BANGLADESH WATER SECTOR NETWORK STUDY

Final Report

Prepared for

PARTNERS FOR WATER

Prepared by

LightCastle Partners

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October 31, 2018

Acknowledgement

We would like to express our deepest gratitude to all those who provided us support for accomplishing this study. We are immensely indebted to the government and private sector key informants including executive directors, project directors, country directors, chief engineers, chairman of associations and sector experts for providing their valuable time and insights.

List of Acronyms

ADB	Asian Development Bank
ADP	Annual Development Plan
BDP2100	Bangladesh Delta Plan 2100
BDT	Bangladeshi Taka
BADC	Bangladesh Agriculture Development Authority
BMDA	Barind Multi-purpose Development Authority
BEZA	Bangladesh Economic Zones Authority
BEPZA	Bangladesh Export Processing Zones Authority
BGMEA	Bangladesh Garment Manufacturers and Exporters Association
BIWTA	Bangladesh Inland Water Transport Authority
BKMEA	Bangladesh Knitwear Manufacturers & Exporters Association
BLD	Billion Liter per Day
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CAPEX	Capital Expenditure
CEGIS	Center for Environmental and Geographic Information Services
CETP	Central Effluent Treatment Plant
DoE	Department of Environment
DPHE	Department of Public Health Engineering
DG	Director General
DWASA	Dhaka Water and Sewerage Authority
EKN	Embassy of the Kingdom of Netherlands
ETP	Effluent Treatment Plant
FBCCI	Federation of Bangladesh Chamber of Commerce and Industries
FSM	Fecal Sludge Management
FY	Financial Year
GoB	Government of Bangladesh
GIS	Global Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ICT	Information and Communications Technology
IDI	In Depth Interview
IFC	International Finance Corporation
IFI	International Financial Institute
IWM	Institute of Water Modelling
JICA	Japan International Cooperation Agency
JV	Joint Venture
KII	Key Informant Interview
LoC	Line of Credit
LGD	Local Government Division
LGED	Local Government Engineering Department
MASP	Multi Annual Strategic Plan
MoA	Ministry of Agriculture
MLD	Million Liter per Day
MoFE	Ministry of Forestry and Environment

MLGRDC	Ministry of Local Government, Rural Development and Co-operatives
MoI	Ministry of Industries
MoWR	Ministry of Water Resources
NGO	Non-Government Organization
OPEX	Operational Expenditure
PaCT	Partnership for Cleaner Textiles
REHAB	Real Estate and Housing Association of Bangladesh
SCADA	Supervisory Control and Data Acquisition
SDP	Sector Development Plan
STP	Sewerage Treatment Plant
WASH	Water, Sanitation and Hygiene
WASA	Water And Sewerage Authority
WB	World Bank
WSS	Water Supply Services
USD	US Dollar

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Executive Summary

The study was commissioned by the Partners for Water Program, an alliance consisting of the Embassy of the kingdom of Netherlands, Ministry of Foreign Affairs, Ministry of Infrastructure and Water, RVO and the Netherlands Water Partnership. The objective of the study is to gather strategic insights on the current status quo and future prospects of the Water Sector in Bangladesh, enabling The Netherlands Embassy to explore avenues for Dutch Private Sector companies, as well as drawing conclusions on the Embassy's position in terms of the Multi-Annual Strategic Plan (MASP). This study has been conducted by reviewing existing literature as well as undertaking 30 plus in-depth interviews with government stakeholders, development partners, private sector enterprises, think tanks, research organizations, associations and sector experts.

Bangladesh's ecological sustainability and economic development is dependent on a number of critical factors. Due to the country's riverine nature with water flowing downstream, it faces a number of challenges: starting from flooding during monsoon season (44,000 metre Cubic feet per second flowing through Ganges) to experiencing drought during off-season (10,738 cubic feet per second). Although much of this variance is due to environment reasons, man-made barriers hindering natural water flow from neighboring country are also contributory factors. Climate change induced sea water level rise is another major factor adversely impacting local ecosystem and livelihood in the Southern region of the country. The Southern division of Khulna is saline prone, which has resulted in lower agricultural yield and economic activities. As a result, the region is experiencing exodus of these climate refugees, seeking economic opportunities in other regions.

Water resource management features heavily in government's development plans. The cabinet has recently ratified the Delta Plan 2100, which features 80 prioritized projects, which will be implemented within 2030 with the World Bank committing to source financing for these projects. From a broader perspective, **infrastructure development, policy and governance** related areas will receive financing in near future as Bangladesh gradually transitions into a middle income status.

Dredging, land reclamation and Urban Water Supply are areas with the highest potential for Dutch organizations. With an annual sedimentation rate of 1.2 billion tons per year, dredging is a potential growth segment, particularly due to the need for improved waterways for managing domestic and cross-border transport. Potential opportunities include providing technical support, capacity building for dredger maintenance and operations, accessories and equipment support etc.

Due to large scale urbanization, city based water suppliers (DWASA, CWASA etc.) have been struggling to expand drinking water and urban waste management facilities. According to UN estimates, Dhaka's population is expected to reach 27.4 million by 2030, with daily demand of 3.425 billion liters. Apart from drinking water, growing population will result in increased investment opportunities in waste water processing and fecal sludge management. Dutch companies can capitalize on existing digitization drive within the government, offering relevant software like SCADA to WASA for optimizing performance. Opportunities also exist in terms of technical assistance in terms of consulting support and organization wide capacity development.

Although country specific economic zones are outside the purview of Bangladesh Economic Zone Authority (BEZA), rest of the economic zones are under the direct supervision of the government body. BEZA intends to setup 100 economic zones across the country and have direct authorization for setting up centralized STPs and ETPs in each of

these zones. Dutch companies can directly collaborate with the BEZA for setting up these treatment plants, as well as offering technical and capacity building support.

Funding for implementing government led development projects have traditionally been sourced from internal revenue sources e.g. direct taxes, or through soft loans or grants from multilateral lenders and foreign Governments. As the country gradually moves towards the middle-income status, grant funding is expected to reduce markedly and be partially replaced by PPP and G2G based funding. China and India have emerged as major development partners, offering funding (grants and loans) to the tune of up to USD 24 billion and USD 4.5 billion respectively. Although the tendering process for many of these projects is expected to be on a level playing field for all the countries, **conditional financing terms, at times, are being used for many development loans.** For example, the Line of Credit (LoC) agreements with India stipulates as closed tendering for Indian firms only, while Chinese loans have similar preconditions for hiring Chinese equipment and service providers.

As Bangladesh's population grows with rising economic prosperity, demand for groundwater- currently catering to 98% if water demand- is expected to keep on increasing. The resulting urbanization and industrialization led by government sponsored economic zones, will require efficient water and industrial waste management. The country's RMG and textile sector has significant economic footprint, contributing 83% of country's export and 12% of GDP, having headroom for further growth. However, the sector (particularly textile sub-sector) has been generating toxic industrial waste, most of which are not properly treated before dissipation. The leather sector is another emerging economic contributor, which faces similar challenges in terms of managing industrial waste water. Although ETPs and STPs have been installed in a number of these factories (mostly RMG and Textiles) and relevant policies are in place, opportunities exist in terms of offering both hardware and technical support for setting up these facilities. World Bank predicts water management capital expenditure for waste water management to top USD 12-16 billion and USD 35-50 billion for textile and leather sectors respectively within 2030.

Garments & Textile and leather sectors have some opportunities with significant pressure for complying with environmental standards, particularly from international buyers and regulatory agencies. Many manufacturers are also aware of potential efficiency upside for adopting environment friendly technologies. However, most of these manufacturers are cost sensitive, opting to install inexpensive equipment with lower capital expenditure. For example, Chinese ETPs are popular among manufacturers due to lower pricing compared to European made ones.

In the **textile sector**, dyeing and washing are water intensive processes with waste-water treatment plants (ETPs) made mandatory for all factories. Currently, the ETPs are sourced from local sources having a price range of USD 470,000 on average. Apart from top-tier factories, most are price-sensitive preferring Chinese machinery and equipment due to affordable pricing. Similar trends have been observed in other market segments like agro-processing and drinking water.

Dutch companies need to devise a marketing strategy focusing on long term benefits for procuring Dutch equipment at premium pricing. In terms of technical assistance and capacity building, Dutch players have some opportunities, though local and regional firms are gradually closing the gap in terms of service quality. Opportunities through exist with JV based project bidding and technology & skill transfer. Inland water including irrigation and fisheries, construction of Inland container terminals and Shipyards have limited opportunity being limited to providing engineering design support and technical assistance.

In **real estate**, opportunities exist in specific zones and satellite cities near the suburbs, where large apartment blocks or condominiums are being constructed, which are few in number at this point in time. Construction of sophisticated water purification and waste water recycling facilities for apartment complex and condominiums will become more popular with growing urbanization and expansion of major cities like Dhaka and Chittagong. For smaller apartment buildings, there is limited opportunity for Dutch companies, as local companies manufacture water tanks, reservoirs for water or sludge at very competitive pricing.

Dutch private sector firms can contribute to a rising economy like Bangladesh, which has its unique challenges in terms of the fall out of climate change, rising population, industrialization led pollution and inadequate infrastructure for water management. Dutch companies have a wide repertoire of relevant products and services offerings for water management, but are likely to be priced out in the local market due to availability of cheaper alternatives. However, establishing strategic relationships with local partners can help optimize costing, enabling Dutch players to create value for the end clients. Dutch companies can also offer equipment and technical assistance to government led infrastructure development projects, funded by multilateral donor agencies.

Summary of Opportunities

High	
Medium	
Limited	

Public Sector(s)	Opportunity
Dredging to counter sedimentation and river erosion	**High**
Integrated Water and Resource Management	**High**
Water treatment in industrial and economic zones	**High**
Urban Drinking Water	**High**
Capacity building of public institutions	**High**
Wastewater market segment, drainage, sewerage, water harvesting, surface water	**Medium**
Water Harvesting	Limited in product market
	High in Services market
River and sea transport	**Medium**
Water for Agriculture	**Medium**
Consultancy services	**Medium to Limited**
ICT and Water, Water for food in combination with ICT and agriculture	**Limited**
Dredging rivers and enhanced surface water irrigation in the south	**Limited**
ICT and Water, Water for food in combination with ICT and agriculture	**Limited**
Dredging rivers and enhanced surface water irrigation in the south	**Limited**
Rural drinking water	**Limited**

BRIEF OVERVIEW OF THESE PUBLIC SECTOR OPPORTUNITIES ARE IN SECTION 3.

Private Sector(s)	Opportunity
Textile companies & Ready Made Garment Sector (Tier 1 companies)- generally large factories (> 2,000 employees) that secure orders from buyers- water treatment plants, sewerage treatment plants	**Medium**
Small scale water treatment plants for agriculture and industrial wastewater (B2B)	**Medium**
Water Efficiency for agro-processing companies	**Medium**
Small-scale Service Market (B2C)	**Medium**
Large-scale Urban Utilities Market (B2B/B2G)	**Medium**
Design, construct, and operate shipyards (Joint Venture or PPP)	**Medium**
Inland container terminal (Joint Venture or PPP)	**Medium**
Water treatment plants for Economic Zones	**Medium**
Effluent treatment plants for Economic Zones	**Medium**
Providing water-based tourism marketing and technical assistance.	**Medium**
Small-scale Hardware Market (B2C)	**Limited**

BRIEF OVERVIEW OF THESE PRIVATE SECTOR OPPORTUNITIES ARE IN SECTION 4.

1. Introduction

1.1 Background of the Study

This study was commissioned by the Netherlands Enterprise Agency (Government of the Netherlands/ Ministry of Economic Affairs) with the aim to garner insights about the current and future opportunities in the Bangladesh water sector and to strengthen the cooperation between the two countries on water.

1.2 Objective

The objective of the study is to gather strategic intelligence on developments in a number of areas of Bangladesh water sector for supporting EKN in drawing conclusions about the strategic positioning of the Netherlands, and for preparing a Multi Annual Strategic Plan (MASP), as well as for supporting the Dutch water sector with insights on the current and future opportunities in Bangladesh.

Specific Objectives

- Recent policy and investment programming by the Government of Bangladesh (GoB) and IFIs
- Programs and financial flows of donors and government
- Updated overview of current opportunities in various segments of the water sector
- Tendering/procurement of projects relevant for the Dutch water sector
- Financial capabilities and capacity of the government, private sector parties and international donors

1.3 Methodology

The study adopted a blended approach utilizing both secondary and primary sources of data for gathering available insights and evaluating future prospects for the Dutch Water Sector in Bangladesh. The research process commenced with the review of existing publications on the water sector including Water Market Scan Bangladesh (2010) by Mott MacDonald; Exploring the Water Management Sector in Bangladesh (2014) by Nyenrode; Bangladesh Positioning Survey for the Dutch water sector (2015) by Aidenvironment etc. among others.

The research process mainly included qualitative tools included Key Informant Interviews (KII), and in-depth Interviews (IDI) of stakeholders, including private sector players (Garments, Leather, Real estate, FMCG, Pharmaceutical), different industry associations (BGMEA, BTA, REHAB etc.), government (Ministry of Planning, BEZA, BADC, BIWTA etc.), knowledge-based institutions (BUET, IWM), NGOs (International Society for Red Cross) and industry experts. ***THE COMPLETE LIST OF STAKEHOLDERS INTERVIEWED PRESENTED IN TABLE 7.1 OF ANNEX-I.***

Type of Stakeholder	Percentage
Government Entities	24%
Private Sector Companies	21%
Association	14%
Sector Experts	14%
Water Research Organizations	10%
Donor funded Projects	10%
INGO and International Consulting Firms	6%
TOTAL	100% (n=31)

Table 1.1: Composition of Stakeholder Interviews

2. Overview of the Water Sector

Bangladesh Water Sector at a Glance

Bangladesh is a riverine country with the Bay of Bengal located in the South of the country. The rivers and floodplains are the main sources of water supporting livelihood of the people, as well as providing the wherewithal for sustaining the local economy. Bangladesh is the ninth most densely populated country in the world. With growing population, industrialization and urbanization, the demand for water resources will keep on increasing.

Primarily, two types of water resources, namely surface and groundwater, make up bulk of Bangladesh's water sources. Flowing rivers and static sources like ponds, beels, haors are stated as surface water sources, cumulatively generating maximum inflow of 140,000 cubic meter per second (during August) and a minimum of 7,000 cubic meter per second (during February) (Source: American Journal of Water Science and Engineering, 2018). The Brahmaputra and the Ganges account for more than 80% of stream flows. The Brahmaputra splits into two branches- the larger branch continuing towards south as the Jamuna and Padma, while the other branch curves southeast as the old Brahmaputra, flowing into the upper Meghna. Groundwater is the main source of water for domestic, industrial and irrigation supplies considering the relatively uncontaminated nature of water, compared with surface water, which usually is polluted, and often bearing waterborne diseases. A total of 95% of the domestic and industrial water supplies and 70% of the irrigation supplies are drawn from groundwater.[1]

The average daily flow of the Ganges is about 10,874 meter cube per second, which reduces to 1,366 meter cube per second during off season and might increase to 44,000 meter cube per second during peak season in August. The Ganges Barrage Project is one of the top 80 priority schemes of the Delta plan, to be implemented by 2031. The estimated cost of implementing these 80 projects is $37 billion, of which, the Ganges Barrage project costs the highest and is given the highest priority (SOURCE: KII- Ainul Nishat). The Ganges Barrage project is aiming to source water for irrigation and cultivation purpose.

The alluvial aquifer system is the most productive ground water source usually consist of three lithological units- an upper clay and silt layer, a middle layer of fine to very fine sand, and a lower layer of fine to coarse sand constituting the main aquifer. The transmissibility of the aquifer can be less than 500 to more than 2000 meter square per day (Source: BWDB), and the storage coefficient varies from less than 1% to 15%. At places, water table can be found within a few meters below the ground surface (Source: American Journal of Water Science and Engineering, 2018). Bangladesh receives plenty of rainfall during monsoon (June to October), with annual rainfall ranging from about 3,200 mm in the northeast to about 1,600 mm in the southwest region.

In spite of monsoon rainfall which replenishes the ground water aquifer levels, the water layer is decreasing per year at a steady rate, and industries which used to source their water requirements from groundwater are being forced to bore deeper for their motorized tube wells. (Source: KII- Drinking Water Company, Aqua Mineral) Textile and RMG sector is one of the key contributors to water demand, 98% of which is sourced underground. [2]

[1] Ashim Das Gupta, Water Sector of Bangladesh in the Context of Integrated Water Resources Management, Water resources development, vol 21, No.2 (2005): 385-398

[2] Sagris, T. and Abbot, An analysis of industrial water use in Bangladesh with a focus on the textile and leather industries, 2030 Water Resources Group (2015)

Industries are required to have licenses for extracting groundwater or end up paying water utility charges to municipalities and city corporations. According to World Bank's benchmarking study, 90% of urban water[3] supply is being sourced from groundwater.

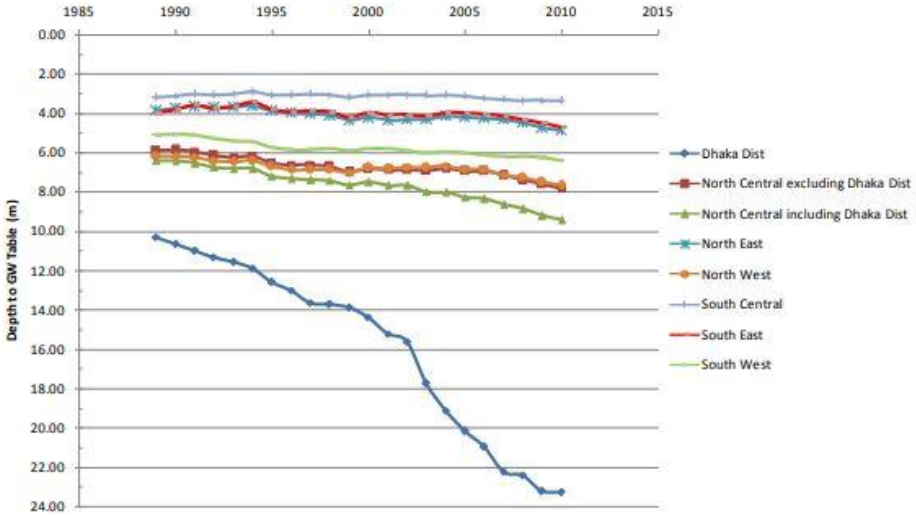


Figure 2.1: Variation of Pre-monsoon ground water table, 5-years moving average

The pre and Post-monsoon water tables showing drastic decrease of ground water Dhaka

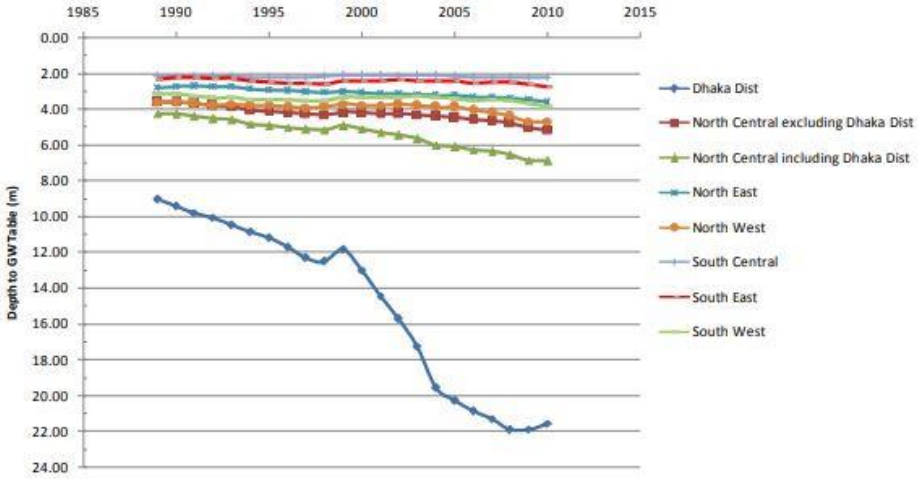


Figure 2.2: Variation of Post-monsoon ground water table, 5-years moving average

The current population of the country is 160 million and is projected to grow to about 202 million in 2050 (forecasted by UN Population Division medium projection). The country's economic growth is around 7% (Source: BBS, 2018), and if this economic growth continues, the country's wealth will increase eight-fold by 2050. These would catalyze increased demand for water in households and manufacturing entities.

The Fifth Assessment Report by IPCC in 2014, quoted Bangladesh as being vulnerable to sea-level rise and natural disasters such as cyclones. The report also estimated that almost 27 million people were at risk of sea level rise by

[3] WSP. Benchmarking to Improve Urban Water Supply Delivery in Bangladesh. (2014)

2050. Currently, the southern districts of Bangladesh is affected by salinity intrusion due to sea level rise. With increased industrialization and urbanization, more and more of the surface water bodies would be suffering from contamination.

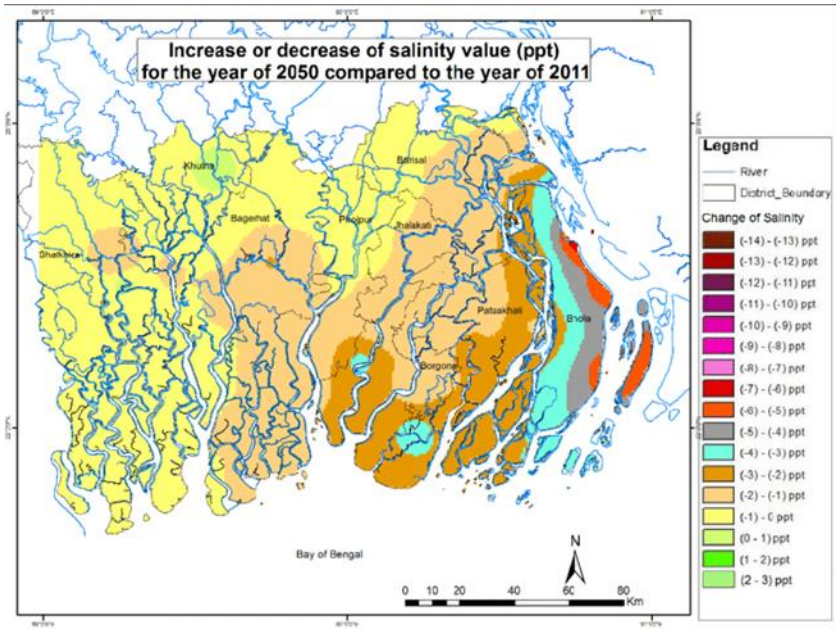


Figure 2.3: Forecasted Salinity Intrusion affecting Southern Districts[4]

According to empirical studies, sectors contributing to water pollution include- Textile, Leather, Agriculture, Paper and Sugar.

Table 2.1: Water pollution source and their ranking in Bangladesh[5]

Industry	Water Pollution	Pollution Product	Ranking
Agriculture	Moderate	1.08	3
Textile	Big	3.35	1
Transport	Small	0.02	6
Construction	Small	0.14	5
Paper	Very Big	0.67	4
Leather	Extreme	1.88	2
Sugar	Extreme	1.72	2

Sugar and Paper manufacturing sectors have been excluded from the study due to smaller number of sugar mills (12 were registered in 2006) and de-growth of the paper industry due to increasing usage of alternatives like electronic devices. The study is focusing on the Textile and Leather sectors owing to comparatively larger industry size and generation and unplanned disposal of toxic chemical contaminated waste water.

[4] Akter, Rabeya, Mashrekur Rahman Sumaiya, Tanveer Ahmed, Anisul Haque, and Munsur Rahman. "Prediction of Salinity Intrusion Due To Sea Level Rise and Reduced Upstream Flow In The GBM Delta." (2016)

[5] M. A. Hannan, M. A. Rahman, M. F. Haque. 'An Investigation on Quality Characterization and Magnitude of Pollution Implsications with Textile Dyeing Industries' Effluents using Bleaching Powder' DUET Journal, Vol 1, issue 2 (2011)

It is projected that industrial water demand can increase by 109%, domestic water demand by 75%, and agricultural water demand by 43% in 2030[6] for taking the water demand to 52.96 billion cubic meter, from 35.87 billion cubic meter in 2014.

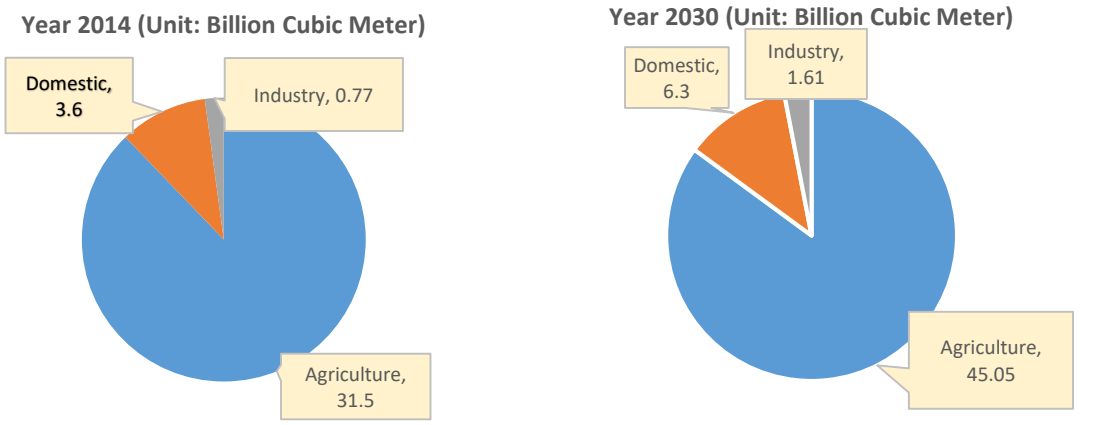


Figure 4.3: Projection on Sector-wise Water Demand in Bangladesh by 2030

The estimated water consumption in the Textile and Leather sectors is estimated to be 4,027 Million Liters per day. The WB estimates annual water demand to reach 6,788 MLD and 80 MLD for the Textile and Leather sector respectively within 2030.

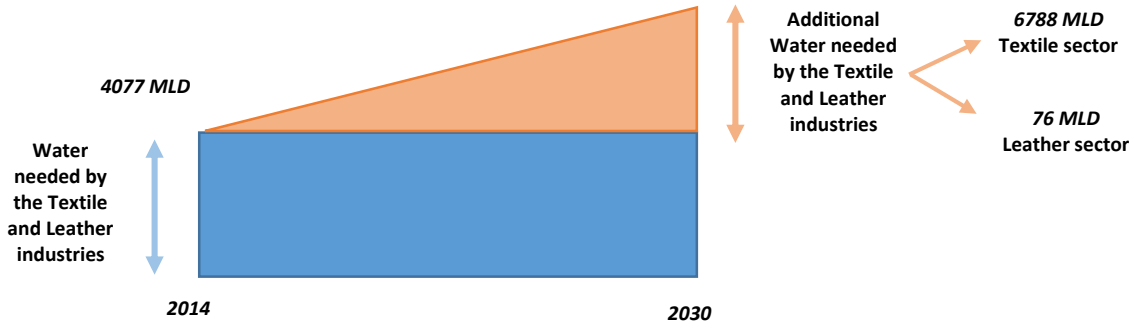


Figure 4.3.2: Projected water demand of textile and leather sector by 2030
Source: An analysis of industrial water use in Bangladesh (2015) by 2030 WRG

Assuming the different projected industry growths, a broad estimate for water sector infrastructure requirement has been estimated by the 2030 Water Resources Group,[7] which gives an indication of the future market size for water related technologies.

[6] PricewaterhouseCoopers, Consolidation and Analysis of Information on Water Resources Management in Bangladesh, (2015)
[7] Sagris, T. and Abbot, An analysis of industrial water use in Bangladesh with a focus on the textile and leather industries, 2030 Water Resources Group (2015)

Broad Market Size in Textile Water Technologies by 2030

Parameter	Forecasted Cost by 2030 WRG*
Capex	12-16 billion USD
Opex	13.7 billion USD
TOTAL	26- 30 billion USD

* Assuming that the textile industry will grow to USD 66.25 billion by 2030, requiring an additional water supply of 6,788 MLD and Implementation of interventions, which will reduce water usage by 20-35%. The costs include an estimate of investment required for new water treatment and wastewater treatment infrastructure by existing factories to comply with environmental standards.

Broad Market Size in Leather Tanneries Water Technologies by 2030

Parameter	Forecasted Cost by 2030 WRG*
Capex	35-50 million USD
Opex	40-47 million USD
TOTAL	75-100 million USD

* Assuming that the leather industry will grow to USD 8.25 billion by the year 2030, requiring an additional water supply of 76 MLD and Implementation of interventions, which will reduce water usage by 20-35%.

Structure of Water Governance in the Public Sector

Following the Water Act 2013, strategic direction on national water resources planning and policy-making is being provided by the inter-ministerial NWRC and its Executive Committee.

The Ministry of Water Resources (MoWR) is regarded as the highest authority in the water sector, and leads the policy formulation, monitoring, implementation of plans and policies relevant to water. However, the MoWR is not directly involved with implementation, but accomplishes it indirectly through five supporting organizations i.e. BWDB, JRC, RRI, BHWDB and WARPO. Among them, particularly BWDB and WARPO are responsible for implementation of water management in Bangladesh.

BWDB supervises implementation, operation and maintenance of large scale water-related projects, while WARPO is responsible for macro-level water resources planning and management and the preparation of the National Water Resources Plan. However, due to institutional constraints indicated by both previous studies[8] and primary interviews, the current activities of WARPO for contributing in Water Governance was found to be very limited. Therefore, while WARPO also has a mandate on planning the location of new industries on the basis of water availability and effluent discharge requirements, their influence and overall actions is assumed to be limited, unless institutional changes improve their current operational modality.

While the Ministry of Water Resources (MoWR) is the principal water regulator, the Department of Environment (DoE) under the Ministry of Environment & Forests (MoEF) is the principal water monitoring agency, with the authority to take legal measures against various water polluters. For example, any effluent plant water discharge not meeting the environmental parameters can be penalized by DOE.

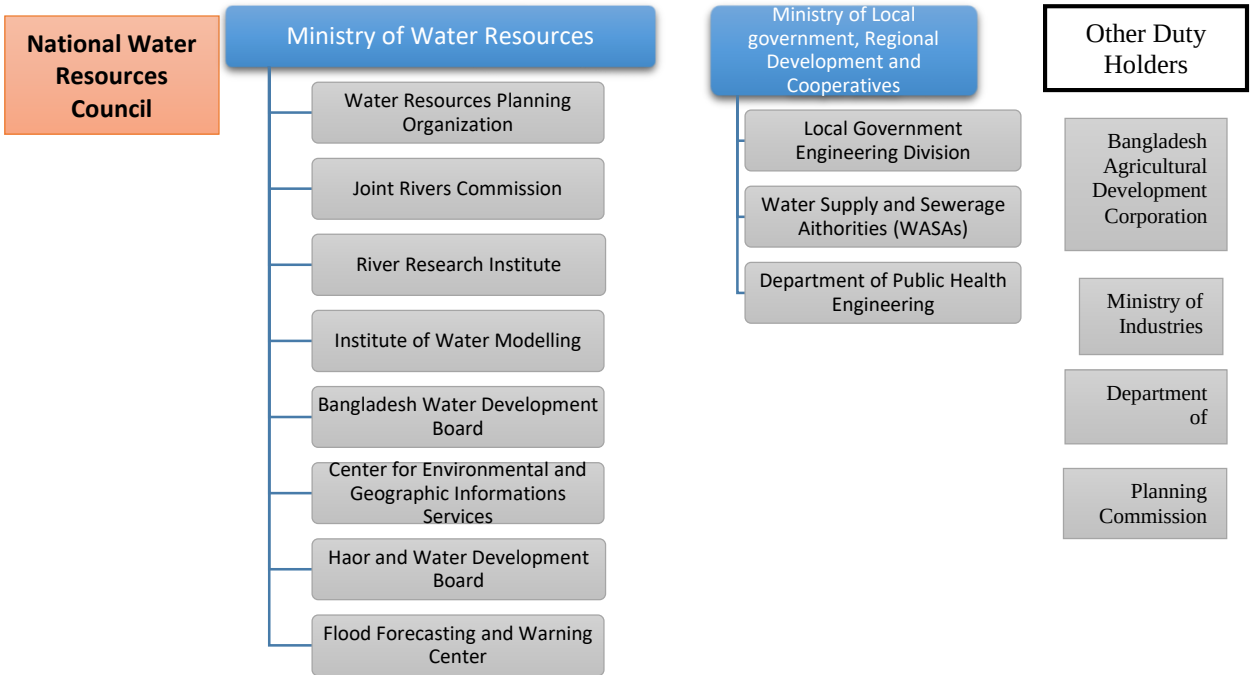


Figure 2.4: Institutional Framework in the Water Sector in Bangladesh

[8] WWF. "*Water Governance in Bangladesh: Challenges and Opportunities Around Policy, Institutional Function And Implementation for a Sustainable Water Future*".(2015)

Table 2.2: Government Stakeholders with Key Responsibilities

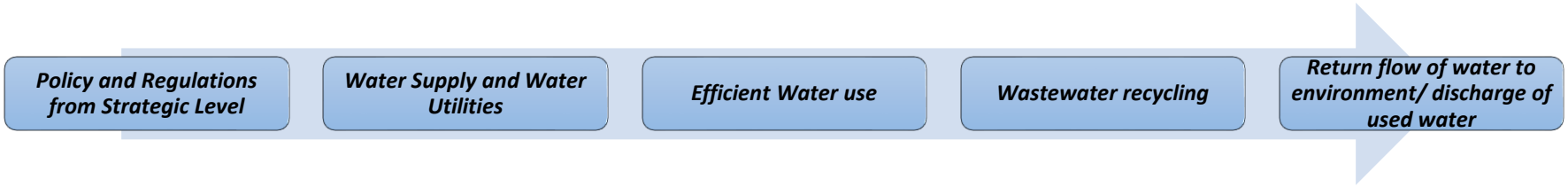
Name of Government Body	Responsibility
National Water Resources Council (NWRC)	Apex body at national level responsible for the formulation of water policy, including interagency coordination and is charged with making recommendations to the Cabinet on issues related to water policy.
Ministry of Water Resources (MOWR)	Managerial body of the government for development and management of the country's water resources. The organization formulates policies, plans, strategies, guidelines, instructions and acts, rules and regulations related to water management
Bangladesh Water Development Board (BWDB)	Planning and execution of water projects throughout the country including flood control, drainage, irrigation, town/coastal protection and erosion control. The functions include construction of water management structures, dredging and re-excavation of channels, land reclamation works, river training and erosion control, construction and maintenance of coastal embankments, and rainwater harvesting, flood and drought forecasting, hydrological survey and investigations, research, establishment and training of water user associations and other stakeholder organizations.
Local Government Engineering Department (LGED)	Development and management of rural projects—small-scale flood control, drainage and irrigation (1000 hectors and less), road, electricity, water supply and sanitation, health improvement etc. emphasizing on local participation with representation in sub-district co-ordination committees
Water Resource Planning Organization (WARPO)	Apex planning and coordinating organization with multidisciplinary professionals from different water use sectors
Centre for Environment and Geographical Services (CEGIS)	Established as a public trust, works using integrated environmental analysis, geographic information systems, remote sensing and information technology
Institute of Water Modelling (IWM)	Mathematical modelling of Bangladesh river systems, geographic information systems, environment and groundwater modelling
Department of Public Health Engineering (DPHE)	Waterworks development projects, and planning in the rural water supply and sanitation sector, in the urban water supply sector
Dhaka Water Supply and Sewerage Authority (DWASA)	In charge of domestic, industrial and commercial water supply of Dhaka
Chittagong Water Supply and Sewerage Authority (CWASA)	In charge of domestic, industrial and commercial water supply of Chittagong.

Government Entities Concerned with Water Usage

There are altogether 30 ministries with 35 departments that are responsible for using of river water and other water resources.

However, the ministries considered as principal water users include-

- Ministry of Agriculture (MoA),
- Ministry of Local Government, Rural Development & Cooperatives (MoLGRD&C),
- Ministry of Industries (MoI),
- Ministry of Textiles & Jute (MoT&J) and
- Ministry of Disaster Management & Relief (MoDM&R)



Water Resources Planning Organization (WARPO), under Ministry of Water Resources (MoWR)

• High level water resource planning and management through National Water Management Plan.

• Planning the location of new industries based on water availability and effluent discharge requirements.

ECNWRC

• Extraction of water, construction that may potentially change the direction of flow of water in a natural water body.

Water utilities under MoLG

Three types of water utilities under MoLG:

- ❖ Water Supply and Sewerage Authorities (WASAs)
- ❖ City corporations
- ❖ Pourashavas.

• Role: planning, construction, operations and maintenance of water supply and sewerage services, including issuing licences for sinking deep tube wells and charges for industrial water use.

Other actors:

The Prime Minister's Office through **Bangladesh Investment Development Authority (BIDA) and the Bangladesh Export Processing Zones (BEPZA)**

• Approval of foreign, joint-venture and local projects.

• Facilitate utility connections including water.

• Water supply and sewerage services within Export Processing Zones (EPZs).

Ministry of Textiles and Jute

• The National Institute of Textile Engineering & Research (NITER) aims to enhance the overall productivity, quality of products and raise efficiency of textile sector

• Monitoring of the textile sector from 2014.

Ministry of Industries

• Developing new policies and strategies for promotion, expansion and sustainable development of Industries.

Other actors:

Bangladesh Garment Manufacturers and Exporters Association (BGMEA)

• Organizing training on social and environmental standards.

Bangladesh Knitwear Manufacturers and Exporters Association (BKMEA)

Bangladesh Chambers of Commerce and Industry (FBCCI)

• Monitoring of site water use reduction.

Utilities under MoLG

• Setting charges for sewerage and wastewater treatment services.

DoE, under Ministry of Environment and Forest (MoEF)

• Monitoring operations of the activities affecting environmental quality and enforce the standards of environmental conservation, including monitoring of ETPs.

Ministry of Textile and Jute

• Approval of registration of textile wet processing units provided effluent treatment plant (ETP) installations are made.

• Monitoring existing ETP capacities in the textile sector from 2014.

Other actors:

BEPZA

• Water supply and sewerage services within Export Processing Zones (EPZs).

BGMEA

• organising training on social and environmental standards.

• Requiring industry to have ETP after 2010 to be its member

Dept. of Environment (DoE), under Ministry of Environment and Forest (MoEF)

• Monitor operations of the activities affecting environmental quality (water, air, land pollution etc.) and enforce the standards of environmental conservation, including monitoring of ETPs.

Figure 2.5: Water Governance value chain with relevant public authorities and stakeholders (Adapted from "Water Governance Mapping Report" (2016).

3. Opportunity Landscaping in the Public Sector

Potential products and services that can be explored by Dutch companies have been synthesized from the report and presented in the table below.

Table 3.1: Potential Areas in the Government Sector

Sector	Potential Product/Services	Stakeholder	Opportunity
Dredging to counter sedimentation and river erosion	Small scale dredging (canals and rivers) and land reclamation. Programming for dredging and revival of dead or dying rivers, channels, canals etc.	BIWTA	**High** Sedimentation is a continuous phenomenon and there will be sustained demand in the long run.
Integrated Water and Resource Management	Preparing long term integrated strategy and investment programs, Water Operating Partnerships, Flood protection and Drainage, polder management and infrastructure	MoWR, BWDB	**High** Mostly technical assistance and policy development support
Water treatment in industrial and economic zones	A central water treatment facility or individual water treatment facilities for food industry, processing industry, Ready Made Garment (RMG) etc. (B2B)	ETP committee in BEZA, BEPZA	**High** Along with waste-water recycling infrastructure deployment, training of human resources and technical assistance
Urban Drinking Water	Construct, improve and operate water supply and sewerage works as well as other facilities to improve environmental sanitation in the city	Dhaka WASA, Chittagong WASA	**High** In terms of future plans of sourcing drinking water from rivers due to decreasing ground water levels, there is opportunity for centralized water purification and waste-water recycling plants
Capacity building of public institutions	Institutional Training	BWDB and other government institutions	**High** Dutch engineering expertise and brand recognition in Bangladesh can be leveraged for long-term projects.
Wastewater market segment, drainage, sewerage, water harvesting, surface water	Joint opportunities with Donor organizations	WB, ADB	**Medium** Government-to-government based contracts can provide opportunities along with joint projects with donor agencies and IFIs.
Water Harvesting	Engineering options for water harvesting (services); Harvesting technology (goods); Desalination (goods)	Private sector and NGOs	**Limited** in product market Product market is price sensitive and China-manufactured products are price competitive.
			High in Services market Services for engineering (design and maintenance) have potential.

River and sea transport	And develop, maintain and operate inland river ports	River Research Institute (RRI), BIWTA	**Medium** Inland Container Terminals and River Ports mentioned in Delta Plan
Water for Agriculture	o Expertise on the recharge of groundwater basins to use less groundwater for irrigation and - services; o Increase water harvesting for irrigation - services and goods; o Treatment and re-use of wastewater for irrigation - services and goods; o Improve and increase efficiency of surface water irrigation, in particular in the South - irrigation management - services; o Development and maintenance of dams and canals - works and goods; and o Reduce impact of saline water intrusion in the South and enhance river water flow	BADC (Bangladesh Agriculture Development Authority); BMDA(Barind Multipurpose Development Authority)	**Medium** In terms of hydrological structures required for irrigation, there might be selective market opportunities.
Consultancy services	Surface water, urban drinking water, drainage and sewerage	WASA and Municipalities	**Medium to Limited** In the medium term, this market will gradually be occupied by local consultants and trained experts
Dredging rivers and enhanced surface water irrigation in the south	Rehabilitation of polders and their management; dredging of rivers; enhanced surface water irrigation; and improved brackish water resource management practices.	Inland Dredging- BWITA Irrigation- BADC, BMDA	**Limited**
ICT and Water, Water for food in combination with ICT and agriculture	Early warning systems and the use of geo data in agriculture in cooperation with mobile data providers	DAE, Flood warning cell in BWDB	**Limited** for flood-based warning systems Limited for geo data in agriculture.
Rural drinking water	Extraction, purification, treatment - services and goods	LGED, DPHE	**Limited** Rural water sources are predominantly tube wells(95%) and local companies dominate the market

3.1 Dredging and reclamation

An estimated 6,000 Km of waterway contains the inland rivers used for transportation and these rivers need to be dredged on a continuous basis. Currently, dredging in 300 major rivers covering 2,393 Km of waterways within next 15 years has been identified as a key strategic imperative. The economic value for implementing this mammoth master plan is estimated to be more than EUR 1.2 bn. **With the government targeting to increase the riverbeds for making them deeper, the need for both capital dredging and maintenance dredging will remain in the future**. **Capital dredging** work will increase as the government is prioritizing dredging of 53 of the country's major rivers. The route which needs most capital dredging is the Dhaka-Baghabari- Barishal Route. Due to the movement of large oil tankers in Barishal-Dhaka route, the need for maintenance dredging of these rivers has to be conducted periodically. One recent development in dredging is the India-Bangladesh joint dredging project of 470 kilometers of two river routes - from Ashuganj to Zakiganj, and Sirajganj to Doikhawa (of Assam in India). India will finance 80% of the cost, while the rest will be financed by Bangladesh. The goal of this project will be improving trade between Bangladesh and India, and facilitating cargo transportation from Kolkata to India's northwestern states.

Currently, multiple Dutch companies are importing Dredgers and dredging components in Bangladesh, and this market segment has significant potential. **Top three dredger importers are IHC Royal, DAMEN and Elecord Dredgers.** DAMEN is particularly active in Bangladesh and has organized seminars (last one arranged in 2017) on dredging. They plan on hosting similar events in 2018-19, through engaging relevant stakeholders. Their main products include- Dredgers, Water Boats and Tug boats.

Government is currently prioritizing **dredging as a project component**. Any project needs to have a mandatory dredging component having up to 50% of the project budget (Source: KII of Ex-BIWTA Director). Since Bangladesh is a riverine country where annual siltation stands at 1.4 billion tons, dredging will always receive priority while planning development projects (Source: KII of Ainul Nishat). Although dredging was originally under the aegis of BWDB and BWiTA, based on widening opportunities for dredging services and government's positive view towards involving the private sector, a number of new dredging companies have become operational.

There are currently 40+ dredger companies operating in Bangladesh with an estimated 200+ dredgers in operations. (Source: COO- SS Rahman Dredger Ltd.) Although a small volume of dredgers are currently built in local shipyards, majority of dredgers are imported. Recently, private sector conglomerates such as Basundhara Group has assembled their own dredging fleet up to 35-40 dredgers, engaging in land-filling for their housing projects and other economic zones.

Opportunity for Dutch Private Sector Companies

Directly engaging in dredging (inland river dredging or for land filling) has very limited opportunity for foreign companies and apart from large-scale G2G tenders, foreign companies do not typically engage in dredging assignments unless the contract is part of a package, involving bilateral or multilateral donor agencies, ensuring stronger monitoring and transparency. For example, a Chinese company is involved in Padma bridge construction project and dredging is carried out by a Chinese company: China Harbour Ltd., which is using its own dredgers. **Apart from these selective opportunities, bidding for dredging tenders are dominated by local firms.** Although 20% of tenders are floated through online tender portals, a number irregularities have been observed, which include bribery and nepotism; resulting in an uneven playing field. Since Dutch companies tend not to engage in unethical practices, some Dutch players have engaged in supplying dredging equipment and accessories to local bidders.

In terms of servicing, these dredgers do not require any maintenance work before 250-500 hours of operations, and the daily maintenance downtime is minimal- which include changing air-filter, oil-water filter and pumps. There are no training institutes in Bangladesh for supporting capacity building of dredger operators and most operators are provided on the job training .Therefore, providing skill based training can be a potential area along with maintenance training.

Table 3.2: List of Some Local and Foreign Dredger Companies

Top Local Companies	
• Asian dredgers Ltd. • Abdul Monem Ltd • Aqua Marine Dredging Ltd • ARK Progressive Dredging Ltd • Amena Dredging & Services Ltd. (New company with 4 dredgers) • Banga Dredgers • Bengal Structure Development Ltd • Basundhara Dredging Co. Ltd. • DBL Dredging Ltd • Future Infrastructure Development • Jamuna Spacetech JV • Kanak Construction Co.	• Mir Akhter Hossain Ltd. • Nabarun Traders Ltd • Nuruzzaman Khan • Orient Trading & Builders • Reve Dredging and Engineering • Reza Construction Ltd • Spectra Engineers Ltd. • Sonali Dredgers Ltd • SS Rahman International • Westarn Marine SY Ltd • Western Engineering (Pvt) Ltd
Foreign companies operating in Bangladesh	**Companies that import dredgers and dredging equipment to Bangladesh**
• China Harbour (China) • Sinohydro Harbour Corp. (China) • Van Oord (Netherlands) • Dredging International (Belgium) • Dredging Corporation of India Limited (DCIL) (India)	• IHC Royal (Netherlands) • Damen Shipyard (Netherlands) • Elecord Dredgers (USA) • BSC Dredging Ltd. (USA) • Italdraghe (Italian, Market presence is low)

DETAILS OF SPECIFIC LOCAL DREDGER COMPANIES ARE ADDED IN THE TABLE 7.4 OF THE ANNEX-VI.

Entry strategy and Way Forward

Due to the high number of dredgers currently being imported by private sector companies and Bangladesh Water Development Board, existing and new fleets would require ongoing repair services and steady supply of accessories, equipment and trainers. This can be a potential area for Dutch companies involved in dredger repairing. **The most common technology or type of dredger is the 18-inch and 20-inch cutter suction type.** From 2010 to 2017, 32 cutter-suction dredgers had been imported by IHC alone (Source: IHC beaver reference list from 2010-2017). New entrants in the Bangladesh market can reach out to the top local dredging companies for selling new units. Alongside, Netherland based manufacturers can provide agent rights to local dredging service providers for selling dredgers to smaller players.

Complimentary with dredging is navigation channel improvement nearby sea-ports and floating sea terminals (such as the LNG Floating Regasification Unit), the inland river ports etc. Additionally, river reclamation and river training can be additional complimentary interest areas for Dutch companies providing technical support and equipment.

3.2 Water treatment in ports and economic zones

Instead of targeting individual factories, targeting an economic zone can ensure reaching out to larger number of factories in one place. However, from stakeholder interviews, we found that for Economic zones, the technologies vary and there is no thumb rule or one-solution-fits-all. The applicability of the technology is dependent on case by case basis. Company management decides whether to adopt high CAPEX- low OPEX or Low CAPEX-High OPEX based technology.

a. Waste water treatment in Ports

Bangladesh has setup a new sea port (Payra) and are expanding capacity of Mongla and Chittagong port. Many ports across the world have waste water treatment facilities, which are absent in all the Bangladeshi ports. Black water (the water stored in the hull of ships, may contain diesel and other water contaminants) and waste stored in ships can be discharged safely at the port.

b. Water Treatment in Economic Zones

The initial pre-feasibility & feasibility studies needed before setting up of factories have a mandatory environmental assessment component which assess the water requirements. BEZA has created an ETP coordination team, which will provide advisory services for the ETP needs and requirements for the zones.

There are broadly two type of economic zones and the tendering process for equipment may vary.

- **Private sector owned-** The tendering is done by the local companies themselves. However, BEZA has authority over the centralized systems (a centralized ETP or STP) for the overall zone.

- **Foreign government owned-** The government-based G2G zones are out of the jurisdiction of BEZA and the individual country determines the type of technology to be used & where it will be sourced from (usually from companies from that country, i.e. a Chinese economic zone will source equipment from a Chinese company)

For example, the LoC given by India includes conditions that the equipment for their individual factories (including ETPs) will be sourced from Indian companies. Therefore, this becomes a closed tender where only Indian companies can participate.

LIST OF ECONOMIC ZONES WITH THEIR TYPE ARE INCLUDED IN THE ANNEX- III.

Similarly, for Chinese economic zones, the tendering & procurement is restricted to only Chinese companies.

In terms of the BEZA constructed centralized ETP/STP, they are currently testing out different modalities such as PPP-based or fully-private sector owned or fully funded by BEZA. The regulator for economic zones hasn't finalized the modality for financing centralized ETPs.

The investment for centralized ETPs are high and any private sector companies are responsible for the individual ETPs in the factories (a private sector conglomerate has multiple industries i.e. multiple type of production factories in their economic zone) and the processed water will then be sent to the central ETP.

The current target of BEZA is to construct 100 economic zones within the next 15 years. 89 of the zones have already received provision (permission from authority regarding allocation of land). The targeted area is 75,000 acres of area and investment of USD 30 billion. BEZA envisions that no manufacturing plant would be setup outside the economic zones within the next 10 years.

Currently two zones are being constructed- the Mirersorai zone in Chittagong which has 30,000 acres of land and the Moheskhali zone which has est. 25,000 acre of land.

Entry strategy and Way Forward
In the Southern economic zones (such as Moheskhali), the current challenge is in the saline water treatment (for drinking and also for industrial purposes). In the Chittagong Mirersorai economic zone, the water sources will include both ground water & river water (since ground water is not in itself sufficient enough in volume). There may be **opportunities in water procurement infrastructure from rivers and subsequent waste-water recycling**. Current priority regarding water treatment is the Southern economic zones of Moheskhali (converting saline water to usage water for drinking & for production). (Source: KII- Director of Planning, BEZA). In the long-term, the government plans to use river reclamation to deposit land and construct economic zones there. **Contact Point:** Executive Member, Planning & Development Bangladesh Economic Zones Authority Phone No (Office): +88029632455 Email: em.planning@beza.gov.bd

3.3 Inland container terminals and Shipyards

The first Inland Container Terminal was built by the government in 2014 for facilitating transport of export containers from capital Dhaka to seaports.

Alongside, the government has issued licenses to different private sector players. Currently, two private sector players- Rupayan and Summit Group have built and are operating individual inland port terminals, while Meghna Group is constructing another terminal. The purpose of these inland port terminals is to transport exportable goods to seaport or for carrying imported good from the seaport.

The recent agreements between India and Bangladesh allowing India to use the Chittagong and Mongla ports, while at the same time, enabling Bangladesh to use Kolkata and halliday ports for transshipment of its garments good to the regional players. The deal will be finalized by delegates from both the countries in New Delhi by end of October 2018.

Table 3.2.1: Description of different Inland Container Terminals currently operational and being constructed

Name	Type	Comment
Pangaon Inland Container Terminal	Public (Operational)	Currently, the only publicly owned ICT operational in Bangladesh, jointly developed by BIWTA and Chittagong Port Authority (CPA) at a cost of BDT 1.54 billion. The project aims towards easing the cargo movement pressure on the Dhaka-Chittagong railway and highway corridors. The terminal has a storage capacity of 3,500 20-foot equivalent units (TEUs) of containers and can handle 116,000 TEU containers annually.
Inland container river port in Ashuganj	Public (under construction)	In May, 2018, the government had signed a deal for setting up an inland container river port in Ashuganj with the Indian 2nd Line of Credit. This project is worth about USD 154 million, 67% of which will be provided by the state exchequer, while the rest would come from the Indian Line of Credit (LoC). The project will be implemented by Bangladesh Inland Water Transport Authority (BIWTA) under the Ministry of Shipping. According to the initial survey, the facility can handle 4,000,000 twenty feet equivalent units (TEUs) of containers on this route per annum.
Summit Alliance Port Limited (SAPL)	Private sector (Operational)	Constructed by the Summit group, currently offering shippers totally dependent on highways, with alternative route in the form of transporting containers from Chittagong to Dhaka through waterways.
Inland Container Terminal by Rupayan group	Private sector (Operational)	Constructed over 30 acres of land on the bank of the river Shitalakhya and is currently operational. The port will connect the main sea port of the country in Chittagong with the industrial hub, mitigating dependence on road transport. The port has been developed with technical assistance from seaport innovations-Denmark. The port can handle 390,000 (three hundred ninety thousand) TEUs annually.
Inland Container Terminal by Meghna Group	Private sector (under construction)	In August, 2017, the government approved construction of an ICT by Meghna Group that will is currently being built at the bank of the Meghna river.
Khanpur Inland Container Port and Depot	PPP Method construction ongoing	The proposal for the construction of Khanpur Inland Container Depot in Narayanganj was initiated in July, 2013. Subsequently, in 2015, the project got awarded a public private partnership contract, with the transaction

		advisory service being led by a consortium of PricewaterhouseCoopers (PwC), BMB Mott Macdonald and UNICONSULT Universal Transport Consulting Gmbh, under the Prime Minister's Office. The estimated capital cost is USD 30-80 million, with an annual capacity of 80,000 TEUs.

Entry strategy and Way Forward

Similar to dredging, it is more feasible for Dutch companies to

1. Sell accessories and equipment that local companies can buy and use for construction and operation of inland ports. Currently three private sector conglomerates - - Rupayan, Summit, Meghna (currently constructing) have inland container terminals. So, initially these groups can be approached for incremental technical support.

2. Allow soft loans or Line of Credit (LoC) for building inland port terminals. For example, Bangladesh is using India's line of credit for the construction of the second government inland container port. According to the terms of the loan, at least 70% of value addition should directly come from Indian suppliers.

3. Technical Support: Dutch organizations can provide technical and consulting support for constructing and operating these inland container terminals.

3.4 Inland water including irrigation and fisheries

In total 26,000 Km of waterways are available, 6000 Km is attributed to inland transport, while the rest is used for agriculture and fisheries (capture and culture).

a. Agriculture

Ministry of Agriculture is one of the key users of the water. The government is currently promoting solar-powered irrigation pumps for replacing diesel fueled ones. Low cost irrigation technology could be another potential market.

The market potential in the agriculture sector is limited due to the presence of low cost local and Chinese player, and due to the price sensitive nature of the target audience (Farmers). Although a number of local and international players are operating in the market, there are limited scope for increasing demand in the future. This is partially due to receding water level and drying up of natural water habitats and rising purchasing capacity of farmers. Alongside, a number of other opportunities have come up in the form of co-operatives, which jointly own agricultural equipment.

Selective opportunities and a niche market for Irrigation exists, such as

- Pivot irrigation (a type of irrigation) in Northern regions where spices are cultivated.
- Springer irrigation in Chittagong hill tracts.
- Use of a pipeline or construction of a water tunnel for moving water from one spot to another.
- In hilly areas (known locally as “Jhiri Badh’’) the preferred structure is small hydraulic dam of 20-40 meter for capturing water from hill for using in cultivation. These structures additionally need associated structures such as sluice gates and water control regulators.
- Currently, there are 37,000 deep tube-wells (average irrigation capacity of 60-80 acre per tube well) covering up to 1,000,000 hectares of land. And there are almost 14,000,000 shallow tube-wells (having average coverage of 2.5 hectors). The use of an advanced tube well head can cover higher catchment area for dispersing water. Currently a deep tube well can disperse up to 80 acres of land, which can be increased to 150-200 with the use of an advanced head.
- Canal dredging with construction of submersed wire- a type of canal which has 4-5 meter of structure with an elevated structure.
- Polders in char-areas: After the use of polder and water-management groups in Southern regions, use of Polders to mitigate water challenges in Char regions can hold potential
- SMART Irrigation (using remote sensing to control water)

While using temperature dependent control switches or remote control switches to control water pumps is not an unknown technology in the farmer community, the total target base for such technology is comparatively limited. In

Bangladesh, over 76%[9] of farmers are smallholders (having less than 1.5 acres of land). These farmers neither have the affordability nor the amount of land to use such ICT-enabled technologies for their farming land. The rest 24% are medium and large farmer categories (with at least 1.5 acres of land) and can be the potential target group for such ICT-based irrigation technologies.

Entry strategy and Way Forward

Specific regions for piloting irrigation-based technologies: (based on discussion with Bangladesh Agricultural Development Authority

- Jesshore beel of Bobodoho (using water from the rain-water clogged canal and ponds for irrigation)

- Chalan beel area of Natore/Pabna (using pivot irrigation to water crops during dry season and using the same to remove excess water from canals during wet season).

Small Accessories Market for Irrigation

- The use of an advanced tube well head can cover higher catchment area for dispersing water. (Currently a deep tube well can disperse up to 80 acres of land which can be increased to 150-200 with the use of an advanced head)

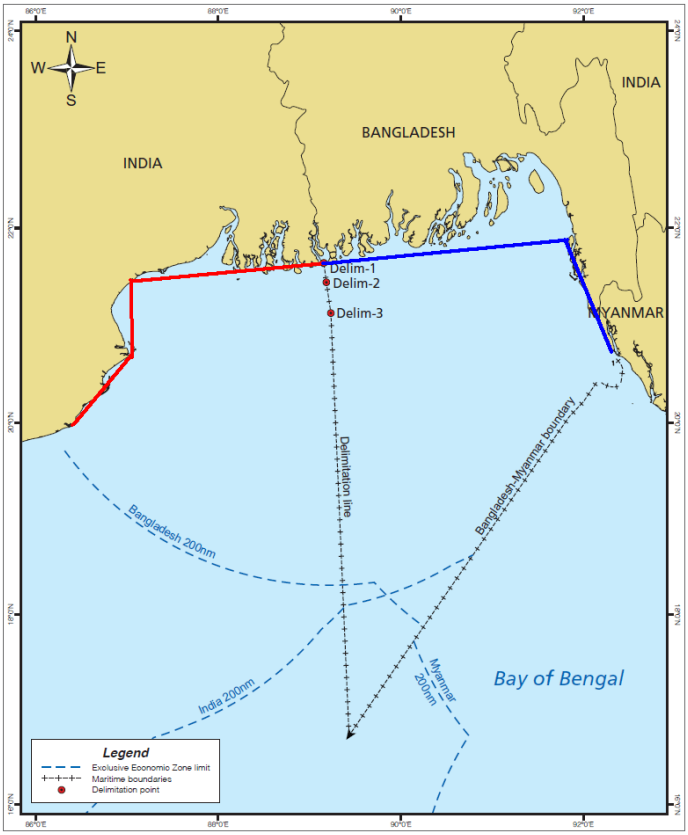
Contact Point
Chief Engineer (Construction)
Phone (office): 029550896
Email: chiefengineer_const@badc.gov.bd
Bangladesh Agricultural Development Authority (BADC)

[9] IFPRI, Bangladesh Integrated Household Survey (BIHS). (2015)

b. Fisheries

Bangladesh maritime area constitutes 118,000 square KM hosting at least 400 species, of which 90 are commercially important. The country recently resolved maritime area dispute with Myanmar and India, which has increased the maritime boundary to a large extent. This would enable opportunity for marine fishing.

The International Tribunal for the Law of the Seas (ITLOS) in Hamburg, Germany, gave its judgment on the maritime boundary dispute between Bangladesh and Myanmar (case 16), on March 14, 2012. The Tribunal for Bangladesh & Myanmar drew baselines for both the countries. For Bangladesh, one line was from Mandarbaria Island (east of Hariabhanga estuary) to the Kutubdia Island and the other from Kutubdia to Naf River (land boundary terminus with Myanmar). The western boundary of the relevant area was drawn by a straight line from the Mandarbaria point towards south along 180-degree azimuth (Line C Figure 1). The relevant area was estimated 283,471 sq km on the sea, of which Bangladesh was awarded 111,631 sq km and Myanmar 171,832 sq km areas.



The Tribunal considered continental shelf claims beyond 200 nautical miles. While both Bangladesh and Myanmar argued that the other should not have entitlements beyond the EEZ, the Tribunal continued the natural 215-degree angle prolongation of the demarcation line beyond 200 nautical miles. In the end, both Myanmar and Bangladesh willingly accepted the Tribunal's decision and both have proceeded with oil and gas exploration partnerships.

According to recent (2018) estimates by World Bank, the ocean economy contributes USD 6.2 billion in terms of gross value , accounting 3% of the country's GDP. The detailed industry-wise percentages are given as below:

Table 3.2.2: Opportunities in different segments of the Blue Economy of Bangladesh

Industry	Value in USD Billion	Percentage
Tourism and Recreation	1.5	25%
Marine fisheries and aquaculture	1.4	22%
Transport	1.4	22%
Offshore oil/gas extraction	1.2	19%

Source: Toward a Blue Economy by WorldBank[10]

[10] Patil, P.G., Virdin, J., Colgan, C.S., Hussain, M.G., Failler, P., and Vegh, T. *Toward a Blue Economy: A Pathway for Bangladesh's Sustainable Growth*. Washington, D.C., The World Bank Group (2018).

Compared to other Asian countries, the capture fish volume (in inland rivers and marine coastal areas) is one-third e.g. an Indonesian fish catching fish boat catches three times more fish than a Bangladeshi fishing boat. Due to lack of efficiency of local trawlers, Bangladeshi fishermen are unable to catch fish beyond the depth of 200 meter.

This can be resolved by purchasing or deploying modern deep sea trawlers. Government has expressed interest in directly working with other countries for extracting fisheries from the sea. To this end, countries like Japan, China, Australia and Netherlands, Sri Lanka, India and Maldives have formally expressed interest in pursuing marine fishing on PPP basis. The current government is looking into these proposals.

3.5 Urban Water Supply and Sewage

a. Government Projects

Urban infrastructure development is currently attracting significant investment from the government as seen in the SDP (Sector Development Plan). World Bank is also investing in the drinking water and sewerage infrastructure in Dhaka and Chittagong. Currently, a French company, Suez, is involved in the construction of sewerage and water infrastructure. However, opportunities for Dutch companies are present in terms of providing technology and knowledge-based support. A computer controller system is currently being used in DWASA enabling the authority to control water flows by an automatic system. The opportunity for similar systems known as SCADA(Supervisory Control and Data Acquisition) to help digitize the different municipality and sewerage authorities can be a prospective area (Source: DWASA interview).

In terms of related and complimentary services, capacity building of staff such as vocational training related to O&M is a prospective area. Along with Bangladesh, other regional players such as Nepal, India, Bhutan also need infrastructure improvement and investment will continue in these areas. With the construction of urban infrastructure projects, the need for new O&M will move to the forefront along with catering to the training needs.

The WASA and municipalities have started on focusing in sewerage waste management in addition to the sewerage

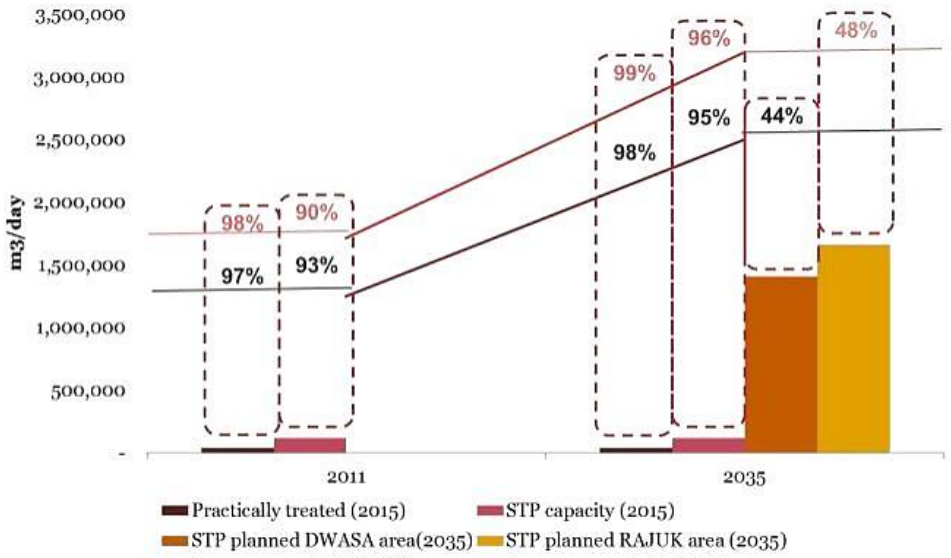


Figure 3.1: Estimated sewerage volume in 2035 compared to benchmark values of 2011
Source: Consolidation and Analysis of Information on Water Resources Management in Bangladesh by PWC(2015)

waste collection in line with established policy frameworks. The Institutional and Regulatory Framework for Faecal Sludge Management (FSM) has been released in 2017 by Department of Public Health Engineering (DPHE).

In addition to the drinking water needs of the urban population, the need for waste-water and faecal sludge treatment will lead to investments in these areas.

According to United Nation's estimates, the population of greater Dhaka will reach 27.4 million by 2030. Taking average of 125 Liters of water per person per day, the total amount of water needed will be 3.425 billion. The DWASA is currently planning to construct six new surface water treatment plants by 2035 for meeting additional domestic water demand. These will deliver a total supply capacity of approximately 3,000 MLD (Million Liters per Day) at an estimated development cost of more than USD 4.1 billion. DWASA expects that this additional surface water capacity will reduce the long term reliance on groundwater from 80% to approximately 20% of the water supply.

Entry strategy and Way Forward

Small products Market (B2C)

Another area for Dutch companies can be supply of small equipment and accessories needed for large infrastructure projects such as valves, pumps, water meters etc. However, the prime criteria for procurement in terms of both government and private sourcing is competitive pricing. Therefore, a possible way forward can be JVs between Dutch and local companies for bringing manufacturing on-shore, supported by Dutch technology and knowledge transfer. The opportunity for producing cheaper infrastructure products can also open up the prospect of exporting these technologies to other developing and underdeveloped countries at competitive pricing.

Case Study: Joint-Venture between a Netherlands and a Bangladeshi Company

BM Container Depot Ltd is a Netherlands – Bangladesh joint venture company that is based in Chittagong. It started operating as an Inland Container Depot from the beginning of May 2011. The depot is used for packing and unpacking export and import containerized cargos. The ICD is situated 20 kilometers from Chittagong port and comes equipped with machineries like reach stackers, empty handlers, forklifts, cranes, prime movers, trailers etc. All of these machineries are imported from Japan, Sweden, Sri Lanka and India.
(Source: www.bmcdl.com)

3.6 Energy

a. Coastal

One of the experts mentioned opportunities for generating renewable energy (hydro) harnessing the coastal waves. This can be a great opportunity for electrifying the economically backward coastal region in Bangladesh. In the coastal region, current electrification rate is less than 3% and most of coastal islands are devoid of productive infrastructure.

In May, 2014, a deal was signed between US-DK Green Energy (BD) Ltd. and Power Development Board. US-DK Green Energy (BD) Ltd is a joint venture between Taylor Engineering Group of USA, ph-consulting group of Denmark and Multiplex Green Energy of Bangladesh. The project aimed at establishing a wind power plant with a capacity of 60 MW at Kurushkul, southeast of Moheshkhali at a cost of USD 120 million. The project funding was provided by Danish wind turbine company Vestas.

b. Renewable energy used in irrigation

For example, solar-based drip irrigation (Also known as “solar pump with drip irrigation system”) in Char & hill areas (where electric wires cannot be used) can be the main method of irrigation in those areas where surface water sources are scarce. However, **opportunities exist only in terms of a government-to-government based context in which the engineering design, operational modification, technical assistance will be sourced from Dutch origin as part of a conditional investment loan.**

c. Maritime Gas Block

Bangladesh awarded an offshore block to Posco Daewoo Corporation of South Korea for gas exploration in March 2017. As per the agreement, the two-dimensional seismic survey would begin this year, and based on the outcomes of the survey, the real picture of gas availability could be known by 2019, according to Petrobangla. The block is adjacent to block-12 of Bangladesh. Bangladesh has 26 blocks in the Bay, of which, 15 are deep-sea blocks and 11 are in shallow waters.

Bangladesh's efforts to attract international oil and gas companies for deep-sea blocks explorations have been delayed due to low oil prices in the international market for over two years. The low price discouraged oil companies from expanding to new territories.

Similar type of oil-gas exploration and extraction contract opportunities may exist for Dutch companies.

3.7 Funding Trends for Public Sector Projects

The funding sources for public sector projects ranging from infrastructure to capacity development comes from three key sources:

Government Source: Government's development projects stipulated in Annual Development Plan (ADP) are fully or partially financed from government's internal revenue sources.

Loans and grants from other governments, IFIs, multilateral donors: The government receives international funding through loans or grants, either from other governments (G2G basis) or from multilateral development agencies like IMF, World Bank and ADB. Alongside, some development projects are directly getting funded from international financial institutions in exchange of implicit sovereign guarantee.

Private Sector Funding: While private sector funded projects as well as PPP projects are selectively fewer in number and were concentrated mainly in energy sector, currently water infrastructure projects are being piloted under this modality. For example, the central ETPs in economic zones are being developed on PPP basis.

Table 3.3: Comparison between different G2G investment trends

Countries	China	India	Japan	Germany
Investment Amount	USD 24 billion (signed in 2016)	USD 4.5 billion (signed in 2017)	USD 1.83 billion (signed in 2018)	381.8 million (signed in 2018)
No. of projects	25 projects under the loan agreement signed in 2016	7 project under the third LoC	6 projects under ODA in 2018	
Sectors	• Power, • Infrastructure • Water	• Power • Railroads • Highway roads • Shipping and ports	• Power • Infrastructure • Port	• Power and Renewable Energy • Textile • Water • Good Governance • Climate Change Adaptation to Urban Areas
Interest rate	2-3%	1%	Around 1%	2.49%
Payment period	15 Years	20 years	30 years	16 years
Grace Period	5 years	05 years	10 years	05 years

SOME KEY HIGHLIGHTS OF THESE DIFFERENT DONOR GOVERNMENTS ARE GIVEN, HOWEVER A MORE COMPREHENSIVE LIST OF DIFFERENT PROJECTS FUNDED BY THEM IN PROVIDED IN ANNEX-II FOR FURTHER REFERENCE.

Country Profile: China

Investment Amount	USD 24 billion for 27 projects (Signed between Chinese Prime Minister and Bangladeshi Prime Minister in 2016)
Sectors	Power, Infrastructure, Water (water treatment plants, infrastructure development of port facilities etc.)
Broad Strategy	As part of China's OBOR (One Belt One Road) initiative or the Bangladesh-China-India-Myanmar Economic Corridor, investments are heavily focused on infrastructure projects covering communications such as Highways, Railroads. Part of the investment loans of USD 24 billion include 12 projects for developing railway infrastructure.
Highlighted Projects ***(DETAIL OF MORE PROJECTS ARE GIVEN IN ANNEX-II)***	• The biggest project under the loan agreement is in terms of building 225-kilometre rail link on both sides of Padma Bridge within 2022, signed between Bangladesh Railway and China Railway First Group Co. Ltd in August, with a deal size of USD 3.13 billion. • Six projects worth of USD 700 million were earmarked for implementation which includes partial financing for two Power plants worth USD 3 billion, Info Four network USD 1.56 billion, BTCL USD 1.60 billion and Single Point Mooring Terminal USD 5.00 billion. • USD 249 million for expansion and modernization of Mongla Port facilities awarded to Chinese Contractors (Expected completion date: 2021) • USD 350.6 million for Rajshahi WASA surface water treatment plant (Expected completion date was 2015 but project delayed)
Payment Period	15 Years with a grace period of 5 years
Interest Rate	2-3%

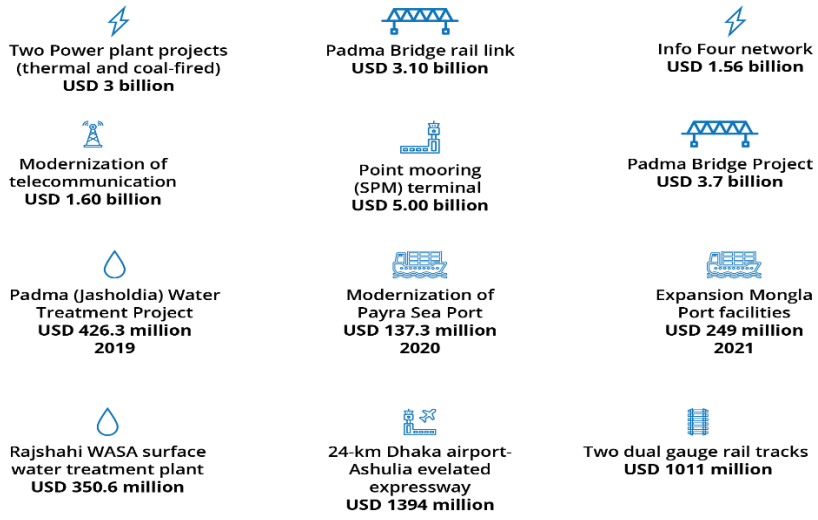


Figure 2.2: A glimpse of different development projects funded by China

Country Profile: India

Investment Amount	India has committed more than USD 7 billion of loans to Bangladesh over a period of 8 years. The first Line of Credit (LoC) was USD 862 million signed in 2010 and the second LoC of USD 2 billion was signed in 2016. The third LoC, signed in 2017, is worth USD 4.5 billion, which is aimed at funding 17 major projects in Bangladesh.
Sectors	• Power • Railroads • Highway roads • Shipping and ports
Broad Strategy	According to the latest LoC agreements, Indian companies will get work through selected bidding and 65-75% of the materials to be used in the projects will have to be imported from India (signed October, 2017). Bangladesh is India's largest trade partner in South Asia with bilateral trade almost tripling to USD 7.52 billion in 2016-17 from USD 2.75 billion in 2008-09.
Highlighted Projects ***(DETAIL OF MORE PROJECTS ARE GIVEN IN ANNEX-II)***	The government of India in July 2017 sanctioned USD 54.4 million for dredging the Brahmaputra river. Investment in two economic zones- Mirsorai zone worth USD 100 million and Moheskhali zone worth USD 100 million. Upgradation of Mongla seaport and chittaagong seaport under transshipment and transit agreement.
Payment Period	20 years for repaying the loan and with grace period of five years
Interest Rate	Indian LoC agreements specify interest rate of 1% a year.
Private Sector	In total, 13 agreements in the private sector worth nearly USD 10 billion were signed during the visit of Prime Minister of Bangladesh to India in 2017 in areas such as energy, logistics, education and medicine.

Country Profile: Japan

Investment Amount	JICA signed a loan agreement with the Bangladesh government for providing about USD 1.59 billion in six infrastructure projects as part of their 39th ODA package (Signed June, 2017). The projects included- sea-port and power-plant development at Matarbari, the Dhaka mass rapid transit project (Roads and Highways Development), Jamuna Railway Bridge Construction Project.)
Sectors	Power Infrastructure (Roads, Railways) Port
Broad Strategy	Japan's development agency- Japan International Cooperation Agency (JICA) is the leading player in the power sector of Bangladesh with the Power Sector Master Plan-2016 being formulated by them along with Bangladesh Power Development Board.

	As mentioned before, Japan is working on a joint public private project management platform, which will allow Japanese companies to participate and secure work using the government to government system, allowing them to avoid any open bidding.
Highlighted Projects ***(DETAIL OF MORE PROJECTS ARE GIVEN IN ANNEX- II)***	• JICA is working on a water resources development project phase-II (USD 105.5 million) as part of the loan agreement of USD 1.59 billion (Expected completion date: March, 2023) • The biggest project (USD 4.6 billion) a sea-port and power plant in Matarbari with JICA offering partial funding, implemented by a consortium of three firms- Sumitomo, Toshiba and IHI (Expected completion date: July, 2024)
Payment Period	Maturity of the loan is 30 years with a 10-year grace period
Interest Rate	Construction- per annum 1% interest rate, Health services- 0.9% interest rate and Engineering services 0.01% interest rate. However, the front end fee is 0.2%

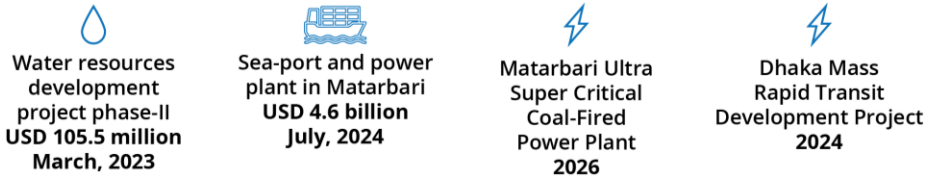


Figure 2.4: List of few Japanese projects in the 38th ODA Package of 2018

Country Profile: Germany

Investment Amount	In January 2018, Bangladesh had signed agreements worth USD 381.8 million. These agreements include both technical and financial support. Of these, USD 103.4 million is allocated for climate change adaptive drinking, water resources management Dhaka (Saidabad Water Treatment Plant Project, Phase III). The implementing agencies of the projects are - Power Division, Local Government Division, WASA and the Ministry of Forests and Environment.
Sectors	Power and Renewable Energy Textile Water
Broad Strategy	Germany is involved in deploying funds through GIZ. Since Bangladesh RMG sector's largest export destination in Europe is Germany, GIZ has been involved in Bangladesh's textile industry since 2005. Their main mode of intervention is through capacity development. Although Bangladesh had historically accepted only development grants from Germany, in 2014, Bangladesh inked a loan agreement with Germany worth USD 52 million. The loan was for investing in power transmission system in the country's western region.
Highlighted Projects	• The German conglomerate Siemens is going to be a major investor in Bangladesh, financing USD 8.1 billion for generating 8,000MW electricity in Payra. • Bangladesh is buying the products and services from Veridos GmbH (a joint venture of Giesecke+Devrient and state-owned Bundesdruckerei) on a government-to-government basis, under the project titled 'Bangladesh e-Passport and formulation of automated border control management' at an estimated cost of USD 553.07 million (July 2018 to June 2028) • GIZ is implementing a project for training 30,000 plus managers and staff in the RMG industry on fair pay, fire safety and safe handling of chemicals. This project is implemented on behalf of German Federal Ministry of Economic Cooperation and Development (BMZ) and funded by European Union (EU). • GIZ is focusing on supporting setting up of 'Central Effluent Treatment Plants (CETPs) for Economic Zones (EZs) in Bangladesh', and to this end, has arranged a seminar with BEZA as well as signing a memorandum of understanding (MOU) in April 2017. The document was signed by BEZA, 2030 Water Resource Group (WRG) and GIZ for initiating a technical and knowledge-based partnership for facilitating establishment of CETPs.
Payment Period	16 years including five years of grace period.
Interest Rate	2.49% interest rate
Private Sector	German companies in Bangladesh have launched German Business Council for supporting growth of their businesses. The council is expected to organize business networking events for building relationship with different companies.

Other Development Partners

Russia

Russia has committed to provide **USD 500 million as technical and financial support** for **constructing the Rooppur Nuclear Power Plant Project.**

Russia has interest for investing **USD 100 million** in the **ICT sector** of Bangladesh.

Belgium

Jan De Nul Group (JDN) and Payra Port Authority (PPA) signed a joint venture company agreement in 2017, for the **Payra Deep-Sea Port dredging project, worth USD 626.6 million.** The Payra Port Project has 19 components of which capital dredging is the key one.

The Payra Port Authority (PPA) will have 51% share in the joint venture company and the rest 49% will be held by Jan De Nul. The firm will bear 20% of the cost of capital dredging from its equity **and 80% of the funding will come from the Belgian government in the form of loan**. The interest rate on the loans will be 0.85% and the repayment period is 12 years. The joint venture agreement between both the parties will be valid for 15 years and loans will be repaid through tolls collected from vessels berthing at the seaport.

Agency Francaise De Development (AFD)

In 2012, AFD has started its operations in Bangladesh by signing a Credit Facility Agreement in January 2013 with the GoB for a loan to support a Transport Project in partnership with Asian Development Bank (ADB). AFD is focused towards the development of the urban infrastructures, such as providing drinking water, supplying clean and sustainable energy and the climate change adaptation strategy of the Government.

Under the project "Dhaka Environmentally Sustainable Water Supply Project" (DESWSP**), funded by the Asian Development Bank (ADB), French Development Agency (AFD) and European Investment Bank (EIB)**, construction of a **water plant for DWASA was given to the French joint venture SUEZ-VEOLIA**. The project is worth **USD 318.3 million** and will be operated under the **DBO or design-build-operate modality.**

KOICA

On 2018, KOICA (Korea International Cooperation Agency) has signed a MoU with ICT division and LGD division and a2i program. "**Digital Municipality Service System"** project's aim is to establish a digital platform to manage all types of resources in an organized, effective and efficiency way. It will digitalize 10 Municipalities (Tungipara, Ramgoti, Faridpur, Jhenaidah, Natore, Singra, Pirganj, Tarabo, Mymensingh, and Sirajganj and **promote e-governance.**

SIDA (Swiss International Development Agency)

The 2014-2020 country strategy of SIDA commits to a total of **USD 178.5 million** (1.6 billion SEK) of development funds focusing on expanding its support in **education, health, women's rights (under Democratic development) and climate change adaptation.**

4. Opportunity Landscaping in the Private Sector

Multiple areas have been identified from the secondary literature for identifying possible opportunities in the private sector.

Table 4.1: Potential Areas in the Private sector (Based on Secondary Research)

Sector	Potential Product/Services	Stakeholder	Opportunity
Textile companies & Ready Made Garment Sector	Water treatment plants, sewerage treatment plants	WDF factories/ knit and woven textiles	**Medium** Industry receptive to environment-friendly technologies with a business case
Agriculture and industrial wastewater (B2B)	Small scale water treatment plants	Targeting of Economic Zones	**Medium** Prevalence of local companies that manufacture and import water treatment solutions
Agro-processing and drinking water companies	Water Efficiency	PRAN RFL, ACI Agribusiness, Basundhara, Square Consumer Products Lim.	**Medium** Prevalence of local companies that manufacture and import water treatment solutions
Small-scale Service Market (B2C)	Upgradation of irrigation pumps/ hydraulic structures	Farmers in Northern Districts	**Medium** Lower disposable income and high price sensitivity
Large-scale Urban Utilities Market (B2B/B2G)	Pumps, valves, motors for large infrastructure	PRAN RFL, ACI, Sigma Engineers Ltd	**Medium** Opportunities for joint venture with local players entrenched within the market.
Shipyards and Environmentally friendly scrapyards	Design, construct, and operate(Joint Venture or PPP)	Western Marine Shipyards, Dockyard and Engineering Works Limited, Khulna Shipyard	**Medium** Lack of accessory industries and high capital intensive nature of the venture
Inland container terminal	Design, construct, maintenance, TA (Joint Venture or PPP)	Summit Group, Meghna Group, Rupayan Group, Kanpur Inland Terminal and Depot	**Medium** Due to high capital investments, only business conglomerates will be interested
Economic Zones	Water treatment plants, Centralized Effluent treatment plants (CETPs)	Southern Zones such as Moheskhali EZ and Mirsorai EZ	**Medium** Economic zone authority interested but investment is needed and mode of

			operation is yet to be finalized
Water-based tourism infrastructures	Providing marketing and technical assistance.	RAJUK, Divisional City Corporations	**Medium** Currently being outsourced to the army or the local city corporation authorities
Small-scale Hardware Market (B2C)	Irrigation pumps	PRAN RFL, ACI Motors, Sigma Engineers Ltd	**Limited** Presence of strong local sector players in the market

In broad sense, product market in different industries have medium to limited potential for any business opportunity for Dutch private sector companies. Due to the general price-sensitive nature of business and management, sourcing destinations are China or India mainly due to cost competitiveness. However, premium products and machineries including chemicals and sophisticated equipment are still sourced from European countries but most local companies again prefer cheaper alternatives from China, India, Thailand, Korea etc. Small-scale hardware market is dominated by local industries and may not be possible for Dutch companies to compete due to basic reason of importing the goods or products at a higher price. Instead, services such as engineering design, maintenance training offer higher market potential due to Dutch companies being renowned for their technical and engineering expertise globally.

Water treatment can range from water recycling to waste water treatment ranging from urban infrastructure projects to commercial industries (manufacturing factories). In Bangladesh, roughly 20% of pollution is from textile factories, 20% is from leather industry, the rest 40% is from urban waste (used by city inhabitant and commercial industries connected to municipal drains), 10% is from transportation and the rest are from commercial industries such as agricultural, pharmaceutical etc. (Source: 2030 Water Resources Group, World Bank)

4.1 Garments and Textile

Market Size: USD 30.61 billion worth of exports, employing an estimated 4.2 million workers
Players: Approximately 2,500-3,000 factories in the RMG and Textile industry
Sector Growth Prospects: Medium, apparel sector registered 8.76% growth in 2017-18

Table 4.2: Summary of specific opportunities in the Textile and RMG sector

Parameter	Comments	
Players	**2000-2500 factories**	
Potential Markets	The Dutch companies may find open market for wastewater treatment plants (ETP) & their accessories (such as Pump Motor, Filter Press, Blower, Diffuser, Dozing pump, Gear Motor/Agitator, lab equipment & chemicals. Currently not gazetted, but the Department of Environmental (DoE) is pushing to make a STP (Sewerage Treatment Plant) mandatory for factories having more than 500 employees.	
Market Sizing ***(DETAILED MARKET SIZE CALCULATIONS ARE GIVEN IN THE ANNEX V)***	**Effluent Treatment Plant (ETP)**	USD 139,860,000
	Sewerage Treatment Plant (STP)	USD 13,960,000
Financiers	***Green financing by banks and FIs through credit quotas*** To accelerate climate resilient investments, the minimum credit quota of direct green finance is set at 5% of total loans from January 2016 onwards. (Bangladesh Bank as acts as regulator, bank and FIs as implementing institutions. Textile is one of the key targeted industries with sensitive (potentially high) environmental impacts. ***Bangladesh Bank Refinancing Schemes*** Loans are provided for 50 green products in targeted green sectors at 5% interest rates chargeable to the customers capped at 9%. Around USD 500 million was pledged for this scheme. In 2015 BDT 2 billion (USD 200 millon) of the pledged funds, also called Green Transformation Fund (GTF), is allocated for water and energy use efficiency in textile industry, including ETPs.	
Technologies	There is no ideal ETP for a textile dyeing industry but the best options consist of several units. The combined **physiochemical and biological treatment** is the most **common type** used in textile sector, while **chemical ETPs are most popular**. In case of machinery and equipment used in ETPs, **variable frequency drives** are popular (they help in controlling the speed of the electric motor). **Energy efficient motors, upgraded heating, cooling, ventilation systems, energy efficient lighting systems are also poplar accessories**.	

Sourcing Destinations	Most companies use locally assembled ETPs. Imported ETP equipment in Bangladesh are from China, India, Taiwan, Italy and Germany etc. Name of some local ETP suppliers include - Meem Water Technology, WaterWin Limited, OSMOTECH BD., Azuya Water Engineering Ltd., Water Link Bangladesh, Green Genesis Engineering Ltd. etc. ***DETAIL OF THESE COMPANIES ARE ADDED IN THE ANNEX VI.***

Primary Insights

One of the notable incidents in the industry is the Rana Plaza industrial accident which started a wave of workplace safety compliance reforms. Currently, one prominent trend in the industry is setting up or converting factories into 'green buildings' and getting certified as LEED factories. While the factory workplace reformation was a reactive event, in response to the Rana plaza tragedy; the green factory initiative is a proactive for many players. Currently, there are 72 LEED certified factories in Bangladesh. This trend shows the transition of the apparel industry towards sustainable practices in a proactive manner. Therefore, opportunities for promoting environment friendly technologies in water conservation will align with the industries outlook for sustainable and greener technologies. However, at the end, since factory management are price-sensitive in nature, the business case for promoting such technologies is mandatory.

a. Waste water treatment in Textile factories

Fabric production phase is estimated to consume 50% of the overall water usage in this sector. In the phase, the most water intensive part of the production process is the wet processing component in the fiber processing factories, accounting for almost 85% of the water consumed. (Source: 2030 WRG report, 2015)

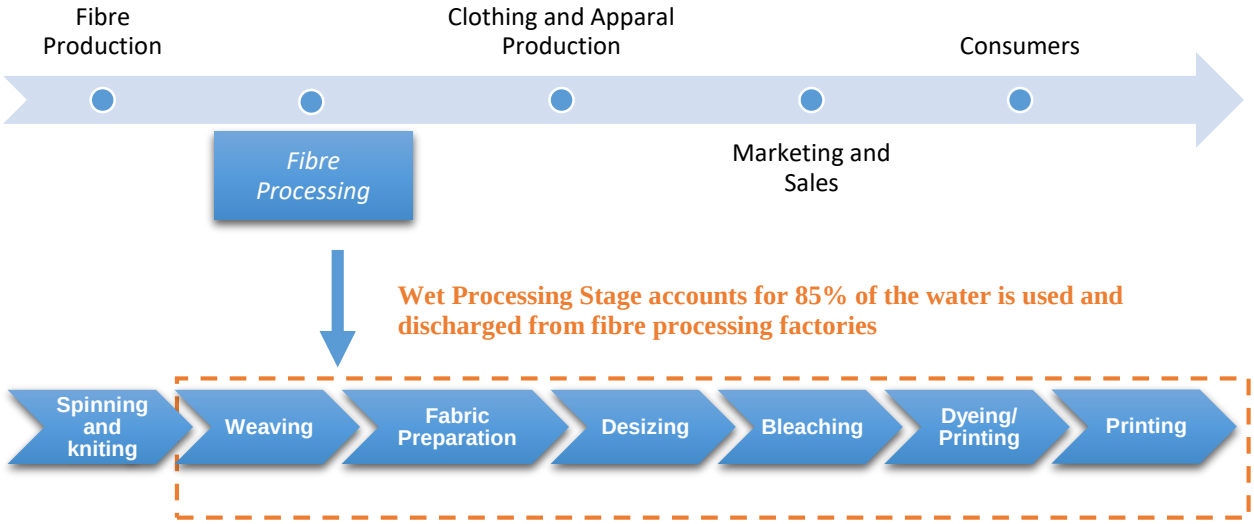


Figure 4.1: Value chain of the textile industry with Flow diagram of fibre processing stage in WDF factories (Source: 2030 WRG Report, 2015)

Table 4.3: Water consumption and water withdrawal amounts in value chain stages of the textile industry

Value Chain Stage	Process/Activities related to water in the value chain	Consumption*	Water withdrawal*
Fibre Production	• **Agriculture and petrochemical supplies** • **Yam/fibre producing/ spinning mills**	**52%**	**46%**
Fibre Processing	• **Dyeing and fabric finishing** • **Weaving** • **Knitting**	**43%**	**47%**
Other Stages	**Others -** • **Confection of clothing and apparel** • **Transport** • **Stock/man management**	**5%**	**7%**

Consumption is defined as 'water used and not returned to its source' and withdrawal is defined as 'water diverted or withdrawn from a surface water source'

Bangladesh has approximately 2,000-2,500 factories in the garments industry. Of them roughly, 10% or 200-250 are top tier meaning they work directly with the global clients complying with safety standards and policies for work regulation (Source: Echotex). When any of these companies are expanding their operations, they would be needing additional ETPs or STPs for their factories. For example, Ha-Meem group is investing USD 60 million for expanding their denim plant in Maona. The Viyellatex group received funding worth USD 40 million in 2017 for setting up a new spinning unit. Among the rest of the mid and small-tier players, a number of factories maintain some environmental standard and work as 'sub-contractors' for top-tier factories, producing apparel for global brands. The rest of the factories are low tier and lack a safe working environment as well as being noncompliant with safety and environmental regulations. There are almost 500 to 700 Wet processing units dedicated to the washing, dyeing, and finishing (WDF) of textiles. Around 70% of WDF textile units are located around or in Dhaka, and the remaining units are in Mymansingh and Chittagong. (Source: WRG Study 2015).

The market lies between the aspiring mid-tier and expanding top-tier segments of the RMG sector. Ready-made Garments factories do not involve water intensive process and produce solid waste as a by-product for their operations (except sweater factories, which produces some wastewater). In textiles, knit and woven dyeing are mainly the most water intensive production process. The source of water pollution contributed by textiles is wet processing steps. It includes sizing, desizing, scouring, bleaching, mercerizing, dyeing, printing and finishing. Desizing, scouring and bleaching processes produce large quantity of wastewater.[11]

DETAIL OF TOP TIER GARMENTS COMPANIES ARE GIVEN IN ANNEX VI.

[11] Dey, Shuchismita, and Ashraful Islam. "A review on textile wastewater characterization in Bangladesh." Resources and Environment 5, no. 1 (2015): 15-44.

A study[12] analyzing effluent data from 2005 to 2014, found that the **major three textile oriented industrial areas - Savar, Narayangonj, Gazipur are severely affected by textile effluent**.

There is no ideal ETP for a textile dyeing industry but a number of factors determine the type required. Some of these factors include- the size of the factory; the exact nature of the industrial process, and thus the waste being generated; the funds allocated for installing and operating the ETP; the compliance criteria specified by buyers (if any); and the engineering consultants contracted for designing and developing the ETP.

The wastewater generated in textiles also contain a significant volume of harmful chemicals and ETP usage has been made mandatory by the DoE (Department of Environment) for reducing emission of harmful wastewater in the surrounding environment.

While some of these companies have an aspiration for moving up the ladder for becoming a fully compliant factory or becoming eligible for supplying to international retailer brands (like Walmart, Levi's, Uniqlo etc.), some of these factories are comfortable operating in the mid-tier segment, opting for sub-contracting work that does not require any additional permit or certification. (Source: KII- IFC PaCT Interview).

Bangladesh Ministry of Environment and Forest's (MoEF) environment protection law of 1995 stipulates that all new textile wet-processing plants must install an effluent treatment plant (ETP), in reality the number is much lower. A study by UNIDO[13] in 2011 found only 29% of textile wet processing units to be compliant. Also, many companies that had an installed ETP facilities did not run it due to high operational costs.

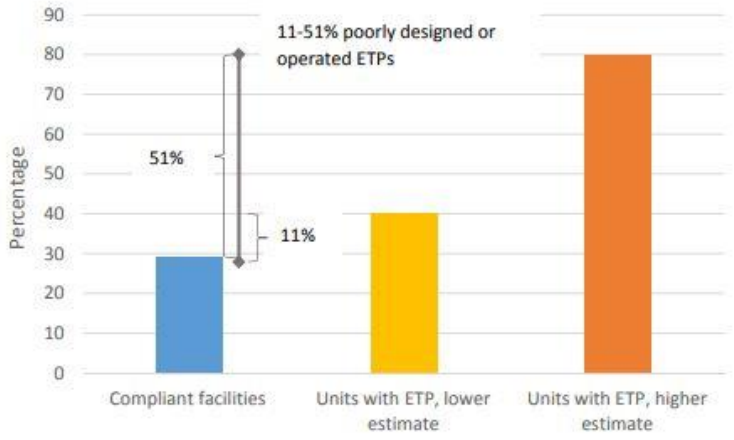


Figure 4.2: The Percentage of Poorly Designed or Poorly Operated ETPs in Bangladesh Textile Wet Processing Units (Adopted from Water Governance Mapping Report: Textile Industry Water Use in Bangladesh)

Since textile processing and dyeing are the most water intensive process in RMG manufacturing, this segment should be targeted. Textile industries consume high volumes of water per unit of fabric. In 2016, an estimated 217

[12] Khan, Mohidus Samad, Shoeb Ahmed, Alexandra EV Evans, and Matthew Chadwick. "Methodology for performance analysis of textile effluent treatment plants in Bangladesh." Chemical Engineering Research Bulletin 13, no. 2 (2009): 61-66.

[13] Park, J, The Treatment of Textile Effluent – the current status with particular reference to Bangladesh. Support to the Bangladesh Quality Support Program Textiles and RMG Component, UNIDO, (2011)

million meter cube (m^3) of wastewater was produced for manufacturing 1.80 million metric tonnes of fabrics (Source: Professor Samad, BUET). In 2021, it is estimated that 349 million meter cube (m^3) of wastewater will be produced using conventional dyeing practices.

However, opportunities may reside in sludge management since new provisions by the department of environment is considering making STP (Sewerage Treatment Plant) compulsory for all garments factories with at least 500 workers. (Source: KII of ETP Expert)

It should be noted that locally produced ETPs can be assembled at a much lower price (almost $1/4^{th}$ the price of an Italian ETP i.e. a locally procured ETP can cost 100,000 Euro whereas an Italian ETP can cost about 400,000), and majority of ETP in our country are locally assembled. Only top tier companies invest in high value foreign ETP. Over the years, ETP has become a common practice with majority of textiles are now equipped with an ETP. (Source: KII of ETP Expert). Currently, dyeing factories have very limited land, and a dyeing factory using an ETP that can operate in small area & has a small size can be a potential product.

Some of the most frequently used technologies in water conservation in textile factories are listed from the PaCT phase-I database containing 102 factories-

- Heat recovery from condensate, hot jacket, dying machine
- Reducing water consumption by installing water trigger nozzles instead of hose pipes, open pipes and for general cleaning
- Heat and water recovery from condensate
- Reducing water consumption by process modification of knitted fabric and denim
- Reduction in water & electrical energy consumption by eliminating generator cooling tower
- Implementation of central sample washing tank instead of separate sample washing for each dyeing machine
- Boiler-automatic blow down control
- Use of waterless direct softener injection washing for reducing water consumption
- Lab to Bulk RFT process performance improvement
- Minimizing Heat Loss by proper insulation of bare surface, pipes, valves and correction of steam leakages
- Retrofit of PLC based monitoring and control system on Belly washers
- Promoting the concept of “zero discharge”

(Source: PaCT Interview and Database)

Entry strategy and Way Forward: ***Strategy will involve a three-step approach to promote Dutch Water Technologies in the Garments Sector***
Three type of initiatives need to be taken in a step-by-step manner- 1. Easy technologies (short term) 2. Capacity development (mid-term) 3. Collaborative program approach (long-term)

Easy Technology at affordable price

Collaborative approach to technology innovation (such as importing the technology and procuring locally) which will provide both quality and cost.

Since management in RMG and Textile sectors are cost-sensitive, for promoting Dutch technologies which are efficient but costly, the solution would be to present not just the CAPEX and OPEX of the product but presenting the **life-time Cost-Benefit along with the business case.**

Capacity Development

Factories have the ability to buy better and environment-friendly technologies, but there is gap in the understanding of management regarding the usefulness of these equipment. Capacity development of middle management/staff needs to be done, so they can understand the importance of environment friendly equipment and promote these to their senior management.

Collaborative Program Approach
Long-term projects for promoting water conservation technologies with a view to institutionalizing the approach will help solidify the positioning of these technologies.

Focusing on the fact that **durability & quality wins in the long-run,** and associated branding activities can help position Dutch technologies.

4.2 Leather Industry

Market Size: USD 1.08 billion of export of leather and leather goods. Currently, 155 tanneries produce 124 million square foot of leather annually. (Source: Secretary, Bangladesh Tanners Association)
Players: Currently 165 tanneries employing an estimated 25,000 workers
Sector Growth Prospects: Medium. From FY 2006-07 to FY 2016-17, the leather industry has been witnessing an average annual growth of 16.65%. However, in 2017-18 there was relocation of the Tanneries to the industrial zone in Savar, which disrupted the operation of almost half the tanneries leading to 12% decrease in export earnings. (Source: Chairman, Bangladesh Tanners Association)

Table 4.4: Summary the tannery industry opportunities

Parameter	Comments
Players	**165 tanneries in Savar industrial zone**
Potential Markets	Leather production from raw hide is a water intensive industry. Use of efficient tanning drums can converse the water used during the production process. Use of advanced technologies such as **chrome recovery and chrome liquor recycle, counter current soaking, enzyme assisted soaking, mechanical desalting, ammonia free deliming using carbon dioxide** etc.
Market sizing	USD 11,150,000 ***(DETAILED MARKET SIZE CALCULATIONS ARE GIVEN IN THE ANNEX V)***
Financiers	***Green financing through Financial institutions*** For accelerating climate resilient investments, minimum credit quota of direct green finance has been set at 5% of total loans from January 2016 onwards. (Bangladesh Bank acts as a regulator, while FIs are the implementing institutions)
Technologies	Converting raw hide into processed leather requires the use of 'Tanning Drums' and multiple steps using different types of chemicals. When tanneries were located in Hazaribagh area, majority of players used local Tanning Drums which were inefficient and used 50,000 Liter of water per ton of processed raw hide.
Sourcing Destination /Countries	The currently relocated tanneries are more resource conscious and almost 70% of them use Tanning drums imported from Chin and Italy, which are more efficient and use 36,000-40,000 Liter of water per ton of production. However, the international standard is 24,000 Liter per tonne of production, indicating that there is a huge potential for improvement.

Primary Insights: Largest market for Bangladeshi leather and leather goods exports is Asia (40%), followed by Europe (33%), North American, Africa and Australia. Since, European and North American buyers are environmentally conscious, promotion and use of environment friendly technologies will be taken-up by buyers.

Initially the Hajaribagh area in Dhaka consisted of 220 tanneries for processing raw hide into processed leather. They were relocated to Savar based on a High Court order, instructing government to cut power and gas connections to the tanneries; thus compelling the owners to relocate to the purpose-built Savar Leather Industrial Park. Currently there are 155 tanneries located in the Leather industrial zone in Savar, and many had to be closed down temporarily due to lack of plots in the park. This zone also includes a SME cluster having some 600 SMEs providing peripheral service to the leather industry. Currently, the tanneries produce an estimated 240 million cubic meter of leather per year. An estimated 25,000 people work here in these tanneries.

The raw hide to leather production stage in tanneries currently require 36,000 Liters per tonne of raw hide, while the international standard is 24,000 Liters per tonne of raw hide. (Source: KII- Chairman, Bangladesh Tanners Association). Along with water, more than 450 kg of chemicals are used for processing per tonne of raw hide. The different stages involved in leather production from raw hide is given in table 4.2, indicating the potential for optimizing water usage.

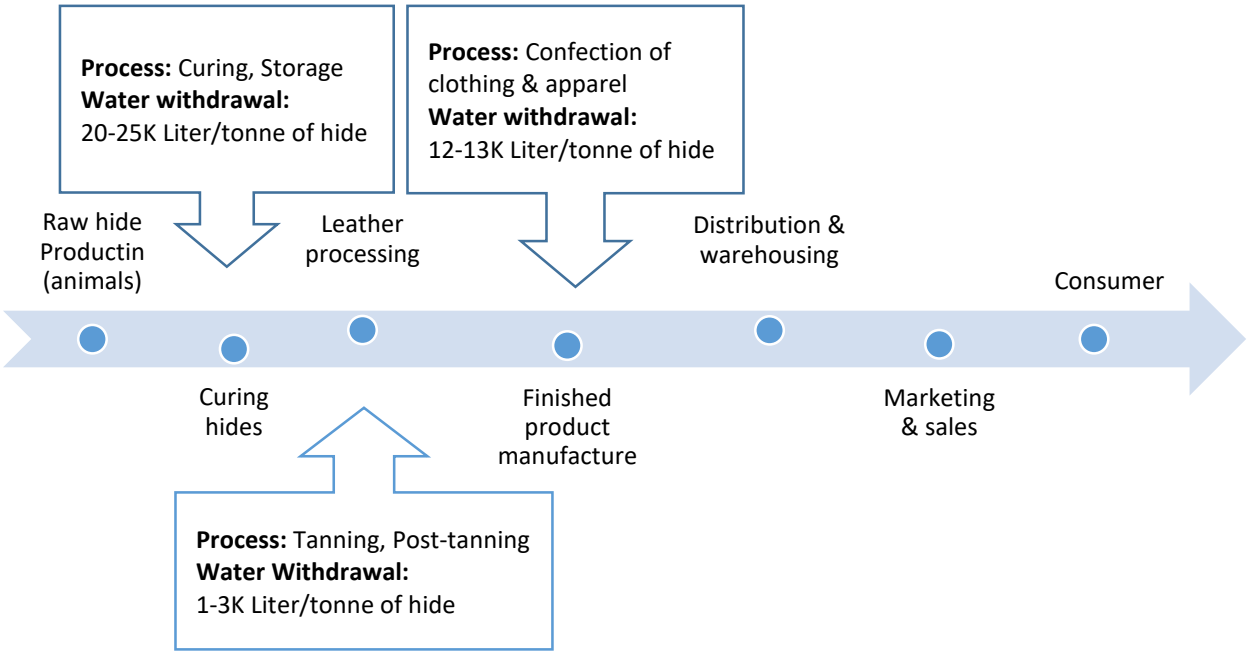


Figure 4.4: Leather Sector Value Chain with water withdrawal processes and amounts

If annual production growth rate of 20% is used for the next 5 years, the total production by 2021 will be around 746 million kg of leather (conventional tanning process) generating about 30 million m3 wastewater. Again, if the annual growth rate of 35% is used, the total production in 2021 will be 1,345 million kg of leather, generating about 54 million m3 wastewater. This volume is 1.8 times higher than the wastewater volume of 2016.

Table 4.5: estimated Wastewater production in Leather Industry in 2021 using conversional production methods[14]

Scenario	Leather	Wastewater
Production in 2021 at 20% growth rate	746 million KG	30 million m^3
Production in 2021 at 35% growth rate	1345 million KG	54 million m^3

The industrial zone in Savar has a Central Effluent Treatment Plant (CETP) which was constructed by and is currently operated by Bogura RD (a local company) having a capacity of 20,000 m^3. With the growth of the leather industry shown in the projected scenarios in table 4.3, capacity expansion will be needed through either constructing additional CTEPs or expanding the capacity of the current CTEP.

Reduction in waste-water emission provides multiple benefits for the tannery owners and a business-case can be developed for attracting tannery owners to adopt water efficient technologies.

1. Cost minimization due to lower usage of water
2. Cost minimization due to lower usage of chemicals (larger volume of water dilutes the chemicals)
3. Cost minimization due to lower usage of energy (due to lower volumes of water)
4. Cost minimization due to lower amount of waste-water produced (Lower charge paid to CETP)

Currently, machinery such as Tanning Drums are mostly imported from Italy (due to Italian Leather having a global brand name), while the rest coming from China. Previously, small number of equipment were imported from Germany and France but imports have stopped completely. In terms of chemicals, highest volume is imported from Italy, and second highest from Netherlands. Two well reputed companies include- Smith & Jones and Stann. Germany is another chemical import destination.

Table 4.6: Different steps in the Leather processing industry

Steps	Steps used in Converting Raw Hide to Processed Leather	Water Used International Standard (Unit: Liter)	Water Current Used (Unit: Liter)
1	Soaking	9,000	12,000
2	Liming (Use of lime and sulfur compounds to separate hair from the hides)	6,000	10,000
3	Lime-fleshing	1,000	2,000
4	Deliming and bating (To remove the lime and make the leather soft)	5,000	8,000
5	Pickling (use of salt and other chemicals such as Chromium)	1,000	2,000
6	Pre-Tanning/Wet blue tanning (Also, known as crust-dyeing)	2,000	4,000
	TOTAL	**24,000**	**38,000**

Source: Interview- Bangladesh Tanners Association

[14] Hossain, Laila, Sumit Kanti Sarker, and Mohidus Samad Khan. "Evaluation Of Present And Future Wastewater Impacts Of Leather Industries In Bangladesh." (2017)

Although as source of water both ground water and river water can be used, river water is currently not being used since there is a higher water processing cost.

Entry strategy and Way Forward
It should be noted that the most water-intensive steps include **soaking (salt washing)** used for raw hide processing and **Liming** which uses chemicals such as lime and caustic soda for cleaning the surface. While according to international standards, per tonne (1000kg) of raw hide needs 9000 Liter of washout with water in the socking stage, tanneries in Savar use 12,000-15,000 Liter. Also, liming standard is 6000 Liter per tonne of raw hide but tanneries in Savar use 10,000 Liter. Therefore, usage of improved machinery and advanced technologies can initially optimize water use in these two steps. Cleaner production options for tannery industries include **chrome recovery and chrome liquor recycle, counter current soaking, enzyme assisted soaking, mechanical desalting, ammonia free de-liming using carbon dioxide** etc. which can have a potential market in terms of efficient production. ***A LIST OF TANNERY COMPANIES ARE INCLUDED IN ANNEX VI.*** **Initial Stakeholder to target:** **BTA (Bangladesh Tanners Association)** **Email: bta@tannersbd.com** **Contact Person:** **Additional secretary** **Bangladesh Tanners Association** **Chairman** **Bangladesh Tanners Association**

4.3 Real Estate Industry

Market Size: 540 billion BDT[15] (2015)
Sector Growth Prospects: Medium. Market growth of 42.4% from 2005-2015 (average growth 4% year on year)
Industry Actors: More than 1100 (Source: Interview- REHAB)

Opportunity for Dutch Companies: Due to decreasing ground water levels, the water supply will be sourced from rivers and central purification plants will be constructed in the urban cities. For Southern cities and coastal zones, drinking water is a challenge due to salinity intrusion and a centralized desalination plant will be the solution. Since water supply is governed by WASA and Municipalities in urban cities, a Government to Government contract can help secure such contracts.

Table 4.7: Summary the Real Estate industry opportunities

[15] Mutual Trust Bank, *Monthly Business Review MTBiz*, vol 8, issue 4 (May 2017)

Parameter	Comments
Players	Top players in the real estate industry include: Basundhara Group, Advanced Development Technologies, Alliance Properties, Amin Mohammad Group, Anwar Landmark, Artisan Group, Avenue Builders, Bangladesh Development Group., Building technology and ideas ltd., Navana Real Estate, Concord Real Estate, Shanta Holdings Ltd., Assurance Developments Ltd., Rangs Properties Ltd., Sheltech, Comprehensive Holdings Ltd. etc.
Potential Markets	Centralized water supply plant for apartment buildings in satellite cities or neighbouring districts of Dhaka city like Gazipur, Manikganj, Munshiganj, and Narayanganj. The southern district of Khulna another growth stop owing to
Market sizing	A centralized water supply or sanitation tank can vary due to size of the apartment and also is influenced by government regulations.
Technologies	**Centralized water recycling plant or septic tank.**
Sourcing countries	**Existing water reservoirs are procured from local companies. In terms of waste-water and faecal sludge equipment, Chinese and Indian manufacturers provide quality products at affordable price.**

Interviews with the real estate association and few realtors revealed that apartments currently use a centralized reservoir or tank which collects water from the WASA designated central water tanks. Used water is sent back to the sewerage through drains and pipes. The current central water reservoir system in apartments use plastic tanks and pipes manufactured by local companies such as RFL, Gazi, Madina, Bengal etc. The opportunity for Dutch companies in this segment is limited since local players are providing equipment at a lower price (due to cost advantage from local production). However, the source of urban water source will slowly be shifting from ground water to river water (Source: DWASA). Few centralized water purification terminals will be needed along with the infrastructure for providing the purified river water to urban households.

Entry strategy and Way Forward
Stakeholders for Urban Cities: DWASA and Chittagong WASA. Currently, Dhaka city is expanding towards the east through “Purbachol” and habitation complexes (apartment blocks and buildings). All these newly inducted residential areas would be requiring water purification plants as well as STPs for processing wastewater and sludge. Government Stakeholders to target include LGD, DPHE and Municipalities in Southern districts particularly focusing on Khulna and Barishal regions.

4.4 Shipbuilding and Scrapyards

Market Size: USD 30.35 million (between July and December of FY18)
Sector Growth Prospects: Shipping export growth is 9% per annum (Source: President, Shipbuilders Association Ltd.)
Industry Actors: Seven shipbuilding companies in Bangladesh and 69 shipyards are engaged in building and repairing ocean going ships

Opportunity for Dutch Companies: Joint-venture opportunities with Dutch companies for shipyards or environment friendly scrap-yards

Table 4.8: Summary export-oriented shipbuilding companies

Parameter	Comments
Players	The top shipbuilding companies in Bangladesh include - Khulna Shipyard, Western Marine Shipyard, Ananda Shipyard, Chittagong Dry Dock, FMC Dockyard, Karnaphuli Shipyard, and Ready Point Shipyard. Additionally, shipyards such as High Speed, Western Fishers Shipyard, Narayanganj Engineering, Khan Brothers, Meghna Shipyard, Radiant Shipyard, Three Angle, etc have the capacity for building international quality ships. Western Marine Shipyard and Ananda Shipyard are export-oriented.
Potential Markets	Western Marine Shipyard and Ananda Shipyard exported 40 ships to 14 countries from 2009 to 2017 worth $170 million, which were both small and medium sized vessels (Source: Export Promotion Bureau Data). Western Marine Shipyard accounted for 89% of export earnings (USD 150 million), exporting 31 ships, while Ananda Shipyard earned USD 20 million by exporting 9 ships. To ship importers are the EU countries- Denmark, Netherland, Sweden and Germany. Other importers include- Ecuador, Finland, Tanzania, New Zealand, Gambia, UAE, Uganda, Kenya, India, and Pakistan. (Source: Export Promotion Bureau)
Market sizing	Bangladesh's export in the shipbuilding sector is USD 700 M and domestic market has aggregate demand of USD 3.0 Billion. (Source: President, Shipbuilders Association) USD 650.83 billion will be spent across the world for procuring new ships by 2026. (Source: Projection by Business Wire). And market for small ocean-faring vessels will stand around USD 400 billion annually.
Technologies	Bangladesh exports main smaller vessels such as Cargo Vessels, Passenger Ferries and Patrol craft. (Source: President, Bangladesh Shipbuilders Association)

The Netherlands make very advanced ships, however with rising labor costs, the industry will look for alternate destination for outsourcing production.

Ships with a volume larger than 50-60 thousand tonnes are considered large ships which have high demand in the international market, however small ships (lesser than 30,000 tonnes) are currently being made by Bangladeshi shipyards, including small ferries for inland water transportation.

The strategy of the Bangladesh Shipping industry is to initially start building smaller ships and gradually progress to building larger ones in the medium to long term. (Source: Director, Bangladesh Shipbuilders Association). However, the industry is facing a number of challenges, which include high capital investment requirements and lack of supportive ecosystem for supplying components. Seasonality effect of demand is another industry fundamental and global economic downturn can adversely impact demand for ships.

Currently, Bangladesh can't support construction of larger sea-faring vessels (above 50,000 tons). Transportation of larger ships in Bangladesh is currently not possible due to inadequate capacity of existing ports and Shipyards. A floating shipyard or dockyard needs to be constructed first for supporting building of larger ships.

In a nutshell, major shipbuilding countries such as China, Japan and Korea are focused on building large ocean-faring vessels, which are less labor intensive. This has left a void in the market for building small ocean-faring vessels, i.e. vessels with a capacity not exceeding 25,000 DWT. This gap is now being filled by countries like Bangladesh, India and Indonesia. Among the 69 shipyards building and repairing inland and coastal vessels, majority (70%) are located in and around Dhaka and Narayanganj, along the riverbank of Buriganga, Shitalakya and Meghna, followed by the Karnapuli river in Chittagong (20%). The rest are located in Poshur River in Khulna (6%) and in Barisal (4%) division.

Entry strategy and Way Forward

Opportunity for Dutch Private Sector Companies

Opportunities exist in terms of Joint-Venture initiatives for setting up **environmental friendly scrapyard and shipbuilding dockyard**. The current scrapyards in Bangladesh use manual labor for dismantling ships and scrapping of iron and other accessories. Current process is not environmental friendly and opportunities lie with using low cost affordable labor in a regulated and safe way under environmentally safe provisions e.g. disposition of waste filled tankers, harmful chemicals in a safer way. Scrapped materials can be used for construction of newer ship vessels. However, constraints such as lack of associated industries for forging, melting; skilled human resources and a construction yard for releasing the vessels into the deep sea are limit opportunities.

Sourcing of associated materials and technological expertise from Netherlands and combining with the low wage cost of Bangladeshi workers can help create a 'win-win' scenario. However, due to the high capital investments required, these shipyards will only be economically feasible if favorable government policies (such as tax exemption or low interest rate loans etc.) are enacted for supporting the overall industry.

Contact Point
Director
Bangladesh Shipbuilder Association

4.5 Pharmaceuticals

Market Size: USD 103 million exports in 2017-18 with the domestic market estimated at USD 1.7 billion
Players: 173 active players, however the top 20 players constitute 86% of market share
Sector Growth Prospects: Medium with historic industry CAGR of 15%
Opportunity for Dutch Companies: Chemicals and Waste-Water Treatment

Primary Insights: The pharmaceutical factories which are export-oriented adhere to strict environmental policy regulations and have waste-water treatment plants. The top 15 companies are mainly focused on exporting medicines. In terms of Pharmaceutical machinery and equipment, India is the first choice followed by Germany, Denmark and France. It should be noted that some raw materials such as Active Pharmaceutical Ingredient (APIs) are currently sourced from Netherlands. Considering competitive pricing for capital machinery and APIs, the sector hold limited opportunities for Netherland based companies.

The principal manufacturing steps in pharmaceuticals sector requiring water include:

(a) Preparation of process intermediates;
(b) Introduction of functional groups;
(c) Coupling and esterification;
(d) Separation processes such as washing and stripping
(e) Purification of the final product.
(Source: World Bank, Pharmaceuticals Manufacturing, Pollution Prevention and Abatement Handbook)

Additional product preparation steps include granulation, drying, tablet pressing, printing, and coating, filling, and packaging. Each of these steps may generate air pollution, liquid effluents, and solid wastes. Approximately 200 kg wastes per ton of product is generated.

According to National Drug Policy-2016, all manufacturing pharmaceutical plants must have an ETP and the installation of an incinerator is encouraged. Similar to textile factories, chemical ETPs are popular in pharmaceutical manufacturing plants. In case of machinery and equipment, variable frequency drives, energy efficient motors, upgrading heating, cooling, ventilation systems etc. are popular.

4.6 Irrigation pumps and others

Market Size: Fragmented, with an estimated 37,000 deep tubes and almost 14,000,000 shallow tube wells
Players: Top players include RFL, ACI, Bengal, Gazi etc
Sector Growth Prospects: Medium. Since, Bangladesh is an agrarian economy, mechanization of technologies related to cultivation and agro-processing will become more mainstream

Opportunity for Dutch Companies: Opportunities exist in terms of G2G contracts through conditional development loans. Since total irrigated land in Bangladesh is 5,500,000 Hectares, there are opportunities in terms of hydraulic structures & tunnel system with water regulating structure in both sourcing of irrigation water and removal of drainage water.

Opportunities in Hydraulic Structure based on interview with BADC.

Table 4.5: Different Opportunities of Hydraulic Structures in Bangladesh

Type	Suggested Hydraulic Structure	Comment
water structures used in canal digging	Canal digging with submersed wire structure (RCC) Box Culvert (which can be used to move agricultural goods)	Smaller hydraulics has more opportunities compared to larger structures. A type of water-bridge named aqua duct (RCC overhead structure) can be constructed and used for long distances along with a Box culvert (small bridges on canals). For smaller distances and smaller canals, the process used is syphon (used in the irrigation).
water tunneling system	Hydraulic tunneling with pumping station.	For moving water from river and other large water bodies for irrigation and drainage.
Hydraulic elevator Dam and Rubber Dam	Hydraulic elevator Dam is a comparatively bigger structure made using RCC on canals and medium size rivers. They can be up to six meter high. Rubber dam (3.5 meter height) is being constructed on canals & medium sized rivers. The advantage is that the height can be changed and can be suspended into the ground when not being used (during dry season).	Currently, there are 65 rubber dams in place throughout the country and a feasibility study is being carried out by government organizations for understanding the opportunity of deploying additional rubber dams.
Hydraulic Infrastructure for Coastal regions	Sluice-gate	Used to control water in tidal zones. The Blue Gold project is currently implementing similar infrastructure projects in the Southern zones. There are limited opportunities for future expansion.

Entry strategy and Way Forward
Collaboration opportunities exist for deploying easy to use hydraulic structure focusing on irrigation and drainage. Joint venture agreements with leading private sector players (PRAN-RFL or ACI) can help with technology transfer and on-shore manufacturing.

4.7 Capacity building and consulting

Advisory services (TA or consulting) opportunities for bigger Dutch firms exists with Donor funded projects with very limited opportunities with local private sector (since they are cost sensitive).

Currently, multiple types of organizations are involved in water-sector related consulting projects, starting from local firms to educational institutions to individual consultants. However, in terms of stringent quality standards that are needed for Donor-funded or IFI-funded work, such as a joint project of World Bank or ADB, the choice for local firms are limited (Source: Country Director, MottMcDonald).

Public Sector trusts: Prominent ones include– the Institute of Water Modelling (IWM) and Center for Environment and Geographical Studies (CEGIS)
Educational Institutes: ITN-BUET; Institute of Water and Flood Management (IWFM), BUET; Center for Climate Change, BRAC University
Individual Consultants: Ex-BIWTA or Ex-BWDB directors etc.

Recommendations by EuroConsult Mott Macdonald

There are skilled human resources between 25-35 years of age and experts between 60-65 years of age in the consulting industry, but gap exists in the mid-tier.

4.8 Drinking Water Company

The main source of water used in industries is ground water. Currently, layer for underground water is getting lower each year with companies drilling deeper tube well pumps with electric motors. However, the deeper layers of water are now being found to be contaminated (Source: Director, Aqua Mineral).

The deteriorating quality of ground water indicates the overuse of water reservoirs underground, with more and more tube wells extracting water from the group.

A water bottling company uses filtration and water is purified in two stages- microbiological purification and Chemical purification.

Equipment used in the microbiological or chemical purification stage are often sourced from European countries. For example, membrane-filters are a sophisticated filter and pharmaceutical grade membrane-filters can be sourced from UK based companies. For Chemicals such as ion exchangers needed for the chemical purification stage, countries such as US or China are more popular.

In terms of machinery such as filling, packaging, labelling machinery- China, Thailand, Korea, Germany etc. are popular sources. For machinery, closer destination countries are preferred such as China, Thailand, Korea since securing after-sales service in case of machine malfunction is easier from these destinations (e.g. a trained engineer from Thailand who can come, examine and fix an equipment is comparatively less cheaper than a trained engineer from Germany).

Challenges in the industry are technical gaps such as lack of trained manpower for operating the machineries or for repairing.

Entry strategy and Way Forward
Opportunities in machinery imports are limited due to presence of nearby competitors-China, Thailand, Korea, India etc. However, chemicals are sourced from Netherlands and sophisticated equipment such as high-grade membrane filters, ion-exchange resins etc. are sourced from Europe.

5. Policy Landscaping

Recent policy and investment programming by the Government of Bangladesh (GoB) and IFIs

The water sector has always featured prominently in the policymaking process of the government, especially considering the riverine nature of the country, high population density and persistent increase in seawater level contributing to salinity.

Among multiple policies and central strategic plans of the government, the newly drafted Bangladesh Delta Plan 2100 is assumed to act as the roadmap for Water related project investments in upcoming years. **Environmental sustainability, natural disaster response and climate change** are central themes of the Bangladesh Delta Plan 2100. According to governments SDP 2011-2025, the Water sector needs an estimated investment of USD 20,936 million.

The Ministry of Water Resources (MoWR), MLGRDC and Ministry of Agriculture (MoA) spend a considerable amount of funds in water related activities and investments. Excluding the MoWR, 35 central government organizations, affiliated with 9 different ministries have functions relevant to the water sector, while NWRC precedes over all these institutions in matters of water policy and legislation.

Table 5.1: Budget allocation for different government ministry and departments in the ADP 2017-18

Name of Department/Ministry	Amount in USD	Percentage
Local Government Division	484.4	81.4%
Ministry of Agriculture	20.4	3.4%
Ministry of Chittagong Hill Tracts Affairs	1.1	0.2%
Ministry of Disaster Management and Relief	0.1	0.0%
Ministry of Environment and Forest	0.3	0.1%
Ministry of Fisheries and Livestock	10.6	1.8%
Ministry of Shipping	42.9	7.2%
Ministry of Water Resources	34.4	5.8%
Rural Development and Co-operatives Division	1.2	0.2%
Grand Total	**595.4**	**100%**

Source: Annual Development Budget 2017-18 by GoB

It should be noted that recent policies and budget allocation in combatting the effects of climate change is a development focus for the government and water is a priority area in that respect. Funded by multilateral and bilateral sources, the Government established Bangladesh Climate Change Trust Fund (BCCTF) and has an allocation of BDT 2,639 crore (approx. USD 310 million). The Ministry of Water Resources is the highest recipient of this fund, with an estimated USD 133 million or (44% of total allocation). Apart from that, the total allocation of MoWR in FY 2017-18 budget has been USD 697 million, of which 35.98% has been allocated for climate change related projects and programmes. Thematic areas which show increase in absolute contribution include Comprehensive Disaster Management (19.36%), Climate Resilient Infrastructures (6.09%), Capacity Building and Institutional Strengthening (5.44%) and Research and Knowledge Management 0.69%).

Table 5.2: Medium Term Expenditure Estimates and Projection under MoWR (FY 2017-18 to 2019-20) (Unit: USD in Thousands)

Description	Budget	Revised	Budget FY 2017-18	Projection	
	FY 2016-17			FY 2018-19	FY 2019-20
Bangladesh Water Development Board	536,726	551,706	674,389	739,478	813,700
Joint River Commission	798	520	878	965	1,062
WARPO	1,263	1,380	2,459	7,032	7,603
River Research Institute	1,462	1,700	4,432	5,200	5,898
Secretariat	8,062	1,013	11,616	2,849	3,107
International Organisations	7	7	8	9	9
Department of Bangladesh Haor and Jolabhumi Development	6,172	3,154	3,446	3,816	4,080
Grand Total:	554,491	559,480	697,228	759,348	835,460

Source: Climate Protection and Development: Budget Report, 2017-18

Although the Ministry Budget Framework does not mention strategies and actions directly relating to combatting adverse effects of climate change, the project and programmes activities carry out the climate change agenda of the MoWR.

Table 5.3: Projects relating to climate change under Ministry of Water Resources (MoWR)

Projects Strongly Relevant	Projects Moderately Relevant
• Rehabilitation, protection, strengthening of polders; • Repair of breaches of polders; • Coastal embankments improvement projects	• Flood control and livelihood in hoar areas, • Emergency cyclone rehabilitation, • Erosion protection, river bank protection, • Dredging of river, • Pre-monsoon flood protection • Restoration and reconstruction of submerged embankments.

Source: Climate Protection and Development: Budget Report, 2017-18

The ADB has a 2020 program committing USD 985 million for improving access to water and sanitation in urban and municipal environment. Besides, ADB focuses on the improvement of agriculture production through improved water and resource management (river basin) and disaster risk management, pledging USD 290 million till 2020.

Policy Regarding Ground Water Use

The policy titled "Groundwater Management in Agricultural Activities Bill, 2018" -an enabler for reducing wastage of water and ensuring well planned use of groundwater, has been passed in the parliament by the end of January, 2018. This newly proposed law empowers an Upazila Parishad to form and supervise an Upazila Irrigation Committee (UIC). This UIC will conduct field research and provide licenses among the interested and qualified farmers in exchange for a fee. After the law comes into effect, any unlicensed user of groundwater will be fined up to BDT 10,000 (approx. USD 117) with provision for seven days of imprisonment.

Bangladesh Delta Plan 2100

Deltas are created due to the complex interaction of rivers and tidal processes resulting in sedimentary deposits. Bangladesh is part of the Ganges-Brahmaputra-Meghna Delta or GBM Delta, which is the world's largest and populated delta. For being a low lying delta region (One third of the country stands lower than 5 meters), Bangladesh is vulnerable to the effects of climate change (such as sea-level rise). Additionally, the country is disaster-prone, suffering from floods, droughts, erosion, cyclones. The high population density and land scarcity puts more strain on the water resources resulting in pollution and damage to the ecosystem. In 2050, it is estimated that additional 14% of the area will be exposed to coastal floods leading to movement 35 million climate refugees.

The Delta Plan 2100 is a long-term multi-sectoral techno-economic plan formulated by the General Economic Division of the Bangladesh Planning Commission and funded by the Netherlands Government. The Delta Plan 2100 aims for a long-term, holistic and integrated water management system. The Delta Plan is formed around the vision which Bangladesh wants to achieve in 2100 for her Delta. The strategies outlined in the Delta Plan focus on two national strategies in addition to six hot-spots having similar water challenges –

- Coastal Zone,
- Barind and Draught Prone Area,
- Hoar Region,
- Chittagong Hill Tracts and Coast
- Major River and Estuary
- Urban Areas

The total of eight strategies (two national and six hot-spot based) are tested through an assessment framework against four scenarios to provide a robust, future proof and climate-change proof.

The draft of the BDP 2100 was approved by the National Economic Council (NEC) on 2 September, 2018. A total of 80 project proposals have been selected for implementation. Among them, 81.25% (65 out of 80) are infrastructure projects, while the rest (15 out of 80) involve institutional capacity development and research. According to the draft of the BDP 2100, an estimated USD 37 billion by 2031 is needed for ensuring food and water security and for fighting disasters. World Bank will help Bangladesh source funding for implementing the projects. The required funding for the currently approved projects would come from government sources, development partners, Green Climate Fund, as well as from the private sector. To implement the plan, two percent of the GDP would be required and Bangladesh

is also expected to receive assistance from Green Climate Fund in lieu of USD 2 billion every year (Source: KII-Planning Commission).

Programs and financial flows of donors and government

According to SDP 2011-2025, GoB has plans to invest USD 20.9 billion on WSS (drinking water, sanitation and drainage). These investments are scheduled for 2011-2015 USD 5.4 billion, 2016-2020 USD 7.5 billion and 2020-2025 USD 8.0 billion.

Table 5.4: Different Water Sector Investment Categories in SDP in Water Supply and Sanitation (WSS) Category

Categories	Total (in USD Million)
Urban Water supply	8,411.1
Urban sanitation	3,951.7
Urban drainage	2,123.2
Rural water supply	1,677.9
Rural sanitation	1,077.5
Total	**17,241.4**

Source: Sector Development Plan (SDP) 2011-2035 by GoB

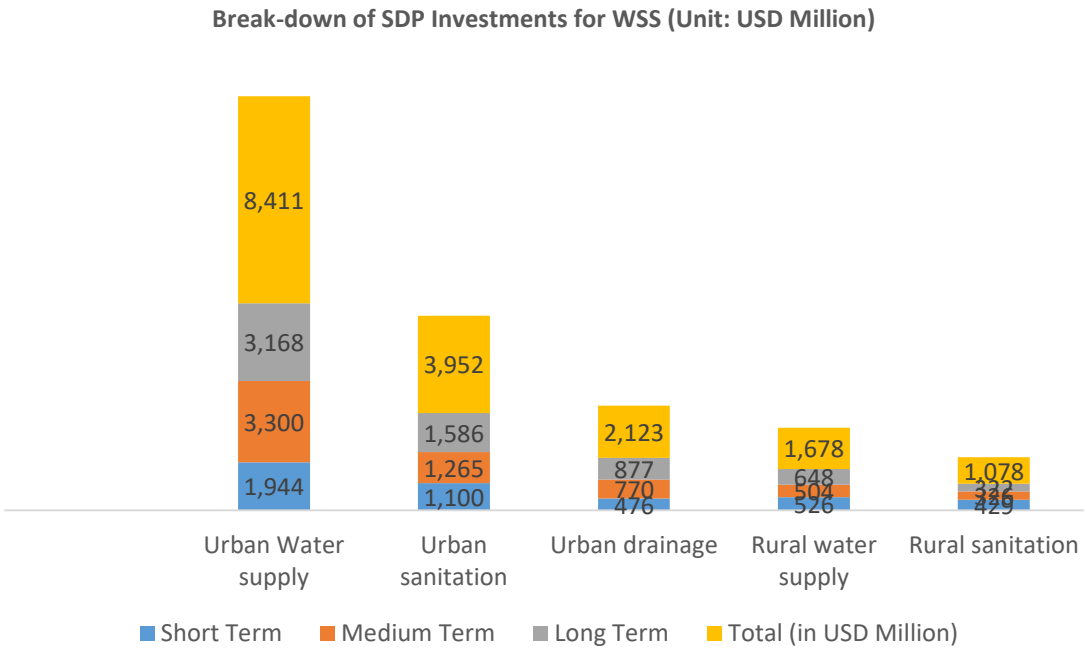


Figure 5.1: Break-down of SDP Investments in Water Sector (Water Supply and Sanitation)

According to 7FYDP, 2% of national budget will be allocated for investments in the Delta plan. The document mentions that the World Bank and the ADB are now facilitating potential support for Bangladesh from the Green Climate Fund. The Bangladesh Delta Plan 2100 also includes proposal for eight projects for possible support by this Fund.

The proposed 20.9 billion USD for Water Sanitation and Drainage is segregated to be funded 80% by the government and rest 20% from private sector and development partners.

Tendering/procurement of projects relevant for the Dutch water sector

Tendering guidelines and principals for all companies (local or foreign) are the same. However, procurement practices often lack transparency and are usually coupled with significant bureaucratic burden. Under the Private Sector Investment program (PSI), subsidies are available for Dutch and foreign companies entering into long-term cooperation with local partners in developing countries.

For dredging, tenders can be issued by Bangladesh Inland Water Transport Authority (BIWTA) and Bangladesh Water Development Board (BWDB). Almost 20% of tenders are e-tenders that can be applied electronically. Although evaluation of tenders is expected to be based on price competitiveness, in reality, non-transparent means such as nepotism and bribery are prevalent. The current trend for foreign companies engaging with the project are either through co-bidding with a local partner or, bidding in only donor funded development projects which have stringent protocols.

One notable finding was that the Land, Infrastructure, Transport and Tourism Ministry of Japan, and the Public Private Partnership (PPP) Authority of Bangladesh are working to float a joint public private project management platform (Contract signed in 2018). Japan will invest in Bangladesh's infrastructure projects under this new arrangement which will allow Japanese companies to work under the government-to-government system without participating in any bidding.

It should be noted that, India when providing their Line of Credit, in accordance with the “Make in India” policy of Indian prime minister Modi, which specifies that under the line of credit a minimum of 75 percent of goods and services needs to be of Indian origin; adheres to this condition and tendering has to be limited to Indian companies for implementing projects financed from the government loans. Similar conditions are also given for Chinese loans that tendering of projects must only include Chinese companies.

A LIST OF CURRENT TENDERS IN THE PUBLIC SECTOR AND JOINT TENDER PROJECTS WITH GOVERNMENT AND IFIs ARE GIVEN IN ANNEX IV.

6. Recommendations

With Bangladesh aspiring to become a middle-income country within 2030, the development requirements and landscape of the country is shifting in the water sector from WaSH related project interventions to large infrastructure, policy and governance projects. Netherlands can align with this shifting funding by establishing their leadership in the policy and governance of Water Sector initiatives of Bangladesh. While the Delta plan was funded and the initial implementation of projects under the Delta Plan are prioritized by the Netherlands which are currently being funded by the WorldBank and Government of Bangladesh, it should be noted that the possibilities of leveraging the Delta Plan initiative can go beyond mere project implementation.

The Delta Plan for Bangladesh is an example of policy transfer and highlighting such policy transfer initiatives can contribute to the marketing of Dutch Leadership in the water sector on a global scale. Since, Bangladesh and Netherlands are hydrologically, economically and geographically different, direct policy implementation is not feasible. Rather policy transformation such as the Delta Plan initiative can be a way forward for developing countries like Bangladesh.

Some of the strategic recommendations of the study include-

1. For successful implementation of water projects, the mindset of the stakeholder need to be changed from water Development to Water Management i.e. not only focusing on constructing large value infrastructure projects but emphasizing on holistic management including O&M and future sustainability through institutionalizing project-based initiatives.

2. One of the constraints in the current ecosystem preventing the sustainable implementation of the initiatives is the existing practices in the Water Sector and one important step recommended by key experts was restructuring of the Water Development Board.

3. In the training and capacity development initiatives, senior government representatives are sent for foreign tours, which have limited effectiveness since being seniors they have fewer years left (sometimes less than 2-3) to implement their knowledge regarding Dutch expertise. The current mix of government officials should include ample number of influential and young government officials who can promote Dutch expertise.

In the private sector, no generalized recommendations can be made since each industry varies in their characteristics and trends. A summary of the findings according to priority is provided below-

1. In the private sector, opportunities primarily lie in the dredging sector. As mentioned previously, Bangladesh suffers from an estimated 1.2 billion tonne of slit sedimentation in her rivers and dredging will be a key component of river management in future years. With an estimated 100+ dredgers currently present in Bangladesh, the need for accessory equipment and training of manpower for operating these dredgers will become vital. Complementary with river dredging are river training and land reclamation projects and equipment.

2. The export-driven industries such as RMG and leather are being more environmentally compliant in their factories by adhering to global standards and preserving their brand image. Ready Made Garments and

Textile is the largest industry of Bangladesh employing an estimated 4.2 million workforce and earning more than USD 30 billion per year. From manufacturing perspective, ready-made garments such as knit and woven are not water-intensive and apart from some sweater factories producing waste water, most of Ready Made Garments produce solid waste. On the other hand, textile is a water intensive industry due to the dyeing component in production. From the perspective of the heavy workforce employed in garments or RMG factories, water for drinking and sewerage treatment plant (STP) can be potential areas. Technologies which can produce electricity from STP are more lucrative for factory management as they provide an inbuilt business case for their factories in terms of cost minimization. (Source: KII Interview-Sustainability Manager, DBL Group)

3. Leather tanneries currently use water as part of processing leather from raw hide. Currently, tanneries on average, use 38,000 liters of water for processing a tonnes of raw hide. According to Tanner's association, water consumption can be reduced to 24,000 liters per tonnes of hide, using more efficient equipment like tanning drums. Majority of the tanners have moved to the leather industrial park in Savar, which has a Centralized Effluent Treatment plant (CETP). Tanners have to pay CETP usage charges based on their dissipation level. Hence, adopting efficient equipment would reduce tanners' effluent treatment charges.

4. One of the recent Sanitation highlights is The Institutional and Regulatory Framework for Faecal Sludge Management-2017. After providing access to sanitation, sanitation management is the next tier of development agenda. In near future, all municipalities will need to make a Fecal Sludge Management facility. Currently there are 313 municipalities in Bangladesh and only 13-14 of them have FSM facilities. Since the framework for Fecal Sludge Management was constructed by SNV Netherlands, there is potential for Dutch Private Sector Companies to engage in FSM related infrastructure and equipment in future.

5. In the Real Estate Sector and Water-Sanitation equipment and accessories (including Drinking Water and Fecal Sludge management), the local industries dominate the current product market. For example, 95% of rural water supply is dependent on tubewells and local conglomerate RFL is the market leader dominating the industry through cost competitiveness. For pipes, valves, switches and other accessories, local industries will always have the advantage of price. The way forward for Dutch Private Sector companies is through Joint-Venture initiatives which combine the local cost competitiveness and Dutch expertise. The vision should also be not limited to the Bangladesh context and instead should aim for additional export to African countries with similar markets.

6. Opportunities for environmentally friendly shipyards and scrapyards have potential but also are subject to constraints such as lack of nearby accessory industries, the lack of a dock for building of large vessels of more than 50,000 tonne of volume etc.

Entry Strategies in Specific Segments

Sector	Stakeholders	Specific Action Points for Partnership for Water	Opportunity for Dutch Private Sector
Public Infrastructure	BWDB, LGED	• Provide investment (soft loans) for BWDB infrastructure projects regarding water supply and dredging; • With LGED, provide investment (soft loans) for small scale water supply, sewerage infra-structure projects; water desalination plants in coastal regions	• Advocate as a sourcing destination for infrastructure equipment and materials
Public Capacity building/TA	BWDB, LGED	• Arrange institutional capacity building programmes for BWDB; • capacity building training for LGED staff on small-scale water project maintenance, monitoring	• Engage private sector companies adept at providing skills training for technical topic (engineering design, O&M)
Policy-Governance	WARPO/ MoWR	• WARPO capacity development for coordination/ help in water sector policy formulation (policy transfer & transformation) • Promote integrated water management projects and institutionalize to create a centre of excellence, working as a permanent link.	• Policy formulation/transfer may not provide private sector opportunities or scope • The scope of appointing Dutch consultants and project management specialists for integrated water management projects
Dredging	Public sector companies-DBL, Bangla dredgers, Basundhara	• Dredging is a priority area of the government, however import of dredgers will become saturated quickly due to the high number of dredgers currently being bought by Bangladesh conglomerates.	• Opportunity lies in import of dredgers as well as providing technical assistance for equipment and capacity building of staff for dredger operations and maintenance.
Textile Companies	BGMEA/ BTMEA MoJT/BTMA	• Use PaCT as an entry point to promote Dutch technologies. • Participate in current trade fairs regarding water	• Connect to factories in PaCT database that are interested in adopting water efficient tefchnologies

		technologies and organize exclusive trade-fairs to promote Dutch technologies	• Showcase Dutch technologies in jointly arranged trade-fairs with business case.
Leather Tanneries	BTA, LGMEAB	• Do piloting to find any areas of collaboration with Associations. • Supply of production equipment (tanning drums that can have water efficiency or water saving capabilities).	• Arrange workshop/seminar with the tanneries to promote water-efficient technologies along with a business-case
Urban sewerage	DWASA/ CWASA/ Municipalities	• Use SNV Netherlands as an entry-point for Faecal Sludge Management infrastructure for local government WASA or municipalities	• Source materials, accessories and human-resources for construction of FSM infrastructure
Urban water supply	Municipalities in the South/NGOs	• Provide water-supply solutions (e.g. centralized desalination plants)	• Provide equipment and technologies relevant to water desalination plants
Shipbuilding or Environmental Scrapyard	Western Marine, High speed shipbuilders Ltd., Khulna Shipyard	• Promote the formation of a joint-venture by allowing access to funds and accessory technologies and influence government policies to boost favourable policies	• Having a joint-venture initiative with a local company which has existing infra-structure. However, this is a capital intensive industry and the lack of supporting industries make opportunities limited.
Real Estate Companies	Basundhara, Alliance Group Navana, Ananta Amin Mohammad group etc.	• Arrange trade-fairs and seminars to promote complete technology solutions that provide a business-case (e.g. water recycling that can be used again or, renewable energy solutions integrated with the design etc.)	• Targeting real estate developers in expanding cities such as Khulna, Dhaka, Chittagong, Rangpur along with their satellite hubs such as Narayanganj, Norshindi, Gazipur in case of Dhaka where apartment blocks or commercial condominiums are being constructed.
Water supply Hardwares Market	PRAN-RFL, ACI, Bengal Group	• Promote collaboration for Joint-venture companies by allowing favourable policies.	• Currently domestic companies existing who produce at a cheaper rate. Entry strategy would be a Joint-venture with an existing local company using their distribution channels.

Annex I: List of Key Informants

Table 7.1: Key Informant Interviews with stakeholder name and type

Sl.	*Stakeholder*	*Type*	*Person Interviewed*
1	**BGMEA(Bangladesh Garments Manufacturers Association)**	Garments Association	Mohammad Monower Hossain Senior Deputy Secretary
2	**Dulal Brothers Lim.**	Garments Player	Mohammad Zahidul Islam Sustainability Manger
3	**Ecotex**	Garments Player	Mr. Anis Rahman Managing Director
4	**Specialist – Effluent Treatment Plants**	Sector Expert	Mr. Md. Abdubakar Ahmed CEO Eco Aid Foundation
5	**Planning Commission, General Economic Division**	Government Entity	Murtuza Zulkar Naim Noman Senior Assistant Chief & Assistant Project Director Bangladesh Delta Plan 2100 Formulation Project
6	**Mercantile Marine Department**	Government Entity	Md. Shafiqul Islam Principal officer
7	**Mongla Port Authority**	Government Entity	Mr. Fokrul islam Chief Hydrographer
8	**BADC (Bangladesh Agricultural Development Commission)**	Government Entity	Md Ferdousur Rahman Chief Engineer (Planning)
9	**BEZA (Bangladesh Economic Zones Authority)**	Government Entity	Dr. M. Emdadul Haque Executive Member (Planning)
10	**BEZA (Bangladesh Economic Zones Authority)**	Government Entity	Shakil Ahmed Environmental Specialist
11	**EuroConsult Mott Macdonald**	International Consulting Firm	Ben Witjes Country Director
12	**CEGIS (Center for Environment and Geographic Information Services)**	Water Research Organization	Malik Fida A Khan Deputy Operations Director

13	**PaCT (Partnership for Cleaner Textiles)**	Donor funded Project	Mohammad Zahin Rahman Operations Analyst, IFC
14	**2030 Water Resources Group**	World Bank Project	Javed Bin Karim Senior Advisor
15	**DWASA (Dhaka Water and Sewerage Authority)**	Government Entity	Bojwwin Stark Resident Project Manager
16	**Blue Gold Project**	Donor funded Project	Bart Brookhuis Water management Consultant
17	**IHE Delft**	Netherland-based Water Research Institute	Shahinoor Hasan Researcher
18	**REHAB (Real Estate and Housing Association of Bangladesh)**	Real Estate Association	Alamgir Alamin President
19	**IWM (Institute of Water Modelling)**	Water Research Organization	Abu Saleh khan Deputy Executive Direction
20	**Specialist- Wastewater in Textile**	Industry Expert	Dr. Mohidus Samad Khan Department of Chemical Engineering BUET
21	**Specialist- Water and Flood Management**	Industry Expert	Dr. Shahjahan Mondal Institute of Water and Flood Management BUET
22	**Specialist- Inland water transport and dredging**	Government Entity	Dr. Reaz Ahmed Professor, MIST Ex-Director BIWTA (Bangladesh Inland Water Transport Authority)
23	**Aqua Mineral**	Private Sector	Rajib Matin Director Aqua Minerals Ltd.
24	**Bangladesh Tanners Association**	Association	Md. Shaheen Ahamed Chairman Bangladesh Tanners Association
25	**Samota Leather Complex Ltd.**	Private Sector	Md. Mizanur Rahman Managing Director

			Samota Leather Complex Ltd.
26	**Shipbuilders Association Bangladesh**	Association	Haidul Karim Khan Director Shipbuilders Association Bangladesh
27	**Specialist**	Industry Expert	Dr. Ainul Nishat Water Sector Specialist Professor Emeritus, BRAC University
28	**Red Cross International**	Sector Expert	Ahsan Habib Wathab Engineer and Sanitation Expert International Society for Red Cross (ICRC)
29	**Specialist**	Sector Expert	Nirjhor Rahman Ex- Country Lead, Water Sanitation for Urban Poor (WSUP)
30	**Square Pharmaceuticals**	Private Sector	Abdullah Al Mizan Senior Officer R&D
31	**SS Rahman Dredger Ltd.**	Private Sector	Iqbal Siraj COO (Chief Operating Officer)

Annex II: List of G2G development Projects

Table 7.2: Notable development projects under China, India, Germany, Japan

Sl.	Country	Project	Value (USD)
1	China	two Power plant projects (1320 megawatt thermal power plant in Patuakhali's Payra and a 1320 MW coal-fired power plant in Chittagong's Banshkhali)	USD 3 billion
2	China	Padma Bridge rail link	USD 3.10 billion
3	China	Info Four network including Development of National ICT Infra-Network for Bangladesh Government Phase-iii" (Info-Sarker) project	USD 1.56 billion
4	China	BTCL (modernization of telecommunication network for "digital connectivity" i.e. connecting 2,250 unions with the upazilas concerned through optical fiber cables and set up business process outsourcing (BPO) centers)	USD 1.60 billion
5	China	installation of a single point mooring (SPM) with double pipelines which will enable crude and finished petroleum products to be directly taken to the Eastern Refinery in Chittagong's Patenga from deep sea these two pipelines	USD 5.00 billion
6	China	Padma Bridge Project	USD 3.7 billion
7	China	Padma (Jasholdia) Water Treatment Project (Expected date of completion: 2019)	USD 426.3 million
8	China	primary infrastructure and facilities at Payra Sea Port (Expected date of completion: 2020)	USD 137.3 million
9	China	expansion and modernization of Mongla Port facilities (Expected date of completion: 2021)	USD 249 million
10	China	Rajshahi WASA surface water treatment plant (Expected date of completion was 2015, but delayed)	USD 350.6 million
11	China	24-km Dhaka airport-Ashulia evelated expressway	USD 1394 million
12	China	Joydebpur to Ishwardi dual gauge rail track and Joydebpur-Mymensingh dual gauge rail track	USD 753 million and USD 258 million
13	China	Marine dirve expressway, coastal protection work from Shitakundu to Coxs Bazar	USD 2856 million
14	Germany	Climate change adaptive drinking, water resources management Dhaka (Saidabad Water Treatment Plant Project, Phase III)	USD 103.4 million
15	Japan	JICA is working on water resources development project phase-II (Expected date of completion: March, 2023)	Value is USD 105.5 million as part of the loan agreement of USD 1.59 billion

16	Japan	Sea-port and power plant in Matarbari with JICA and a consortium of three firms- Sumitomo, Toshiba and IHI (Expected date of completion: July, 2024)	USD 4.6 billion
17	India	Brahmaputra dredging (Sanctioned July, 2017)	USD 54.4 million
18	India	Upgrade 245km of road stretches in three major highways – Benapole-Jessore-Narail-Bhanga, Ramgarh-Baruerhat, and Moynamoti-Brahmanbaria-Sarail – to provide transit facilities to Indian trucks	
19	India	Upgrade of Chittagong and Mongla seaports under the transit and transshipment agreement	
20	India	Construction of new dual-gauge rail line between Bogra and Sirajganj	
21	India	Development of Saidpur airport in Nilphamari	
22	India	Development of two economic zones for investors	USD 100 million for EZ in Mirsarai, Chittagong and USD 100 million for EZ in Moheskhali.
23	India	Installation of 100,000 LED lights in Dhaka, Chittagong and Rajshahi	
24	India	Development of 765 KV interconnected power transmission network	
25	Japan	Matarbari Ultra Super Critical Coal-Fired Power Project, two 600MW power plants will be built to generate 7,865GWh of electricity per year (Expected date of completion: 2026) Part of 39th ODA signed in 2018	USD 599.7 billion
26	Japan	Dhaka Mass Rapid Transit Development Project (urban rail network aiming to eliminate traffic congestion by providing transportation to over 570,000 people every day) (Expected date of completion: 2024) Part of 39th ODA signed in 2018	(Line 5) USD 65.6 million (Line 6) USD 706.4 billion
27	Japan	Jamuna Railway Bridge Construction Project Part of 39th ODA signed in 2018	USD 311.6 billion
28	Japan	Matarbari Port Development Project (E/S) Part of 39th ODA signed in 2018	USD 23.6 billion
29	Japan	Health Services Strengthening Project Part of 39th ODA signed in 2018	USD 58.4 billion
30	Japan	Hazrat Shahjalal International Airport Expansion Project	USD 687.6 billion

		Part of 38th ODA signed in 2017	
31	Japan	The Kanchpur, Meghna and Gumti 2nd Bridges Construction and Existing Bridges Rehabilitation Project Part of 38th ODA signed in 2017	USD 471.9 million
32	Japan	Dhaka Mass Rapid Transit Development Project (Line 1) Part of 38th ODA signed in 2017	USD 5.05 billion
33	Japan	Matarbari Ultra Super Critical Coal-Fired Power Project Part of 38th ODA signed in 2017	USD 69.16 billion
34	Japan	Dhaka Underground Substation Construction Project Part of 38th ODA signed in 2017	USD 183.2 billion
35	Japan	Small Scale Water Resources Development Project (Phase 2) Part of 38th ODA signed in 2017	USD 106.07 billion

Annex III: List of different Economic zones with their status

Table 7.3: List of Export Processing Zones, Non-Government Economic Zones and Science and Technology Based Economic Zones

Type	Names	Comment
Non-Government Economic Zone	Meghna Industrial Economic Zone (Under Construction)	Non-government zones hold higher potential since comparatively lower entry barriers for promoting technologies.
	Meghna Economic Zone (Under Construction)	
	Fomcom non-governmental Economic Zone (Proposed)	
	A.K.Khan non-governmental Economic Zone (operational)	
	Abdul Monem Economic Zone (operational)	
	Comilla Economic Zone (operational)	
	Garments industrial park (operational)	
	Sonargaon Economic Zone(operational)	
	PowerPac Economic Zone (Mongla)	
Export Processing Zone (EPZ) in Bangladesh	Adamjee Export Processing Zone	No opportunity since CETP are already operational under PPP-basis in these zones
	Chittagong Export Processing Zone	
	Comilla Export Processing Zone	
	Dhaka Export Processing Zone	
	Ishwardi Export Processing Zone	
	Karnaphuli Export Processing Zone	
	Mongla Export Processing Zone	
	Uttara Export Processing Zone	
	Rangunia Export Processing Zone (Proposed)	
Science and Technology based Economic Zone	Janata tower Software Park (Completed)	Limited opportunities since these industries are not production-based and more service-oriented industries requiring lesser industrial solutions for manufacturing or production (such as waste-water treatment plants and such)
	Jessore Software Technology Park (under construction)	
	Kaliakoir high tech park (Block development ongoing)	
	Keranigonj Special IT Economic Zone,Dhaka (Under construction)	
	Dhaka high tech park (proposed)	
	Khulna high tech park (proposed)	
	Rajhshahi high tech park (Land acquiring)	
	Sylhet Electronic City (Under Construction)	
	Sylhet high tech park (Land acquiring)	
	Chittagong high tech park (Land acquiring)	
	CUET IT business incubator centre, Chittagong (under construction)	
	Rangpur high tech park (Land acquiring)	
	Barisal high tech park (Land acquiring)	
	Mohakhali IT Village (Land acquiring)	

Table 7.3.2: List of Economic Zones under Construction

Economic Zone	Division	Status	Expected Completion Year
Sirajgong Economic Zone	Rajshahi	Under Construction	2019
Bagerhat Economic Zone	Khulna	Under Construction	2020
Mirsarai Economic Zone,	Chittagong	Under Construction	2020
Anowara (Gohira)	Chittagong	Under Construction	2021
Srihotto Economic Zone,	Sylhet	Under Construction	2021
Sripur Economic Zone (Japanese Economic Zone)	Dhaka	Under Construction	2019
Sabrang Special Economic Zone	Chittagong	Under Construction	2022
Agailjhara Economic Zone	Barisal	Under Construction	2022
Anowara Economic Zone-2,	Chittagong	Under Construction	2022
Jamalpur Economic Zone	Mymensigh	Approved	2024
Narayangonj Economic Zone	Dhaka	Under Construction	2021
Narayangonj Economic Zone-2 (Under construction)	Dhaka	Under Construction	2022
Bhola Economic Zone	Barisal	Under Construction	2020
Ashuganj Economic Zone (Under construction)	Sylhet	Under Construction	2022
Kustia Economic Zone	Khulna	Under Construction	2023
Panchagar Economic Zone	Rangpur	Under Construction	2024
Nilphamari Economic Zone (Under construction)	Rangpur	Under Construction	2022
Narshingdi Economic Zone	Dhaka	Under Construction	2022
Manikganj Economic Zone	Dhaka	Under Construction	2019
Dohar Economic Zone, Dhaka	Dhaka	Under Construction	2020
Habigonj Economic Zone	Sylhet	Under Construction	2021
Shariatpur Economic Zone	Dhaka	Under Construction	2021
Jaliardip Economic Zone,Teknaf-Cox'sbazar	Chittagong	Under Construction	2022
Natore Economic Zone	Rajshahi	Under Construction	2021
Maheskhali Economic Zone-1	Chittagong	Under Construction	2022
Maheskhali Economic Zone-2	Chittagong	Under Construction	2023
Maheskhali Economic Zone-3	Chittagong	Under Construction	2024
Cox'sbazar Free trade Zone (Maheskhali)	Chittagong	Under Construction	2023
Shariatpur Economic Zone-2	Dhaka	Under Construction	2024

Table 7.3.2: List of Economic Zones with location, size and status

Economic Zones	Region	Size (Acres)	Status
Meghna Economic Zone	Narayangonj	245	Under Construction
Meghna Industrial Economic Zones	Narayangonj	80	Under Construction
Meghna Economic Zone-2	Comilla	102	Under Construction
AK Khan Economic Zone	Narshingdi	200	Under Construction
Abdul Monem Economic Zone	Munshiganj	216	Under Construction

Graments Industrial Park (BGMEA owned)	Gazaria	532	Under Construction
PowerPac Economic Zone	Mongla	205	Under Construction
Sirajganj Economic Zone	Sirajganj	1035	Proposed
Sonargaon Economic Zone	Narayanganj	300	Proposed
Comilla Economic Zone	Comilla	270	Proposed
East Coast Group Economic Zone	Habiganj	150	Proposed
City Special Economic Zone	Dhaka	115	Proposed
Fomcom Economic Zone	Bagerhat	80	Proposed
Magura Group Economic Zone	Narayanganj	52	Proposed
Jaj Bhuiyan Economic Zone	Narayanganj	40	Proposed
Karnaphuli Dry-Dock Economic Zone	Chittagong	20	Proposed

Annex IV: List of Recent tendering projects

Table 7.4.1: List of Government Tendering Projects (Till October 10, 2018)

Category	Ministry/Division	Agency	Funding Information	Package Name
Water Treatment	Ministry of Shipping	Mongla Port Authority	Non_Development GOB	Expression of Interest of surface water treatment Plant of ongla Port Authority.
Water Treatment	Ministry of Shipping	Chittagong Port Authority	Own Funds	Operation & Maintenance of Desalination & Water Treatment Plant including Supply of Chemicals and Spares Parts at CPA.
Water Treatment	Ministry of Health and Family Welfare	Directorate General of Health Services (DGHS)	Non_Development GOB	Medical Equipment-(OT-ICU) Air Conditioning System, AVR, Water treatment Plant
Water Treatment	Ministry of Home Affairs	Bangladesh Police	Non_Development GOB	1. Spares of Water Treatment Plant, 2. Spares of Generator, 3. Spares for Refrigerator Container & Tools. 4. Minor Engineering (Carpentering) Items. 5. Minor Engineering (Plumbing) Items
Dredging	Ministry of Shipping	Mongla Port Authority	Development Budget GOB	Dredging at the Food Silo Area in Harbour Channel of Mongla Port
Dredging	Ministry of Shipping	Chittagong Port Authority	Own Funds	
Dredging	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget GOB	Procurement of Amphibious Excavator with cutter suction dredging attachment 05(five) sets
Dredging	Ministry of Shipping	Bangladesh Inland Water transport Authority (BIWTA)	Non_Development GOB	Dredging with ancillary works on River Routes.
Dredging	Ministry of Shipping	Mongla Port Authority	Development Budget GOB	Supply of 01 (one) no. high speed boat for the project Dredging at the Outer Bar in the Mongla Port Channel
Dredging	Ministry of Shipping	Chittagong Port Authority	Own Funds	Supply and Installation of Highmast,Light Fittings etc. for Electrification in Newly constructed 400 Meter Lighterage Jetty under Capital Dredging Project at Sadarghat of CPA
Dredging	Ministry of Shipping	Mongla Port Authority	Non_Development GOB	Supply of 01 no. high speed boat for the project dredging at the outer bar of Mongla Port Authority.
Dredging	Ministry of Shipping	Mongla Port Authority	Development Budget GOB	Supply of 01 no. high speed boat for the project dredging at the outer bar of Mongla Port Authority.
Dredging	Ministry of Shipping	Bangladesh Inland Water transport Authority (BIWTA)	Non_Development GOB	Dredging with ancillary works on River routes.
Dredging	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget GOB	Procurement of Amphibious Excavator with cutter suction dredging attachment 05(five) sets
Dredging	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget GOB	Procurement of 12 Dredger and Ancillary equipments with accessories
Climate Change	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget Grant/Credit	Bangladesh Weather And Climate Services Regional Project Component-B : Strenthening Hydrological Information Services & Early Warning Systems.
Land reclamation	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget GOB	The pilot project in different areas of Bangladesh using Bamboo Bandaling Structures to reduce river erosion, land reclamation and increase navigation, River Research Institute, Faridpur.
Dredging	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget GOB	Procurement of Amphibious Excavator with cutter suction dredging attachment 05(five) sets
Dredging	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget GOB	Procurement of Fork lifter 03(three) sets

Table 7.4.2: List of Joint Government Tendering Projects with IFIs (Till October 10, 2018)

Category	Ministry/Division	Agency	Funding Information	Development Partner	Package Name
Dredging	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget Grant/Credit	IDA (World Bank)	Procurement of Systems for Morphological Survey (1) 15 Handheld TDS; (2) 12 RTK GPS (3) 6 DGPS beacon receiver (4) 8 total stations (5) 4 first order digital leveling machine (6) 2 Sub-bottom profiler.
Irrigation	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget Loan	Asian Development Bank	Farmer's Distribution System, Stage- 3: 5025 ha of Buried Pipe Systems, with Pump and Tele Prepaid Meters for Muhuri Irrigation Project under Irrigation Management Improvement Project) (Package No. CW-06, ICB)
Irrigation	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget Loan	Asian Development Bank	Farmer's Distribution System, Stage: 2: 5400 ha of buried pipe systems, with Pump and Tele Prepaid Meters for Muhuri Irrigation Project under Irrigation Management Improvement Project) (Package No. CW-05, ICB)
Infrastructure	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget Loan	Asian Development Bank	"Turn Key Contract (A) Construction of 1X10/14 MVA, 33/11 KVA Indoor Type Sub-Station and (B) Upgrading of Electrical Distribution (HT, LT Over Head Line) System"
Climate Change	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget Grant/Credit	IDA, World Bank	Bangladesh Weather and Climate services Regional Project Component-B: Strengthening Hydrology Information Service & Early Warning System
Climate Change	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget Grant/Credit	IDA, WB	Bangladesh Weather And Climate Services Regional Project Component-B : Strengthening Hydrological Information Services & Early Warning Systems.
Climate Change	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget Grant/Credit	IDA, WB	Bangladesh Weather And Climate Services Regional Project Component-B : Strengthening Hydrological Information Services & Early Warning Systems.
Climate Change	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget Grant/Credit	IDA, WB	Bangladesh Weather And Climate Services Regional Project Component-B : Strengthening Hydrological Information Services & Early Warning Systems.
Dredging	Ministry of Water Resources	Bangladesh Water Development Board (BWDB)	Development Budget Grant/Credit	Asian Development Bank (ADB), Government of the Netherlands	Re-excavation of 4.350 km of Kuchiamora Khal from km 0.000 to km. 4.350 in C/W KalidasKhali-Arpara Sub-Project under SWAIWRPMP-AF during the year 2017-2018 & 2018-2019.

Annex V: Market Size Estimates for Textile and Leather Industry

Total Addressable Market for Textile factories

Assumption List for calculation of Market Size for ETP

- A top-down approach is used to calculate the Total Addressable market for different technologies
- Data from published articles and Key Informant Interviews is used
- Top tier factories are defined as more than 2,000 workers and 1,000 kg production/day and mid-tier factories are defined as with 500-1,500 workers and average 500 kg production/day
- Of the target group (SAM), 10% is assumed to be early adpoters and 40% is assumed to be late adpoters

Factor	Parameter	Percentage (%)	No. of Factories
TAM (Total Addressable Market)	Total Factories	100%	**2,500**
SAM (Served Available Market)	**High tier factories And Mid-teir factories**	60% of total factories[1]	**1,800**
SOM-1 (Serviceable Obtainable Market)	**Early Adopters (Top-tier factories who will expand their business)**	10% of total	**180**
SOM-2 (Serviceable Obtainable Market)	**Late Adopters (Mid-teir factories who will upgrade their business)**	40% of total	**450**

1. *Source:* 2030 WRG, *An analysis of industrial water use in Bangladesh,* (2015)

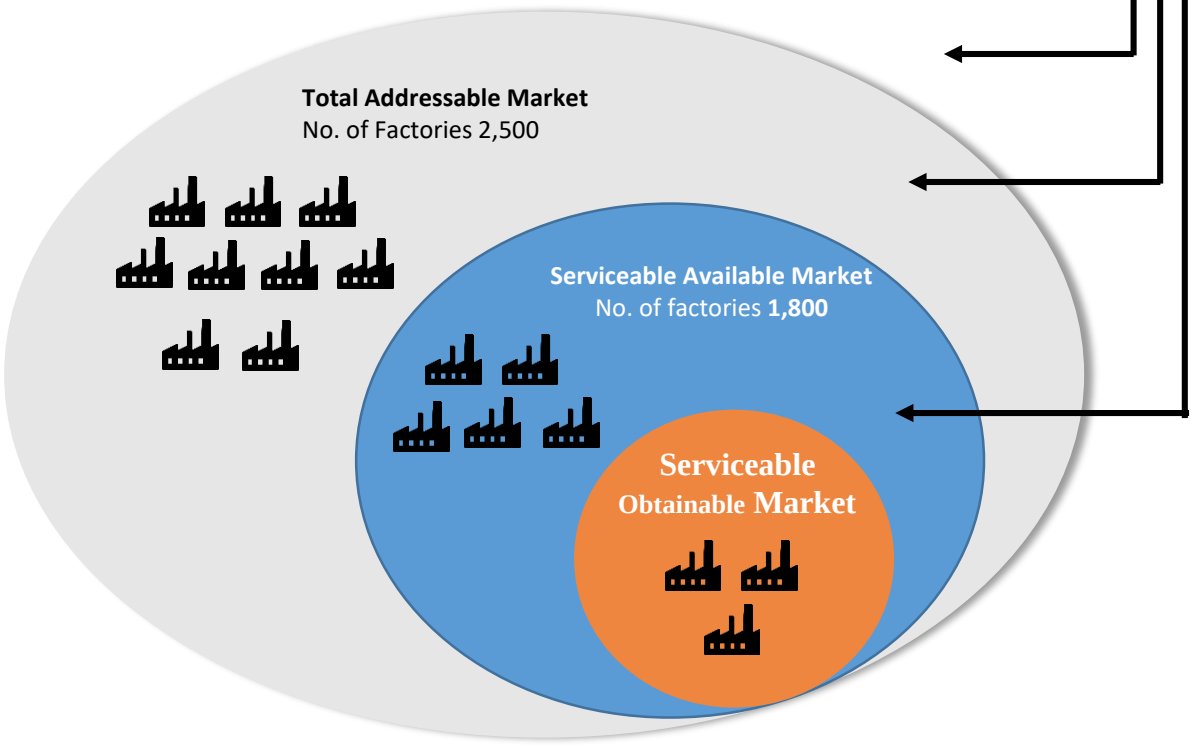


Figure: Total Addressable Market for ETP

Calculation for target market for ETP

Market size is determined by multiplying the size of the target market with the average value of the ETP and estimated percentage of target market in each tier to find the total estimated market.

Technology for wastewater treatment- ETP				
Factor	Parameter/Unit	Amount		
		SOM-1 (Top-tier expanding)	**SOM-2 (Mid-tier upgrading)**	**Total**
Serviceable Obtainable Market (SOM)	Factory	180	450	630
Average Value of ETP[1]	USD	477,000[1]	120,000[2]	-
Total Estimated market	USD	85,860,000	54,000,000	139,860,000

1,2 Data from interview of garments factories and ETP expert

Assumption List for calculation of Market Size for STP

- A top-down approach is used to calculate the Total Addressable market for different technologies
- Data from published articles and Key Informant Interviews is used
- Of the Total, currently 60% of factories are assumed as top-tier and mid-tier with an intention to buy STPs
- Of the factories who will purchase STPs, two groups are assumed, 20% as early adpoters and 40% as late adpoters, and the rest 40% is assumed to not purchase STPs

Factor	Parameter	Percentage (%)	No. of Factories
TAM (Total Addressable Market)	Total Factories	100%	**2,500**
SAM (Served Available Market)	**High tier factories And Mid-teir factories without STP**	60% of total factories	**1,800**
SOM-1 (Serviceable Obtainable Market)	**Top-tier factories who are early adpoters**	20% of SAM	**360**
SOM-2 (Serviceable Obtainable Market)	**Mid-teir factories who are late adpoters**	40% of SAM	**720**

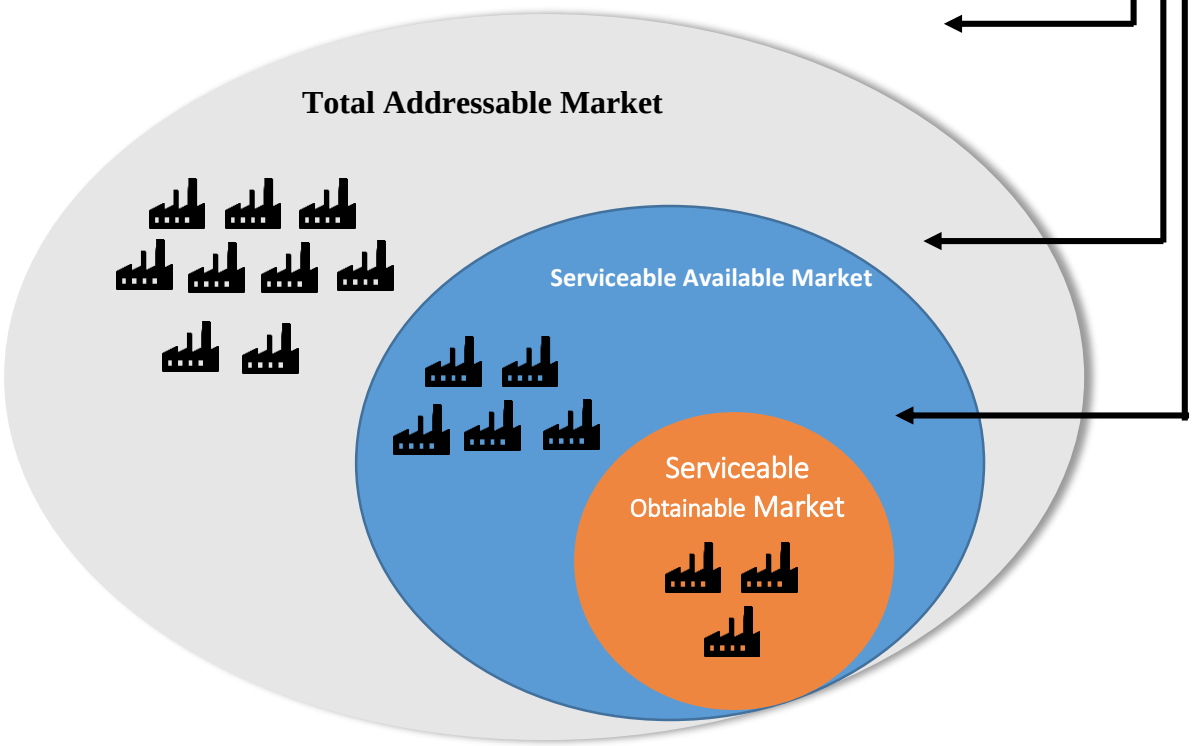


Figure: Total Addressable Market for STP

Calculation for target market

Market size is determined by multiplying the size of the target market with the average value of the ETP and estimated percentage of target market in each tier to find the total estimated market.

Technology for Sewerage Treatment- STP				
Factor	Parameter/Unit	Amount		
		SOM-1 (Top-tier expanding)	**SOM-2 (Mid-tier upgrading)**	**Total**
Serviceable Obtainable Market (SOM)	Factory	360	720	1080
Average Value of ETP[1]	USD	20,000[1]	8,000[2]	-
Total Estimated market	USD	7,200,000	5,760,000	13,960,000

1. *Since top tier factories have more than 10,000 workers, the STP is of higher capacity*
2. *Mid-tier factories have relatively lower number of workers than high-tier, having a smaller sized STP*

Total Addressable Market for Leather Tanneries

Assumption List for calculation

- A top-down approach is used to calculate the Total Addressable market for different technologies
- Data from published articles and Key Informant Interviews is used

Factor	Parameter	Percentage (%)	No. of Tannaries
TAM (Total Addressable Market)	Total Tannaries	100%	**165**
SAM (Served Available Market)	**Tanneries with inefficient tanning drums**	70% of total[1]	**124**
SOM-1 (Serviceable Obtainable Market)	**High-tier tanneries**	20% of total[2]	**25**
SOM-2 (Serviceable Obtainable Market)	**Mid-end tanneries**	50% of total	**99**

1,2 Key informant interview, Bangladesh Tanners Association

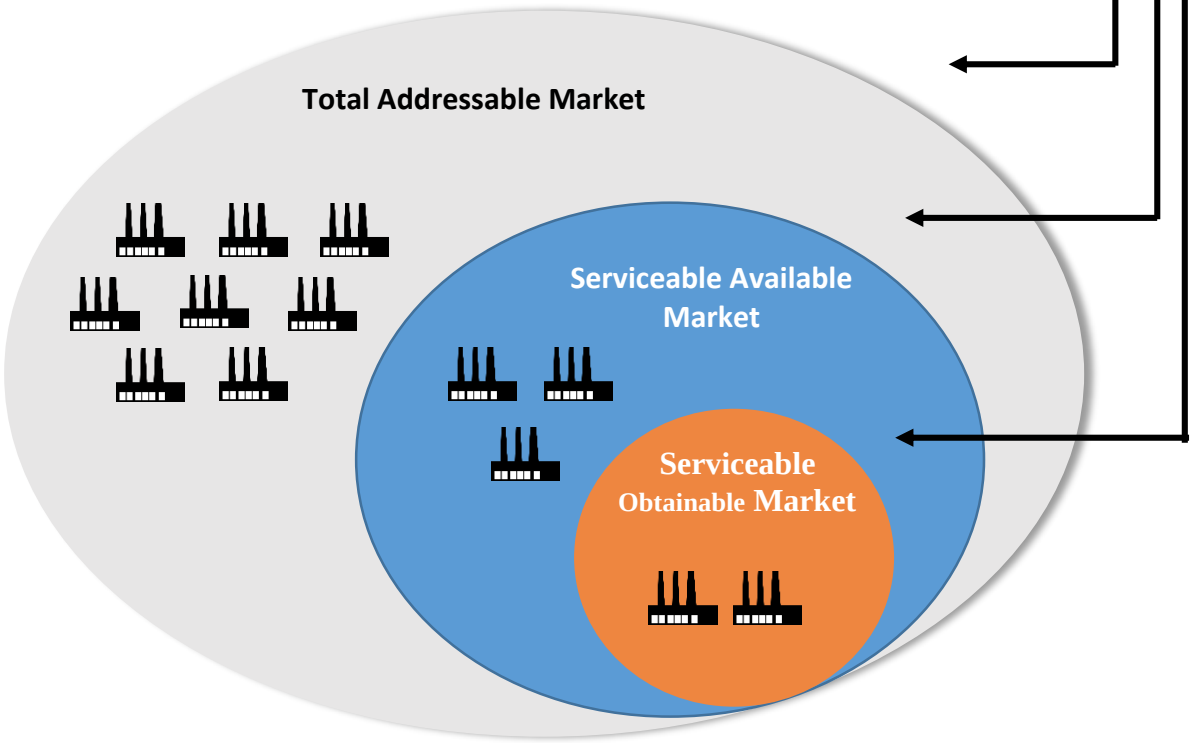


Figure: Total Addressable Market for High Income Consumers

Calculation for target market

Market size is determined by multiplying the size of the target market with the average value of the ETP and estimated percentage of target market in each tier to find the total estimated market.

Technology for Water Production- Tanning drum				
Factor	Parameter/Unit	Amount		
		SOM-1	**SOM-2**	**Total**
Serviceable Obtainable Market (SOM)	Tannery	25	99	124
Average Value of Tanning drum[1]	USD	50,000[1]	10,000[2]	-
Total Estimated market	USD	1,250,000	9,900,000	11,150,000

1,2 Data from interview of garments factories and ETP expert

Annex VI: List of Local RMG & Textile Companies, Tanneries and Water Technology Solution Providers

List of Top Ten Garments Companies

Sl.	Name	Type of Products	No. of Factories
1	*Hameem Group*	Lady's T shirt, Sweatshirt, Cardigan, knitted bottom, CRITICAL CARGOS, HI-FASHION DENIM JEANS, BASIC AND HIFASHION WASHES, Sweaters and Jumpers	23 factories in Bangladesh
2	*Asian Apparels Ltd*	Pants and shorts – Casual, Robes, Caftans, Skirts, Skorts, Sleepwear,Tops, Shirts, Blouses, Men's & Boys Swim trunk, Knit Top & BTM Woven Top & Bottom, Boxers, Pants, Shorts-Casual, Skirts, Skorts, Sleepwear	14 Factories in Bangladesh
3	*Babylon Group*	woven wear manufacturing, knit wear manufacturing, washing plant, printing house, knitting unit, dyeing and finishing of knitted fabrics, embroidery, trims manufacturing, paper converting and packaging	10 factories in Bangladesh
4	*Epyllion*	Men's knit Polo/T shirt, Sweatshirt, Cardigan, knitted bottom, Boy's knit Polo/T shirt, Sweatshirt, Cardigan, Lady's T shirt, Sweatshirt, Cardigan, knitted bottom, Girl's knit Polo/T shirt, Sweatshirt, Cardigan Kid's & Baby's knit Polo/T shirt, Sweatshirt, Cardigan	10 factories in Bangladesh
5	*Givensee Group of Industries Ltd*	Knitwear, Sweater and Woven - T-shirts, Polo shirts, Tank Top, Vest, Jackets	5 factories in Bangladesh
6	*Apex Lingerie Ltd*	Mould Bra, Padded Bra, Wire Bra, Shapewear Bra, Bandeau Bra, Soft Bra, Shorty Panty, Thong Panty, String Panty	1 Factory in Bangladesh
7	*Square Fashions*	Polo Shirts, T-Shirts, Tank Top, Trousers, Hooded Jacket & Cardigan, Sports Wear, Undergarments, Men's & Ladies Fashions Wear, Kids Wear)	Total of 5 factories two focused on RMG and the rest in Textile manufacturing - vertically integrated
8	*Viyellatex Group*	Boy's/Ladies/Men's/Kids knit Polo/T shirt, Sweatshirt, Cardigan	10 factories in Bangladesh
9	*Golden refit garments ltd*	Mens shorts, Ladies full zip, Kids t shirt and nightwear,	1 Factory in Bangladesh
10	*Divine Group*	T-Shirt, Sport T-Shirt, All Kind of Sleeping Suits	11 Factories in Bangladesh

List of Large Tanneries (Provided by Bangladesh Tanners Association)

Sl.	*Name of Company*	Type of Product	Type of Product	Contact Address
1.	Anjuman Trading Corporation Ltd.	Crust & Finished Leather	Md. Shaheen Ahamed Managing Director	Plot no: ZE-28, Tannery Industrial Estate Savar, Dhaka. 01711522288 universalpellis@gmail.com
2	Salma Tannery Ltd.	Crust & Finished Leather	Md. Sakawat Ullah Managing Director	Plot no: ZE-2, Leather Industrial Area, Horindora, Hemayetpur, Savar, Dhaka. 01727094988 salmatannery12@gmail.com
3	Ahsan Habib & Brothers	Crust & Finished Leather	Md. Mizanur Rahman Proprietor	Plot no: ZE-4, Leather Industrial Area, Horindora, Hemayetpur, Savar, Dhaka. 01535475155
4	A. B. S Tannery Ltd.	Crust & Finished Leather	Md. Emam Hossain Managing Director	Plot no-YS-9, Leather Industrial Area, Jhowchar, Savar, Dhaka. 01710978509
5	Samata Leather Complex Ltd.	Crust & Finished Leather	Md. Mizanur Rahman Executive Director	Plot no: ZC4+ZC5+ZC6, Leather Industrial Area, Horindora, Hemayetpur, Savar, Dhaka. 01711528180
6	Asia Tannery Ltd.	Crust & Finished Leather	Mrs. Nur-A-Afroza Sultana Managing Director	Plot no: ZS-26, Leather Industrial Area, Horindora, Hemayetpur, Savar, Dhaka. 01743764507
7	M/S. Fancy Leather Enterprise	Crust & Finished Leather	Md. Samsul Huda Proprietor	Plot no: YS-24, Chamra Shilpa Nagari, Jhauchar, Hemayetpur, Savar, Dhaka. 01819211572 E-mail: fancygroupnet2bd.com
8	Khokon Tannery Ltd.	Crust & Finished Leather	Md. Akbor Hossain Managing Director	Plot no: ZS-7, Leather Industrial Area, Heamayatpur, Jawchor, Savar, Dhaka. 01841111118
9	The Comilla Tannery Limited	Crust & Finished Leather	Mohammad Mahbub Ur Rahman Managing Director	Plot- XE-3, Leather Industrial Area, Jhauchar, Dhaka. 01911287945
10	Amin Tannery Ltd.	Crust & Finished Leather	Abdul Kader Managing Director	Plot no: YS-27 Leather Industrial Area, Savar Dhaka. 01711594563, 02- 8628908
11	Mukta Tannery Ltd.	Crust & Finished Leather	Syed Md. Shahidullah Managing Director	Plot no: ZS-29, Jhawchor Leather Industrial Area, Hemayetpur, Savar, Dhaka. 01711831977
12	Globe Tanning (Bangladesh) Company Limited	Crust & Finished Leather	Mr. Tsang Wing Yiu Managing Director	Dhaladia, Rajabari, Sreepur, Gazipur. 01942521848

13	Reliance Tannery Ltd.	Crust & Finished Leather	Md. Shahjahan Mia Managing Director	Plot no: YA7, YA8, YD4, YB2, YS15, Leather Industrial Area, Jhauchar, Hemayetpur, Savar, Dhaka. 01713011344
14	Ruma Leather Industries Ltd	Crust & Finished Leather	Eng. Mohammad Abu Tahir Managing Director	Plot No: ZD-8, ZS-25, BSCIC leather Industrial Estate, Hemayetpur, Savar, Dhaka. 01711532325, Manager
15	Chandpur Tannery Limited	Crust & Finished Leather	Abdus Sattar Managing Director	Plot no: ZE-38, Lether Industrial Area, Hamayetpur, Savar, Dhaka. 01819279888

List of Companies Selling Water Technologies (Drinking water, Waste-water- ETP, STP etc.)

Sl.	Name of Company	Area of Focus	Type	Type of Water Technologies
1	**D-Water Tech Ltd.**	Factories, Commercial Buildings and real estate	Imports merchandise from China, Taiwan and Japan and markets at whole sale and retail basis	Water and waste water treatment plant,(RO, EDI, UV, Ozone, Ion exchange, Distillation, Sea water desalination, STP, Central Water Treatment, Iron Removal, Water Softener
2	**HRG Engineering Limited**	Factories, Residential users	Local manufacturer of Water Treatment Plant	Water Softening Plant, Demineralization Water Treatment Plant, RO Plant, Drinking Water Treatment Plant, Iron Removing Plant. Supplies accessories such as Sand Filter, FRP Vessel, Multiport Valve, RO Membrane, Cation, Anion & Mix Bed Resin etc.
3	**Water Fine Treatment & Filters**	Residential users, commercial buildings	Imports water treatment plants from USA, Taiwan	Water Treatment plant, D.M. plant, Water softener Iron Removal plant, All types of Cartridges, Hot & Cold Water Dispenser PC & PET Bottle.
4	**WaterWin Limited**	Residential users, commercial buildings	Imports and locally manufacturers water and wastewater treatment equipment	Water treatment plant, House Hold R.O Water Purifier System, UV System, Online System, Water Filter, Water treatment Chemical, Water Softener, D.M Plant, Iron Removal Plant
5	**Meem Water Technology**	Factories, Commercial Buildings	local manufacturer of Water Treatment equipment	RO & UV Water Purifier, All Kinds of Water Treatment Plant (ETP, WTP & STP), Demineralization Plant, Ozone Generator, UV Sterilizer, Filtration, Iron, MBSR Resin, Auto Filling, Capping, Packaging for Jar and Bottles
6	**OSMOTECH BD.**	Factories, Commercial Buildings	Wholesale distributor and assembler of Reverse Osmosis Systems, and Components. Imports from Taiwan.	Water Treatment Plant, Iron Removal Plant, Water Softener Plant, DM Water Plant, (Battery Water Plant), Water Recycling Plant, Zero Liquid Discharge Plant, Effluent Treatment Plant, RO Membrane Cleaning Chemicals
7	**CleanTech Engineering**	Factories, Commercial Buildings	Water-treatment part supplier and local manufacturer	Water Purifier & Filter, Water Treatment Plant, Iron Removal Plant, RO Plant, DM Water Plant, (Battery Water Plant) Mobile Drinking Water System, Zero Liquid Discharge Plant, Effluent Treatment Plant, Water Treatment Accessories, Clarifies & Filters.
8	**Azuya Water Engineering Ltd.**	Residential users,		Water Purifier & Filter, Water Treatment Plant, Iron Removal Plant, Water Softener Plant, DM Water Plant, (Battery Water Plant), Water

		commercial buildings		Recycling Plant, Zero Liquid Discharge Plant, Effluent Treatment Plant, RO Membrane Cleaning Chemicals, Filter Feed Pump
9	**Green Genesis Engineering Ltd.**	Factories, Commercial Buildings	Local manufacturers of pumps for water, sewerage	Water Purifier & Filter, Water Treatment Plant, Iron Removal Plant, DM Water Plant, (Battery Water Plant), Water Recycling Plant, Zero Liquid Discharge Plant, Effluent Treatment Plant, RO Membrane Cleaning Chemicals, Filter Feed Pump
10	**Water Link Bangladesh**	Factories, Residential users, commercial buildings	local manufacturer of Water Treatment equipment	Household Water Purifier, Commercial Water Purifier, Accessories, Filter Media and Chemicals, Effluent Treatment Plant (ETP), Industrial Water Purifier, Industrial Pump, Wastewater Recycle Plant

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