability of Chinese water courses.

The issues of poor management and general scarcity are compounded with the lack of sufficient waste water treatment and pollution mitigation. SEPA reported that 70% of the water in 5 of the 7 major Chinese rivers are too polluted to be designated for beneficial use.⁵⁰ Approximately half of this pollution is due to agricultural runoff and pesticide use while the remaining portion is attributed to the growing volume of untreated municipal and industrial waste water.⁵¹

Issues of water scarcity in China impact India directly because the two countries share multiple river courses. As China grows increasingly water stressed, it will have greater incentive to utilize its Southwestern water resources to its full capacity. China is also becoming

⁴⁸ Xie, J. (2009). *Addressing China's Water Scarcity Recommendations for Selected Water Resource Management Issues*. The World Bank. Retrieved from <http://documents.worldbank.org/curated/en/996681468214808203/pdf/471110PUB0CHA0101OFFICIAL0USE0ONLY1.pdf>

⁴⁹ Shen, D., & Speed, R. (2009). *Water Resources Allocation in the People's Republic of China Flows in China Project View project*. (2009, International Journal of Water Resources Development, Queensland), 211

⁵⁰ Shalizi, Z. (2008). Water and Urbanization. In *China Urbanizes: Consequences, Strategies and Policies*. Washington DC: The World Bank. Retrieved from http://www.un.org/waterforlifedecade/swm_cities_zaragoza_2010/pdf/03_water_and_urbanisation.pdf

⁵¹ Ibid.

increasingly incentivized to pursue hydropower projects in order to support their massive, developing population.

IV. Geopolitics of the Tibetan Plateau

The last sections have worked to paint the current and projected hydro-political picture between India and China. While individually the water problems encountered by these countries are cause for concern, their compounding effect due to their geopolitics of the Tibetan Plateau make the issues ever-pressing. Previous studies have identified the role of the Tibetan Plateau as a potential political sore point for China and its neighbors but have neglected to critically assess the potential for conflict given the geopolitics of the plateau, growing demands of India and China and the increased impact of climate change. This section aims to demonstrate the importance of the Tibetan Plateau for future Sino-Indian relations given its direct impact on the developmental potential of both states.

The Tibetan Plateau located in South Western China has been dubbed “Asia’s Water Tower” because ten of Asia’s most important rivers are headed in the region. The rivers flowing out of Tibet provide water for approximately 50% of the world’s population and account for 70% of total available water in Asia.⁵² Considering the immeasurable value of Tibet to China and all of its downstream neighbors, the growing regional anxieties are understandable.

⁵² Pomeranz, K. (2013). Asia’s Unstable Water Tower: The Politics, Economics, and Ecology of Himalayan Water Projects. *Asia Policy*, 10(16), 4–10. <https://doi.org/10.1353/asp.2013.0023>



Figure 12: Map of rivers flowing out of the Tibetan Plateau

Source: meltdownintibet.com

As China continues to struggle with chronic water shortages, the state may feel increasingly inclined to utilize the waters in Tibet. While the CCP has not signaled any impending action, rumors of a massive west to east river diversion project have been circulating for decades. Meanwhile, India's growing population threatens its own domestic water security. The most important river shared by India and China, the Brahmaputra accounts for 30% of India's available freshwater resources.⁵³

The rivers flowing out of Tibet are not only imperative to satiate the thirst needs of these countries, but also to generate hydropower for their rapidly developing economies. As outlined in previous sections, China and India's total energy consumption has sky rocketed due to their economic development. While arguments can be made that China's growing energy demands

⁵³ Zhang, H. (2015). Sino-Indian water disputes: the coming water wars? *Wiley Interdisciplinary Reviews: Water*, 3(2), 155–166. <https://doi.org/10.1002/wat2.1123>

may be slowing, India will only become increasingly energy hungry.⁵⁴ The continued development of the Indian cities and economic industries are dependent upon the availability of hydropower. Conversely, China's ability to maintain its title as the regional hegemon is also dependent on its adequate access to energy. The issues with hydropower are largely focused on one river: The Brahmaputra.

The hydro-power potential of the rivers shared between India and China have led to anxieties in India's political sphere. The Brahmaputra accounts for about 40% of India's hydro-power potential.⁵⁵ The inability to secure that energy directly threatens India's economic security. Further, if China were to pursue a project on the Brahmaputra that would disrupt waterflow to India, the results could be detrimental. With the phasing out of fossil fuels, China's incentive and capability to pursue major water projects in Tibet grows and so does India's anxiety.

Countries have found ways to share water in the past to ensure mutual benefit. Even within the region, the Mekong River Treaty and Indus Valley Treaty are examples of codified agreements that adequately allocate water. China's management of the Tibetan Plateau challenges multilateral cooperation because of the state's general unwillingness to establish any type of water-sharing agreement. China is not a signatory to any water treaty and has not secured any outflowing water through any other type of arrangement.⁵⁶

India's growing anxiety over China's hydraulic plans is understandable. As the two largest and fastest growing economies in Asia, India and China have incentive to suppress one another's potential growth. The countries also have a history of dispute over the valuable region.

⁵⁴ Bhatnagar, M. (2009). Reconsidering the Indus Waters Treaty. *Tulane Environmental Law Journal*, 22, 271–461.

⁵⁵ Zhang, H. (2015). Sino-Indian water disputes: the coming water wars? *Wiley Interdisciplinary Reviews: Water*, 3(2), 155–166. <https://doi.org/10.1002/wat2.1123>

⁵⁶ FAO. 2016. AQUASTAT Main Database, Food and Agriculture Organization of the United Nations (FAO).

Occupation of Southern Tibet has been disputed by India and China since the mid twentieth century.⁵⁷ Further, China and India's growing inclination to utilize a "plan/neglect/rebuild"⁵⁸ strategy for massive water projects is making water sharing a zero-sum issue.⁵⁹ Rather than focusing on small-scale, sustainable projects or attempting to improve existing infrastructure, both states are pursuing new massive, complicated hydraulic projects that demonstrate a desire to capture as much of the resources available to them as possible. This signals that the waters in Tibet are not being regarded as a shared resource and furthers the "every man for himself" mentality of this hydro-political relationship

China has increasingly relied upon the energy potential of Tibet; Figure 13 demonstrates the growing investment in rural hydropower projects as energy demands have increased by highlighting the increased hydropower and minority energy capacities. China's utilization of these rivers is necessary to sustain their growing cities and industry but causes anxieties downstream. The anxiety is rooted in India's need sustain its growth via the maximization of the Brahmaputra's hydraulic potential. Considering their similar development trajectory, increased Indian investment in hydropower projects could be predicted. Thus, India has increasing incentive to grow anxious over China's pursuit of hydropower and may become increasingly defensive over the Brahmaputra.

⁵⁷ Zhang, H. (2015). Sino-Indian water disputes: the coming water wars? *Wiley Interdisciplinary Reviews: Water*, 3(2), 155–166. <https://doi.org/10.1002/wat2.1123>

⁵⁸ Pomeranz, K. (2013). Asia's Unstable Water Tower: The Politics, Economics, and Ecology of Himalayan Water Projects. *Asia Policy*, 10(16), 4–10. <https://doi.org/10.1353/asp.2013.0023>

⁵⁹ Zhang, H. (2016). Sino-Indian water disputes: the coming water wars? *WIREs Water*, 3, 155–166. <https://doi.org/10.1002/wat2.1123>

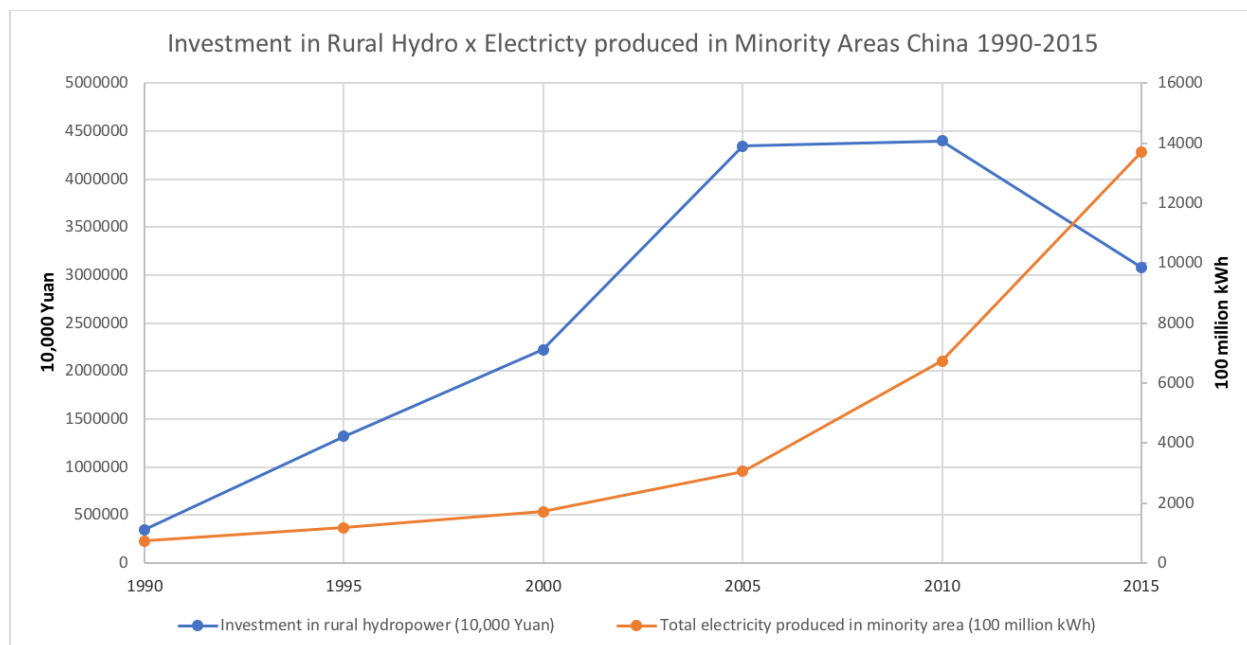


Figure 13: Total Hydropower Capacity vs Total Electricity Produced in Minority Areas China 1985-2017
 Source: 2018. *China statistical yearbook*.

V. Potential for Conflict vs Cooperation

The prevailing issues in the Tibet caused by India and China's export-oriented economic growth has been a hot topic for debate among scholars. The problems associated with the water problems of India and China are not only a matter of public health, but national security. Some scholars like Dr. Brahma Chellaney and Dr. Elizabeth Economy have supported the "water wars" narrative for the Sino-Indian relationship that hypothesizes future conflicts will be based on irreconcilable water disputes. Others, like the Chinese Ministry of Water, have discounted the issue entirely. This paper aims to analyze the potential for conflict based on Fearon's rationalist explanations for war.⁶⁰

⁶⁰ Fearon, J. (1995). Rationalist explanations for war? *International Organization*, 49(3).
<https://doi.org/10.1080/09636410008429423>

In his paper, Fearon asserts that states are rational actors and therefore must have rational reasons to engage in harmful conflicts. This assumption implies that “states should have incentive to locate negotiated settlements” rather than engage in risky and costly warfare.⁶¹ Therefore, states must have sound, rational reasons that make the pursuit diplomatic routes unfavorable. Fearon outlines three key reasons negotiated agreements fail and violent conflicts ensue: (1) Incomplete information between the belligerents (2) commitment problems that obstruct the bilateral trust and (3) the indivisibility of the object or issue in question.⁶²

Based on Fearon’s argument, this paper posits that the potential for war is rooted in lack of accurate information sharing as well as commitment problems rooted in the indivisible nature of Tibet. The lack of sufficient information largely lies in the mixed signals given by both India and China and overall secrecy of the Chinese state. Both countries have incentives to misrepresent their water demands as well as their willingness to fight for access. The countries also face a more difficult commitment problem which is rooted in two key issues: 1) the changing water demands of India and China make any long-term arrangement nearly impossible to configure and 2) the indivisibility of the Tibet Plateau.

This section aims to analyze potential for both conflict and cooperation, first by outlining how these issues could lead to armed conflict if not mitigated and later offering suggestions for the possible de-escalation.

⁶¹ Ibid.

⁶² Ibid.

5.1: Potential for Conflict

India and China have a history of aggression in the Tibetan Region and tensions have only grown in recent years. China and India both claim ownership of Southern Tibet and have gone to war for the territory as recently as the mid 20th century.⁶³ As recent as 2017 Chinese and India troops had a standoff in Doklam, a disputed border area in Southwest China.

India and China alike have demonstrated their willingness to fight for the Tibetan Plateau and preserve their access to its comprehensibly valuable resources. This section aims to analyze how the dependency on the resources of the plateau may transpire into an armed international conflict.

5.1.1: Incomplete Information

One of the major forces that have consistently increased the tensions between India and is the overall lack of accurate signaling and information sharing in regard to their military capabilities, willingness to fight and projected water demand. Fearon identifies this issue as significant because it obstructs accurate communication between two states. One state cannot accurately determine the best course of action without full knowledge of the situation. This paper will focus on the aspect of willingness to fight as it largely plays into the accepted strategic and economic value of the Tibetan Plateau and I extend Fearon's idea to explain why China and India may be incentivized to misrepresent their potential water demand and under-share hydraulic information.

India has demonstrated not only its willingness, but its enthusiasm to challenge Chinese power in the region. In regard to China and India's bilateral relationship, India has signaled that

⁶³ Aldo D. Abitbol, "Causes of the 1962 Sino-Indian War: A systems Level Approach," *Josef Korbel Journal of Advanced International Studies* 1 (Summer 2009): 74-88.

it is growing concerned over upstream dam construction by the Chinese that may impact downstream flow.⁶⁴ Numerous Indian officials have vocalized their concern over the issue and called for a codified resolution to ease anxieties. Undoubtedly, India has made it abundantly clear that the waters of the Tibetan Plateau are a point of contention in their relationship with China. Their recent standoff in Doklam signals their willingness to challenge their regional competitor militarily.

The aggressive nature of Indian signaling may not necessarily mean that they are willing to fight for the plateau, but instead may be a security measure to deter China from pursuing any harmful projects. India's role of the watch dog forces China to more carefully consider the actions they take in regard to their shared waters. Without any official agreement between the countries, India's over-vigilance is the only security measure that can exist. With this in mind, China is then incentivized to keep the established status quo because India has signaled its willingness to go to war if it is challenged.

India's blatant aggression can also be viewed as a bargaining strategy. By stating the value of the Brahmaputra vis-a-vis political signaling, India may be able to obtain a more favorable resolution in the case of an official agreement. India has posited the waters of the Brahmaputra as a liability for their relationship with China. If China wants to avoid a water-war, they will have to acknowledge the value of the Brahmaputra to India.

Alternatively, China has been far less vocal about the issues in the region. The Chinese government has repeatedly stated it has no intention of disrupting the flow of the Brahmaputra. In fact, many Chinese scholars and government officials have even accused India of overstating

⁶⁴ Zhang, H. (2015). Sino-Indian water disputes: the coming water wars? *Wiley Interdisciplinary Reviews: Water*, 3(2), 155–166. <https://doi.org/10.1002/wat2.1123>

the issue.⁶⁵ As stated above, India may have incentive to overstate the value of Tibet and their willingness to fight in order to capture better terms on a potential agreement. Following similar logic however, China also has incentive to understate their position in order to continue with their own agenda without the political oversight. If China sends no signals about future plans, those future plans are much more difficult to obstruct. Further, concealing the value China places on the Brahmaputra allows China to avoid appearing like the aggressor. If China can appear composed and egalitarian, other countries would have less reason to challenge their upstream authority.

China however has not only concealed the value placed on the Brahmaputra, but their overall need for water as a country as well. China will face continued water shortages in the near future that may incentive it to utilize the resources in Tibet. Therefore, China has incentive to hide their water needs from other countries to avoid any objections to future projects. China's secrecy and overall lack of cooperation has been demonstrated numerous times. Most notably, China's unwillingness to enter into any water sharing treaty signals that it is not interested in codifying long-term agreements when domestic and international circumstances are very likely to change. Further, China has been secretive with water data sharing in recent years. In 2017 China refused to send water data to India, a signal that was poorly received by Indian officials.⁶⁶

China and India both have ample incentives to overstate and/or conceal their intentions over the Tibetan Plateau. But the lack of good and clear communication may only be escalating the situation and could continue to taint the trust between the two nations.

⁶⁵ Ibid.

⁶⁶ A. Vishwanath "China and India's Disputes Spill Over Into Their Water Supply", *Stratfor Worldview*, May 22, 2018 <https://worldview.stratfor.com/article/china-and-indias-disputes-spill-over-their-water-supply>

5.1.2: Commitment Problems

Coupled with issues of incomplete information is the overarching inability to commit to any type of resolution for the problem. Commitment problems are rooted in structural reasons that prevent states from trusting one another.⁶⁷ The lack of accurate information sharing between the two states largely breeds these commitment problems. Without accurate knowledge of the opponent's willingness to fight and value of the disputed territory, no resolution can ensure long-term peace. Further, a resolution seems near impossible due to the rapidly changing water needs of both countries. Fearon hypothesizes that commitment problems largely arise when a deal may be viable now but will no longer be in the future. As India and China both continue to grow, their needs will change. If the circumstances of an established deal are to change, both states will have incentive to violate the terms of the deal and act autonomously.

Aside from inaccurate information, the commitment problems rely heavily on the indivisible nature of Tibet given its immense strategic value. Fearon analyzes the problems associated with disputes over mutually strategic territories by stating “[...] both sides might prefer some package of territorial concessions to a fight, but if the territory in question is strategically vital or economically important, its transfer could radically increase one side's future bargaining leverage”.⁶⁸ The Tibetan Plateau is an economic hub for both China and India that directly determines their future economic and political power. It not only ensures their national public health but also fuels their development and provides the energy needed to sustain their massive cities. Thus, whichever entity is in control of the plateau benefits from the gains to regional political power it carries. Loss of control over this area would heavily impact China's

⁶⁷ Fearon, J. (1995). Rationalist explanations for war? *International Organization*, 10(1), 143.
<https://doi.org/10.1080/09636410008429423>

⁶⁸ Ibid.

regional power and therefore causes the hawkish strategy for its management. India, conversely, would gain immeasurable regional power if the result of an armed conflict meant it would gain ownership over Tibet. Based on Fearon's framework, the potential loss to Chinese power with the potential gain to Indian power makes both countries extremely willing to fight over the issue.

Water is a zero-sum resource that it is not only finite but has immeasurable economic value. Any water conceded to India directly impact's China's developmental potential and vice versa. Thus, China will always have incentive to act in its own interest even if that involves violating a codified agreement and India will always have incentive to challenge China's hold over the plateau and violate an agreement in the hopes of gaining more resources.

5.2: Cooperation

While prospects for conflict may seem grim, certain countermeasures can be taken to decrease the likelihood of escalation. The potential for cooperation versus conflict lies in the ability of a potential solution to resolve the issues of incomplete information and commitment problems.

5.2.1: Incomplete Information

One measure to counter issues of misrepresentation is increased data sharing between the two states. China has not voluntarily offered its hydro-data to its neighbors but has agreed to sell the data to some of its neighbors.⁶⁹ Though not ideal, the potential for a business-like exchange of data information between India and China could aid in the trustbuilding process. A mutually beneficial cash transfer for data will ensure reciprocity between the states and provides incentive

⁶⁹ Chellaney, *Brahma Water, Peace, and War: Confronting the Global Water Crisis* (Lanham: Rowman Et Littlefield, 2015).

to cooperate. This would involve China and India setting annual prices for their hydraulic data through the mediation of an international institute. Both countries have incentive to purchase the other's data because it is pertinent to their long-term political and economic success. The countries could also arrange an advisory committee, like that of the Indus Valley Agreement, to meet annually to exchange data and discuss its implications. An agreement of this nature maybe better suited for the time being because no water use concessions are required.

It is imperative that the states address their issues of misinformation before they can draft long-term, sustainable water treaties. India may continue with less anxiety about China's intentions and alternatively China can better account for their domestic needs and regional impact. A bilateral data agreement, brokered by an international institution like the World Bank, would be a meaningful first step to transparency and cooperation.

5.2.2: Commitment Problems

Water is zero-sum but not indivisible. There are ways to equitably divide the resources so that both countries can use them sustainably. Some countries in the region have already drafted their own bilateral and multilateral treaties. Political adversaries India and Pakistan have had a long-standing water sharing agreement in the Indus Valley. Other countries like Cambodia, Laos, Thailand and Vietnam have drafted their own successful multilateral treaty to share the Mekong.

In an ideal world, India and China would overcome their differences and draft their own water sharing treaty but unfortunately the contentious nature of their relationship, as outlined throughout this paper, prevents that from happening. Additionally, China has only signaled disinterest in regard to a water-sharing treaty with any country.

Another unlikely but useful solution would involve dual investment by China and India in shared water projects along the Brahmaputra. A dam placed up stream has far more hydraulic

potential than a dam placed downstream.⁷⁰ China thus has the greatest hydropower potential of all the states in the region. Therefore, if China and India could pursue a joint project further upstream on the Brahmaputra, both countries would capture the hydropower potential while still ensuring each other's sustainable development. Similar to a water sharing treaty, a joint-hydraulic project would be ideal but nonetheless unlikely. As stated, China and India have chosen to pursue a "plan/neglect/rebuild" strategy for hydraulic development that perpetuates a generally uncooperative relationship between the two states. Further the issue of trust between the two states makes this plan risky for both states. Because a joint project will likely be in China, India cannot be sure that they will receive the benefits of the project. China may instead simply agree to a shared project in order to capitalize on the hydraulic potential and go on to claim the project for itself.

An alternative, more plausible solution is to increase water conservation and efficiency domestically in both states. If water is not able to be equitably divided, it should be most efficiently consumed. Pomeranz suggests that both countries cut water use in their agricultural sector, the thirstiest sector in both states. He suggests that increased sharing of water saving technologies between the two states is a good basis for cooperation that would provide both countries with the economic incentives they need to share technologies.⁷¹ This, like a data-only treaty, could act as a trust-building proxy in place of a comprehensive water sharing treaty.

Increased water treatment in both countries would be a meaningful step to ensure maximum water efficiency and combat the widespread polluting of freshwater sources. In China's case,

⁷⁰ Pomeranz, K. (2013). Asia's Unstable Water Tower: The Politics, Economics, and Ecology of Himalayan Water Projects. *Asia Policy*, 10(16), 4–10. <https://doi.org/10.1353/asp.2013.0023>

⁷¹ Pomeranz, K. (2013). Asia's Unstable Water Tower: The Politics, Economics, and Ecology of Himalayan Water Projects. *Asia Policy*, 10(16), 4–10. <https://doi.org/10.1353/asp.2013.0023>

though almost all municipal waste water is treated,⁷² almost 30% of China's rivers were polluted beyond any functional use in 2006.⁷³ Most of this pollution is caused by agricultural and livestock runoff.⁷⁴ The remainder of the pollution is largely caused by untreated or poorly treated municipal and industrial wastewater and runoff in major cities.⁷⁵ Further, China receives a low water efficiency score as compared to other middle-income countries.⁷⁶ An effort by the Chinese state to clean up polluted water sources and improve overall water efficiency and treatment could help mitigate the economic losses caused by water scarcity.

India similarly struggles with a water pollution problem. Unlike China, however, India does not yet have the economic or technological tools needed to mitigate the issues. Currently, only 28% of India's municipal waste water is treated, the remaining 72% is returned to domestic water sources untreated. This not only causes grave health conditions like typhoid and diarrhea that result in economic losses to the state, but it also decreases the amount of available water for drinking, industrial and agricultural use. Efforts have been made to clean some of these rivers, such as the 3-billion-dollar initiative led by Prime Minister Narendra Modi to clean the Ganges,

⁷² China, Zhongguo tong ji xin xi zi xun fu wu zhong xin, International Centre for the Advancement of Science & Technology, and University of Illinois at Chicago. 2018. *China statistical yearbook*. Hong Kong: International Centre for the Advancement of Science & Technology

⁷³ Xie, J. (2009). *Addressing China's Water Scarcity Recommendations for Selected Water Resource Management Issues*. The World Bank. Retrieved from <http://documents.worldbank.org/curated/en/996681468214808203/pdf/471110PUB0CHA0101OFFICIAL0USE0ONLY1.pdf>

⁷⁴ Pomeranz, K. (2013). Asia's Unstable Water Tower: The Politics, Economics, and Ecology of Himalayan Water Projects. *Asia Policy*, 10(16), 4–10. <https://doi.org/10.1353/asp.2013.0023>

⁷⁵ Shalizi, Z. (2008). Water and Urbanization. In *China Urbanizes: Consequences, Strategies and Policies*. Washington DC: The World Bank. Retrieved from http://www.un.org/waterforlifedecade/swm_cities_zaragoza_2010/pdf/03_water_and_urbanisation.pdf

⁷⁶ Xie, J. (2009). *Addressing China's Water Scarcity Recommendations for Selected Water Resource Management Issues*. The World Bank. Retrieved from <http://documents.worldbank.org/curated/en/996681468214808203/pdf/471110PUB0CHA0101OFFICIAL0USE0ONLY1.pdf>

but are still ultimately insufficient.⁷⁷ The Indian and Chinese states alike must focus their energy and resources on improving the efficiency and quality of their own domestic resources before pursuing major hydropower projects or squabbling for additional water use rights.

Along the same lines, a concerted effort by India and China to mitigate their domestic energy use would decrease the overall need for water. Some key changes both countries could undertake are small changes in household demand. This would include a campaign to switch to more energy efficient lightbulbs or decreasing ownership of personal washer and dryer machines as well as other energy intensive personal technologies.⁷⁸

In short, both countries must focus on their own *sustainable* development by planning for future urban and industrial growth. In China, the CCP should make a concerted effort to balance out the uneven domestic population distribution. Over 60% of China's massive population is located in the Northern region of the country which only houses 14% of freshwater resources.⁷⁹ The North also dominates China's agricultural production, contributing further to the illogical distribution in China. The immense effort to irrigate and supply water to the barren area should be redirected to growing southern cities and agricultural production facilities that are located more closely to China's water supply.

In India's case, much of the irrigation schemes in place are relics from the partition of India and Pakistan in 1947 and do not actually efficiently allocate the water *modern* India needs. The irrigation systems established by the Indus Water Treaty between India and Pakistan did not

⁷⁷ Chandrashekhar, V. (2018, February). Dying Waters: India Struggles to Clean Up Its Polluted Urban Rivers. *Yale Environment* 360. <https://doi.org/10.1007/BF02990923>

⁷⁸ Shalizi, Z. (2008). Water and Urbanization. In *China Urbanizes: Consequences, Strategies and Policies*. Washington DC: The World Bank. Retrieved from http://www.un.org/waterforlifedecade/swm_cities_zaragoza_2010/pdf/03_water_and_urbanisation.pdf

⁷⁹ Ibid.

account for the massive Indian demand growth and has thus become antiquated.⁸⁰ India should focus not only on increasing water treatment but also on improving the existing irrigation infrastructure and modernizing the existing treaties to adequately meet the state's changing demands.

Overall, there are advantages associated with cooperation for both China and India. Though the prospect of a comprehensive water allocating agreement is still rather far-fetched, both countries have incentive to create deals to exchange hydraulic data as well as water saving technologies. Further, a future shared water project along the Brahmaputra between India and China would allow both states to capitalize on the hydraulic potential of the river without threatening the others growth. For now, however, both countries should focus on their own domestic water and energy efficiency in order to maximize the water the currently have available to them and mitigate future water stress ad scarcity.

VI. Conclusion

The ongoing problems of the Sino-Indian hydro-political relationship have become a point of international concern. These issues are part of a greater global water crisis that is increasing the potential for water-based conflict. Some academics and politicians have predicted “water wars” between water sharing nations for access to limited water^{81,82}. China and India's problems are of particular concern because of the huge populations and economies of both countries.

⁸⁰ Bhatnagar, M. (2009). Reconsidering the Indus Waters Treaty. *Tulane Environmental Law Journal*, 22, 271–461.

⁸¹ Economy, E., & Levi, M. (2014). *By all Means Necessary: How China's Resource Quest is Changing the World*. Oxford University Press.

⁸² Chellaney, *Brahma Water, Peace, and War: Confronting the Global Water Crisis* (Lanham: Rowman Et Littlefield, 2015).

Conflict in the Tibetan Plateau then is a direct threat to Sino-Indian global public and economic health.

Both India and China have large stakes in this conflict and ultimately have incentive to cooperate rather than fight for a solution. Cooperation is more advantageous for both countries economically, politically and socially. The costs to an armed conflict by Asia's superpowers are extremely high, especially if a loss on the battlefield equates to a loss of water access. An escalation to war would only encourage the zero-sum perspective on water and worsen the already adversarial relationship between India and China. Consequently, the only way to ensure cooperation to begin mending that adversarial relationship. By using trust-building measures and focusing on domestic water consumptions, both countries can signal that they intend to cooperate to create sustainable solutions for all. Ultimately, a cooperative and equitable outcome is most ideal for China and India alike and gives hope to the prospect of finding a long-term solution to the issue.

While water is a major point of contention between India and China, it is not the only sore-point in the bilateral relationship. If an armed conflict was to break out between the two countries, the water issue between China and India could be operationalized to encourage a war but it would not be the sole issue. Thus, the concept of "water wars" in itself may be shortsighted, at least in the Sino-Indian case. Water is only one of a number of major issues between the countries that is impacting their political relationship. As India and China compete for power in the region, they may have greater incentive to participate in armed conflict to ensure their long-term economic and political hold in the region. Water can then be considered to be a major reason for escalation to war but cannot be regarded as the sole driver of conflict.

Though conflict versus cooperation has been represented as a binary, there is a third option: inaction. Inaction may be the most likely outcome of this dispute, at least for now. The two countries can focus on water and energy use domestically to avoid the need to codify a cooperative agreement. China and India's ability to control their domestic water and energy efficiency will have a substantial impact on their developmental potential, irrespective of the overall access to water resources. Neither country can continue to grow if they do not ensure sustainable consumption practices within their borders. Perhaps the best choice for the time being is to suspend bilateral action and focus on individual domestic changes to mitigate future scarcity issues. Both countries will benefit from controlling their internal water and energy demands because, as stated, water is zero-sum in nature. Water's finite quality creates incentive to maximize efficiency, a goal that should precede maximizing access.

The emerging water related issues between India and China also point to future issues China may encounter with other downstream neighbors like Vietnam and Thailand as the countries also begin to develop economically. As the region as a whole increases their economic output and populations, meaningful solutions that include China will become increasingly necessary to ensure continued regional growth. China and India may be able to avoid a codified agreement and armed conflict for now through domestic actions, but those actions will only work to deescalate the problem, not solve it. Ultimately, China and India's water problems signal to a growing global water scarcity problem. How that problem will play out in the global arena will be determined by the ability of countries to deescalate the situations before they become violent.