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Achieving Food, Water and Energy Security by 2030 in Bangladesh

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Abstract:

Being a densely populated country and one of the fastest growing economies of the world in the last decade, Bangladesh progressed remarkably towards achieving the Millennium Development Goals (MDGs), especially in reducing Child Mortality and Maternal Mortality rate. However, Bangladesh has made sustainable progress over the past 40 years in achieving food security, despite frequent natural disasters and population growth (food grain production, tripled between 1972 and 2014, from 9.8 to 34.4 million tons). With one of the fastest rates of productivity growth in the world since 1995 averaging 2.7 percent per year, second only to China[1]. Additionally, Power System Master Plan 2016 of Bangladesh has been prepared to achieve sustainable energy production and consumption[2]. A World Bank press release recently states that a renewable solar energy park is going to be established at Feni district and 350 MW will be generated from solar panels in coming years. Recently, Bangladesh has formulated Bangladesh Delta Plan (BDP) 2100, a 100 years water resource management plan in 2018 aligning with SDGs[3]. The Ganges, Brahmaputra and Meghna formed the largest dynamic delta of the world in linking around 700 rivers (57 trans-boundary). BDP focuses on water security, environmental security, food security and better livelihood; sustainable energy and power production; social and institutional development etc. However, climate change poses the biggest challenge for the successful implementation of BDP. BDP aims to improve six hotspots across the country based on water quality, salinity intrusion and arsenic contamination while preserving fresh water resources. Making the policies into practices through proper implementation, Bangladesh is heading towards achieving SDGs.

Introduction

The economic and environmental background of Bangladesh was not mentionable up to the end of nineteenth century. Although, the country became independent in 1971 from Pakistan facing a brutal oppression and bloodshed war. After the independence, Sheikh Hasina, incumbent Bangladeshi Prime Minister and daughter of Bangabandhu Sheikh Mujibur Rahman, the father of the nation undertook the initiative to formulate Bangladesh National Water Policy in 1999; Bangladesh Water Act in 2013; and Ganges Water Sharing Treaty in 1996 for ensuring the water rights of the countrymen along with high yields for the farmers in the GBM basin. The incumbent government also formulated Bangladesh Delta Plan (BDP) 2100 for the next 100 years for water resources management plan under her leadership.

[1] "Bangladesh: Growing the Economy through Advances in Agriculture," worldbank.org, accessed on 14 April, 2019, https://www.worldbank.org/en/results/2016/10/07/bangladesh-growing-economy-through-advances-in-agriculture.

[2] "Power System Master Plan 2016," powerdivision.gov.bd, accessed on 14 April, 2019, https://powerdivision.portal.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/page/4f81bf4d_1180_4c53_b27c_8fa0eb11e2c1/(E)_FR_PSMP2016_Summary_revised.pdf

[3] Planning Commission, *Bangladesh Delta Plan 2100 Abridged Version* (Dhaka, 2018)

Moreover, the government formulated Sustainable and Renewable Energy Development Authority (SREDA) for sustainable solutions of power and energy as a part of strengthening the institutional capacity.

Rice is the staple food and fish is the main source of protein in Bangladesh. As such, Bangladesh targeted to achieve food security from food sufficiency. The population of Bangladesh is 164.7 million and is increasing at the rate of 1.1 annually in 2018[4]. Moreover, the country is densely populated where 976 people live in per square km[5]. Thus, it is very challenging to increase food productivity while arable land is shrinking each year. Currently the quantity of rice production in the country amounts 36.3 million MT in 2018[6]. Inversely, climate change especially global warming posing a damaging threat to the food security. Flush flood, salinity intrusion, dried and hot weather are causing catastrophe to the farmers along with the consumers. Storm surges like Tsunami, Sidar, Aila, and Mahsen damaging the crops and rural farming infrastructure.

Moreover, Bangladesh had been struggling to increase energy production since the last decades. Along with the other factors of production, electricity plays a vital role in industrial production and economic growth. Currently the electricity production capacity stands 22051 MW which was only 4942 MW in 2009[7]. Thus, Bangladesh has quadrupled electricity generation capacity within the last 10 years. Additionally, the country aims to increase the popularity of renewable energy. Now, 230 MW renewable energy is generated from hydraulic power generation installed at Sangu and Matamuhuri river[8]. Moreover, SREDA has undertaken a program to implement 500 MW Solar Power Development. As such, Bangladesh has been marching towards sustainable and renewable energy along with coal and natural gas-based power generation.

Background

My personal job experience in the development sector especially in the local government system of Bangladesh, practical experience gathered from field inspection of development projects at district level, rural attachment training conducted by Rural Development Academy of Bangladesh have inspired me to grow interest in SDGs and community participation. The SDGs and related publications including different plan document published by General Economics Division of Bangladesh Planning Commission provided the theoretical base while Bangladesh Bureau of Statistics and relevant publications of different ministries and divisions helped me to get statistical data.

The Motivation for Achieving SDGs

The stunning success in achieving the MDGs inspired Bangladesh to be more optimistic for achieving SDGs. The remarkable success in reducing poverty gap ratio, reaching gender parity at primary and secondary school education, mortality rate reduction of under-five aged

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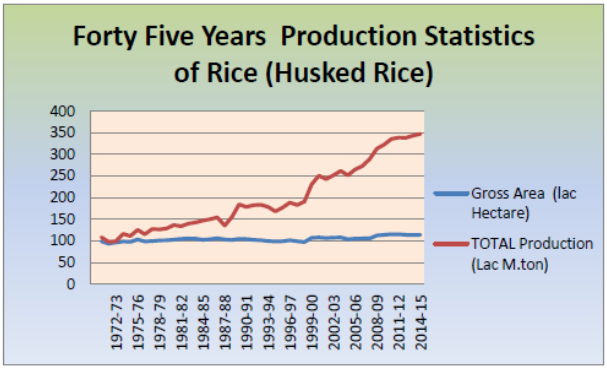
[4] Bangladesh Bureau of Statistics, *Population and Housing Census 2011* (Dhaka, 2015).
[5] Bangladesh Bureau of Statistics, *Population and Housing Census 2011* (Dhaka, 2015), 49.
[6] Planning Commission, *Bangladesh Delta Plan 2100 Abridged Version* (Dhaka, 2018), 7.
[7] Achievement of Last 10 Years, powerdivision.gov.bd, accessed on 23 July, 2019. https://powerdivision.gov.bd/site/page/6cd25d49-3150-482a-8bd0-701d18136af7/%E0%A6%8F%E0%A6%95-%E0%A6%A8%E0%A6%9C%E0%A6%B0%E0%A7%87.
[8] Renewable Energy Program, powerdivision.gov.bd, accessed on 20 July, 2019. https://powerdivision.gov.bd/site/page/7cdf7d30-6656-41ec-aa8a-943193f30a61/R--E-Program.

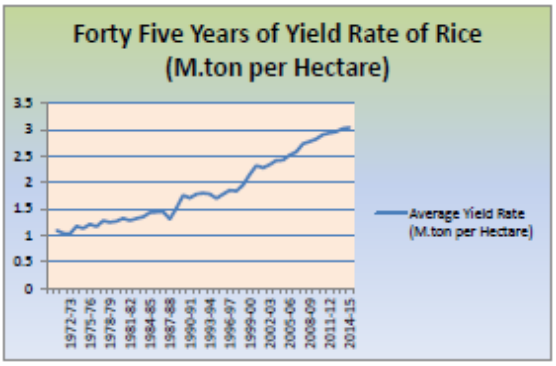
children[9]. Additionally, the Household Income and Expenditure Survey of 2010 data shows that Bangladesh reduced the poverty at a rate of 2.47% annually since 1991-92. Although it has a lot of challenges to overcome in coming years like removing poverty pockets, reducing unemployment and underemployment, stunting and wasting of under-five children[10]. Bangladesh has already aligned all the required policy papers and plan documents with SDGs and started financing for SDGs achievement.

Achieving Food Security from Food Sufficiency in Bangladesh

Globally, 124 million people have been suffering from acute hunger and 151 million children have been suffering from stunting and wasting[11]. Although the prevalence of hunger, undernourishment, child stunting and child mortality in Bangladesh have been reduced from 2000 to 2018. The GHI score of Bangladesh was 36.0 which is reduced to 26.1 in 2018 GHI 2018[12]. However, Bangladesh achieved self-sufficiency in food in 1999 for the first time. At that time, it had requirement of 21.4 million MT which was met by producing 24.9 MT[13].

Agriculture has been playing the most important role in achieving food security along with the economic well-being while contributing 15% to the GDP alone. Rice is the staple food of Bangladesh. Bangladesh progressed tremendously in increasing rice productivity. The productivity increased to 350 Lac/35 million MT in 2015 which was only 100 Lac/10 million MT in 1973[14]. And the rice production stands 36.3 million MT in 2018[15]. It reveals that the rice productivity has been increased 3.5 times in the last 45 years while the population doubled since the independence.





Graph 1 and 2: Forty-Five Years Production Statistics and Yield Rate of Rice[16].

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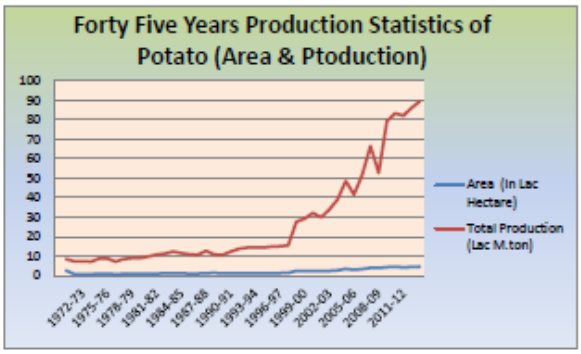
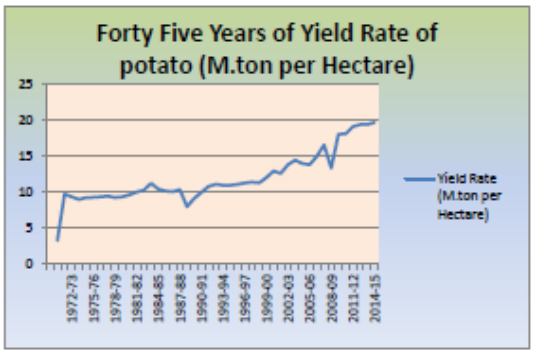
[9] "Bangladesh's Progress on the MDGs," undp.org, accessed 12 June, 2019. http://www.bd.undp.org/content/bangladesh/en/home/post-2015/millennium-development-goals.html.
[10] "MDG Progress Report 2015," undp.org, accessed 12 June, 2019. http://www.bd.undp.org/content/bangladesh/en/home/library/mdg/mdg-progress-report-2015.html.
[11] "2018 Global Hunger Index Results," globalhungerindes.org accessed 12 July, 2019. https://www.globalhungerindex.org/results/.
[12] "2018 Global Hunger Index Results," globalhungerindes.org accessed 12 July, 2019. https://www.globalhungerindex.org/results/.
[13] Habiba, Umma et al., *Food Security and Risk Reduction in Bangladesh 2015* (Springer Japan, 2015).
[14] Planning Commission, *Bangladesh Delta Plan 2100 Abridged Version* (Dhaka, 2018), 7.
[15] Planning Commission, *Bangladesh Delta Plan 2100 Abridged Version* (Dhaka, 2018), 7.
[16] Bangladesh Bureau of Statistics, *45 Years Statistics of Major Crops,* (Dhaka, 2018), 23, Line Graph 1.2.

Potato is another important food and mostly used vegetables in Bangladesh. Most of the Bangladeshi people eat rice with curry and potato is the common item in all of the curries. Although, potato is also very common item in the growing fast food industries. The following graphs show that the potato productivity increased nine-fold in the last 45 years while having fivefold increase in productivity per hectare. Although, wheat production in Bangladesh in not too much to be mentioned.





Graph 3 and 4: Forty-Five Years Production Statistics and Yield Rate of Rice [17]

Bangladesh is one of the leading countries in fish production and world's third biggest country in inland waters capture production[18]. Additionally, Bangladesh is one of the top fresh water fish producing countries in the world. It has 4.70 million hectares of rivers, canals, lakes, ponds and floodplains where fish is produced abundantly which provides 60% of animal protein to our daily life[19]. Moreover, World Fish Centre reveals that 60% of Bangladeshi people eat fish in each alternative day. It also says that the poorest has an average of 44 grams of fish consumption[20]. Recently, the country is aiming to increase marine fishing for utilizing the blue economy[21].

As per the Global Climate Risk Index 2019, Bangladesh has been identified as ninth most natural disaster-prone countries in the world which poses threat to food security at large[22]. In the rainy season, the crops are usually damaged by the heavy rain and flush flood. Bangladesh Rice Research Institute (BRRI) has introduced a number of flood and dry resilient crop variety in the last decade. Notably, BRRI introduced 41 high yielding rice varieties including four types of rich which are draught, flood, salinity and submergence. Additionally, BRRI developed world's first zinc enriched and antioxidant enriched rice varieties[23].

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[17] Bangladesh Bureau of Statistics, *45 Years Statistics of Major Crops,* (Dhaka, 2018), 153, Line Graph 3.2.
[18] "The State of World Fisheries and Aquaculture," fao.org Accessed 11 July, 2019 http://www.fao.org/3/I9540EN/i9540en.pdf.
[19] Department of Fisheries, *Annual Report 2017,* (Dhaka, 2018), 7.
[20] "Aquaculture for Income and Nutrition," worldfoshcenter.org Accessed 17 July, 2019. https://www.worldfishcenter.org/content/aquaculture-income-and-nutrition-ain.
[21] Planning Commission, *Bangladesh Delta Plan 2100 Abridged Version* (Dhaka, 2018), 8.
[22] "Global Climate Risk Index 2019," germanwath.org Accessed 22 July, 2019. https://germanwatch.org/en/16046
[23] "Success Stories 2009-2018," brri.gov.bd Accessed 15 June, 2019. http://www.brri.gov.bd/site/notices/c181858e-fc18-470f-b4f8-e232dfe95808/Success-Stories-2009-18.

Arguably, the contribution of livestock resources is increasing in the last decade for achieving food security. Especially, in the last three years it started increasing constantly. While beef is the most common item among the countrymen as the Muslims have the majority population.

Livestock Species	2015-16	2017-18	Increase (%)
Cattle	23.78 million	24.09 million	0.31 million (1.30%)
Buffalo	1.47 million	1.49 million	0.02 million (1.36%)
Sheep	3.34 million	3.47 million	0.13 million (3.89%)
Goat	25.77 million	26.10 million	0.33 million (1.28%)

Livestock Products	2015-16	2017-18	Increase (%)
Milk	7.28 million	9.41 million	2.13 million (29.25%)
Meat	6.15 million	7.26 million	1.11 million (18.04%)
Egg	11912.4 million	15520.00 million	3607.60 million (30.28%)

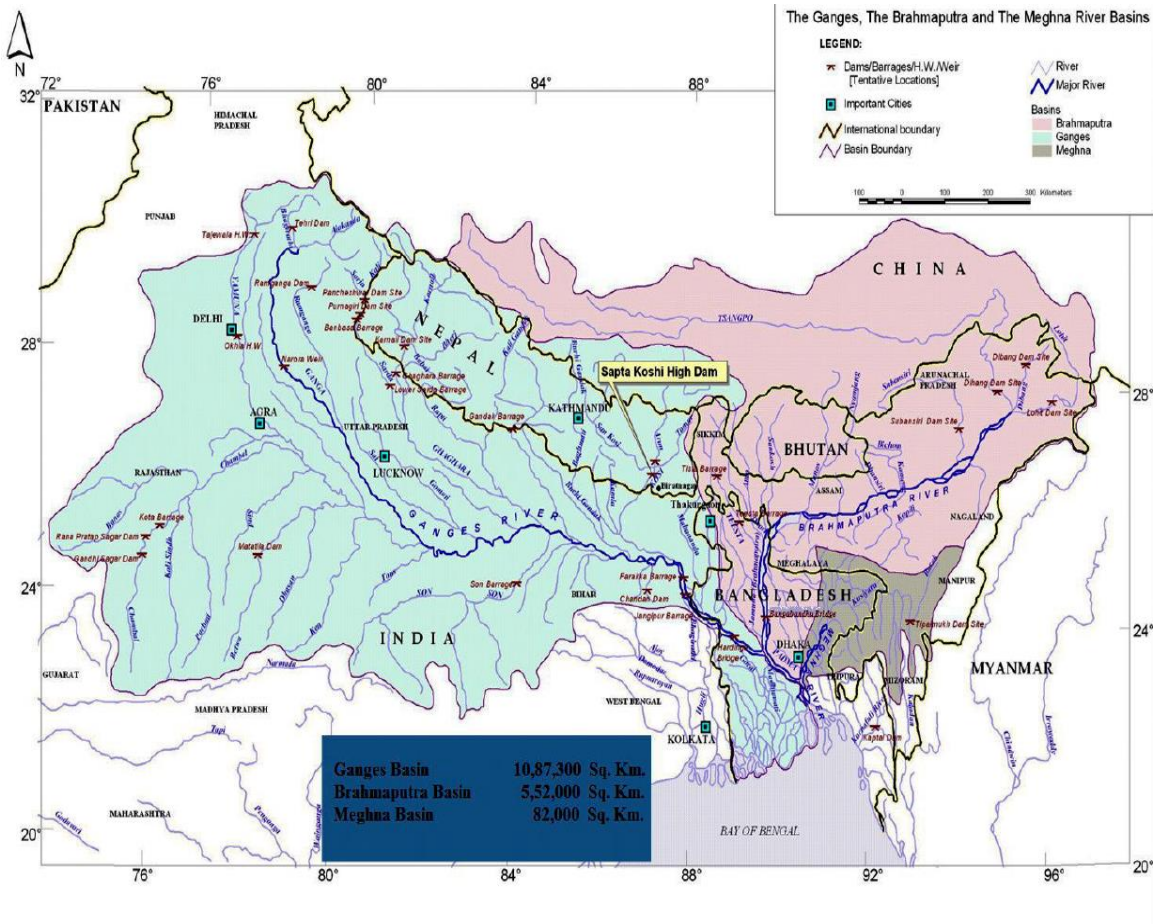
Table 1 and 2: increase of livestock species and products in the last three years[24].

Water Security for achieving SDGs

Water is the lifeline of human civilization. But the fresh water stock is shrinking globally. Water is closely related with agriculture, industry, sanitation, fisheries and wild life, navigation, hydropower, tourism and biodiversity clearly. However, the water is the close associate of flooding, river erosion, and tidal surge. As such Bangladesh has undertaken some policy document like Bangladesh Delta Plan 2100, National Water Policy 1999, Bangladesh Water Act 2013 and Bangladesh Water Rules 2018 to bring efficiency and effectiveness in surface water and ground water management. Some water activists and researchers termed water as fundamental rights. Unless the equitable water rights a number of animal species and women and children may fall in the threat of extinction. The water policy also aims to increase institutional capacity development in water management along with enhancing role of women in water management.

Bangladesh lay in the low land of Ganges-Brahmaputra-Meghna basin in which most of the river water flows from upper region of India and China. In the summer, the rivers get dried and there is no water except sand in the river. Inversely, mighty amount of water come along the transborder rivers in the rainy season and inundate the catchments. Around 70% of the total land area of Bangladesh is less than 1 meter above the se level and 10% of the land is occupied by lakes and rivers[25]. 93% of the water drain out through Bangladesh is generated outside of the country which poses the biggest challenge for the country[26].

[24] Department of Livestock, *Livestock Economy at a Glance* (Dhaka, 2018), 1-2.
[25] Planning Commission, *Bangladesh Delta Plan 2100 Abridged Version* (Dhaka, 2018),8.
[26] Planning Commission, *Bangladesh Delta Plan 2100 Abridged Version* (Dhaka, 2018), 15.



Map 1: the Ganges Brahmaputra Meghna basin[27].

Bangladesh has progressed better in institutional capacity development with the plan and policy documents. Likewise, Water Resources Planning Organization (WARPO) is responsible for finding hydrological regions and planning the development of that water resources at macro level. It prepares short-term and long-term National Water Management Plan. While, Bangladesh Water Development Board undertakes the development projects to develop the water infrastructures and resources.

National Water Policy of Bangladesh ensures the water rights to all and equitable distribution. It clearly states that the ownership of the water vests in the state[28]. It also monitors the water ecology and quality; salinity control; fisheries and navigational operation. Flood and drought monitoring cell also keep a sincere eye on the water flows in the rainy season and requirement in the summer season. Inversely, there are 57 transboundary rivers in Bangladesh out of which 54 rivers with India and 3 with Myanmar[29]. Both the country India and Myanmar are located in the upstream. Thus, they have the geographic opportunity to control the river water in the summer.

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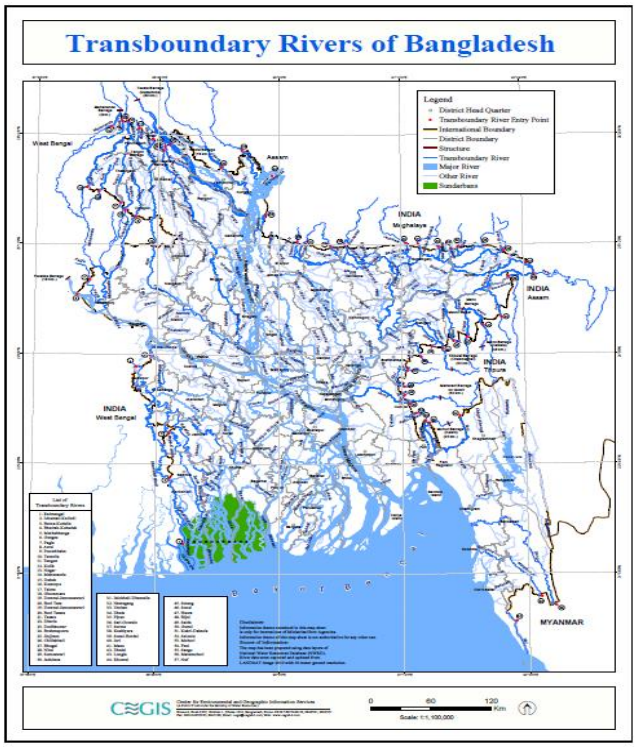
[27] Joint River Commission, Bangladesh, *The Ganges Brahmaputra Meghna basin map* (Dhaka 1973).
28 Ministry of Water Resources, *National Water Policy* (Dhaka, 2000).
29 Joint River Commission, *Bangladesh, List of Transboundary Rivers* (Dhaka 1973).



Map 2: Transboundary Rivers in Bangladesh.

Water Diplomacy between Bangladesh and India begun in 1991 when Sheikh Hasina became Prime minister of Bangladesh. Consequently, the government of Bangladesh and government of India signed the historical Ganges Water Sharing Treaty in 1996[30]. As per the condition, Bangladesh and India will receive guaranteed 35000 cusecs of water in alternate three 1- day period during March 11 to May 10 of each year[31]. The annexure 1 of the treaty shows the water sharing proportion:

Availability at Farakka	Share of India	Share of Bangladesh
70000 cusecs or less	50%	50%
70000 cusecs-75000 cusecs	Balance of flow	35000 cusecs
75000 cusecs or more	40000 cusecs	Balance of flow

Table 3: Water Sharing Proportion of Farakkha Water Sharing Treaty.

Teesta water sharing treaty is still a high priority of Bangladesh but it is lingering by the Indian counterpart especially the Chief Minister of West Bengal Province[32]. Teesta is one of the most important rivers for its influence on agriculture and livelihood in the basin. The river is originated in the Sikkim valley of Himalayan range in India. Parallelly, in May 2018 Indian External Affairs Minister Sushma Swaraj said that the water sharing treaty would not be possible with the consent of provincial government of West Bengal. Around 21 million

[30] Joint River Commission, Bangladesh, *Ganges Water Sharing Treaty 1996* (Dhaka, 1996), 3.
[31] Joint River Commission, Bangladesh, *Ganges Water Sharing Treaty 1996* (Dhaka, 1996), 6.
[32] Harun ur Rashid, " Likehood of Agreement on Teesta Water Sharing," *The Daily Star,* June 30, 2018, https://www.thedailystar.net/opinion/likelihood-agreement-teesta-water-sharing-1597378.

Bangladeshi people live in Teesta basin while only 8 million Indian people in their part[33]. Bangladesh India bilateral relationship got a good speed in 2009 and a draft agreement on water sharing treaty was presented during the visit of Manmohan Singh, the Prime Minister of India. But the initiative was futile for the opposition of Mamata Banarjee, the Chief Minister of West Bengal.

The Government of Bangladesh also tries to maintain water governance for equitable distribution. The National Water Policy also outlines the participation of public and private involvement along with community participation. Moreover, Bangladesh Delta Plan 2100 has clustered and categorized the 64 districts of Bangladesh for assessing water requirement and formulating the action plan where six out of sixty-four districts are less hazard prone for their geographic location[34]. Total country is divided into the following six hotspots.

SL	Hotspots	Land Area (sq.km)	Number of Districts	Name of Districts
01	Coastal Zone	27738	19	Bagerhat, Barguna, Barishal, Bhola, Chandpur, Chattogram, Cox's Bazar, Feni, Gopalgonj, Jashore, Jhalokathi, Khulna, Lakshipur, Narail,Noakhali, Patuakhali, Pirojpur, Satkhira, Shariatpur
02	Barind and Drought Prone Areas	22848	18	Bogura, Chuadanga, Dinajpur, Gaibandha, Joypurhat, Kushtia, Meherpur, Naogan, Natore, Nawabgonj, Nilphamari, Pabna, Panchagarah, Rajshahi, Rangpur, Satkhira, Sirajgonj, Thakurgaon
03	Haor and Flash Flood Areas	16574	3	Bandarban, Khagrachari, Rangamati
04	Chattogram Hill Tracts	13295	29	Barguna, Barishal, Bhola, Bogura, Chandpur, Cumilla, Faridpur, Feni, Gaibandha, Gopalgonj, Jamalpur, Kurigram, Lakshmipur, Lalmonirhat, Madaripur, Manikgonj, Munshigonj, Narayangonj, Natore, Chapai Nawabganj, Noakhali, Pabna, Potuakhali, Rajshahi, Rajbari, Shariatpur, Sirajgong, Tangail, Khulna
05	River System and Estuaries	35204	7	Barishal, Chattogram, Dhaka, Khulna, Rajshahi, Rangpur, Sylhet
06	Urban Areas	19823	6	Gazipur, Jhenaidah, Magura, Mymensingh, Nilphamari, Sherpur

Table 4: List of districts based on hotspots.

Moreover, BDP 2100 stipulates fresh water strategies for sustainability and environmental protection. It includes basin management for storing fresh water resources; excavation of local water storages like canals, baors (bigger wetlands), and ponds; increasing fresh water flow to urban areas; preservation of natural water bodies; maintaining balanced ground water level[35].

[33] Harun ur Rashid, " Likehood of Agreement on Teesta Water Sharing," *The Daily Star,* June 30, 2018, https://www.thedailystar.net/opinion/likelihood-agreement-teesta-water-sharing-1597378.

[34] Planning Commission, *Bangladesh Delta Plan 2100 Abridged Version* (Dhaka, 2018), 6-7.

[35] Planning Commission, *Bangladesh Delta Plan 2100 Abridged Version* (Dhaka, 2018), 18

Marching towards Sustainable Energy

Being one of the fastest growing economy, Bangladesh is facing energy and power insufficiency since 1971. However, Power and energy generation is another contested term for sustainability and pollution. Most of the electricity was generated from natural gas but the country is recently moving to nuclear power generation[36]. Currently, Bangladesh has 133 power plants which produces 22051 MW[37]. However, the per capita energy consumption increased only from 220 kilo watt hour to 244 kilo watt hour in the last ten years[38]. Additionally, Vision 2021of Bangladesh aims to increase renewable energy generation capacity to 5% in 2015 and 10% in 2021[39].

SREDA has planned to undertake commercial projects and social sector projects under the program of 500 MW solar power development[40]. The program aims to replace diesel irrigation pumps with solar power; solar mini grid power systems in rural areas; solar power solutions for commercial building, residential and industrial buildings. It has planned to undertake projects as per following table:

SL	Type of Projects	Capacity (MW)
01	Solar Irrigation	150
02	Solar Mini Grid	25
03	Solar Park	135
04	Solar Roof-top	30
Total		340

Table 5: 500 MW Solar Program[41].

Additionally, the biogas plant for household cooking is getting popular in Bangladesh especially in the rural areas. Rural Development Academy of Bangladesh is trying to familiarize Community Biogas Plant (CBP) which is dependent on a community based participatory mechanism. It is a shared facility and infrastructure where a community accumulates cow dung, slurry and vegetable waste to produce biogas and share the produced biogas in an equitable ratio. Additionally, the biogas powered irrigation system is gaining popularity in the northern districts of Bangladesh.

[36] "Nuclear Power in Bangladesh," world-nuclear.org Accessed 25 July, 2019. https://world-nuclear.org/information-library/country-profiles/countries-a-f/bangladesh.aspx
[37] Power Division, *At a Glance* (Dhaka, 2019).
[38] Power Division, *At a Glance* (Dhaka, 2019).
[39] General Economics Division, Perspective Plan of Bangladesh 2010-2021 (Dhaka, 2012), 62-63.
[40] "500 MW Solar Power Development Program," powerdivision.gov.bd Accessed 26 June, 2019. https://powerdivision.gov.bd/site/page/7d42b92a-8f64-4778-a0a8-b38c1448620d/500-MW-Solar-Program
[41] "500 MW Solar Power Development Program," powerdivision.gov.bd Accessed 26 June, 2019. https://powerdivision.gov.bd/site/page/7d42b92a-8f64-4778-a0a8-b38c1448620d/500-MW-Solar-Program

Photo: Inlet of Community Biogas Plant.
Source: Najmul Huda Imran, 2017

Photo: Fermentation Chamber of Community Biogas Plant.
Source: Najmul Huda Imran, 2017

The Renewable Energy Research Centre (RERC) of RDA has been working on multiple use of renewable energy in the same land. As the land scarcity prevail in Bangladesh and the amount of arable land is decreasing each year. The RERC has introduced multi farming with solar panel system and energy reservation system. Solar power system installed in the gourd field where both are productive.

Renewable Energy Research Centre.
Source: Najmul Huda Imran, 2017

Multi farming with Solar System.
Source: Najmul Huda Imran, 2017

Multi farming with Solar System.
Source: Najmul Huda Imran, 2017

The Joint Working Group (JWG) on Bangladesh-Nepal cooperation for power sharing has recently taken the following decision[42]:

i. Bangladesh and Nepal will use Indian grid for power transmission;
ii. Nepal will be building power transmission line in Nepal-India border;
iii. Bangladesh will be building power transmission lone in Bangladesh-India border;

[42] "Joint Working Group on Bangladesh-Nepal in the Field of Power Sector," moeri.gov.np accessed July 19, 2019. http://www.moewri.gov.np/images/category/JWG-2nd-Nepal-Bangladesh.pdf

Photo: Kutubdia Windmill. Source: Annual Report 2018, Power Division, Bangladesh

Future Challenges

The journey of sustainable development was not smooth since its conception. MDGs also faced a number of challenges where rich countries avoided their roles and responsibilities. But SDGs are for the whole planet. However, Bangladesh faces a lot of challenges for the reasons:

a. The current population size of Bangladesh is 164.7 million while Bangladesh Bureau of Statistics (BBS) in its Population Projection of Bangladesh Dynamics and Trends 2011-2061 projects the population will be 251.45 million in high variant growth assumption; 223.39 million in medium variant growth assumption; and 209.42 million in low growth variant[43]. In this scenario, the food security will be challenging. The quality of food production is questionable with hybrid species. Additionally, a number of local food varieties are extinct for lower yields;
b. Higher temperature reduces the productivity of high yielding rice varieties like Aus, Aman, and Boro[44]. In the summer time, the northern districts of Bangladesh face the desertification for water scarcity. The West Bengal province of India closes the sluice gates of Teesta river. Still the Teesta water sharing treaty is hanging between the two governments;
c. Modernizing the agricultural system is a bigger challenge for the country. The arable land is very smaller in size and shape. Sometimes different cooperatives try to popularize group farming. But this initiative works inversely in benefit-cost sharing;
d. The water quality of 32 rivers has been worsening in the last few years which is indirectly reducing the food productivity, increasing water borne diseases; and influencing environmental degradation[45]. Thus, water quality is a major concern of the country men. BDP 2100 outlines the suitable waste management plan and reduction of urban pollution mostly; supervision and control of urban water pollution and industrial waste; and action research for total water ecosystem[46].

[43] Bangladesh Bureau of Statistics, *Population and Housing Census 2011* (Dhaka, 2015), 21.
[44] Planning Commission, *Bangladesh Delta Plan 2100 Abridged Version* (Dhaka, 2018), 12.
[45] Planning Commission, *Bangladesh Delta Plan 2100 Abridged Version* (Dhaka, 2018), 11.
[46] Planning Commission, *Bangladesh Delta Plan 2100 Abridged Version* (Dhaka, 2018), 19.

Photo: River pollution of Turag river. Source: S M Tareque Sultan, 2018.

e. Meteorological challenges exist for renewable energy generation in Bangladesh[47]. The wind velocity is not stable through the year. While, risk of energy security exists in cross border energy transmission[48]. It mainly depends on the better relationships of the participating countries. If the relation worsens, the utility and benefit of such investment may futile. Furthermore, increasing the capacity of hydraulic power generation is challenging. As the current hydraulic power generation capacity is 230 MW[49].
f. Geographic vulnerability poses threat to transboundary water flow management. Most of the tidal rivers which are originated in China, Nepal, Bhutan and India passes through Bangladesh and drain the huge amount of water to the Bay of Bengal. The waterflow gains huge flow and power during the passage and inundates the catchments each year. The high velocity of water flow also causes river erosions rapidly. In the last year around 4000 families lost their all land and belongings for river erosion in Naria Upazila of Bangladesh[50].
g. Bangladesh is surrounded by India in three sides and the other side is Bay of Bengal. Thus, the Ganges-Brahmaputra-Meghna rivers mainly flow from outside and causes damage in the catchments lying in Bangladesh. Thus, the geographic vulnerability challenges are:
    i. Transboundary river water management;
    ii. Joint flood forecasting and drought management;
    iii. Demand based river basin planning and management by the neighbouring countries;
h. Global Climate Risk Index 2019 reveal that Bangladesh is one of the 10 most vulnerable countries in the world for climate change during 1998-2017 years[51]. Bangladesh Climate Change Trust Fund was established in 2009 for managing and mitigating climate change. Moreover, geographically Bangladesh is one of the most

[47] Power Division, *Power System Master Plan* (Dhaka, 2016), 107.
[48] Power Division, *Power System Master Plan* (Dhaka, 2016), 109.
[49] 'Bangladesh Remains Lowest in Asian Hydropower Production,' The Daily Star, November 03, 2018. https://www.thedailystar.net/bangladesh/lowest-hydropower-producer-in-asia-since-2017-bangladesh-remains-lowest-1655587
[50] Staff Correspondent, "Padma Keeps Eroding Parts of Naria" The Daily Star, September 13, 2018.
[51] "Global Climate Risk Index 2019," germanwath.org accessed 22 July, 2019. https://germanwatch.org/en/16046

vulnerable countries for global warming which increase the propensity of cyclones in the Bay of Bengal. Although, the disaster management capacity of Bangladesh has increased since 1991. The government of Bangladesh has also established Bangladesh Climate Change Resilience Fund (BCCRF) in 2010 which supports to build resilience in facing climate change[52];

i. Most of the power generation is dependant on domestic natural gas[53]. But, the domestic stock of natural gas is shrinking which influence the government to move for coal-based power plant. Rampal powerplant is one of the big coal-based power plants in Bangladesh which will supply 1320 MW electricity[54]. Coal-based power generation is a big challenge for the sustainability. Although, Bangladesh has been implementing its first nuclear power plant at Rooppur[55];
j. The system loss in the power generation sector is getting a burden on the net benefits. Total system loss stands 11.87% in 2018 for transmission and distribution[56]; and
k. Financing for SDGs achievement is another major challenge for Bangladesh. UNDP estimated that the country will require US$409 billion for the required development stipulated in the 7th FYP, a parallel document of SDGs[57].

Window of Hope

Though, low velocity of wind for exists in Bangladesh[58]. While, the joint collaboration of Bangladesh government and U.S. Department of Energy's National Renewable Energy Laboratory (NREL) has been working to meet the challenges of power generation and new opportunities. The NREL found that the coastal belt has the potentiality to produce wind power[59].

Bangladesh has the ample opportunity to exploit the regional hydropower potentiality and cross border transmission system[60]. Bangladesh has been importing 1160 MW electricity from India[61] and continuing the discussion with Nepal for cross border electricity sharing. PSMP 2016 projects to increase cross border energy import to 3500-8500 MW by 2031 and 9000 MW by 2041[62].

Moreover, the government of Bangladesh has adopted participatory approaches for achieving SDGs. One of the fundamental characteristics is 'inclusiveness'. A holistic and inclusive approach will be helpful for achieving SDGs and inspiring the farmers for

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[52] "Global Climate Risk Index 2019," germanwath.org accessed 22 July, 2019. https://germanwatch.org/en/16046
[53] Power Division, *Power System Master Plan* (Dhaka, 2016), 1.
[54] Power Division, *Moitri Super Thermal Power Plant Project (Rampal)* (Dhaka, 2017).
[55] "Rooppur Nuclear Power Plant Project," rooppurnpp.gov.bd accessed July 27, 2019. http://www.rooppurnpp.gov.bd/site/page/76d2f89f-9cd6-4af7-82a7-e1ad01673502/-
[56] Power Division, At a Glance, Dhaka, 2019.
[57] "Strengthening Finance for the 7th Five Year Plan and SDGs in Bangladesh," undp.org accessed July 26, 2019. https://www.undp.org/content/dam/rbap/docs/meetTheSDGs/Bangladesh%20DFA%20-%20Strengthening%20Finance%20for%20the%207th%20Five%20Year%20Plan%20and%20SDGs.pdf
[58] Power Division, Power System Master Plan (Dhaka, 2016), 108.
[59] "Assessing the Wind Power Potential in Bangladesh," nrel.gov accessed July20, 2019. https://www.nrel.gov/news/program/2018/assessing-the-wind-power-potential-in-bangladesh.html
[60] Power Division, Power System Master Plan (Dhaka, 2016), 108.
[61] Power Division, At a Glance (Dhaka, 2019).
[62] Power Division, Power System Master Plan (Dhaka, 2016).

sustainable production of crops. Moreover, BDP 2100 is a parallel plan of actions to ensure long term water and food security, economic growth and environmental sustainability[63] .


Photo: participatory learning and motivating session arranged by RDA, Bogra. Source: S M Tareque Sultan, 2017

The government of Bangladesh focuses on water governance, water sharing treaty, unfinished treaties between the neighbouring countries. Additionally, PSMP has set a target to achieve renewable energy generation capacity 2470 MW by 2021 and 3864 MW by 2041[64].

Policy Recommendation

Qualitative Development Initiative (QDI) which can be a holistic policy for achieving SDGs by 2030 in food, water and energy sector. QDI will focus on prosperity and well-being rather than focusing on only mathematical figures, statistics and paper works on GDP or GNP. The measurement of development has built in discriminatory view only on figures and data rather than bringing the actual development and human capital development. The QDI will work for food standards, water quality and zero pollution by protecting farmers interest, reducing health hazards of the expected consumers, and integrating standards, norms, and values to the stakeholders.

QDI will focus more on capacity development and technical knowledge transfer to the grassroot people to achieve SDGs collectively. It aims human capital development of the unaddressed section who have the potentiality to contribute to the change of the globe with newer skills and capacities to produce quality food, conservative water utilization and renewable energy generation. It will foster innovation utilizing their local knowledge and experience to bring resilience. Real-life example can be the utilization of banana trees and bamboo for making floating boats during floods in Bangladesh which save the human life, dry foods, animals, daily necessaries and belongingness. It will value the geographic and cultural values while bringing prosperity and wellbeing. Likewise, SDGs especial focus on people, planet, prosperity, peace and partnership.

Conclusion

SDGs came up with a great hope and expectation of wholehearted participation of stakeholders from all spheres. Although, MDGs were the only headache of poor countries for developing the indicators and statistics. The paper found that opportunities are expected by every stakeholder while ignoring the challenges with proper attention. Even, food and water

63 Planning Commission, Bangladesh Delta Plan 2100 Abridged Version (Dhaka, 2018), 14.

64 Power Division, *Power System Master Plan* (Dhaka, 2016), 108.

are consumed by everyone who is alive while energy is consumed more by the rich. But, the food, water and energy crisis affect more negatively the poor than the rich. As such, a greater attention is to be paid for collective achievement in SDGs and materializing the motto ‘leaving no one behind’. Bangladesh has been working relentlessly to achieve food, water and energy security along with all other goals and targets of SDGs.

Managing the challenges and making the better utilization of the mentioned windows of hope while applying the QDI approach, Bangladesh will be moving forward for achieving SDGs by 2030. The increase of rice productivity and power generation capacity will foster the SDGs implementation while finishing the unfinished water sharing treating with India and Nepal. Regional cooperation along with global movement for SDGs will create a favourable atmosphere for SDGs achievement.

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