

ENHANCING OPPORTUNITIES FOR CLEAN AND RESILIENT GROWTH IN URBAN BANGLADESH

COUNTRY ENVIRONMENTAL ANALYSIS 2018



SEPTEMBER 2018

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ACRONYMS AND ABBREVIATIONS

µg	microgram
µm	micrometer
3R	reduce, reuse, recycle
ADB	Asian Development Bank
BAPA	Bangladesh PoribeshAndolon
BB	Bangladesh Bank
BBS	Bangladesh Bureau of Statistics
BCIC	Bangladesh Chemical Industries Corporation
BDT	Bangladeshi Taka (Tk)
BELA	Bangladesh Environmental Lawyers Association
BEPZA	Bangladesh Export Processing Zones Authority
BEZ	Bangladesh Economic Zone
BEZA	Bangladesh Economic Zone Authority
BFD	Bangladesh Forest Department
BFIDC	Bangladesh Forest Industries Development Corporation
BFRI	Bangladesh Forest Research Institute
BFSIC	Bangladesh Sugar and Food Industries Corporation
BGMEA	Bangladesh Garment Manufacturers and Exporters Association
BIWTA	Bangladesh Inland Water Transport Authority
BPC	Bangladesh Parjathan Corporation
BSCIC	Bangladesh Small Cottage Industries Corporation
BSEC	Bangladesh Steel and Engineering Corporation
BT FEC	Bhutan Trust Fund for Environmental Conservation
BUILD	Business Initiative Leading Development
BWDB	Bangladesh Water Development Board
CASE	Clean Air and Sustainable Environment
CBECAM	Community-Based Ecologically Critical Area Management
CCTF	Climate Change Trust Fund
CEA	Country Environmental Analysis
CETP	centralized effluent treatment plant
CIP	Country Investment Plan
CoED	cost of environmental degradation
CoUK	Cox's Bazar UnnayanKartripakkay or Cox's Bazar Development Authority
CSR	corporate social responsibility
CWBMP	Coastal and Wetland Biodiversity Management Project
DALY	disability adjusted life year
DAP	Detailed Area Plan
DC	Deputy Commissioner
DCC	Dhaka City Corporation
DG	Director General
DMA	Dhaka metropolitan area

DNCC	Dhaka North City Corporation
DoE	Department of Environment
DoF	Department of Fisheries
DPHE	Department of Public Health Engineering
DSCC	Dhaka South City Corporation
DWASA	Dhaka Water Supply & Sewerage Authority
EA	environmental assessment
EC	electrical conductivity
ECA	Environment Conservation Act
ECC	Environmental Clearance Certificate
ECR	Environment Conservation Rule
EF	environmental fund
EFCC	Environment, Forestry, and Climate Change
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EPZ	export processing zone
EQS	Environmental Quality Standards
ESRM	Environmental and Social Risk Management
ETP	effluent treatment plant
FCK	fixed-chimney kiln
FD	Forest Department
FFZ	floodflow zone
FY	fiscal year
GoB	Government of Bangladesh
GDP	gross domestic product
GHG	greenhouse gas
GIS	geographical information system
GIZ	Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)
GNI	gross national income
HAP	household air pollution
HHK	Hybrid Hoffman kiln
IEE	initial environmental examination
IFC	International Finance Corporation
IHME	Institute for Health Metrics and Evaluation
IQ	intelligence quotient
ISO	International Organization for Standardization
JICA	Japan International Cooperation Agency
LGED	Local Government Engineering Department
MIST	Military Institute of Science & Technology
MoC	Ministry of Commerce
MoEFCC	Ministry of Environment, Forest, and Climate Change
MoF	Ministry of Finance
MoHPW	Ministry of Housing and Public Works
MoI	Ministry of Industry
MoL	Ministry of Land
MoP	Ministry of Planning

MoTJ	Ministry of Textiles and Jute
MSDP	Mymensingh Strategic Development Plan
NBR	National Board of Revenue
NBSAP	National Biodiversity Strategy and Action Plan
NDC	Nationally Determined Contribution
NGO	nongovernmental organization
PaCT	Partnership for Cleaner Textile
PCB	polychlorinated biphenyl
PIL	public interest litigation
PM2.5	particulate matter with diameter smaller than 2.5µm
POP	persistent organic pollutant
ppb	parts per billion
PPD	public-private dialogue
ppm	parts per million
PSDSP	Private Sector Development Support Project
RAJUK	Capital Development Authority or Rajdhani UnnayanKatripakha
RECP	resource-efficient and cleaner production
RHD	Roads and Highways Department
RMG	readymade garment
SDG	Sustainable Development Goal
SEZ	special economic zone
SME	small and medium enterprise
TLCC	Town-Level Coordination Committee
TSDF	treatment, storage, and disposal facility
TSIP	Toxic Sites Identification Program
TSP	Textile Sustainability Platform
UDD	Urban Development Directorate
ULAB	used lead-acid battery
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
VCG	village conservation group
VSBK	vertical shaft brick kilns
VSL	value of statistical life
WASH	water, sanitation, and hygiene
WB	World Bank
WDI	World Development Indicators
WEF	World Economic Forum
WHO	World Health Organization
WRA	water retention area
WTP	willingness to pay
WWF	World Wildlife Federation

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EXECUTIVE SUMMARY

Bangladesh aspires to become an upper-middle-income country by growing its gross domestic product (GDP) at 7 to 8 percent per year in the next decade. The country has sustained robust economic growth (6.7 percent of GDP per year on average), led by industrial development and urbanization, for the past three decades. In July 2015, Bangladesh officially graduated to the level of lower-middle-income country with a gross national income (GNI) per capita of over US\$1,046. Looking forward, besides increasing export revenues, remittances, and private sector investments, Bangladesh will need to substantially expand productive employment opportunities to sustain growth and ensure its benefits are widely shared.

In tandem with its economic development, Bangladesh has been increasingly urbanizing—led by the massive growth of Dhaka, the nation’s capital. The national urban population grew at an average annual rate of 3.5 percent, and is expected to increase from 28 percent of Bangladesh’s total population today to 40 percent by 2025 (World Bank 2015). At the same time, the population living in slums within the urban areas is growing at double the average urban rate—around 7 percent annually. Over the last two decades, Dhaka’s population doubled; yet because of land constraints, the city is now among the world’s most densely populated. In 2011, population density was already about 8,000/sq. km in Dhaka’s metropolitan area (DMA), and 31,000/sq. km in Dhaka City Corporation (DCC) (BBS 2014). Population density in slums, meanwhile, is estimated at about 205,000/sq. km in Dhaka and 255,000/sq. km in Chittagong, the second largest city in Bangladesh.

Yet urbanization and industrial growth have come with high environmental costs that are increasingly harming Bangladesh’s prospects for continued strong economic progress. Growth has featured uncontrolled urbanization and industrialization in a context of inadequate pollution control and poor management of natural resources that provide critical ecosystem services. Encroachment of wetland areas, combined with inadequate waste management and maintenance of drainage canals, have increased cities’ vulnerability to flooding and reduced their climate resilience. These worrying trends have adverse implications for the livability and long-term sustainability of cities and the health and well-being of their inhabitants. In addition, environmental risks often affect women disproportionately. Reducing negative environmental externalities is a priority if Bangladesh is to continue to reduce poverty and achieve shared prosperity (World Bank 2015).

Urban environmental pollution is already imposing a significant cost on Bangladesh’s economy. In 2015, the total annual number of deaths and disability adjusted life years (DALYs) attributable to air pollution, inadequate water, sanitation, and hygiene (WASH), arsenic in drinking water, and occupational pollutants in urban areas is estimated at some 80,000 and 2.6 million, respectively in 2015. In Dhaka alone, the corresponding estimates are almost 18,000 and 578,000. The economic cost of this mortality in terms of foregone labor output is estimated at US\$1.40 billion in all urban areas of Bangladesh, and at US\$310 million in Dhaka alone. This is equivalent to 0.7 percent and 0.2 percent of Bangladesh’s 2015

national GDP, respectively. Taking into account the broader welfare impacts of mortality that go beyond foregone labor output, the economic impact is estimated at US\$6.52 billion in urban Bangladesh and US\$1.44 billion in Dhaka alone, which are equivalent to 3.4 percent and 0.7 percent of the 2015 national GDP, respectively (see Table ES-1). These figures may be considered as the lower and upper ends of a plausible range of estimates of the economic cost of mortality attributable to quantifiable environmental health risks. In addition, the costs of productivity loss in the readymade garment industry due to air pollution, of IQ loss among children exposed to lead from industrial sources, and of morbidity from air pollution and inadequate WASH were estimated.

Over the last decade, Bangladesh has improved its policy regime and systems for environmental and pollution management. Since 2006, when the World Bank’s first Country Environmental Analysis (CEA) for Bangladesh was published, the country has made tangible progress in further developing environmental policies, guidelines, and legislation. This progress toward mainstreaming the environmental agenda across government is especially apparent in the country’s national development, environment, and climate change strategies, as well as in specific

enhancements to the legal framework for pollution control, management, and accountability. Some industry-specific initiatives for scaling up cleaner production practices have also gained momentum.

Yet much more needs to be done to arrest the stark effects of pollution and environmental degradation on people’s health and economic productivity.

Achieving Bangladesh’s objective to reach upper-middle-income status through cleaner and more resilient growth will depend on further developing and strengthening a range of complementary policies and systems for environmental protection, urban development, and industrial management. This is even more critical and urgent for Bangladesh than for most other countries at a similar income level due to its uniquely high population density and vulnerability to climate risks. Moreover, institutional reforms and capacity building will be key in all areas to ensure effective implementation of adopted strategies and policies. Based on the analysis in this CEA, priorities for reform and investment should include the following:

- i. **Enhance environmental policy and institutions at the national level.** To reverse the trend of environmental degradation and promote cleaner and resilient growth, significant policy

TABLE - ES-1: ESTIMATED COST OF MORTALITY IN URBAN BANGLADESH AND GREATER DHAKA (US\$ BILLION) AND NATIONAL GDP (2015) EQUIVALENCES

	Urban Bangladesh				Greater Dhaka			
	Welfare Loss		Foregone Output		Welfare Loss		Foregone Output	
	Amount	GDP equiv.	Amount	GDP equiv.	Amount	GDP equiv.	Amount	GDP equiv.
PM2.5 air pollution								
ambient	2.42	1.24%	0.49	0.25%	0.53	0.27%	0.11	0.06%
household	1.27	0.65%	0.25	0.13%	0.28	0.14%	0.06	0.03%
Inadequate water, sanitation and hygiene								
direct impact	0.43	0.22%	0.14	0.07%	0.09	0.05%	0.03	0.02%
indirect impact	0.08	0.04%	0.04	0.02%	0.02	0.01%	0.01	0.00%
Arsenic in drinking water	0.80	0.41%	0.18	0.09%	0.18	0.09%	0.04	0.02%
Occupational pollutants	1.52	0.78%	0.29	0.15%	0.34	0.17%	0.06	0.03%
TOTAL	6.52	3.35%	1.40	0.72%	1.44	0.74%	0.31	0.16%

and institutional reforms at the national level are required. The Department of Environment (DoE) needs to be reformed and allocated adequate resources to modernize its information management, monitoring, and enforcement systems; build up and organize its staff to more effectively respond to pressing environmental challenges; and effectively decentralize to district and divisional levels, with priority given to areas/cities with the highest levels of pollution. Beyond the DoE, it is essential to mainstream environmental management and green development objectives across all relevant line ministries and agencies to create an enabling environment for sustainable growth.

- ii. **Enhance environmental management at the local/city level.** A lack of local-level urban planning capacity is leading to unplanned urbanization, not only in Dhaka but also in many secondary towns. Integrated urban planning that takes into account the role of natural resources is necessary for livable city development. Local governance should be strengthened through institutional reform, particularly to clarify overlapping or overlooked mandates in urban planning and implementation that result in a lack of accountability in terms of protecting wetlands and other environmental assets from encroachment and pollution. A major effort is needed at the local/city level to clarify institutional arrangements and strengthen capacity for effective implementation and enforcement of the adopted policies and plans. There is also a pressing need for regional waste management facilities, including ones that can handle the hazardous wastes that contaminate soil and increase health costs. The underlying policy regime will need to be improved to make better waste management options viable and financially sustainable. Finally, better planning and increased investments in secondary cities could relieve the concentrated pressure on Dhaka.
- iii. **Strengthen the enforcement and accountability regime.** There is significant scope to increase accountability, trust, and deterrence in the environmental enforcement regime by modernizing and replacing what is perceived as an ad hoc application of the “polluter pays principle” with a transparent, rule-based system that can

serve as an effective deterrent to polluters. Such rules should be complemented with (i) realistic and scientifically grounded emission/discharge and ambient environmental quality standards; (ii) an option to develop a monitorable and time-bound compliance plan when the current technology is unable to meet the standard; and (iii) the operationalization of a funding stream dedicated to environmental remediation (see point iv, below). A comprehensive information management system with automated monitoring for compliance and enforcement would help reduce enforcement costs and improve its effectiveness. Outside experts should be used to support environmental clearance processes and compliance monitoring to supplement DoE’s staff capacity. A more effective environment court system and greater transparency of environmental information are also important tools for holding polluters accountable.

- iv. **Leverage market-based instruments to protect the environment and unlock green financing.** Achieving sustainable growth will require that the private sector and markets direct more resources toward greener activities and investments. As a complement to adopting and enforcing environmental regulations, using fiscal instruments to internalize environmental externalities would help minimize resource use and pollution from production and consumption. Adequate pricing of key resources, such as water and energy, are essential to foster their efficient use. Building on current efforts, Bangladesh should strive to scale up financing for green investments. Following successful initiatives in other countries, Bangladesh could also consider establishing a national trust fund dedicated to conservation and environmental management to diversify sources of funding.
- v. **Promote resource-efficient and cleaner production (RECP) as a tool for reconciling environmental performance with competitiveness.** Mainstreaming RECP among polluting industries can help reconcile better environmental performance with competitiveness. The adoption of RECP can be scaled up by addressing several gaps related mainly to awareness and to technical and financial capacity, both on the part of industry and government. Bangladesh

could consider establishing a dedicated technical institution to identify, demonstrate, and promote cleaner technologies, following the model of Cleaner Production Centers adopted in many countries. To foster private investments in clean technologies, public-private dialogue also needs to be strengthened among government, industry, and financial institutions.

- vi. **Harness the power of public pressure.** Pressure from citizens, especially those in the rapidly expanding middle class, have been a major driving force for change in tackling pollution in various

countries. In this regard, enhanced disclosure and accessibility of data on environmental degradation and pollution (e.g., ambient air and water quality, emissions from industries) is key for empowering citizens. It is also important to make urban communities, including children, more aware of the value of natural resources and the importance of including, protecting, and managing wetlands and their functions in urban settings. To this end, relevant agencies should organize events and programs on what citizens can do, and develop and disseminate educational materials on wetlands' values, functions, and management.

INTRODUCTION

Bangladesh aspires to become an upper-middle-income country by growing its gross domestic product (GDP) at 7 to 8 percent per year in the next decade. The country has sustained robust economic growth (6.7 percent of GDP per year on average), led by industrial development and urbanization, for the past three decades.¹ In July 2015, Bangladesh officially graduated to the level of lower-middle-income country with a gross national income (GNI) per capita of over US\$1,046. Looking forward, besides increasing export revenues, remittances, and private sector investments, Bangladesh will need to substantially expand productive employment opportunities to sustain growth and ensure its benefits are widely shared.

In tandem with its economic development, Bangladesh has been increasingly urbanizing—led by the massive growth of Dhaka, the nation’s capital. The national urban population grew at an average annual rate of 3.5 percent, and is expected to increase from 28 percent of Bangladesh’s total population today to 40 percent by 2025 (World Bank 2015). At the same time, the population living in slums is growing at double the average urban rate—around 7 percent annually. Over the last two decades, Dhaka’s population doubled; yet because of land constraints, the city is now among the world’s most densely populated. In 2011, population density was already about 8,000/sq.km in Dhaka’s metropolitan area (DMA), and 31,000/sq.

km in Dhaka City Corporation (DCC) (BBS2014). Population density in slums, meanwhile, is estimated at about 205,000/sq. km in Dhaka and 255,000/sq. km in Chittagong, the second largest city in Bangladesh.

Urbanization and industrial growth have come with high environmental costs that are increasingly harming Bangladesh’s prospects for continued strong economic progress. Growth has featured uncontrolled urbanization and industrialization in a context of inadequate pollution control and poor management of natural resources that provide critical ecosystem services. Encroachment of wetland areas, combined with inadequate waste management and maintenance of drainage canals, have increased cities’ vulnerability to flooding and reduced their climate resilience. These worrying trends have adverse implications for the livability and long-term sustainability of cities and the health and well-being of their inhabitants. Reducing negative environmental externalities is a priority if Bangladesh is to continue to reduce poverty and achieve shared prosperity (World Bank 2015).

Since 2006, substantial efforts have been made to strengthen environmental policies and regulations. In 2006, the World Bank published the first Country Environmental Analysis (CEA) for Bangladesh.² The analysis intended to help the Government of Bangladesh (GoB), civil society, and development partners identify and address critical environmental

¹. WDI 2017.

². The CEA is an upstream analytic tool that aims to integrate environmental considerations into the development process and sustainable development assistance by identifying key areas for policy reform, institution building, and investment.

constraints to sustainable, poverty-reducing growth. The study included the cost of environmental degradation and identified three significant target areas that needed priority attention: (i) urban and indoor air pollution threats to human health; (ii) treatment of urban and industrial sewage in Dhaka; and (iii) the continuous decline of capture fisheries. A set of actions in each target area was proposed, and a series of measures that could strengthen environmental governance was identified. Annex A presents progress made on the recommendations. Over the last decade, the GoB has integrated the Sustainable Development Goals (SDGs) in its National Development Strategy (2010) and Seventh Five-Year Plan (2015), and taken substantial steps to strengthen environmental policies, legislation, and regulations. Enhancing urban resilience and reducing greenhouse gas (GHG) emissions by promoting energy efficiency among industries are key areas of the Nationally Determined Contribution (NDC), and some industry-specific initiatives for scaling up cleaner production technologies and practices have gained momentum.

Nonetheless, policies and institutions need further strengthening. In practice, pollution continues to occur unabated, due largely to the weak institutional capacity of enforcement agencies and the insufficient engagement of other key players. It is becoming increasingly urgent for Bangladesh to further strengthen its regulatory framework and institutional capacity to manage negative environmental externalities associated with rapid industrial and urban growth. This includes significantly strengthening environmental monitoring, enforcement, and public awareness efforts, as well as better embedding environmental considerations across the government ministries. At the same time, more needs to be done to incentivize the private sector to adopt resource-efficient and cleaner production (RECP) technologies and practices,³ building on successful existing initiatives. In addition, cities need to proactively plan and manage their environmental assets to ensure continued livability as well as climate resilience,

notably by better incorporating wetlands into urban planning, enforcing zoning, and investing in waste management.

Given the growing environmental challenges that Bangladesh's cities face, this CEA focuses on the country's urban areas. The report analyzes the impacts and causes of pollution levels and natural resource degradation in Dhaka and other rapidly growing cities. It updates the first CEA prepared over a decade ago with the aim of (i) better understanding the environmental challenges, trends, and implications of rapid economic growth in urban areas; and (ii) identifying paths toward cleaner and more climate-resilient growth⁴ through technological changes and institutional, regulatory, and policy reforms. The analysis includes case studies at the city level, including the Greater Dhaka area and other cities of various sizes.

This report has benefited from three background papers⁵ and several consultations with a wide range of stakeholders. It is structured as follows:

- *Chapter 1* presents the updated impacts and costs of environmental degradation in Bangladesh's urban areas based on the assessments of economic and social costs of air, water, and soil pollution.
- *Chapter 2* analyzes the institutional framework for environmental management and green growth in Bangladesh. It outlines recommendations to improve policies, regulations, and institutional capacity in the areas of pollution management, resource efficiency, and environmental performance.
- *Chapter 3* presents several case studies that focus on cities of various sizes to draw specific recommendations for resilient urban development, with a particular focus on urban wetlands management.
- *Chapter 4* summarizes the findings and prioritizes recommendations for Bangladesh to embark on greener and more climate-resilient growth.

³ Following the definition established by UNIDO and UN Environment, RECP refers to the “continuous application of an integrated preventive environmental strategy to processes, products and services to increase efficiency and reduce risks to humans and the environment.”

⁴ Clean/green and resilient growth can be defined as “growth that is efficient in its use of natural resources, clean in that it minimizes pollution and environmental impacts, and resilient in that it accounts for natural hazards and the role of environmental management and natural capital in preventing physical disasters” (World Bank 2012).

⁵ The three background papers are “Impacts and Costs of Environmental Degradation in Urban Bangladesh,” “Towards Clean and More Resilient Cities,” and “Institutions for Clean and Green Industrial Growth.” The third background paper became a basis of this synthesis report.

CHAPTER 1.

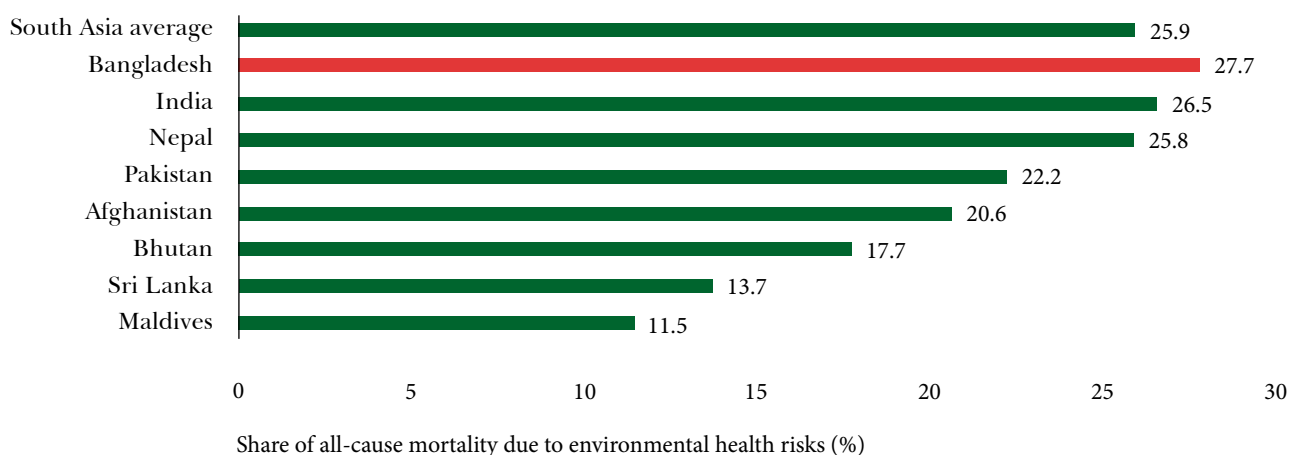
IMPACTS AND COSTS OF ENVIRONMENTAL DEGRADATION IN URBAN BANGLADESH

1.1 IMPACTS AND TRENDS

Globally, Bangladesh is among the countries most affected by pollution and other environmental health risks. Diseases caused by pollution were responsible for 16 percent of all deaths worldwide in 2015 (Landrigan et al. 2018). In Bangladesh, this proportion was nearly 28 percent; as such, Bangladesh's numbers were the highest out of all of South Asia, where the average was nearly 26 percent (see Figure 1-1). In other words, of the 843,000 cause-attributable deaths estimated

for Bangladesh in 2015, some 234,000 were due to environmental pollution and other environmental health risks—more than 10 times the number of deaths from road injuries/traffic accidents (21,286). Fine particulate matter (PM2.5) air pollution, both ambient and indoor, is by far the most significant environmental risk, causing about 21 percent of all deaths in Bangladesh.⁶ While air pollution is the leading environmental risk factor in all South Asian countries, the levels in Bangladesh are the highest in the region (see Figure 1-2).

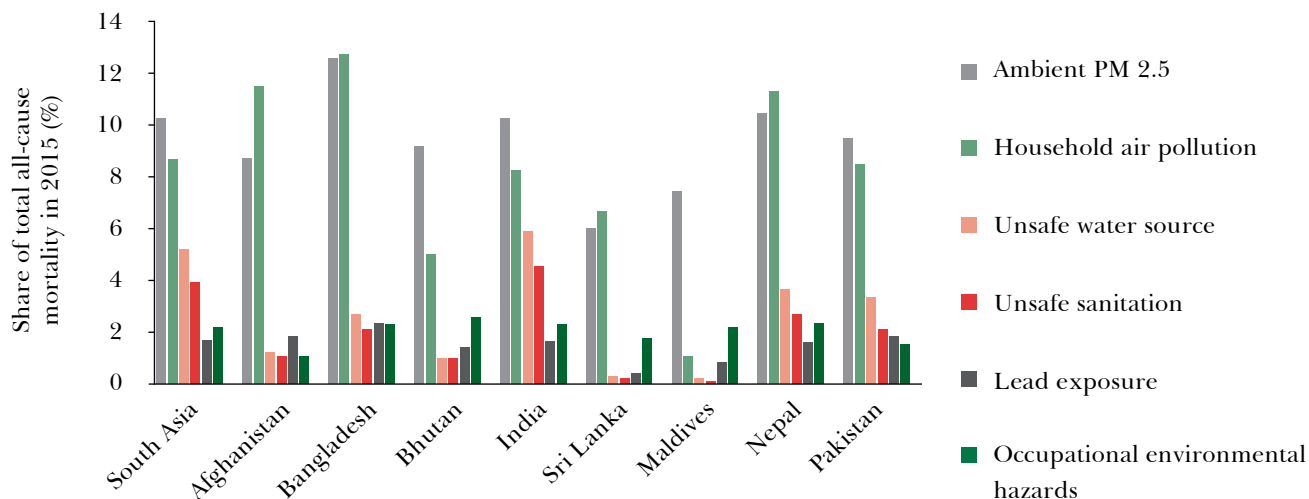
FIGURE - 1-1: DEATHS ATTRIBUTED TO ENVIRONMENTAL RISKS IN SOUTH ASIAN COUNTRIES, 2015 (%)



Source: IHME 2017.

⁶ The joint impact of ambient and indoor air pollution is lower than the sum of these risk factors individually (indicated in Figure 1-3) due to interactions of effects.

FIGURE - 1-2: SHARE OF ENVIRONMENTAL RISKS IN MORTALITY IN SOUTH ASIA, 2015 (%)

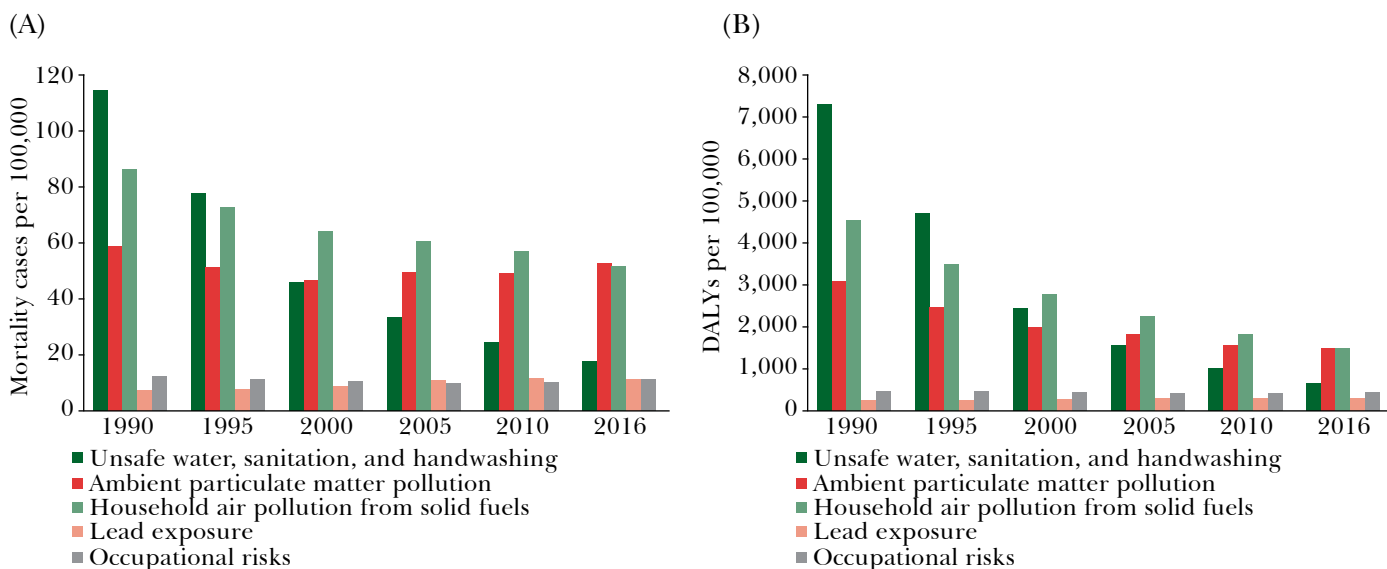


Source: IHME 2016.

During the past three decades, Bangladesh, like many other developing countries, has experienced a dramatic shift in exposure to environmental health risks. The role of “traditional” environmental risk factors has decreased while that of modern risks linked to urbanization has increased. As Figure 1-3 shows, between 1990 and 2016, premature deaths and disability attributed to unsafe water, sanitation, and hygiene (WASH) fell drastically. The size and

impact of indoor air pollution also decreased, albeit less dramatically. At the same time, rapid growth of export-oriented manufacturing—notably of textiles and readymade garments (RMGs)—and the concurrent increase in the urban population—from less than 40 million in 2006 to more than 55 million in 2015 (WDI 2017)—had immense impacts on exposing the growing urban population to environmental hazards.

FIGURE - 1-3: EVOLUTION OF MORTALITY AND DISABILITY ATTRIBUTED TO ENVIRONMENTAL RISKS IN BANGLADESH OVER TIME



Source: Estimated from IHME 2017.

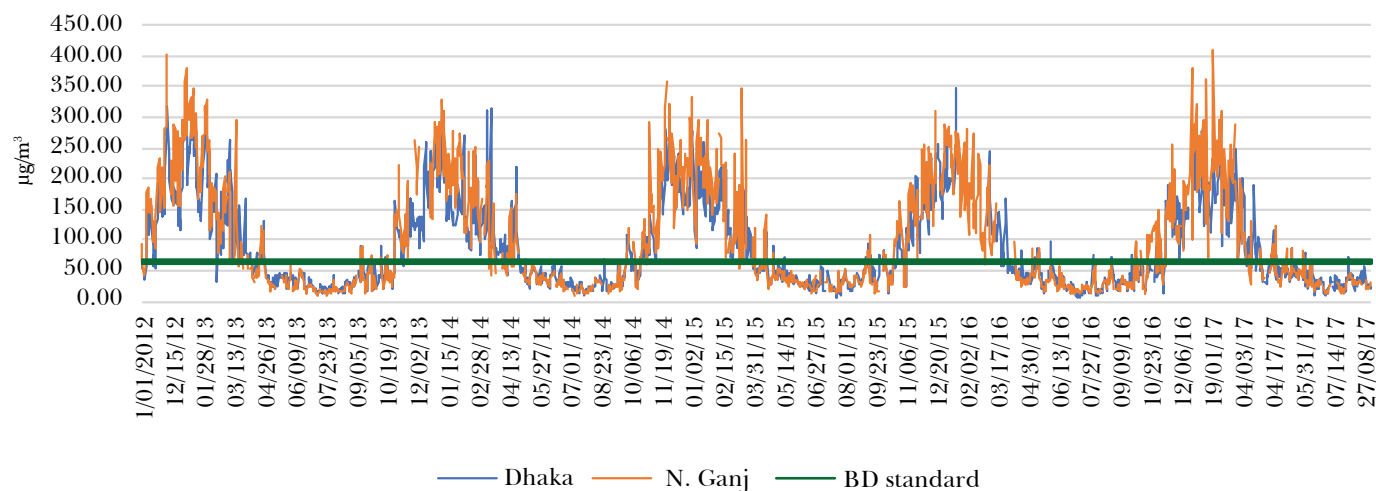
Ambient air pollution. Mortality from ambient PM_{2.5} air pollution, which has been shown to cause cardiovascular and respiratory diseases, and cancer, appears to have declined little in Bangladesh since 1990 (see Figure 1-3). There is also increasing international evidence that air pollution reduces the productivity of healthy workers, including in the RMG industry, which in Bangladesh is significant for continued competitiveness and high GDP growth. Based on data from 11 continuous air quality monitoring stations in eight urban areas, the urban population-weighted annual PM_{2.5} concentration is estimated at 80 $\mu\text{g}/\text{m}^3$ for 2013–15, more than five times the Bangladeshi standard and eight times the World Health Organization (WHO) guideline. The source apportionment undertaken by the Department of Environment (DoE) identifies vehicles and brick kilns among the key sources. The seasonal nature of brick kiln operations leads to seasonal variations in ambient PM_{2.5} concentrations. Consequently, in winter, daily concentrations are in the range of 150–350 $\mu\text{g}/\text{m}^3$, or 2.5–5 times the national standard for 24-hour mean PM_{2.5} concentration, 65 $\mu\text{g}/\text{m}^3$ (see Figure 1-4).

Household air pollution. A Department of Health Services survey found that 50 percent of urban households use solid fuels (NIPORT, Mitra and Associates, and ICF International 2016). Considering that Bangladesh’s urban population is about 55 million

and the average household size is about 5, this translates into 5.5 million urban households that use solid fuels for cooking in urban areas alone. Recognizing the immensity of the challenge, the GoB has been supporting a program to replace traditional cookstoves with improved ones, and as of 2017 had delivered one million improved cookstoves. Nevertheless, a 2017 household survey found that the reduction in household air PM_{2.5} concentration is limited, from 265 $\mu\text{g}/\text{m}^3$ in households using traditional cookstoves to 211 $\mu\text{g}/\text{m}^3$ in those with improved cookstoves (Begum 2017.) The overall exposure depends on where in the dwelling cooking takes place and the number of hours per day spent indoors vs. outdoors.

Inadequate WASH. Inadequate WASH directly and indirectly affects public health. Directly, poor WASH causes diarrheal infections and other health effects, which in turn lead to mortality, especially in young children. Indirectly, poor WASH contributes to poor nutritional status in young children who experience diarrheal infections. Problems related to water supply and health are intensified where industrial pollutants contaminate water systems because treatments that control infectious agents do not effectively remove many toxic chemicals from drinking water. There are hundreds of industrial chemicals, pharmaceuticals, and pesticides in water systems. Much of the worst biological and chemical drinking water pollution

FIGURE - 1-4: SEASONAL VARIATION IN AMBIENT PM_{2.5} AIR QUALITY IN DHAKA AND NARAYANGANJ



Source: DoE 2017.

FIGURE - 1-5: BATTERY RECYCLING



Photo credit: Mr. Raihan Uddin Ahmed

is seen in rapidly urbanizing and industrializing Bangladesh, where local waterways and groundwater are heavily polluted and serious health conditions are widely reported, but no alternative water sources exist (World Bank 2008). Dhaka Water Supply & Sewerage Authority's (DWASA) monitoring results with regards to dissolved oxygen and biological oxygen demand of six Dhaka rivers in May 2015 indicate that at most of the monitoring stations, river water quality was at class IV or V, well below drinking water quality (DWSSP 2005). In low-flow winter months, all rivers surrounding Dhaka are designated as ecologically critical areas, as they are almost completely unable to sustain life. High heavy metal concentrations have been documented near industrial areas in the water column and sediments (Ahmed et al. 2010; Siddiquee et al. 2012; Islam et al. 2014).

Arsenic in drinking water. Arsenic in groundwater—which serves as the primary source of drinking water—is largely a natural occurrence, mostly affecting rural areas. However, with urbanization, it is becoming a problem for the urban water supply in some urban growth centers such as Khulna. Arsenic causes death

and disability from cardiovascular diseases, cancer, and infectious diseases. According to the Multiple Indicator Cluster Survey 2012–13, nearly 20 percent of the urban population had arsenic above 10 parts per billion (ppb), which is the WHO guideline, in their drinking water (BBS and UNICEF Bangladesh 2014).

Occupational pollutants. Occupational pollutants in the workplace include carcinogens such as asbestos, polycyclic aromatic hydrocarbons, silica, sulfuric acid, trichloroethylene, arsenic, benzene, beryllium, cadmium, chromium, diesel exhaust, secondhand smoke, formaldehyde, and nickel; particulate matter, gases, and fumes; and asthmagens. In Bangladesh, workers in industrial establishments—including micro, small, and medium facilities that use any of these materials as inputs—face the risk of cancer, chronic respiratory disease, and other health impacts due to the lack of mitigation practices, including the use of personal protective equipment. For example, an estimated 22,000 workers in Bangladesh's shipbreaking industry are exposed to elevated levels of asbestos, polychlorinated biphenyls (PCBs), cadmium, lead, and mercury in the naval and merchant ships they dismantle (Sarraf et al. 2010).

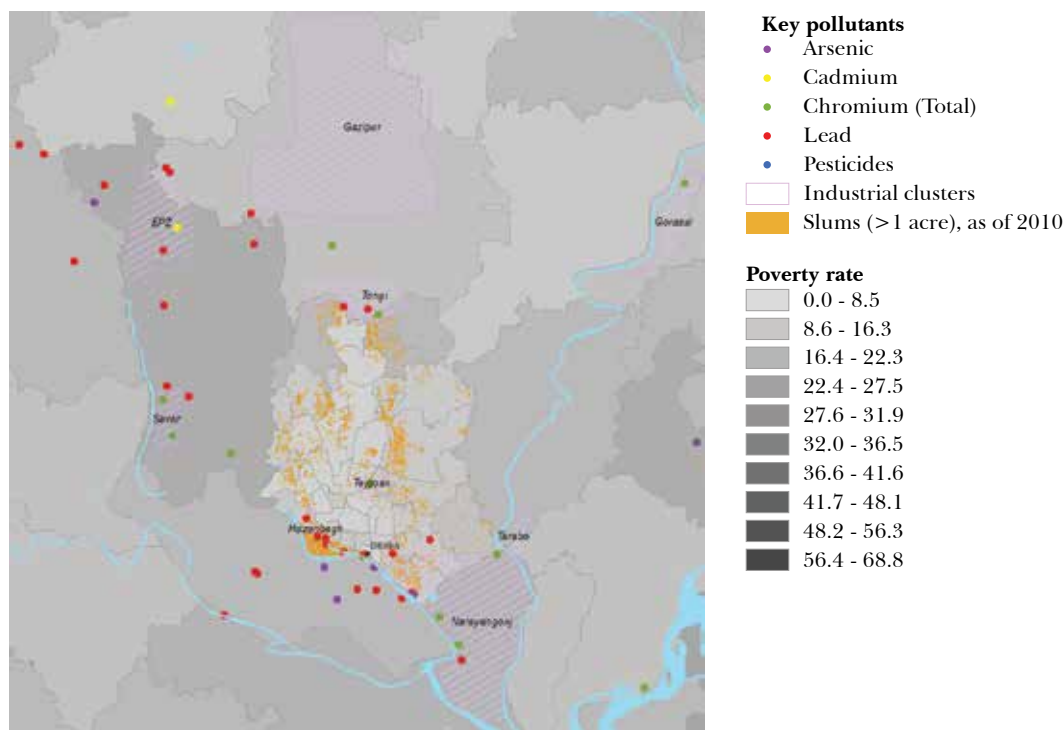
Soil, heavy metal, and chemical pollution. Urbanization and industrialization have increased the amount of waste generated. Without proper collection and disposal, solid waste clogs channels, leading to urban floods. Unsafe recycling of hazardous waste, including of used lead-acid batteries (ULABs) on a growing number of sites and waste from shipbreaking, poses a growing public health hazard.

Lead. Human exposure to lead can result in increased incidence of cardiovascular disease and diverse neurological outcomes. High levels of lead exposure by pregnant women can lead to miscarriage, stillbirth, premature birth, and low birth weight. Young children are particularly vulnerable to the toxic effects of lead, which may include death and irreversible neurological and behavioral impacts. Informal recycling of ULABs (see Figure 1-5) is among the key sources of lead contamination of soil and air. While there are currently 148 known ULAB sites, the total number is more than 1,100, and the number of people at risk is nearly one million.

Heavy metal contamination and the poor. An initial visual analysis of spatial association of heavy metal-contaminated sites in Greater Dhaka suggests that pollution hotspots tend to be in poor areas. Figure 1-6 shows upazila-wise poverty rates in Greater Dhaka, the location of slums as of 2010, known land contamination sites by type of pollutant (color) and population at risk (size), and the metropolis's nine industrial cluster areas for small and medium enterprises (SMEs). Noteworthy is the geographical overlap of lead and chromium pollution and slums in the southwest, which is dominated by ULAB recyclers and the leather industry.

Solid waste dumping and encroachment on wetlands. In a number of Bangladesh's urban areas—most notably Dhaka, but also in emerging smaller cities such as Pabna—wetlands and khals (channels) provided flood retention and drainage prior to the accelerated urban development of recent decades. As more and more people moved into urban areas, these wetlands were encroached upon, reducing them in size by

FIGURE - 1-6: LAND CONTAMINATION HOTSPOTS, POVERTY, AND SLUMS IN AND AROUND GREATER DHAKA



Source: World Bank, WFP, and BBS 2010; World Bank, forthcoming a; Pure Earth, n.d.; Gruebner et al. 2014.

nearly 75 percent in slightly more than 40 years (see Figure 1-7). This CEA found that between 2010 and 2016, 41 percent of flood flow zones (FFZs) and 21 percent of water retention areas (WRAs) that had been designated as such by the Capital Development Authority, or Rajdhani Unnayan Katripakha (RAJUK), in the Detailed Area Plan (DAP) had been converted, raised, and used for other purposes. In addition, as urban populations grew, more solid waste was generated. In the absence of a well-functioning waste collection and disposal system, wetlands and khals turned into dumping grounds for waste, in

addition to sewage. The result has been an increase in so-called urban floods even following moderate amounts of precipitation, often lasting for weeks, as the accumulated rainwater cannot be channeled out of the urban area (Dasgupta et al. 2015). Urban floods cause significant damage to health through the propagation of infectious diseases, property, infrastructure, and livelihoods. Chapter 3 presents in-depth case studies on wetlands encroachment and its implications.

Reduced groundwater availability. Groundwater recharge area is diminishing with urban development

Box 1-1: Women Are Disproportionately Impacted by Environmental Risks

Household air pollution (HAP). Health effects from HAP disproportionately affect women and young children, who spend the most time inside residences. Pregnant women are especially vulnerable to HAP. Because of their increased inhalation and deposition in fatty tissue, more pollutants are diffused into the placenta and accumulated in fatty tissue. Exposure to air pollutants also restricts the regular transport of oxygen and nutrients to the fetus, resulting in adverse pregnancy outcomes such as stillbirth, low birth weight, miscarriage, and retarded fetal growth (Dutta et al. 2017; Hackley, Feinstein, and Dixon 2007; Butter 2006).

Inadequate WASH. Women and girls bear a disproportionate burden of limited access to clean and safe water. Water pollution and water scarcity affect women's health, nutrition, workload, and, consequently, their opportunities to overcome poverty. Because of their central role in water fetching, which is physically demanding and time-consuming, women and girls have reduced time for education and income-generating opportunities. They are also more exposed to environmental health risks from water pollution because they are responsible for collecting and storing water and washing clothes and utensils. Poor water quality also contributes to reduced property values, aggravating women's limited access to land, housing, and other assets. In addition, lack of access to proper water resources and the increasing demand for water by households, farms, and industries can create societies that are more unequal, unstable, and prone to tensions and conflicts (WWAP 2015)—situations in which women are more vulnerable to gender-based violence. Additionally, inadequate sanitation and lack of separate toilets in schools contribute to reduced attendance and increased dropout rates among girls reaching puberty.

Exposure to chemicals. Because of biological and gender-related factors, women and men have different vulnerability and exposure to chemical pollution. For example, persistent organic pollutants (POPs) may cause moderate to severe congenital defects, impairing health over multiple generations. Research also indicates that women are more vulnerable to cadmium and lead poisoning (Butter 2006, 222). Occupational activities that are typically performed by women both inside and outside the home result in increased exposure to toxic chemicals. For example, women are at greater risk from exposure to pesticides used in urban agricultural activities—by applying those chemicals to crops, storing pesticides at home, or recycling pesticide containers for domestic use due to lack of protective equipment and awareness of harmful chemicals. Because of their role in housekeeping, women are more exposed to toxic chemicals from cleaning products, pest control, and house building materials (for example, asbestos, lead, mercury, and arsenic).

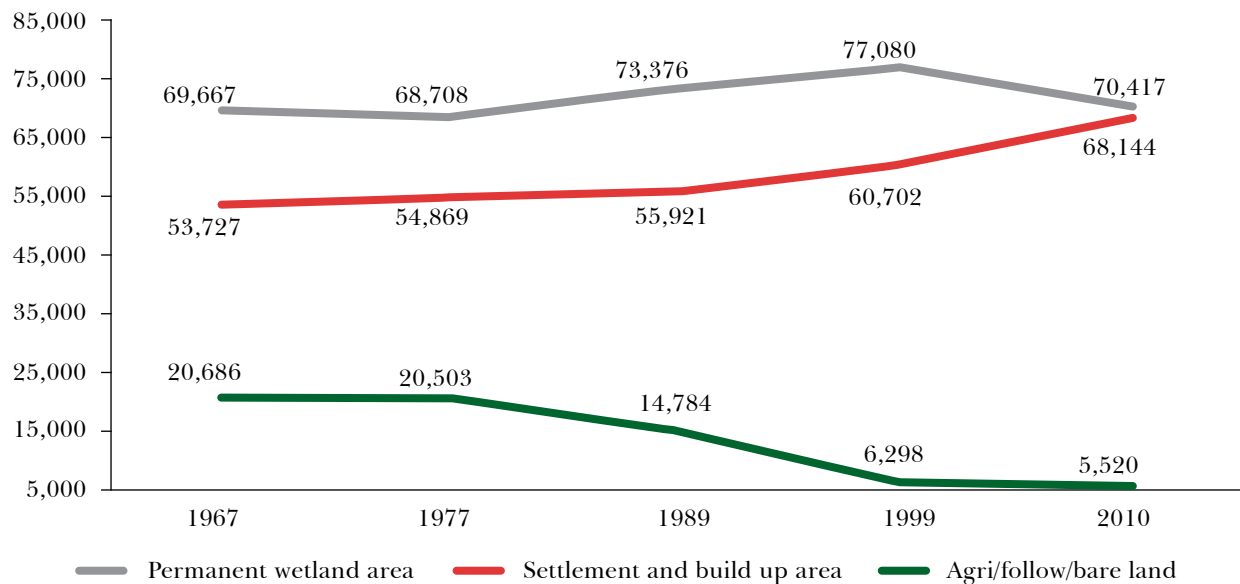
Source: World Bank, forthcoming 2018b.

due to increased extraction for drinking and industrial purposes and reduced recharge capacity. Water depletion is acute in Dhaka City. In 1990, the depth of the water table was 15 m in central Dhaka and 4 m in peri-urban areas (Abedin and Rakib 2013), while in 2002 it was 50 m and in 2005 was 60 m. The pervious layer is important to effectively recharge groundwater. With increasing pavement in urban areas, a substantial area of suitable pervious layer has been lost, which reduces the potential to recharge groundwater and thus exhausts aquifer levels. In addition, imperviousness of the ground increases storm runoff by reducing runoff “lagtime” and puts increased pressure on drainage canals. It is noted that DWASA relies on groundwater to supply drinking water to the residents of Dhaka City; thus, loss of the pervious layer combined with the loss of wetlands would affect water availability. In Chittagong, extraction of groundwater has accelerated salinity intrusion.

1.2 FROM IMPACTS TO ESTIMATING ECONOMIC COSTS

These environmental impacts have large economic costs for Bangladeshi society.⁷ When workers—especially highly skilled ones—cannot work because they get sick or die, both industry and the economy suffer production losses. Both families and public agencies incur treatment costs. No less important are the strains and suffering of impacted individuals and families. Pollution also makes it more expensive for water authorities to abstract and deliver safe drinking water to citizens; it also restricts recreational amenities for urbanites, such as strolling along, swimming, or fishing in rivers. Finally, clogging natural drainage channels with sewage and solid waste has been directly linked to urban floods in Dhaka, impacting health, property, and production (Dasgupta et al. 2015).

FIGURE - 1-7: HISTORICAL CHANGE IN WETLANDS, BUILT-UP AREAS, AND AREAS UNDER AGRICULTURE/FALLOW/BARELAND (HA) IN DHAKA CITY



Source: CEGIS 2012.

⁷ The World Bank published its last CoED study on Bangladesh in 2006. It is important to note that the estimates are not comparable due to (i) differences in coverage—while this CoED focuses on the environmental cost in urban and industrial areas, the 2006 CoED covered pollution issues nationwide and included natural resources degradation issues, including fisheries and forestry; and (ii) differences in methodology—estimation methodologies have evolved during the past 12 years. Hence, as tempting as it might be to make comparisons, especially of the overall CoED estimates, doing so would be misleading.

TABLE - 1-1: DEATHS AND DALYS ATTRIBUTABLE TO ENVIRONMENTAL RISK FACTORS

	Urban Bangladesh		Greater Dhaka	
	Deaths	DALYs	Deaths	DALYs
PM2.5 air pollution				
ambient	30,353	857,432	6,685	188,843
household	15,933	456,572	3,509	100,557
Inadequate water, sanitation and hygiene				
direct impact	4,893	409,157	1,078	90,114
indirect impact	966	108,511	213	23,899
Arsenic in drinking water	10,028	313,377	2,209	69,019
Occupational pollutants	19,087	482,877	4,204	105,350
TOTAL	80,294	2,627,926	17,897	578,781

Source: Forest Cover Map, FAO (2010)

Scope. This section examines those economic impacts for which cause-effect linkages have been well-established and credible estimation methodologies and data are available. As such, the CEA focused on (i) diseases and reduced worker productivity caused by ambient and indoor PM2.5 air pollution; (ii) diseases caused by unsafe water combined with inadequate WASH; (iii) diseases caused by occupational carcinogens, particulate matter, and asthmagens; (iv) diseases caused by arsenic in drinking water; and (v) reduced intellectual ability caused by children’s exposure to lead. The fact that the CEA was unable to estimate other losses does not mean they equal zero; it just means that at this time they could not be estimated.

Methodology. Two approaches were used to estimate the economic cost of the health burden attributed to pollution: *foregone labor output* and *lost welfare*.⁸ In both cases, the numbers of premature deaths (mortality) and disability adjusted life years (DALYs) that are

attributable to a particular environmental risk were estimated and adjusted for multiple risk factors, where applicable.. To this end, data published by the Global Burden of Disease Project (IHME 2016), the DoE, the Bangladesh Bureau of Statistics (BSS), and a variety of national and international organizations and researchers were used, and state-of-the-art estimation techniques were applied. Next, the estimated mortality was multiplied with the present value of lifetime earnings (based on 2015 urban per capita income) to calculate foregone labor output and with the value of statistical life (VSL) to calculate the welfare loss.⁹ Where possible, the cost of morbidity was estimated using appropriate methodologies.

Results. Using the two approaches above, the total annual number of deaths and DALYs in 2015 attributable to environmental risks in urban areas was estimated at some 80,000 and 2.6 million, respectively (see Table 1-1). In Dhaka alone, the corresponding estimates are almost 18,000 and 579,000.

⁸ A detailed discussion of the methodology used in the CoED exercise may be found in the background paper, “Impacts and Costs of Environmental Degradation in Urban Bangladesh.”

⁹ A VSL measure “represents an aggregate of individuals’ willingness to pay (WTP) for marginal reductions in their mortality risks. It is not the value of any single person’s life or death, nor does it represent a society’s judgment as to what that value should be” (Narain and Sall 2016). VSL is estimated using the stated preference approach, whereby surveyed individuals are asked how much they would hypothetically be willing to pay to marginally reduce their mortality risk. As such, VSL is not limited to the value of output that would be lost in case of premature death, but covers an array of other values that contribute to an individual’s and society’s welfare. Therefore, this measure is not directly comparable with GDP. The method used to derive a VSL measure for Bangladesh is described in the background paper.

TABLE - 1-2: SUMMARY OF COST OF MORTALITY ESTIMATES IN URBAN BANGLADESH AND GREATER DHAKA (US\$ BILLION) AND NATIONAL GDP (2015) EQUIVALENCES

	Urban Bangladesh				Greater Dhaka			
	Welfare Loss		Foregone Output		Welfare Loss		Foregone Output	
	Amount	GDP equiv.	Amount	GDP equiv.	Amount	GDP equiv.	Amount	GDP equiv.
PM2.5 air pollution								
ambient	2.42	1.24%	0.49	0.25%	0.53	0.27%	0.11	0.06%
household	1.27	0.65%	0.25	0.13%	0.28	0.14%	0.06	0.03%
Inadequate water, sanitation and hygiene								
direct impact	0.43	0.22%	0.14	0.07%	0.09	0.05%	0.03	0.02%
indirect impact	0.08	0.04%	0.04	0.02%	0.02	0.01%	0.01	0.00%
Arsenic in drinking water	0.80	0.41%	0.18	0.09%	0.18	0.09%	0.04	0.02%
Occupational pollutants	1.52	0.78%	0.29	0.15%	0.34	0.17%	0.06	0.03%
TOTAL	6.52	3.35%	1.40	0.72%	1.44	0.74%	0.31	0.16%

The economic cost of this mortality in terms of foregone labor output is estimated at US\$1.4 billion in all urban areas of Bangladesh and at US\$310 million in Dhaka alone. This is equivalent to 0.6 percent and 0.1 percent of Bangladesh’s GDP in 2015, respectively. Considering the broader welfare impacts of mortality that go beyond foregone labor output, we estimated the economic impact at US\$6.52 billion in urban Bangladesh and US\$1.44 billion in Dhaka alone, which are equivalent to 3.4 percent and 0.7 percent of the 2015 GDP, respectively (see Table 1-2). These figures may be considered the lower and upper end of a plausible range of estimates of the economic cost of mortality attributable to quantifiable environmental health risks.

In addition, non-mortality costs of several aspects of environmental degradation in urban areas have been assessed. Specifically, following Narain and Sall (2016), the cost of health burden of PM2.5 air pollution was estimated at 10 percent of the welfare loss estimate, namely US\$370 million. The annual productivity loss of healthy workers in the RMG industry caused by ambient air pollution is estimated at US\$90 million annually, a significant figure as it points to a potential vulnerability of Bangladesh’s wage competitiveness in this nationally important export sector. The treatment

and time costs of illness attributed to inadequate health are estimated at US\$130 million. Finally, the lost income due to IQ loss in children exposed to lead near ULAB sites is estimated at US\$50 million (see Table 1-3). These estimates do not lend themselves to being added together due to differences in the estimation

TABLE - 1-3: ADDITIONAL COED ESTIMATES (US\$ BILLION) AND 2015 NATIONAL GDP EQUIVALENCES

	Amount	GDP equivalent
Productivity loss in RMG industry due to air pollution	0.09	0.04%
Foregone labor output due to IQ loss in children exposed to lead	0.05	0.03%
Morbidity from air pollution		
ambient	0.24	0.12%
household	0.13	0.07%
Morbidity due to inadequate WASH	0.13	0.07%

methods used. Equally as important, adding them up would suggest completeness, whereas in fact, for the majority of environmental health risks, the cost of disability—that is, treatment cost or lost productivity—is an area that still needs to be investigated.

It is important to note that these estimates are conservative and do not reflect the entire cost of urban environmental degradation. This is because these figures cover only a select number of environmental degradation impacts on humans, for which data and established estimation methodologies are available, and also because estimations were made using conservative assumptions. For example, it was not possible to estimate the cost of lost biodiversity and recreational services from severe water pollution, or of the health and behavioral impacts of exposure to lead. In addition, impacts of urban pollution go beyond the limits of urban areas. A good example is PM2.5 air pollution, which impacts peri-urban and rural areas near the cities where the pollution sources are.

Nevertheless, the estimates point to the gains that could be made in terms of human health,

productivity, and general welfare if environmental management in urban areas was improved. The next chapters present recommendations for priority institutional, technological, and planning measures to be implemented by regulators, industries, and city governments to achieve cleaner industries and more resilient urban areas. Undoubtedly, these measures come with costs to be incurred by these parties. However, these estimates show that such measures would also help avoid significant costs to the economy and society. The selection of priority measures would be best done on a location-specific cost-benefit or cost-effectiveness analysis, whereby the avoidance of some of the costs identified would be accounted for as benefits.

The CoED exercise further highlights the need for more research in Bangladesh on emerging environmental externalities and their costs. In particular, the sources of heavy metal contamination by industrial and non-industrial sources, and the health and developmental impacts attributable to different sources, need to be better understood. Finally, it will be important for Bangladeshi research institutions to lead such research.

CHAPTER 2.

POLICY AND INSTITUTIONAL FRAMEWORK FOR POLLUTION CONTROL AND CLEANER PRODUCTION

To put Bangladesh on a greener growth trajectory, the government will need to strengthen different policies and institutions and better leverage complementary approaches. With respect to industries, these include systems to (i) control pollution by enforcing environmental standards and enabling public pressure; and (ii) support a shift toward cleaner technologies and practices. This chapter presents an analysis of existing policy and institutional systems that pertain to industrial pollution, and makes recommendations for their development. The chapter's particular focus on the manufacturing sector is justified by the sector's increasing contribution to air, water, and soil pollution, by the concentration of polluting manufacturing firms in and around urban areas, and by the government's plans for further growth of this sector, notably through the establishment of many new economic zones. The key components of this analysis are:

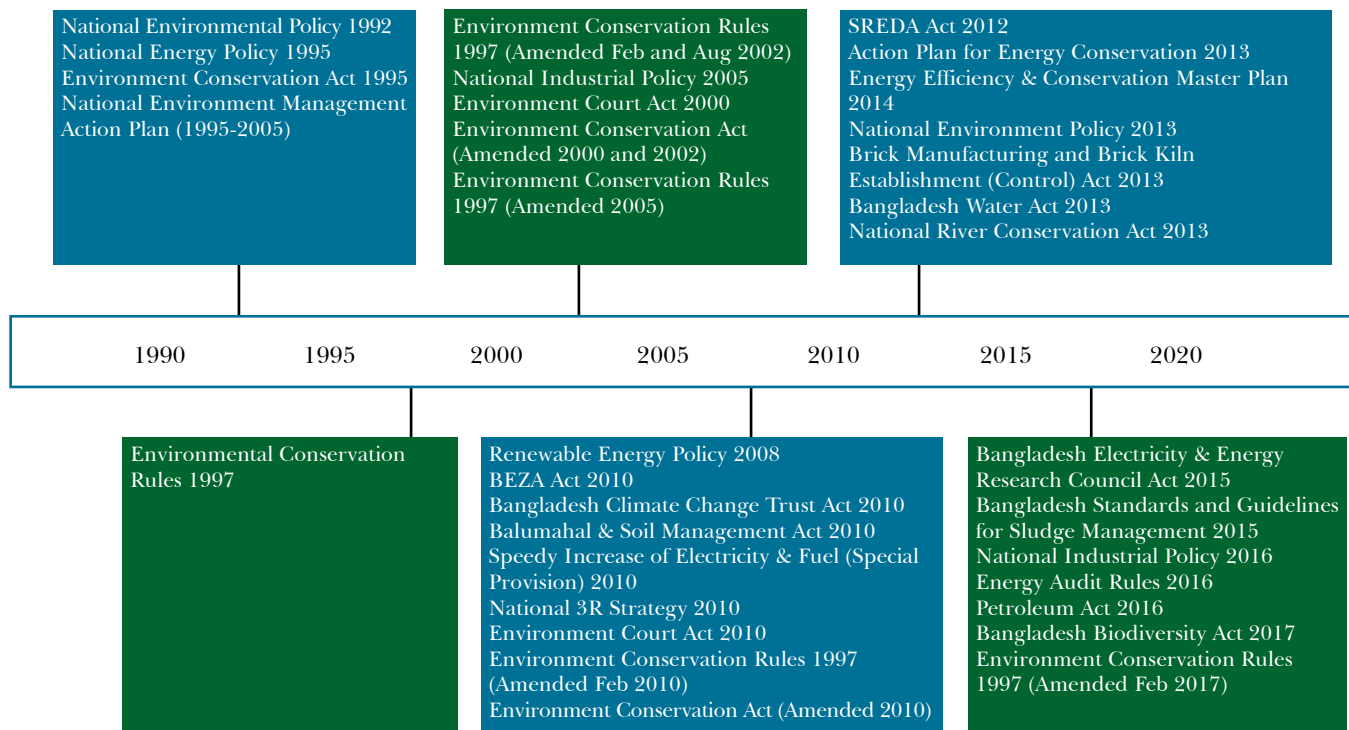
- Adequacy of core environmental policies, regulations, and standards that govern industries and other sources of pollution;
- Effectiveness of the enforcement and accountability regime, including the primary environmental regulator and the environment court system, as well as civil society as an agent in holding polluters accountable; and
- Status of approaches to foster cleaner production.

2.1 CORE ENVIRONMENTAL POLICIES AND STANDARDS GOVERNING INDUSTRIES

Bangladesh's policy and legal framework governing environmental performance has been gradually improving. The 1992 National Environment Policy was Bangladesh's first environmental law, which was revised in 2013 and is currently being updated. Since then, over 25 different acts, policies, guidelines, and regulations have been instituted that play a role in regulating the environmental footprint of industries and development activities, as well as promote RECP. Figure 2-1 summarizes the chronological development of these policies and regulations (further information on progress since 2006 to build the environmental policy and regulatory framework is provided in Annex A).

The policy framework and enforcement regime need to be strengthened to effectively address mounting environmental degradation and pollution. The available benchmark data suggests that Bangladesh's regime for environmental protection is not as strict as in some other countries in Asia. Figure 2-2 compares Bangladesh with select countries based on both the stringency of environmental regulations and their enforcement. The rankings are based on responses given by more than 14,000 executives in 148 countries to a survey carried out by the World Economic Forum (WEF). The highest ranked countries in the region include Japan and Korea (both high-income economies), and Malaysia (upper-middle-income). However, Bangladesh ranks lower than several lower-

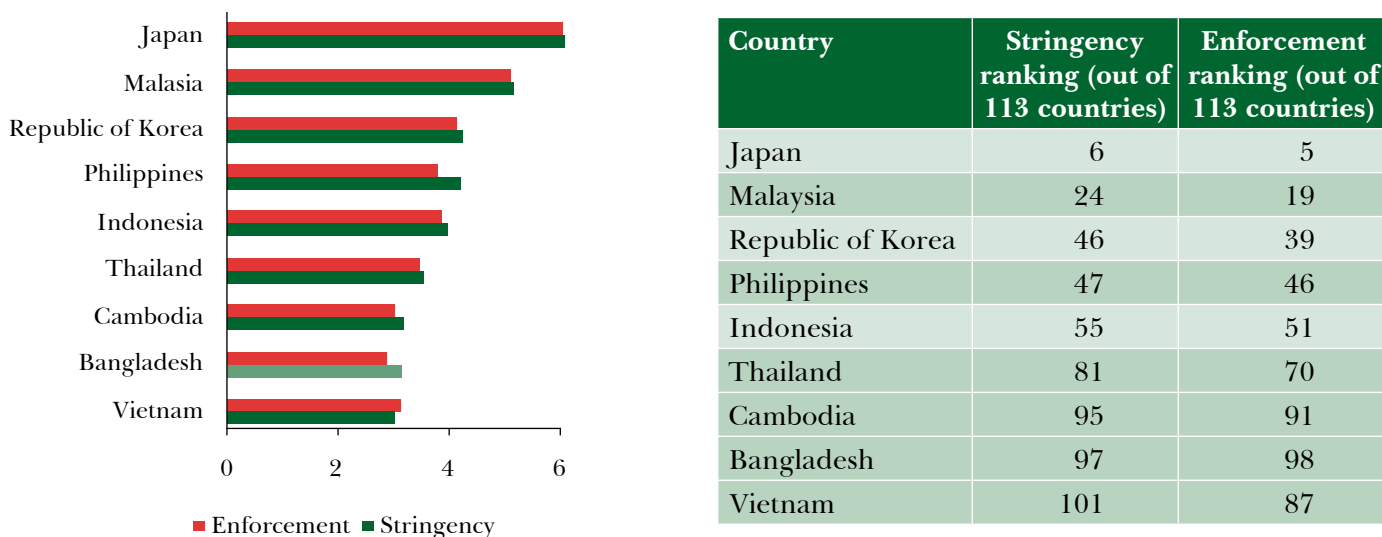
FIGURE - 2-1: CHRONOLOGY OF POLICIES, REGULATIONS, AND STRATEGIC PLANS RELATED TO ENVIRONMENTAL PROTECTION, INDUSTRIAL POLLUTION MANAGEMENT, AND RESOURCE EFFICIENCY IN BANGLADESH



middle-income countries, such as the Philippines, Indonesia, and Cambodia. Although the surveyed group ranked Bangladesh higher than Vietnam in

terms of stringency, Bangladesh was perceived as weaker on enforcement. The key areas in need of improvement are discussed below.

FIGURE - 2-2: STRINGENCY AND ENFORCEMENT OF ENVIRONMENTAL REGULATIONS IN SELECTED COUNTRIES, 2015



Source: Browne et al. 2014. For more details on the methodology used to ensure data quality, see the Global Competitiveness Report 2014–2015 at <http://reports.weforum.org/global-competitiveness-report-2014-2015/results-computation/>.

2.1.1 Revising the Environment Conservation Rule

Bangladesh’s umbrella act for conserving the environment, improving environmental standards, and controlling and mitigating pollution is the Environment Conservation Act (ECA) of 1995. The ECA is operationalized through the Environment Conservation Rule (ECR) of 1997, Bangladesh’s main legislative tool for the environmental regulation of industries, which is currently being updated.¹⁰ The ECR 1997 lays out (i) the requirements for and procedures to obtain and renew an environmental clearance for industries or other development activities; and (ii) the national environmental quality standards for ambient air, various types of water, industrial effluents, emissions, noise, vehicular exhaust, etc.

– Improving the transparency of the environmental clearance process

The ongoing revision to the ECR provides a precious opportunity to introduce stronger requirements for public consultation and disclosure of environmental information. The revised ECR is expected to improve the environmental clearance process, which is the government’s main opportunity to review and evaluate the potential environmental impacts of a proposed industrial facility (or other development activity), and to specify environmental mitigation, management, and monitoring requirements. The new proposed ECR does make consultations mandatory for “Red” category projects (highest potential risk) to obtain site and environmental clearances, which is a very important and positive amendment to the ECR 1997. Nonetheless, the draft ECR revision leaves the public disclosure of draft or final Environmental Impact Assessment (EIA) reports to the discretion of the Director General (DG) of the DoE. In practice, at least some information is typically disclosed at the local level as part of public consultations for Red category projects, but completed assessments—which should outline the mitigation and management requirements of the industry or facility—are not readily available to local communities or the general public. In addition,

there is no requirement for local disclosure, in the local language, of summary information from the initial environmental examination (IEE)/EIA process. EIA findings are also not systematically disclosed on the DoE website or any other government site, unless mandated by the disclosure requirements of donor agencies. Furthermore, the DoE does not publicly disclose environmental monitoring information from industries or development projects, or compliance records, including fines or compensation levied for violations and damages.

Improving public disclosure and access to environmental information will increase transparency, accountability, and public trust in the system. Greater transparency would help the DoE uphold the objectives of the ECA and ECR by better enabling public pressure to hold polluters accountable. In line with international good practice, the DoE should require public disclosure of all environmental information related to facilities and development projects subject to Environmental Clearance Certificates (ECCs). This should include IEEs/EIAs, summaries in the local language, terms of the ECC (including any special conditions imposed by the DoE), and ongoing compliance monitoring and enforcement data. The online component of a public disclosure system of industry-specific environmental information could be achieved by building on the recently developed online system for ECC issuance and other services recently developed by the DoE. Under the new system, an entrepreneur can submit a clearance application and monitor it online from his or her own office. This online system will help create a central database of industries, industry types and categories, and ECC renewal status. However, public access to such information in this system is still very limited. There is significant scope to advance this system to incorporate additional data fields and provide public access to more information, including EIA report summaries, renewal status, environmental monitoring reports, and so on. It is therefore recommended to (i) further develop this system to incorporate key environmental clearance and compliance information of the industries; and (ii) make the information publicly available.

¹⁰ A draft revision of the ECR was completed and approved by the Director General of the DoE in late 2017, and at the time of writing it was awaiting formal approval by the ministry for official gazetting. The draft was made available to the World Bank by the DoE for early review. See Annex B for detailed observations and recommendations on the draft revised ECR.

– Improving environmental quality standards

The usefulness of environmental clearances and monitoring requirements in controlling pollution hinges on the environmental quality standards (EQS) that underpin them. Bangladesh’s EQS are set by both the ECA of 1995 and the ECR under it (both the prevailing 1997 rules and subsequent amendments, and the 2017 proposed revisions). They include ambient standards, i.e., limits to the concentrations of certain chemical substances that pose significant risk to human health, the environment, or biota (such as fisheries, biodiversity, forests etc.), as well as complementary limits for discharges, emissions, and losses for these substances.

The proposed standards in the draft ECR revision are partially strengthened, but could be more coherent. Some standards are tightened, but without adequate justification or nuance to reflect and provide guidance for specific technologies used in Bangladesh. For example, the emissions standard for brick kilns has been tightened but the reduction appears ad hoc and remains significantly above what is readily achievable under currently available technologies. Water quality standards have also been tightened, but a few (namely those regarding iron) are now below WHO and developed countries’ standards, which seems impractical/unachievable from an economic perspective and lack clear justification from a health perspective.

The process of revising the EQS would benefit from wider technical and public review and comment. To facilitate this review, a background paper explaining and justifying the proposed changes would need to be prepared and published. This would enable a sound scientific and public debate to facilitate (i) adjusting certain standards to be meaningful and achievable in the Bangladeshi context, as well as to clarify many standards that are too generic and lack technology-specific thresholds (notably for power plants); (ii) tightening other standards that are now behind current technologies (such as brick kilns) and inconsistent with international norms; and (iii) clarifying standards that do not currently appear to

be practical from an enforcement perspective, given existing baseline pollution levels (such as ambient air quality standards).

Ambient standards need to be supported by compliance monitoring of pollution levels and a periodically updated plan to achieve compliance. The DoE has some legal authority to collect and publish information on environmental pollution, and publishes an annual report. However, monitoring and reporting of area-based (e.g., for airshed, water basin, ecosystems, etc.) environmental quality data is not legally binding. Some DoE initiatives are underway, such as the monitoring of criteria air pollutants in major cities.¹¹ The data is disclosed with a 24-hour lag period. The DoE also performs ambient water quality monitoring for the four rivers around Dhaka. Area-based environmental quality monitoring is recommended, with a gradual, phased approach starting with the most polluted hotspots, accompanied by strengthening the capacity of the DoE to perform monitoring and compliance with EQS. Furthermore, disclosing environmental quality monitoring data in real-time, where available, will increase its utility to the public and raise public awareness.

2.1.2 Legal Framework for Industrial Hazardous Waste Management

Hazardous waste management remains an under-regulated and relatively unpublicized aspect of the country’s industrial development. Bangladesh is a signatory of the Basel Convention (Secretariat of the Basel Convention 1989) and the Stockholm Convention.¹² The Bangladeshi legal framework on hazardous wastes centers on the Hazardous Waste and Ship breaking Waste Management Rules of 2011, promulgated under the ECA of 1995 (amended). Hazardous materials (hazmats)—of which hazardous wastes are a subset—are defined and classified under the rules (details are provided in Annex D). Data on the extent of hazardous wastes in Bangladesh is outdated and incomplete, although a 2007 DoE study indicates that industries producing hazardous materials are centered largely in Dhaka and Chittagong. Most hazardous wastes get disposed of in regular landfills,

¹¹. Currently in the eight largest cities, soon to be scaled up to an additional five cities under additional financing from the World Bank–funded Clean Air and Sustainable Environment (CASE) Project.

¹². Stockholm Convention on Persistent Organic Pollutants (2001).

where chemicals may leach into groundwater and contaminate soils, or be burned and release toxins into the air.

The hazardous materials management regime needs to be improved, especially in terms of data collection, regulations, and institutional framework. Further assessment is needed to better understand the current quantities and types of hazardous material produced in Bangladesh and the challenges and options related to its disposal. Importantly, the legal framework also requires further review—for example, to fully align the hazmats classification system with Basel Convention requirements, and to clearly mandate a 3R (reduce, reuse, and recycle) approach for industries, including considering full product lifecycles as part of industrial permitting requirements. There is also a need to set up a system, including policy, regulatory, and funding aspects (with clarity on revenue structure for financial sustainability) to clean up and remediate legacy contamination.¹³

2.2 ENFORCING ENVIRONMENTAL COMPLIANCE

Even a robust legal and regulatory framework is only as effective as its implementation. The institutions charged with implementing and upholding the laws and regulations are therefore the second critical pillar of environmental governance. The following section examines three essential elements of an effective compliance, enforcement, and accountability regime: (i) the capacity and effectiveness of Bangladesh’s DoE, as the country’s primary environmental regulatory authority; (ii) the environment court system; and (iii) civil society as an agent and promoter of environmental accountability.

2.2.1 *The Department of Environment*

Bangladesh’s DoE has the mandate to implement Bangladesh’s legal and regulatory framework for environmental protection, but lacks the resources to effectively do so. The DoE is the only institution in Bangladesh with a mandate for environmental

protection, and has been given wide powers under the 1995 ECA.¹⁴ However, as the reality on the ground shows, the DoE is under equipped to effectively address the country’s mounting pollution challenges. The DoE, which sits under the Ministry of Environment, Forest, and Climate Change (MoEFCC), was established in 1977 as the Environmental Pollution Control Board following promulgation of the Environment Pollution Control Ordinance of 1977. This Board was assisted by a Pollution Control Cell, which ultimately grew into the Department of Environmental Pollution Control and subsequently the Department of Environment. Under the provision of the 1995 ECA, the DoE is responsible for:

- granting ECCs to factories and development projects;
- undertaking inspections of industrial units and monitoring compliance with and enforcement of environmental standards;
- preventing activities likely to cause environmental degradation; and
- carrying out various other advisory and research activities.

– Strengthening human resources and the organizational structure

With the increase in responsibilities over time, as well as the country’s growing environmental challenges, the DoE requires a significant increase in staffing to perform its core functions. The volume of tasks undertaken by the DoE has increased manifold over the last two decades due to the scale of environmental issues and regulatory demand, and changing economic, population, and environmental conditions. However, its manpower has not increased nearly enough to accommodate this increase. The DoE currently operates with a staff of 431 against an approved 735 posts (the rest being vacant due to bureaucratic delays). In 2016, the DoE requested the additional hiring of 1,222 staff to meet its needs for all district and divisional offices, but only managed to get 172 new posts approved. If Bangladesh is to successfully tackle pollution and set the country on a long-term sustainable development path, the DoE’s

¹³. Additional analysis and recommendations are provided in Annex D.

¹⁴. Other institutions that also play a role in promoting and regulating industrial production—and can therefore help shape the environmental outcomes of those activities—are discussed in Section 2.3.

TABLE - 2-1: STAFF IN SELECTED COUNTRIES' ENVIRONMENTAL AGENCIES

	Bangladesh	Philippines	Mexico
Population (million)	161.0	100.7	127.0
GDP (US\$ million)	195.1	292.5	1,143.0
Total approved agency headcount	735	1,780	6,593
National population per employee, based on approved headcount	220,000	56,573	19,262

Note: Based on data from GoPh 2018, GoM 2018, and World Bank 2017.

budget allocation and approved headcount need to reflect its central importance in this challenge.

While Bangladesh aspires to become a middle-income country, the DoE's approved headcount is significantly lower than that of environmental agencies of comparatively sized middle-income countries, where staffing data was available. Using total population per approved agency staff as a proxy measure, Table 2-1 compares Bangladesh's DoE with approved posts in the Philippines's Environmental Management Bureau, and the sum of approved posts covering similar environmental policy, compliance, and enforcement functions in Mexico, which are spread across three Mexican agencies.¹⁵

Staffing increases are especially needed at the divisional and district levels. Inadequate manpower and physical resources at the field level do not allow the DoE to extend its activities in a fully decentralized way. The DoE is set up in six divisional headquarters,¹⁶ underneath which are field offices in 21 districts (out of the 64 districts in 8 divisions of Bangladesh) (see Figure 2-3). Divisional offices typically have 5–6 staff, while district offices typically have just 3 staff. They are nonetheless supposed to process all files related to environmental clearances, remediation, and corrective and enforcement actions for all industries and development activities that trigger such requirements in that division/district. Industries seeking environmental clearance or processing of other compliance-related actions in districts with no

DoE office have to apply to the nearest DoE office. This often results in processing delays, as it further burdens the already overstretched neighboring offices. Moreover, in areas with no district office, the DoE also lacks eyes on the ground to monitor and follow up on cases of ECC noncompliance.

A needs assessment for DoE services based on concentration of industries and polluting activities would allow prioritizing of opening and staffing field offices. For example, with the increased number of washing and dyeing plants in Valuka, Mymensingh, as well as polluting industries in Netrokona and Sherpur, additional resources in this region are strongly justified. The recently approved Divisional Office in Mymensingh likewise needs to be quickly staffed given that area's trends in industrial development and urban growth. With the increased need to protect sensitive ecosystems, stop hill-cutting, and address pollution, additional manpower is also urgently warranted for Cox's Bazar District Office. In some of these industry-intensive districts, it may be further warranted to have DoE offices at the subdistrict (upazila) level.

Aside from decentralization, the DoE needs to ensure that the core functional areas related to major environmental priorities are clearly reflected in the organogram. Since the 2006 CEA, the DoE has commendably created a Directorate for Air Quality with functional focus on Air Quality Management, as well as a Directorate for Climate Change. However, similar directorates do not exist for other core

¹⁵ Mexico's Ministry of Environment (SEMARNAT), the agency that approves environmental clearances and conducts environmental enforcement for the energy sector (ASEA), and the enforcement of environmental regulations by Procuraduría Federal de Protección al Ambiente (PROFEPA).

¹⁶ Currently, there are eight divisions in Bangladesh, with Mymensingh the latest formed out of the Dhaka Division.

functional areas, such as water quality, wastewater management, hazardous waste management, environmental quality, laboratories, and so on. Adding such directorates would help ensure that these issues receive the attention they require and bring the DoE in line with the environmental authorities of many other countries.¹⁷

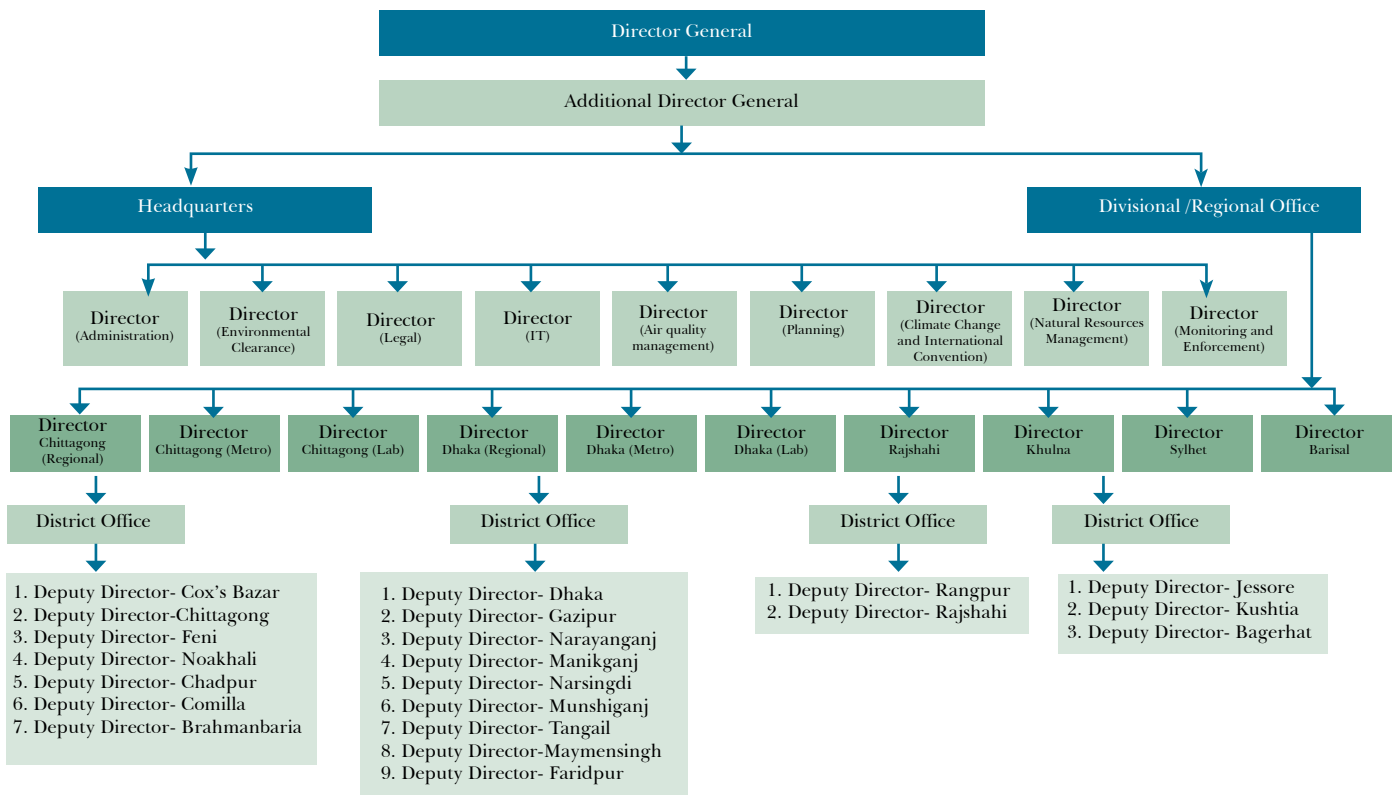
Full separation between environmental clearance staff and monitoring and enforcement staff would enhance accountability and efficiency. As shown in the organogram (see Figure 2-3), environmental clearance is already separate from monitoring and enforcement at the directorate level. However, staff are not consistently distinct in divisional and district offices. This separation needs to be further implemented through clear job descriptions and responsibilities down to the district level offices.

An “environmental cadre” system could be considered to help attract and retain talented and competent professionals, as well as bolster the DoE’s authority within the government. Under the current system, professional career staff cannot make it to senior leadership levels due to lack of a cadre. This serves as a disincentive for recruitment and long-term retention of professional staff, who may choose instead to seek opportunities in the private sector or elsewhere after hitting the internal “glass ceiling.”

– Improving information management systems

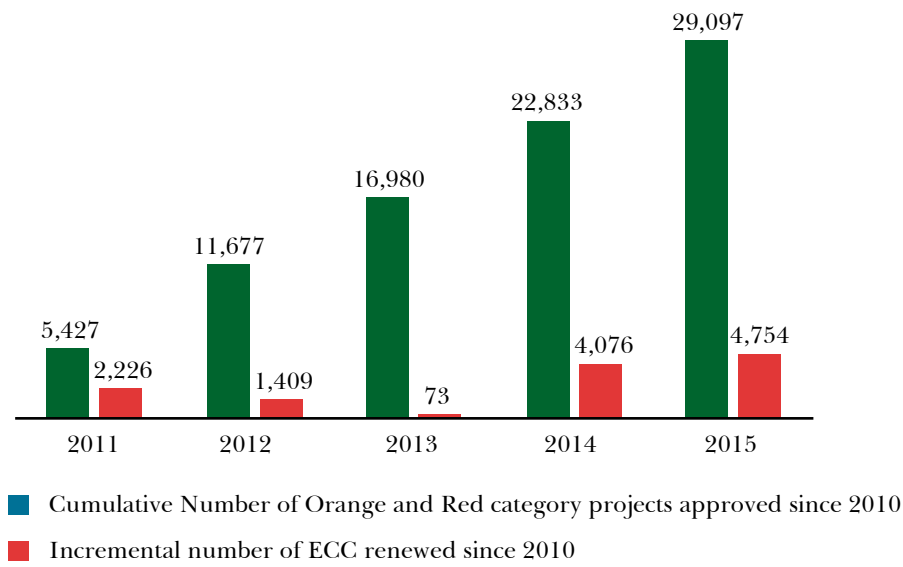
The environmental clearance renewal system is poorly implemented, undermining its utility. Project proponents are currently required to follow the conditions prescribed by the ECC granted by the DoE regarding the implementation of mitigation

FIGURE - 2-3: ORGANOGRAM OF THE DEPARTMENT OF ENVIRONMENT



¹⁷. A quick way to achieve this without excessive organizational reform may be to put the general affairs and services in the office of the DG/ADG, thus freeing the positions of a number of directors (e.g., administration, law, IT, etc.) and to replace these positions with directors with functional focus and deliverable objectives. With the new Climate Change Division (section) in the ministry, the Climate Change Director’s functions may be considerably reduced. Thus, the functions of this director (which may only be inter-agency liaison now) may be placed under the Planning Director, freeing another director position. Further comparative information and examples of organizational structures for agencies/departments from other countries with similar roles and responsibilities are provided in Annex C.

FIGURE - 2-4: EXPECTED AND ACTUAL NUMBER OF ECC RENEWALS, 2010–15



Source: Ahmed and Ferdousi 2016.

measures and the agreed monitoring program. The Environmental Management Plan (EMP)—a requirement for obtaining the ECC—becomes a binding obligation. Additionally, project developers and industrialists must also apply for periodic ECC renewal for the entire lifespan of the project or facility. The application for ECC renewal is supposed to include environmental monitoring data, which should serve as an important indicator for the effectiveness of mitigation measures suggested in the EMP. Data collected over the last five years regarding the issuance and renewal of ECCs shows a growing disparity between the project EIA approvals and the number of ECC renewals. While the number of renewals should theoretically match the cumulative number of ECCs issued to the total projects each year, the number of additional renewals is only a small fraction of this expected number (see Figure 2-4). This indicates that the DoE’s internal mechanisms for tracking, monitoring, and following up on ECC renewals are currently ineffective. In many cases, it has been found that the proponents are totally unaware of this particular provision of the 1997 ECR, which is also a symptom of the DoE’s inadequate capacity for follow up.

The DoE should invest in better monitoring and enforcement systems. Developing a comprehensive information management system and database to

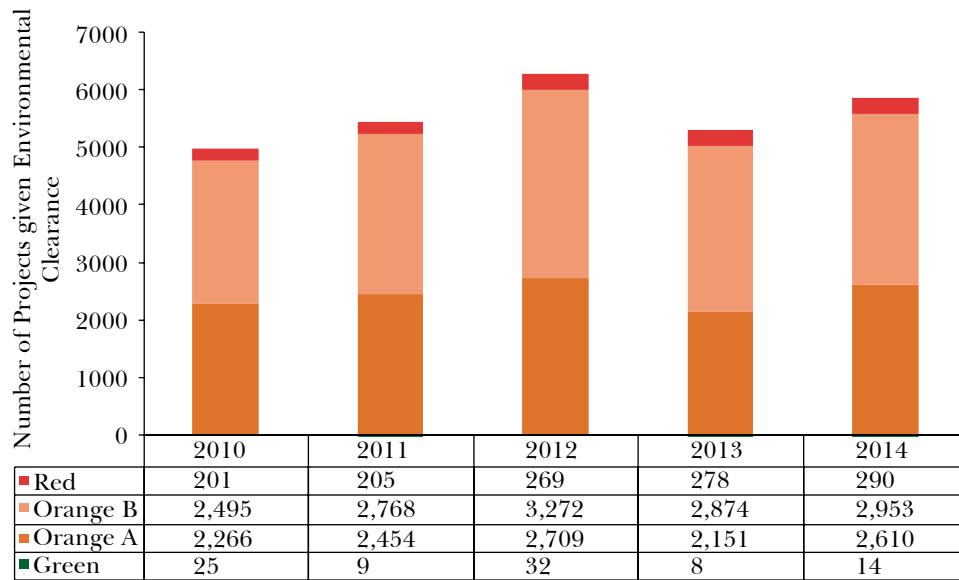
track all ECC holders, the status of their compliance, and ECC renewal would make the DoE’s enforcement function more efficient. Such a system should be transparent to the public via a website portal to enhance polluters’ accountability. The portal could also receive automated monitoring data from industrial clusters and large industries, and track grievances related to environmental management issues on specific facilities or projects.

– Bringing in outside expertise and outsourcing

Drawing on outside experts for EIA review could be a way to supplement the DoE’s limited internal capacity for the environmental clearance process.

The increase in the number of Red category project applications in Bangladesh over recent years (see Figure 2-5) have created additional workload, if the DoE is to adequately scrutinize the EIA documents required to issue ECCs. These EIA reports are mostly related to power, water resources, land resources, and infrastructure development projects, which require a wide variety of expertise to review and monitor. Though most Red category projects are typical, there are some projects for which EIA reports require very specific expertise to review (e.g., nuclear power plants, coal-based power plants). Under the current system, only DoE officials review the EIA, and no independent technical experts are involved. Therefore, not only

FIGURE - 2-5: NUMBER OF DIFFERENT PROJECT CATEGORIES GIVEN ECC, 2010–14



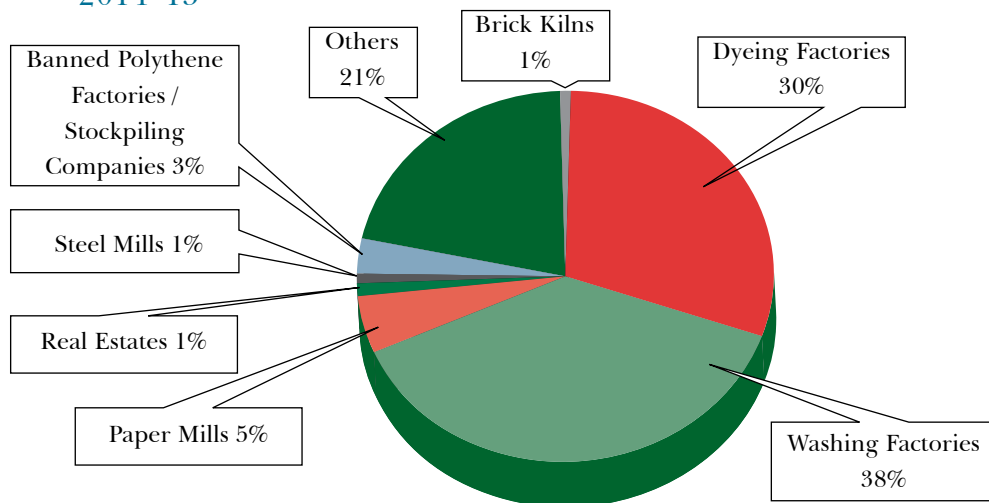
Source: Ahmed and Ferdousi 2016.

does the sheer volume of Red category projects become burdensome to an understaffed technical committee, but the lack of specific expertise in the evaluation committee might result in poor quality EIA reports being approved. The proposed 2017 ECR has a provision for constituting a clearance committee in the DoE for deciding on Red category projects. It is recommended that the committee involve outside

experts to assess Red category projects and advise on whether site and environmental clearances should be issued.

Similarly, the DoE can look into ways to outsource its monitoring activities to competent consulting firms, given inadequate in-house staffing and multiple mandates. Even with the best data management

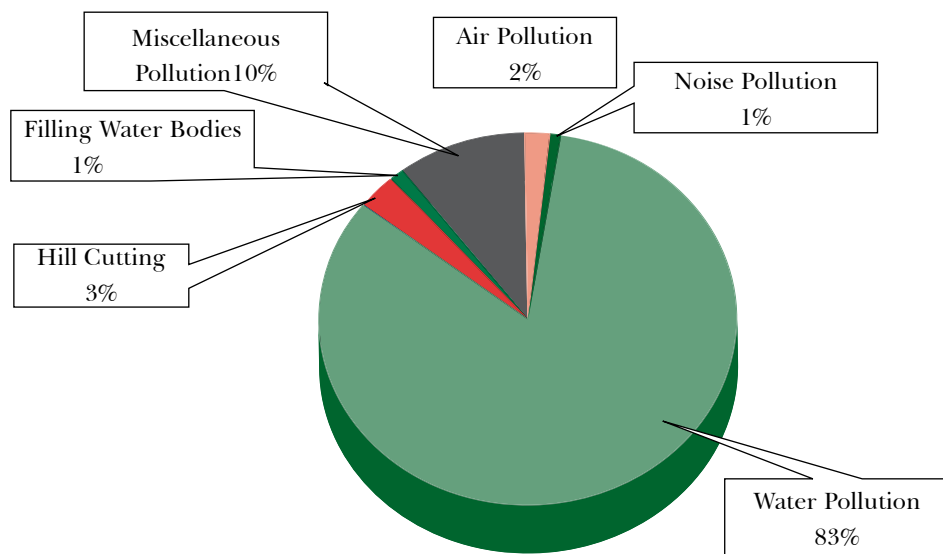
FIGURE - 2-6: PROPORTION OF INDUSTRIES SUBJECT TO DOE ENFORCEMENT, 2014–15



2014-2015 FY Enforcement activities (based on industry type)

Source: DoE 2016.

FIGURE - 2-7: DOE ENFORCEMENT BASED ON NATURE OF POLLUTION, 2014–15



2015-2016 Fiscal Year Enforcement Activities (based on nature of pollution)

Source: DoE 2016.

systems, competent staff are still needed to review monitoring data and follow up with polluters. In this regard, the DoE could leverage the services of different laboratories of other government organizations and educational institutions.

– More consistent application of penalties

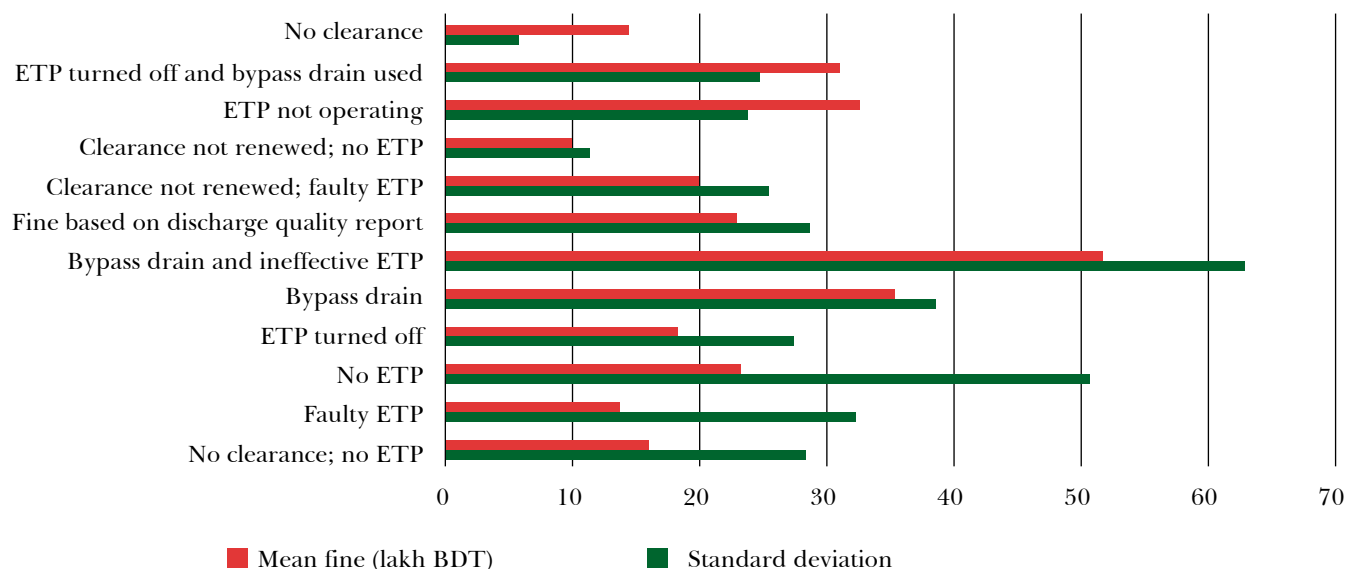
The current penalty system does not provide effective deterrence and requires an overhaul. The DoE applies the “polluter pays principle” for environmental conservation according to Section 7 of the 1995 ECA (amendment 2010), which states that if it appears “that any act or omission of a person is causing or has caused injury to the ecosystem, the person may bound to compensate that.” Factories that contribute to water pollution have been fined the most compared to other industries (see Figures 2-6 and 2-7). Those fined the most (both in terms of number of industries and quantity fined) were dyeing operations, washing factories, and paper mills. However, water pollution continues unabated and river water quality has continued to deteriorate. This may be due to various factors, including: (i) fines/compensation are not high enough; (ii) fines/compensations are not realized; (iii) the degree of enforcement activities is very low compared to the number of industries responsible for

pollution; and (iv) there are other sources of pollution beyond industry (e.g., municipalities, agriculture), further pointing to the importance of the area/watershed-based approach noted above. The DoE should reassess its strategies to identify and address actual causes of pollution.

Ad hoc application of the polluter pays principle needs to be replaced with a rule-based system under the ECA. The DoE applies the polluter pays principle to calculate the fines incurred by a particular polluting industry (which is based on a calculation of cost for treatment per cubic meter of wastewater times the volume of wastewater discharged). However, evidence from various newspaper reports suggest that fines (i) are arbitrary in nature and do not distinguish between different levels of violation; (ii) may be too low to deter polluting activities; and (iii) do not clearly distinguish repeated offenders. Table 2-2 shows the level of fines for different violations, which appears to vary among different groups of violations and even within a group. Even if the factory is fined twice a year, for an average of BDT 10,00,000 (approx. US\$120,000), it would be more economical to pay the fine rather than run a wastewater treatment plant.¹⁸ Furthermore, the DoE does not currently maintain a comprehensive database of inspections, fines, and compensation levied. The

¹⁸ It has been estimated that the average cost of wastewater treatment for a textile dyeing factory is around BDT 32 per cubic meter using chemical method, which can translate into an annual cost of BDT 1,33,50,000 for a small factory (Prothom Alo 2013).

TABLE - 2-2: FINES IMPOSED BY THE DOE ON INDUSTRIES CAUSING WATER POLLUTION, 2011–16



Source: Haque 2017.

policy implications are significant, as the lack of clear evidence that repeating an offense will result in greater fines weakens deterrence (Haque 2017). A rule-based system is needed, which specifies progressive fines that vary with the ranked level of violation. Repeated violators must be penalized at progressively higher rates or subjected to forceful closure. Also, the DoE needs to maintain a proper database for recording inspections so it is easier to track industries' activities after they are penalized.

The process of collecting fines needs to be more efficient. Table 2-3 shows that in most cases, fines are collected less than 50 percent of the time. Two key reasons for this inefficiency may be: (i) payments are made in installments; and (ii) project proponents take shelter in courts, which delays the process if an injunction is ordered. On the latter, the High Court has over time developed more confidence in the DoE's compensation calculation methodology, and in recent instances has approved the DoE's method

TABLE - 2-3: DOE ENFORCEMENT ACTIVITIES BASED ON POLLUTION TYPE, 2014–15

Pollution type	No. of entities fined	Compensation imposed (Crore)	Compensation collected (Crore)	Collection rate
Air pollution	68	2.10	1.19	57%
Noise pollution	3	-	-	
River pollution/water pollution	283	32.52	15.42	47%
Cutting hills	9	1.50	0.60	40%
Filling water bodies	10	0.34	0.16	47%
Other	29	0.49	0.47	96%
Total	402	36.95	17.84	48%

Source: DoE 2015a.

of collecting compensation—and even instructed the DoE to calculate compensation on the court’s behalf. It is therefore possible that fine collection may become more efficient in the future. It is nonetheless recommended that the DoE look into additional ways to enhance expedient collection of fines, which will also serve to increase their deterrence value.

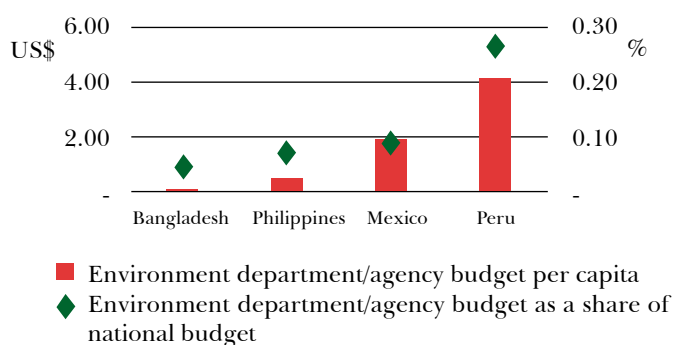
– The DoE’s financial sustainability

The DoE’s non development budget (e.g., recurring core expenditure) has been stagnant, despite the department’s increasing responsibilities. In the fiscal year (FY) 2017 national budget, the MoEFCC’s total allocation was BDT 10.3 billion (approx. US\$124 million), or about 0.2 percent of the national budget. The DoE’s budget within this allocation was BDT 1.02 billion (approx. US\$12.3 million), or about 10 percent of the MoEFCC’s budget.¹⁹ In the most recent (FY18) budget, the MoEFCC’s total allocation went up by about 8 percent, to BDT 11.2 billion (approximately US\$135 million). Within this envelope, the DoE’s budget allocation increased to BDT 1.36 billion (approx. US\$16.4 million), which is an increase of 34 percent over the previous year. By comparison, the overall national budget increased by 15 percent during the same period. While the increase in the DoE’s budget compared to the national budget is notable, the additional budget is allocated almost entirely to development expenditures (e.g., financing public investment projects, which are a one-time budget for specific purposes), rather than nondevelopment expenditures (e.g., recurrent expenditures for carrying out core functions, such as public officials’ salaries, goods needed to provide services, social or economic interventions, interest payments, and so on). The increase in the DoE’s budget for nondevelopment expenditures is only 2 percent over the previous year—which actually represents a net decline when factoring in annual inflation of approximately 5.6 percent. The DoE’s nondevelopment budget for the

current year is only BDT 365 million (approximately US\$4.4 million).

By international comparison, the DoE’s budget is notably low to fulfill its mandate. It is not easy to provide direct international comparisons due to limited public availability of detailed budget information, a variety of methodologies or categorical groupings employed by different countries in their public reporting, and varied environmental contexts and institutional structures for environmental agencies across countries. However, some comparisons can still be made. Figure 2-8 compares budget allocations to comparable environmental authorities or agencies from Bangladesh, the Philippines, Mexico, and Peru. The information is presented on a per capita basis, and as a share of the national budget, taking into account that the selected countries’ populations and economies vary widely. The DoE’s budget allocations are significantly smaller than those of the other countries, particularly when compared on a per capita basis.

FIGURE - 2-8: ANNUAL BUDGET ALLOCATED TO ENVIRONMENTAL DEPARTMENTS/AGENCIES OF SELECTED COUNTRIES



Source: Based on GoPh 2018, GoM 2018, GoPe 2018, MINAM 2018, OEFA 2018, and SENACE 2018b.²⁰

¹⁹. In addition to the DoE, there are four institutions under the MoEFCC: the Forest Department (FD), the Bangladesh Forest Industries Development Corporation (BFIDC), the Bangladesh Forest Research Institute (BFRI), and the Bangladesh National Herbarium.

²⁰. Bangladesh’s data is based on the DoE’s most recently available annual budget allocations. The Philippines’ data is for the Environmental Management Bureau. In Mexico, data include aggregate budget for (i) policy making at the Ministry of Environment (SEMARNAT); (ii) the agency that approves environmental clearances and conducts environmental enforcement for the energy sector (ASEA); and (iii) the agency that oversees enforcement of environmental regulations (PROFEPA). In Peru, the estimates comprise the aggregate budget for (i) policy making at the Ministry of Environment (MINAM); (ii) the agency that approves EIAs (SENACE); and (iii) the environmental enforcement agency (OEFA).

2.2.2 Environment Court System

Outside the DoE, the environmental enforcement regime is limited by the lack of an effective environment court system. In Bangladesh, a separate environmental court system is envisioned under the law, but has not been fully implemented to date and remains difficult to access for the public. This section discusses the limitations and possibilities for reforming this system.

The environment court system was established with the idea that specialized courts would expedite cases related to environmental pollution. Bangladesh's traditional *adalat* (court) system was deemed inadequate for executing environmental laws and policies. For this reason, the government enacted the Environment Court Act of 2000, which was revised in 2010, with the aim of ensuring implementation of the 1995 ECA and 1997 ECR through judicial activities. The act aims to establish one or more environment court in each district, presided by a joint district judge. However, it does not mandate the creation of a separate or independent environment court in each district. As such, only three district-level courts (Dhaka, Chittagong, and Sylhet—all established under the original 2000 Act) and an appellate court in Dhaka have been established to date.

Despite the continued growth of Bangladesh's environmental problems, very few cases have been filed in the three environment courts and the environment appellate court. Just 100 cases are filed on average in Bangladesh's environment courts every year. Between 2003 and June 2015, 467 cases were filed in the Dhaka Divisional Environment Court, of which 350 were disposed and 117 are still pending as of writing. During a similar period, almost 350 cases were filed in the Chittagong Divisional Environment Court, of which 250 are still pending at the time of writing. The country's only environment appellate court,

situated in Dhaka, received just 43 appeals during 2005–15. In contrast, the Green Tribunal system in India—which was set up in 2010 under a similar mandate (but with a broader scope and covering a number of environmental laws)—has disposed 19,970 cases between its creation and September 2017, from its central and zonal benches (National Green Tribunal 2016).²¹ It has been perceived as a “fast-track court” for effectively and expeditiously disposing cases relating to environmental protection and conservation. Bangladesh's environment courts have not achieved a similar level of confidence and efficiency. As another point of comparison, almost 700,000 cases are filed every year in the Environment Control Board of New York City (Sajal 2015).

Several factors may contribute to the low use of the environment court system to date:

- i. The legal framework limits people's right to access environment courts directly.²² There is an exception to this provision, whereby the court may recognize an offence of a complainant directly, but the procedural provisions are more complicated,²³ and this probably discourages potential complainants from moving forward with their cases.
- ii. Given the current set up, the general understanding is that since the DoE is primarily responsible for filing a suit and performing an investigation, the ability of the environment courts to properly function rests with the DoE. Yet as previously discussed, the DoE's capacity is extremely limited, especially in district and divisional offices.
- iii. The environment courts' jurisdiction is limited. According to the 2010 Act, environment courts can only entertain offences and claims for compensation under “environmental law,” which is defined to include the 1995 ECA and 1997 ECR, and provides for other laws to be added to the list if subsequently specified by the government

²¹ For more information see National Green Tribunal, <http://www.greentribunal.gov.in/Home.aspx>.

²² According to Section 7(4) of the 2010 Environment Court Act, “No Environment Court shall receive any claim for compensation under environmental law except on the written report of an Inspector of the Department of Environment (DoE).” Section 6(3) states, “No Special Magistrate Court shall take cognizance of an offence except on the written report of an Inspector or DG, DoE.”

²³ If the environment court/Special Magistrate Court is satisfied that a person presented a written request to the said inspector to accept a claim for compensation/a complaint and no action was taken within 60 days after such request, and that such claim/complaint deserves to be taken into cognizance for the purpose of trial, then the court may, after giving the inspector or DG a reasonable opportunity to be heard, directly receive the claim for compensation/complaint without such written report or may, if it considers appropriate, direct the said inspector to investigate the claim/offence.

in an official gazette. However, only one other law—the Brick Manufacturing and Brick Kilns Establishment (Control) Act of 2013—has been subsequently specified by the government in the official gazette to fall under the jurisdiction of the environment court.

- iv. Even if the courts were open to the public to directly file cases against polluters, proving environmental pollution requires technical knowledge and scientific evidence, both of which are typically out of reach for common citizens without institutional assistance. If that assistance is not available (either from the DoE or any interested parties), the case is unlikely to be pursued, especially because common citizens may be too intimidated to file a lawsuit against polluters with potentially powerful economic and political connections.

To make the environment court system a more effective mechanism for holding polluters accountable and to provide public recourse in the case of environmental damages, several actions could be taken. In particular:

- i. The Environment Court Act of 2010 would benefit from amendments to make the environment courts people-focused, allowing the public to directly file lawsuits rather than going through the DoE, and to have a broader mandate covering all environmental policies and acts.
- ii. Setting up environment courts in all districts would facilitate public access.
- iii. DoE field offices need to be strengthened in terms of skilled manpower to provide better support to the public in filing cases with the environment courts. This is relevant even if the act is amended to allow for direct filing, given that affected parties are still likely to require assistance to gather evidence and provide technical backing to the lawsuit.

2.2.3 Civil Society

The third key element of any effective environmental enforcement system is the ability of civil society to play an active role in holding polluters accountable. This subsection discusses the Bangladeshi civil society’s capacity in this regard, and ways that it could be further strengthened to contribute more actively to environmental protection and sustainable development.

In Bangladesh, public interest litigation (PIL) has allowed important strides in establishing environmental case law to hold companies or individuals accountable for causing environmental harm. The concept of PIL emerged in Bangladesh’s judicial administration in the early 1980s, primarily inspired by its evolution and use in India and Pakistan. Since then, it has been crucial in the country’s development of environmental jurisprudence. By definition, PIL means litigation filed in a court of law for the protection of “public interest,” which includes environmental issues as they relate to the fundamental right to have a healthy and safe environment in which to live. Previously, only individuals whose interest was directly affected typically filed such litigation. Nowadays, any concerned citizen (or citizen group) can file a PIL case on behalf of a group of individuals whose rights are affected. The Bangladesh Environmental Lawyers Association (BELA) has been leading the PIL movement in Bangladesh. Some notable environmental PIL cases are synthesized in Table 2-4. All these resulted in the High Court issuing a rule on the implementing and regulatory agencies asking for an explanation of negligence, or by directing the executing agencies to immediately cease harmful activities.

Bangladesh’s civil society has played a notable role in advocating for environmental protection. Bangladesh Poribesh Andolon (BAPA), launched in 2000, is one of the most prominent civil society organizations in the country. Its mission is to create a nationwide, united, and strong civic movement to protect Bangladesh’s environment. BAPA has already brought some positive changes to the environmental cause in Bangladesh, working together with other environment-focused civil society organizations, such as the Coalition of Environment NGOs, Forum of Environmental NGOs, Association of Development Agencies Bangladesh, etc. Some successful campaigns that eventually influenced the government to adopt environmental protection measures include, for example:

1. Removal of two-stroke engine vehicles, which were a major cause of urban air pollution in Bangladesh;
2. Ending the use of leaded gasoline in Bangladesh;
3. Passing a ban (in 2018) limiting lead content in paint to 90 ppm;
4. Re-imposing the ban on the use of polythene bags; and

TABLE - 2-4: SAMPLE PUBLIC LITIGATION CASES

Public interest litigation	Environmental issues addressed
Dr. Mohiuddin Farooque vs. Bangladesh and Others	Indiscriminate cutting of hills causing degradation and ecological imbalance of Chittagong
Dr. Mohiuddin Farooque vs. Bangladesh and Others	Negligence in preventing the fire that engulfed the Magurchara gas field and adjoining areas while the Occidental oil company was carrying out their regular excavation, regulatory bodies approving such activities without proper EIA
BELA vs. Bangladesh and Others	Illegal encroachment on the Buriganga River
Biplob Kumar Roy vs. Bangladesh and Others	Illegally leasing out parts of the Nobogonga River in Narail, affecting the livelihood of poor fishermen
BELA vs. Bangladesh and Others	Illegal earthfilling of Ashulia FFZ by Jamuna Builders Ltd. in 2002 without the permission of RAJUK, in gross violation of the Master Plan
BELA vs. Bangladesh and Others	Unlawful filling up of Gulshan, Banani, and Baridhara lakes for creating housing plots
Quazi Faruque vs. Ministry of Shipping and Others	Inadequate life-saving buoys and apparatuses in all launches carrying passengers
BELA vs. Bangladesh and Others	Pollution of coastal and marine ecosystems caused by the disposal of hazardous shipwastes from the shipbreaking operation in Sitakunda of Chittagong in violation of environmental and labor protection
BELA vs. Bangladesh and Others	Relocation of tanneries in the Hazaribagh area to suitable locations and ensuring adequate pollution prevention devices are developed in the new location under existing regulations

Source: DoE 2015a.

5. Initiating a river-saving movement in Dhaka, leading to the removal of many structures encroaching on rivers in and around Dhaka.

Strengthening the general public’s awareness can be a way to exert pressure on polluters and hold the system accountable. Print and electronic media are already playing an important role in this regard. The citizenry’s greater environmental awareness also helps individuals to make smarter personal choices in terms of consumption patterns and market behaviors, which in turn puts pressure on manufacturers and vendors to clean up their supply chains and manufacturing practices.

Civil society’s role in environmental protection could be enhanced by improving information

transparency, raising awareness of environmental issues and concerns, and establishing mechanisms for engagement. With the broader adoption of smart phones, Internet access, and social media, there are new opportunities to strengthen awareness of environmental issues in urban areas. By supporting public education and awareness—such as by developing apps through which to display environmental information such as pollution data, updates on environment court cases, public consultation events for EIAs, etc.—and by establishing online platforms that allow community members to identify polluters anonymously (to protect whistle blowers and the general public from retaliation), the government could reap the benefits of greater shared responsibility for environmental outcomes, as well as citizens’ eyes and ears on the ground to track polluters.

2.3 PROMOTING BETTER ENVIRONMENTAL PERFORMANCE AND GREEN GROWTH

Improving environmental performance in Bangladesh could yield significant social and economic gains.

Most industries in Bangladesh continue to rely on inefficient and polluting technologies and practices. However, there is clear evidence from polluting sectors (textile, leather, brick) that investments in better environmental outcomes through RECP could be financially profitable for firms while generating multiple benefits, such as mitigating GHG emissions, saving scarce resources, and reducing pollution. This would help firms reduce the cost of compliance with environmental regulation. It would also make them more competitive by enhancing productivity and, for industries inserted in global value chains (e.g., textiles, garment, leather), their capacity to respond to increasingly stringent buyer requirements. Despite this, several policy and market failures have limited the uptake of RECP to date.²⁴

Policies, regulations, and programs to foster RECP can complement, incentivize, and enhance environmental compliance. While far more attention and resources are needed to bolster the DoE's core functions in regulating and enforcing environmental standards, this alone is unlikely to ensure a green development path for Bangladesh. This section looks at the policies and role for the DoE and other institutions to promote RECP.

2.3.1 Policy Framework for RECP

In Bangladesh, policies to foster RECP have been limited, to date. Industry-related environmental policy and regulations have so far mainly focused on “end-of-pipe” pollution control requirements and measures. Some policies—including the national 3R policy and the 2016 Industrial Policy—have promoted more efficient and sustainable use of resources, but have yet to be implemented. Promising pilot initiatives have been successful in some polluting sectors, such as brick making and textiles, but more efforts are needed to scale them up and reach more sectors and types of firms. Stepping up efforts to mainstream cleaner

production through regulatory/institutional reforms and targeted programs would significantly contribute to reducing industrial pollution, especially if combined with more effective enforcement.

Inadequate pricing of resources and the lack of instruments to internalize environmental externalities in production costs are partly responsible for the current situation. In particular, the absence of water charges and unmetered use of groundwater by water-intensive industries, such as textile and leather production, have long encouraged inefficient use and make water conservation unattractive from a purely financial perspective. Charges for industrial use remain rare and water supplied through water authorities has been significantly underpriced compared to other countries (WRG 2015). This situation could change with the implementation of the upcoming Bangladesh Water Act, which will officially introduce a tariff on water usage. Likewise, industrial use of oil products and natural gas has been subsidized, which, in addition to burdening public finances, disincentivizes energy efficiency and the switch to cleaner energy sources (Nordic Council of Ministers 2017). Finally, unlike several other developing countries that have addressed environmental issues through taxation (such as China, Malaysia, and Vietnam), Bangladesh has not yet resorted to fiscal policy as a way to internalize environmental externalities from resource use and pollution. Recent attempts to introduce a pollution tax for industries and a carbon tax have been abandoned after lobbying from targeted sectors. On the other hand, customs duties on some products, such as chemicals (World Bank 2014) and solar panels (Daily Star 2017), are increasing the cost of cleaner products and technologies.

2.3.2 Institutional Framework for RECP

Several ministries and departments beyond the DoE can help create an enabling environment for greener industrial growth. Industrial development in Bangladesh will continue to come at a high cost to the environment unless the DoE becomes more involved in RECP-related issues, and without other parts of government dedicating more attention to sustainability concerns. Environmental systems and capacity must

²⁴ For an analysis of constraints to cleaner production in the case of the textile industry, see “The Bangladesh Responsible Sourcing Initiative: A New Model for Green Growth” (World Bank 2014).

be developed and strengthened, particularly among the institutions responsible for directly overseeing industry, industrial estates—special economic zones (SEZs) and export processing zones (EPZs)—and commerce. The following subsections discuss how the DoE, the Ministry of Commerce (MoC), the Ministry of Industry (MoI), the Bangladesh Export Processing Zones Authority (BEPZA), the Bangladesh Economic Zone Authority (BEZA), and the Ministry of Finance (MoF) are contributing and could further contribute to the greening of Bangladesh’s industrial sectors.

– *The DoE*

The DoE could play a more active role to promote cleaner production, in partnership with industries and their associations, which will facilitate compliance. While monitoring and enforcing environmental regulations should remain priority functions, many environmental agencies around the world also disseminate knowledge and provide industries technical support to foster the adoption of cleaner technologies and practices. In industrial sectors with high potential for efficiency gain, such as brick production (see Box 2-1), raising awareness and lifting technical and financial obstacles to cleaner production may go a long way toward bringing industries in line with environmental standards while improving their productivity and competitiveness.

The DoE could build on its experience in the brick sector to promote RECP at a larger scale. The brick example shows how different instruments can be used complementarily to advance the transition to cleaner production. This experience could inform the development of a more comprehensive framework to promote RECP, coordinating both push and pull factors.²⁵ Regarding the latter, there is a need for more sources of information and technical support for industries. As a starting point, virtual and/or physical knowledge centers could be established. Institutional modalities could also be explored to conduct research and development on RECP and provide firms in priority polluting sectors with more direct technical support to pilot and demonstrate new RECP technologies. For instance, the National Cleaner Production Centers sponsored by the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP) have played this role in almost 50 developing countries over the last two decades, but no such center has been established in Bangladesh (UNIDO and UNEP 2015). Various institutional modalities that involve the public and private sector, as well as academia, could be explored for such a center. Finally, the GoB could support the development of the private supply of RECP-related technologies and services. The DoE could consider using a public and private dialogue platform such as the Green Growth Working Group²⁶ to better coordinate efforts by different actors to promote RECP.

Box 2-1: Combining Policy Changes and Technical Support to Industries for Cleaner Brick Production in Bangladesh

Strong regulations can usefully be coupled with programs to support the adoption of cleaner technologies. In the brick sector, the DoE led both policy changes and a supporting program to help brick kiln operators become cleaner.

The availability of cleaner brick-making technologies presents an opportunity in Bangladesh. Five different technologies are used in brick kilns in the country: fixed-chimney kilns (FCKs), Zigzag, Hybrid Hoffman kilns (HHKs), vertical shaft brick kilns (VSBKs), and tunnel kilns (World Bank 2011). Among these technologies, the traditional FCK is the least efficient and most polluting, while tunnel kilns are the most efficient and least polluting. Other technologies, such as improved Zigzags and HHKs, are substantially cleaner, consume less energy, and emit much lower amounts of pollutants, but are still being piloted in Bangladesh. Table 2-5 shows the clear benefits in terms of environmental and production efficiency by converting to cleaner technologies, although some technologies, such as Hoffmann and HHKs, require larger upfront investments.

²⁵. A more in-depth analysis of opportunities and challenges to promote RECP among manufacturing SMEs in Bangladesh is carried out through an ongoing regional technical assistance implemented by the World Bank.

²⁶. The Green Growth Working Group was recently established by Business Initiative Leading Development (BUILD) and cochaired by the private sector and the MoEFCC.

TABLE - 2-5: COMPARISON OF DIFFERENT TECHNOLOGIES' ECONOMIC AND ENVIRONMENTAL BENEFITS

Kiln Type	Number	Fuel consumed per 100,000 bricks	Investment & Operation costs (million USD) ^a	Production capacity (million/kiln)	PM reduction compared to FCK
FCK	4,500	20-22t coal	1.7	4	
Zigzag	150	16-20t coal	1.6	4	40%
Hoffmann (gas)	20	15-17,000m ³ NG	5.7	15	90%
HHK	10	12-14t coal	5.7	15	60%

Source: S. Guttikunda & M. Khaliqzaman (2013)

^{a)} Costs include initial investment, land, building, operational, and taxes estimates (World Bank, 2011)

The availability of profitable cleaner technologies was not sufficient on its own to convert many kilns, which also required a complementary mix of technical assistance, financial support, and regulations. In 2009, the majority of brick kilns in Bangladesh were highly polluting FCKs, and only a few percent were using Zigzag and Hoffman kilns with lower emissions. Key policy changes, including a government notification in September 2010 that banned FCKs, along with the Brick Manufacturing and Brick Kilns Establishment Act of 2013, which restricted locations and coal use, set the stage for a major technology shift.

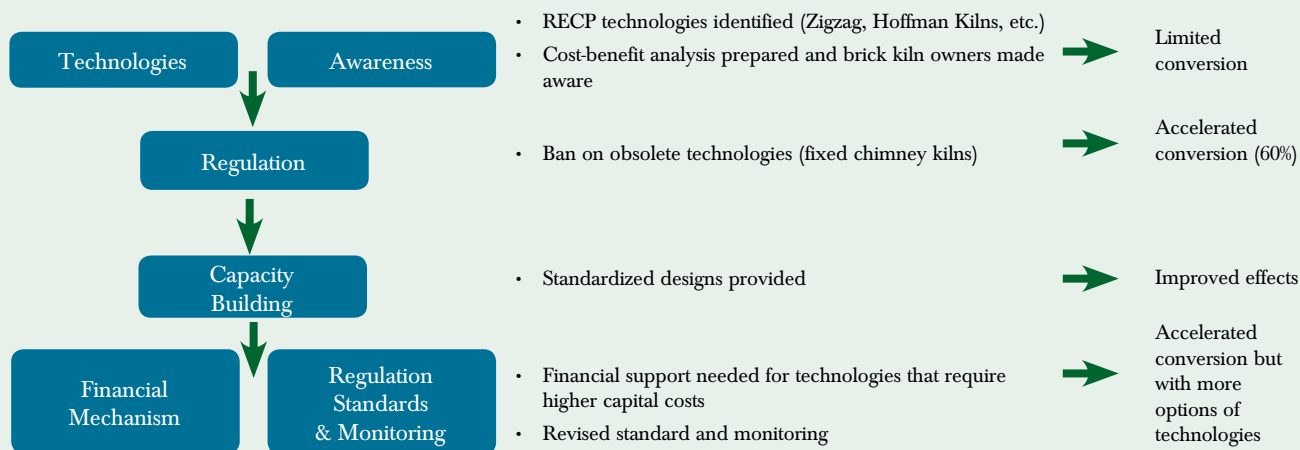
TABLE - 2-6: BRICK PRODUCTION USING DIFFERENT TECHNOLOGIES

Type of technology	2009				2017			
	Number of kilns	% of total	Annual production (billions)	% of total production	Number of kilns	% of total	Annual production (billions)	% of total production
FCK	4,500	92.2	13.5	89.5	2,373	35.2	7.1	31.2
Zigzag	150	3.1	0.5	3.0	4,247	63.0	12.7	55.8
HHK	30	0.6	0.5	3.6	61	1.0	1.1	4.8
Tunnel	0		0.0	0.0	58	0.9	1.7	7.6
Others	200	4.1	0.6	4.0	5	0.1	0.2	0.7
Total	4,880	100	15.1	100	6,744	100	22.8	100

Source: DoE 2017.

However, the brick kiln case has shown that technical assistance is critical to achieve the policy changes intended benefits. In most cases, quick conversions did not follow the standard design for improved Zigzag kilns developed by the DoE. The emission levels of these converted kilns are highly variable, and in some cases as bad as the FCKs. The World Bank-financed CASE project is contributing with standardized design and providing support to address technical challenges. Today, about 60 percent of brick kilns have now converted to a cleaner technology (traditional Zigzag). The CASE project was launched on the premise that the DoE could play an important role in supporting industries to retrofit their initially hastily converted kilns to effectively comply with the lower emission standard (i.e., PM

emission < 200 mg/m³). The following illustrates how different instruments worked as drivers to advance transition in the brick-making sector and how one instrument without complementary instruments is likely to result in far more limited outcomes.



– Ministry of Commerce

The MoC has a mandate to promote better environmental management of export-oriented industries, and could do more in this regard. This could include updating the export policy to incorporate environmentally sustainable production considerations, which are not included in the current policy. The MoC’s previous export policy (2012–15) had a clear focus on environmentally friendly technology in its objectives, and mentioned that export-oriented institutions will be encouraged to obtain ISO 14000 certification (environmental management). This previous policy also specifically mentioned taking steps to establish wastewater treatment plants in the RMG industry and encouraged waste management initiatives for the leather industry, especially for the new BSCIC facility in Savar, near Dhaka. In 2015, the MoC issued a new export policy (2015–18) that prioritized 12 sectors as having the “most potential” and labelled 14 other sectors as “special development.” However, the new policy does not mention environmental, health, and safety requirements or good practices for any of these sectors.

With respect to imports, the MoC plays a role in restricting certain harmful substances and mandating minimum environmental, health, and safety standards. The current Import Policy Order (2015–18) includes relevant content in this regard. Imports/exports to and from Bangladesh Economic Zones (BEZs) and EPZs are generally outside the purview of this policy. However, the policy does state that the banned items listed in Annexure 1 of the policy order cannot be imported, including to BEZs and EPZs. Furthermore, it states that for other imported items into BEZs and EPZs, “rules & regulations related to public health and environment must be observed strictly” (Section 15, clause 1). The policy also has specific conditions for potentially harmful substances. For example, under Section 35 (Import of Waste and Scrap), Clause 37 specifies that importers of Break Acrylic need to notify the DoE immediately after import. Also, importers of ozone-depleting materials need permission from the DoE (Chapter 6, Clause 56). The policy also refers to the 1995 ECA in relation to scrap vessels of the shipbreaking industry (Chapter 6, Clause 39).

²⁷ Measured average emission levels of seven improved Zigzag kilns designed and piloted in the CASE project is 71 ± 36 mg/m³. So, more than 99.9 percent of the kilns of this design should be able to meet the 200 mg/m³ standard.

The MoC is well positioned to sponsor laws targeting specific chemicals that can harm the environment or the public. One example where the Commerce Minister has stepped up in this regard was to propose the Formalin Control Act, which was passed in 2015. The act regulates the import, production, transportation, storage, sale, and use of this preservative. The ministry has also prepared a draft law on classifying and treating industrial sludge, in collaboration with the MoEFCC. The MoC could take the lead on sponsoring and advocating for stronger legislation on other hazardous substances.

– Ministry of Industry

The MoI has the potential take on a greater leadership role in environmental management and RECP through its core function of issuing and overseeing industrial policy. A good example of the MoI’s role in issuing a specific rule that directly addressed environmental aspects of a specific industry is the Ship Breaking and Recycling Rules (2011), which aim explicitly for “safe and environmentally sound ship recycling in Bangladesh.” The ministry also participates in various national committees that broadly relate to environmental management, including the Climate Change, Climate Finance, and National Rivers Commission. However, with respect to other industries with major environmental footprints, the MoI has not been visible in incorporating environmental concerns into industry-specific policies and rules. The ministry’s overarching Industry Policies of 2010 and 2016, which aim to promote industrial development in Bangladesh, could also have more explicitly referenced environmental sustainability standards and encouraged clean production practices in industries.

The MoI has a number of ways to promote and oversee environmental management of industries. While the MoI in Bangladesh has little control over private industries, it could aim to provide support for RECP by making this a more prominent focus of its National Productivity Organization.²⁸ On the other hand, the MoI oversees a number of industrial corporations and could encourage them to strengthen

their environmental management systems and invest in RECP. These bodies include:

- i. The Bangladesh Chemical Industries Corporation (BCIC), which operates paper mills, urea factories, tiles factories, etc.;
- ii. The Bangladesh Sugar and Food Industries Corporation (BFSIC), whose main activity is sugar production;
- iii. The Bangladesh Steel and Engineering Corporation (BSEC), which manufactures wires, pipes, cars (Pragoti), and motorcycles (in association with Honda) and manages dry dockyards; and
- iv. The Bangladesh Small Cottage Industries Corporation (BSCIC), established in 1957, which facilitates the growth of medium, small, and cottage industries through promotion and capacity building activities, including by administering 74 industrial estates.²⁹

– BEPZA

The Bangladesh Export Processing Zones Authority (BEPZA) has made some efforts to improve its systems and capacity in environmental management. This is despite the Bangladesh Export Processing Zones Authority Act of 1980 not having any specific environment-related clauses. In BEPZA’s investment proposal form for investors, proponents notably need to provide certain information related to the composition of effluents and their proposal for in-house treatment; arrangements for disposing of any dangerous or injurious chemicals; and arrangements for environmental controls (BEPZA 2013). However, in BEPZA’s 2013 Information for Investors booklet, there is no specific guidance on conducting an EIA for the proposed industry or mention of any requirements for obtaining environmental clearance from the DoE. Adding such guidance would help to further mainstream environmental considerations into BEPZA’s operations.

At the zone level, BEPZA could do more to ensure each of its zones are properly sited, designed, and managed from an environmental, health, and safety

²⁸. For more information, see the National Productivity Organization’s website at <http://www.npo.gov.bd>.

²⁹. Nine more industrial estates are being developed and 11 more are proposed. For more details, see the BSCIC website at <http://www.bscic.gov.bd>.

perspective. A template for zone-level planning and management exists through the Environmental Management Framework (EMF) that BEPZA developed for the World Bank-financed Private Sector Development Support Project (PSDSP) in 2010 and then updated in 2015. The project assists in the development of EZs and EPZs in accordance with “international practices of building safety, environmental and social safeguards” (Rosario 2015). The project also supports private investments in building central effluent treatment plants (CETPs) in existing zones. The EMF, which only applies to the Bank-financed project, provides an outline of the necessary procedures for minimizing environmental and social impacts of the project components and subcomponents. The EMF aims to fill the gap between the government’s environmental regulations related to EPZs and the World Bank’s own safeguard policies. A review of the project’s experience with applying the EMF—with the aim of refining and updating it based on lessons learned so it can be adopted across all of BEPZA’s operations—would be a useful exercise. For example, one area in which further procedures and guidelines would be important relates to planning new zones. Neither the 1997 ECR nor the proposed 2017 ECR revision includes a requirement for zone-level environmental clearance. Nonetheless, when new zones are being planned, comprehensive environmental assessments (EAs) should be undertaken to ensure that nearby environmentally and socially sensitive receptors, environmental vulnerabilities, cumulative impacts of the zone, and other developments in that area on the natural resource base (land, air, and water, and biodiversity) are taken into account.

BEPZA has made important inroads in building its internal staff and systems capacity on environmental management, which should be continued and further scaled up. In 2015, 38 BEPZA officials underwent a three-month training program on environmental management of EPZs organized by BEPZA and the Military Institute of Science & Technology (MIST). Also, BEPZA recently requested the Asian Development Bank’s (ADB) cooperation in setting up CETPs in EPZs (BEPZA 2017). A reported online environmental monitoring system recently initiated at

the Dhaka EPZ is a further positive step. It should be evaluated and updated periodically, integrated with the monitoring database, and be publicly accessible through an online monitoring portal, which should be set up by the DoE (see Section 2.2) and scaled up across all EPZs.

In addition to environmental compliance, BEPZA could aim to promote RECP in the zones it manages.

This could include both support at firm-level and zone-level programs to foster cleaner production and “industrial symbiosis.” In doing so, it could draw on the international experience with eco-industrial parks.³⁰

– BEZA

Unlike BEPZA, environmental management is built into the legal framework of the Bangladesh Economic Zone Authority (BEZA). First, Clause 33 of the 2010 BEZA Act requires “the Authority, economic zone developers, industrial units established in economic zones, financial and business institutions...to comply with international commitments recognized by the Government of Bangladesh including compliance to all existing laws on environment and environmental protection.” Second, as per the 2010 BEZA Act, the Minister and Secretary of the MoEFCC are members of the BEZA governing board.

In spite of this, BEZA’s permanent capacity to deliver on its environmental responsibilities is not firmly established. Currently, BEZA has 72 staff and the government recently approved an organogram with an additional 158 staff (BEZA 2016). Under one donor-financed project to build BEZA’s capacity, there is a dedicated environmental specialist staff. However, there was no information available about positions with environmental management-related roles in the new organogram. Environmental monitoring systems are also needed at the zone level, for all zones, to enable the identification of non-compliances by individual industries within the zone, as well as to ensure that common facilities, such as CETPs or common waste disposal facilities, are keeping the zone as a whole in line with relevant environmental quality standards.

³⁰ See, for instance, the joint international framework for eco-industrial parks published by the World Bank, UNIDO, and GIZ in 2017 (<https://openknowledge.worldbank.org/handle/10986/29110>).

As mentioned in the previous section, BEZA should adopt guidelines and procedures to ensure that new economic zones are planned to incorporate comprehensive EAs. These assessments would need to take into account proximity of nearby zones, proximity of environmentally or socially sensitive receptors, potential environmental vulnerabilities, as well as other existing and potential developments in the area. For example, there are numerous zones existing and proposed within the Greater Dhaka region that can have considerable cumulative impacts. Like BEPZA, BEZA could also aim to foster cleaner production in the zones to be established. Synergies between industries could, for instance, be taken into account when selecting tenants.

– Ministry of Finance

The MoF can play a key role in fostering green growth through fiscal policy, as well as facilitating access to finance for green investments. On both fronts, MoF agencies, including the National Board of Revenue (NBR) and Bangladesh Bank (BB), have some initiatives in place, which should be developed and scaled up to impact the rapid pace of industrial development.

The NBR is the country’s apex body for tax administration. Recently, NBR announced income tax concessions for garments exporters with internationally recognized Green Building Certificates (*Independent* 2017). This is part of the government’s effort to promote pollution-free industrialization as well as a low-carbon economy. The 2016 draft national industrial policy includes some provisions for fiscal incentives, where responsibility for acting upon the policy is entrusted to the Tariff Commission and NBR. Specifically, Section 4.19 outlines “special incentive/assistance for promoting green and environment friendly power system based on renewable energy.” The government could also consider using more

environmental taxes, including a carbon tax, to disincentivize pollution and wasting resources.

The Bangladesh Bank, the country’s central bank, has played a pioneering role among developing countries to drive green finance through policies and regulations over the last decade. It was the first central bank in the world to issue a Green Banking Policy. In 2011, it published an Environmental Risk Management Guidelines for Financial Institutions in Bangladesh (BB 2011), followed in 2015 by Guidelines on Environmental and Social Risk Management (ESRM) for Banks and Financial Institutions (BB 2015). These efforts aimed to improve environmental management capacity in the financial sector, which supports the country’s industrial growth. Despite this, volumes of green finance remain limited so far (UK Aid 2017).

Building on results achieved to date from several refinancing/on-lending schemes,³¹ there is scope for the BB to accelerate the growth of green lending. Several of the above-mentioned schemes have faced slow disbursements for various reasons, such as implementation difficulties, lack of capacity among partner financial institutions, and lack of awareness/interest among potential borrowers. There is an opportunity to take stock of progress to date on green finance and identify remaining obstacles on both the supply and demand sides.

– The private sector

The private sector is critical for scaling up cleaner production. The government should actively engage with the private sector to ensure that opportunities and obstacles for RECP in different sectors are well understood, to obtain feedback on public interventions on pollution control, and to promote cleaner production. Public-private dialogue (PPD) is key here to identify, design, and monitor needed reforms. The

³¹. These schemes, implemented through partnering financial institutions, have included the Refinance Scheme for Renewable Energy and Environmentally Friendly Financeable Sectors launched in 2009 (BDT 2.5 billion disbursed over FY13–17, half of which was for effluent treatment plants); the ADB-supported Financing Brick Kiln Efficiency Improvement Project launched in 2012 (US\$50 million, of which 16.2 million disbursed as of mid-2017); and the Green Transformation Fund for Export Oriented Textile and Leather Sectors announced in 2016 (US\$200 million). In addition to this, a US\$100 million JICA-financed Energy Efficiency and Conservation Promotion Financing Project was implemented in 2016 by the Sustainable and Renewable Energy Development Authority (SREDA) to finance investments in energy efficiency equipment, including in industries, through financial intermediaries. More recently, the World Bank–financed Sustainable Enterprise Project was designed for scaling up cleaner production among microenterprises through microfinance institutions.

Green Growth Working Group recently established by the Business Initiative Leading Development (BUILD) and co-chaired by the private sector and the MoEFCC is a valuable initiative that ought to be developed with a strong mandate to foster RECP.³² Specific PPD platforms for priority industries could be established as needed, with relevant public actors and industry associations. The Textile Sustainability Platform (TSP), established in 2016 under the Partnership for Cleaner Textile (PaCT) as a PPD platform to promote efficient resource use in the sector, is a good example.

Companies can play a major role through corporate social responsibility (CSR) and supply chain initiatives. Multinational corporations operating in Bangladesh have been under increased domestic and international pressure to commit to CSR following the 2013 Rana Plaza collapse. While this has partly focused

on building and worker safety, this renewed attention can also be used to push environmental sustainability. Regarding supply chains, leading international brands in the textile and apparel industry have since 2014 been closely involved with the successful PaCT program financed by the International Finance Corporation (IFC) (see Box 2-2). In 2016, PaCT notably embarked on a partnership with Levi Strauss & Co to promote its suppliers' environmental and social compliance and cleaner production in the Bangladeshi textile industry (Levi Strauss & Co. 2016). Beyond export-oriented sectors, firms that produce for the domestic market could also be encouraged to develop their green CSR and sustainable supply chain initiatives. India is an interesting example of rapidly growing CSR in the domestic private sector, which has been mandated by a specific legal provision since 2014. This has led to an increase in CSR expenditure, amounting to around

Box 2-2: The Partnership for Cleaner Textile (PaCT)

PaCT started in 2014 (phase 2 was launched in October 2017) to promote the textile wet processing sector's long-term competitiveness and environmental sustainability through the adoption of best practices for RECP. Implemented by the IFC, PaCT works with global apparel brands, the Bangladesh Garment Manufacturers and Exporters Association (BGMEA), and over 200 export-oriented textile factories. Its four pillars are:

- i. **Brands.** Reduce supply chain risks by working with leading global brands to integrate environmentally sustainable practices in design and sourcing decisions.
- ii. **Factories.** Support the adoption of best practices in textile factories by raising awareness, conducting diagnostics, and supporting implementation. This involves undertaking both (i) basic cleaner production assessments on how a factory can incorporate cleaner processes and adopt low- or no-cost measures to reduce its water footprint; and (ii) deep dives for a smaller number of factories to undertake full engineering assessments that take into account dyeing, finishing, laundry processes, and utilities. It helps factories to significantly reduce water, wastewater, sludge, and their carbon footprint, and to improve their environmental performance and production efficiency.
- iii. **Sector.** Address sector transformation and regulatory policy gaps (e.g., recommendations to the MoEFCC regarding what penalties to institute for the use and discharge of chemical pollutants).
- iv. **Investment facilitation.** Matchmaking between banks, textile factories, and technology suppliers, and build capacity for identifying and assessing bankable projects.

³² Business Initiative Leading Development (BUILD) was established in 2011 as a joint initiative for PPD on private sector development of the Dhaka Chamber of Commerce and Industry (DCCI), in partnership with the Metropolitan Chamber of Commerce and Industry (MCCI) and the SME Foundation (SMEF). Several thematic working groups are cochaired by a private sector leader and senior official from a relevant ministry. BUILD is a primary source of recommendations for meetings of the Private Sector Development Policy Coordination Committee (PSDPCC), a high-level forum established at the Prime Minister's Office (PMO) and chaired by the Principal Secretary to the Prime Minister (<http://www.buildbd.org>).

PaCT activities to date have included:

- **Cluster-level work:** GIS mapping, water consumption and pollution footprint assessments, developing centralized solutions, addressing WASH issues for local communities, etc.
- **Financial mechanisms:** Helped BB establish the Green Transformation Fund to finance RECP in the textile and leather sectors.
- **Information:** The IFC and BGMEA jointly established a technical knowledge hub, the Textile Technology Business Center (TTBC), to improve access to information on best practices, resource-efficient technologies, financing options, and technology suppliers, making matches between service providers and industries.
- **Tools:** Developed a resource management diagnostic tool for continuous improvement in factories (PaCT Advantage).
- **Public-private dialogue:** Launched the national TSP with BUILD, extending research, technical, and secretarial support.
- **Knowledge:** Publishes reports and case studies of factories' successful experiences with different aspects of RECP, etc.

The program has achieved major impact so far, in terms of water savings (21.6 billion liter/year), energy savings (2.5 million MWh/year), GHG emissions avoided (460,000 tCO₂e/year), wastewater avoided (181.8 billion liter/year), investments (US\$39 million) and factory savings (US\$16.3 million/year).

Source: PaCT, <http://www.textilepact.net>.

US\$1 billion in 2017 for the top 100 listed Indian companies, 11 percent of which were dedicated to environmental causes (KPMG 2018).

Finally, a concerted effort by several ministries and agencies, private sector, and civil society is required to reverse trends of environmental degradation and shift the country toward a green development path. While the DoE's continuous efforts to strengthen

enforcement are essential, such efforts would become too costly and unsustainable without the cooperation of other ministries and agencies, as well as the private sector. Coordination among ministries and agencies would help harmonize the policies to promote better environmental performance. A better coordinated mechanism to incentivize the private sector is needed to scale up cleaner production, and PPD plays a critical role.

CHAPTER 3.

TOWARD CLEANER AND MORE RESILIENT CITIES IN BANGLADESH

This chapter analyzes environmental management at the city level. While national-level institutions are responsible for most aspects of environmental policy, planning, enforcement, and incentives (see Chapter 2), some roles and responsibilities have been decentralized to city-level institutions on various aspects of land use, natural resource and industrial planning, zoning and management, as well as provision of municipal services like solid waste and wastewater management—all of which significantly influence urban sustainability and climate resilience.

A case study approach was adopted to examine the city-level institutional complexity on these issues, and to spatially analyze outcomes on the particularly critical issue of wetlands encroachment and degradation. Through consultations with various stakeholders, five cities were selected that span across different sizes, governance structures, development patterns, and multidimensional sustainability challenges:

- Dhaka—a megacity with a complex institutional setting and immense environmental challenges.
- Narsingdi-Madhabdi—these two municipalities (Paurashavas) of moderate size, only 11 km apart, present contrasting industrialization growth patterns.
- Mymensingh—a historical town with hardly any large industries, but likely to undergo changes as it has recently become a Divisional Headquarters and a City Corporation.
- Cox’s Bazar—a medium-sized coastal municipality facing various pressures on its natural resources.

The city has a high potential to continue to grow rapidly as a tourism city.

- Pabna—a small but growing municipality surrounded by wetlands that are threatened with encroachment and pollution due to the shift from traditional agriculture to unplanned infrastructural development.

3.1 UNDERSTANDING ENVIRONMENTAL MANAGEMENT RESPONSIBILITIES AT THE CITY LEVEL

Before delving into the specific selected cities, it is important to note the variety of governance arrangements that affect urban planning and environmental management across Bangladesh, with varying degrees of institutional complexity. Certain powers are devolved from the national institutions to local government authorities—e.g., City Corporation, upazila, or Union Parishad governments—but in the cases of the country’s five largest cities (Dhaka, Chittagong, Khulna, Rajshahi, and Cox’s Bazar), an additional layer of urban governance resides with the urban development authorities, which fall under the Ministry of Housing and Public Works (MoHPW). RAJUK (Dhaka’s urban development authority) is the oldest and largest in terms of jurisdiction area, manpower, revenue, and expenses. The mandate of these institutions is to develop, monitor, and enforce the structure plans, master plans, and detailed area plans of their respective cities. They also play an important role in regulating urban developments,

such as by issuing building development permits in accordance with their plans and rules.

The mandates of local government authorities, national institutions, and urban development authorities sometimes overlap at the city level. The jurisdiction of urban development authorities, where they exist, can cover more than one City Corporation, municipality, and Union Parishad, which creates multiple layers of urban planning and development. Some of their activities most relevant to wetlands management—such as land acquisition, filling and preparing land for housing and mixed-use projects, the construction of roads (including flyovers and bridges), etc.—are also carried out by City Corporations, municipalities, and Local Government Engineering Departments (LGEDs). City Corporations are meanwhile tasked with providing basic municipal services; ensuring public health; removing, collecting and managing garbage; supplying water; maintaining and managing drainage and water bodies; building and maintaining road networks; ensuring public safety; managing disasters; and managing open spaces and parks (City Corporation Act 2009). In almost all cases, their planning role is further duplicated by the Urban Development Directorate (UDD) of the MoHPW. UDD has developed Master Plans for several Divisional Headquarters (Rangpur, Sylhet, Barisal, and Mymensingh), as well as for other urban towns and cities.

As the case studies show, this multi-layered urban institutional arrangement in practice contributes to suboptimal management and protection of natural resources and the ecosystem services they provide in and around cities—particularly wetlands. The “wise use of wetlands” strategy under the 2014 update of the National Biodiversity Strategy and Action Plan (NBSAP) was a sound regulatory initiative. However, it has been poorly implemented by cities of all sizes due to lack of clear mandates and accountability for master planning. In small towns, urban plans tend to be developed by Paurashavas, municipalities, or LGEDs; in the case of Cox’s Bazar, it is the UDD. Meanwhile, implementation is left to multiple

institutions with varying capacity and authority, and sometimes to the Union Parishads, which typically lack capacity to effectively enforce the plans. Only when an area is 70–80 percent built up (often after many low-lying areas and wetlands have been filled up in an ad hoc manner), does the Local Government Division give it the status of Paurashava/City Corporation.³³ At that point, only the remaining 20–30 percent of land designated to that urban area is available for planned development/urbanization, thus setting cities up to face difficult trade-offs in stimulating and allowing for growth while also meeting environmental objectives under the NBSAP. As cities continue to grow and come under the management of an urban development authority, the institutional complexity increases across urban planning and implementation roles and responsibilities, without consolidated accountability and clear ownership over the multidimensional challenges of natural resource and environmental management. Table 3-1 illustrates this complexity for the case study cities, which span different types of city governance structures. Details for each city are analyzed in the subsequent section of this chapter.

3.2 URBAN ENVIRONMENTAL MANAGEMENT EXPERIENCES IN CASE STUDY CITIES

3.2.1 Dhaka—The Mega City

Dhaka, the capital city of Bangladesh, is ranked as the ninth largest megacity in the world (Ahmed 2015). After independence in 1971, Dhaka underwent rapid growth along social, economic, political, and institutional dimensions. Over the last 25 years, Dhaka City’s population increased by about threefold, from 6.8 million in 1991 to 18.2 million in 2016 (Siddiqui et al. 2010; UN 2016). Today, the DMA covers 360 sq. km, although the 2010 DAP covers a broader area of 590 sq. km. This case study considers the DAP as the basis of the analysis.

Dhaka is the country’s economic powerhouse, but is also beset with urbanization and environmental

³³. According to Section 3 of the Paurashava Act (2009), a rural area can be declared a “city area” if 75 percent of the people are involved in nonagricultural professions, 33 percent of the land is of a nonagriculture type, population density is not less than 1,500 people/sq. km, and the total population will not be less than 50,000 people. Also, “no objection” needs to be provided by the relevant Union Parishad. If objection is raised, the government will need to resolve the issue within three months (MoEFCC 2011, Section 3).

TABLE - 3-1: INSTITUTIONAL MAPPING FOR ENVIRONMENTAL MANAGEMENT IN FIVE CITIES

Organization	Urban planning (land use and zoning)	Urban development control	Environmental monitoring and enforcement	Solid waste management	Water & wastewater management	Urban drainage management	Air pollution management	Traffic and transport system	Other urban services	Wetlands and urban biodiversity	Regulation of industries ^b
DoE			Dh, CXB, MNP				Dh, CXB, MNP			Dh, CXB, MNP	Dh, CXB, MNP
Urban Development Authority	Dh	Dh			Dh	Dh		Dh		Dh	Dh
City Corporation	Dh ^a	Dh ^a		Dh	Dh	Dh		Dh	Dh	Dh	Dh
DWASA					Dh	Dh			Dh	Dh	Dh
Other utilities (e.g., power development board, Titas)									Dh, CXB, MNP		Dh, CXB, MNP
LGED	MNP							Dh, CXB, MNP			
RHD								Dh, CXB, MNP			
MoL	MNP	MNP				Dh, CXB, MNP				Dh, CXB, MNP	
Deputy Commissioner	MNP	MNP								CXB, MNP	
BWDB						Dh				Dh, MNP	
Police								Dh, CXB			
BFD			CXB							CXB	
Paurashava	CXB, MNP	MNP		CXB, MNP	CXB, MNP	CXB, MNP		CXB, MNP	CXB, MNP	CXB, MNP	CXB, MNP
DPHE					CXB, MNP						
UDD, Cox's Bazar	CXB	CXB						CXB			CXB
DoF										Dh, MNP	

Notes:

- a. The City Corporations are involved in the planning process and have a Chief Town Planner position. They also have a role in development control through the 2009 City Corporations Act. Also, by varying the holding tax rates, they can indirectly influence urban development control in urban areas.
- b. National-level institutions also play a role, such as the MoI, MoC, etc.
- c. Dh: Dhaka; CXB: Cox's Bazar; MNP: Mymensingh, Madhabdi and Narsingdi, Pabna.

challenges that increasingly threaten inhabitants' quality of life, productivity, and health. In particular, city residents live with increasingly polluted air and waterways. Dhaka's environmental degradation is influenced by a variety of factors, including institutional coordination issues, overlapping mandates, capacity constraints, and lack of awareness among the public, government officials, and entrepreneurs. However, there are cases in which long-standing environmental problems have been addressed through strong leadership and coordination efforts, such as the iconic Hatir Jheel Project (for restoring the wetlands), and the relocation of tanneries.

Numerous institutions are responsible for various aspects of planning, developing, and managing greater Dhaka City's urban development. With respect to wetlands and waterways in and around Dhaka, these institutions include RAJUK, DWASA, DCC (north and south), the Bangladesh Water Development Board (BWDB), the DoE, the Department of Fisheries (DoF), the Bangladesh Inland Water Transport Authority (BIWTA), the Cantonment Board, the Ministry of Land (MoL), district administrations, and adjacent municipalities. These institutions have distinct roles and responsibilities and often perform their activities independently of each other. However, they also have some areas of overlapping mandate or where better coordination is needed to address entrenched environmental challenges.

– Major environmental issues in Dhaka due to unplanned urbanization

Sustained unplanned urbanization, the infilling and delinking of perennial wetlands and rivers, and the shrinking of many link canals across Dhaka has exacerbated urban flooding and contributed to various recurring environmental problems. Flooded roads contribute to traffic congestion and health hazards from the spread of vector borne diseases. The polluted state of rivers around Dhaka City further reduces their ability to provide important ecosystem benefits.

The loss of FFZs³⁴ and WRAs³⁵ across the city in recent years is particularly striking. The DAP

identified, mapped, and recommended protection for 30,252 ha of FFZs and 2,240 ha of WRAs to reduce the risk of flooding in Dhaka City. However, a field investigation carried out in November 2017 for a background paper to this CEA revealed that, in just eight years (2010–17), 41 percent of FFZs and 21 percent of WRAs have been converted, raised, and used for other purposes, including settlements and to establish industries and brick kilns (see Table 3-2 and Figure 3-1).

TABLE - 3-2: CHANGE IN DAP-DESIGNATED FFZS AND WRAS, 2010–17

Land use	DAP-designated area, 2010 (ha)	Present area, 2017 (ha)	Area lost (ha)	Change (%)
FFZ	30,252	17,851	12,401	-41.0
WRA	2,240	1,779	461	-21.0
Total	32,492	19,180	13,312	-41.0

Fieldwork and analysis revealed that infilling for settlements and urban areas is responsible for 73 percent of FFZ and WRA conversions in both western and eastern sides of the city. Sand filling for housing caused over 18 percent of FFZ loss, while just over 8 percent was lost to raising land for the establishment of brick kilns. Similarly, WRAs are primarily converted to privately owned housing areas (87 percent), followed by urban areas/settlements (11 percent) and brick kilns (1 percent). It is noted that brick kilns are only found within the WRAs located in the eastern part of the DAP. Sand filling is also rampant on the eastern side, where 93 percent of the total retention area has been converted due to sand filling. Field investigation and satellite map analysis of the relevant areas have revealed that real estate companies, industry owners, and brick kiln owners/operators filled up these low-lying areas. An image analysis found that the city is expanding into low-lying flood-prone areas that correspond to the FFZs and WRAs, and these areas are now experiencing increased localized flooding. Aside from the infilling of FFZs and WRAs, a recent

³⁴. FFZs were defined by RAJUK in the DAP as areas typically inundated during flood events and/or inundated for a specific season.

³⁵. WRAs were defined by RAJUK in the DAP as ponds that hold floodwater or excess/runoff water from heavy rains for an indefinite period.

study (Chowdhury, Bhuyain, and Kabir 2015) revealed encroachment of more than 100 ha into the four rivers around Dhaka City, including 39.34 ha of Buriganga, 49 ha of Turag, 3.6 ha of Balu, and 9.64 ha of Shitalakkhya. The change in land use pattern is presented in Figure 3-1.

TABLE - 3-3: POTENTIAL INUNDATION UNDER DIFFERENT RAINFALL SCENARIOS WITHIN THE DAP AND BUILT-UP AREAS

Scenario	Water level considered	Total potential inundated area (ha)	Potential inundation of built-up areas (ha)
1	4 m (158 mm rainfall)	63,365	21,287
2	5 m (210 mm rainfall)	81,816	32,411
3	6 m (256 mm rainfall)	103,096	49,377

The result is that huge parts of Dhaka are frequently inundated following even a very small amount of rainfall. Figure 3-2 shows a simulation of potential inundation from a 233 mm rainfall event (based on an actual such event on October 22, 2017), under a scenario of complete drainage system saturation or blockage. The analysis shows that such an event could translate to potential inundation of 94,024 ha within the DAP, including 44,869 ha of built-up areas. Detailed simulations and analysis of potential flooded areas under three different rainfall scenarios, and of the corresponding inundation extents both for the DAP area as a whole and for built-up areas within the DAP, indicate that under high rainfall conditions—which are increasingly likely with climate change—Dhaka City faces severe drainage congestion and consequent flooding. The findings are presented in Table 3-3 and Figure 3-2.

A related problem stemming from in-filling and rapid urban development is the loss of groundwater recharge areas. Data suggest that groundwater depletion is acute in Dhaka City. In 1990, the depth of the water table was 15 m in central Dhaka and

FIGURE - 3-1: CHANGES TO FFZS AND WRAS, 2010 (LEFT) TO 2017 (RIGHT)

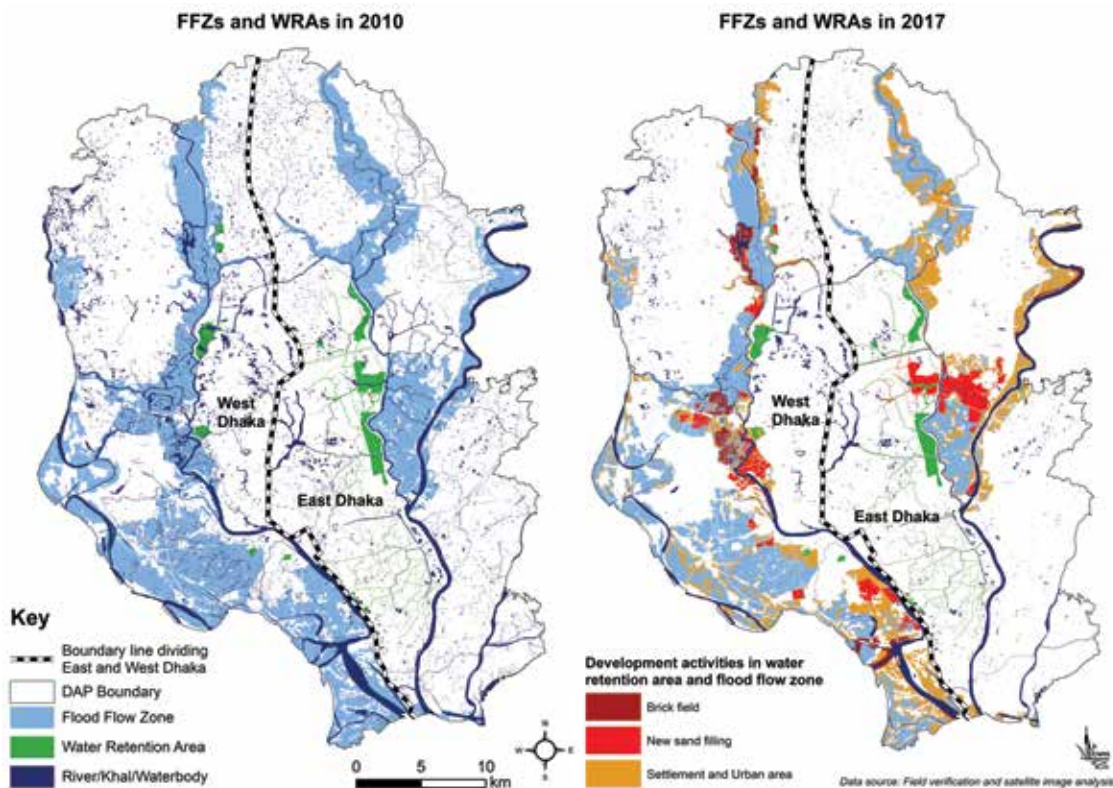
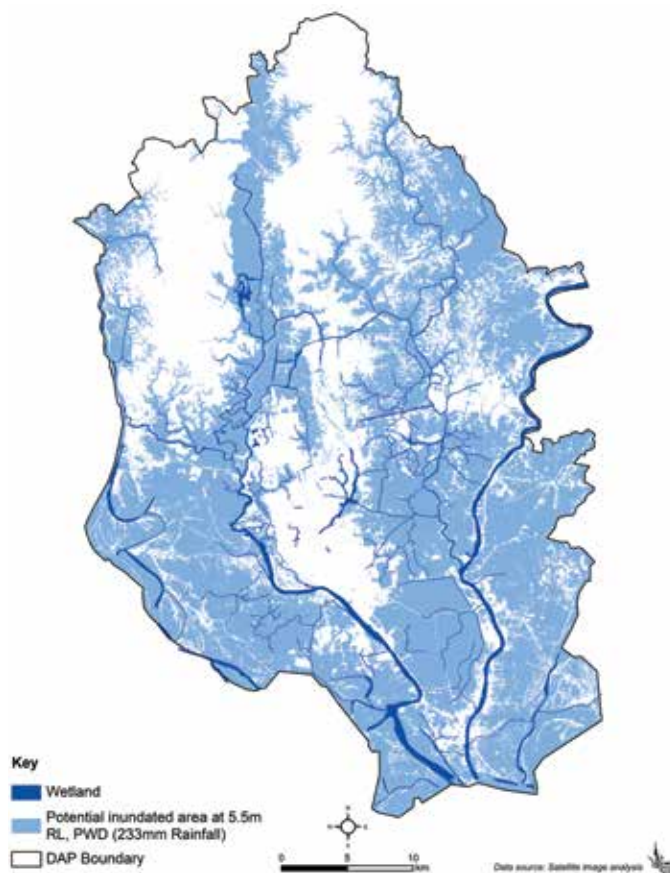


FIGURE - 3-2: POTENTIAL INUNDATED AREA UNDER 233 MM RAINFALL WITHIN DAP AREAS



4 m in peri-urban areas (Abedin and Rakib 2013). The pervious layer is important to effectively recharge groundwater. With the increased paved area, a substantial area of suitable pervious layer has been lost, reducing the potential to recharge groundwater; this exhausts aquifer levels and has adverse effects on the availability of drinking water for urban residents. The Earth's surface is made impervious from manmade construction features that considerably reduce infiltration and groundwater recharge, increase storm runoff by reducing runoff "lagtime," and put increased pressure on drainage canals. It is noted that the DWASA relies on groundwater to supply drinking water to the residents of Dhaka City; thus, loss of the pervious layer combined with the loss of wetlands would affect water availability. The effect

of groundwater shortage is currently acute in the dry season, and it is likely that this problem would be aggravated in the future should there be further losses of wetlands and pervious surfaces.

As yet another effect of the in-filling of wetlands in Dhaka, high-rise buildings built on sand-filled, low-lying areas are more susceptible to liquefaction effects during earthquakes. A study conducted in four sites in Dhaka City (Islam et al. 2010) revealed that liquefaction depth from existing ground level varies between 1.5–13.5 m, 1.5–4.5 m, 1.5–6.0 m, and 1.5–4.5 m for Bashundhara, Mirpur DOHS, Banasree, and Purbachal sites, respectively. Since the liquefaction depth is shallow, making the foundation deeper may overcome problems, but may also damage roads and other facilities (Islam et al. 2010).

– A way forward for reduced waterlogging and flooding

To counter these challenges, Dhaka can and must do far more to prevent encroachment, as well as invest in and sustainably manage the city's wetlands and canals for maximum urban benefit. As outlined below, this requires a range of investments as well as institutional actions to restore and deepen canals, address solid waste management problems, and enforce master plans to prevent future encroachment. The effects of restoring a specific canal on inundation levels under different scenarios were assessed based on GIS analysis. The Ramchandrapur Canal is currently 2,786 m long and covers an area of 3.06 ha, with its width 9–18 m at different points and its depth varying from 1.2–2 m (see Figure 3-3)³⁶. Due to encroachment, reduction of size, and waste dumping, the canal's water passage capacity was reduced and has become inadequate for draining the storm water from its catchment. As a result, every year following monsoon rainfall, land adjacent to the canal gets inundated and remains so for 1–3 days on an average, while the low-lying Balur Math is waterlogged for around 12 days. The different scenarios analyzed suggest that widening and deepening the canal could significantly reduce flooding in adjacent areas compared to the baseline, by up to 39 percent with a 4 m widening plus a 1.5 m deepening.

³⁶. For this assessment, a 1,480 m long section of the canal was considered. This section starts from Kallyanpur Point to 1,480 m upstream (to Nobodoya Housing Point). An adjacent area of this section has low-cost housing, and the settlers are making roads along the canal by dumping wastes; these areas of the canal have the potential to be widened and deepened.

FIGURE - 3-3: RAMCHANDRAPUR CANAL

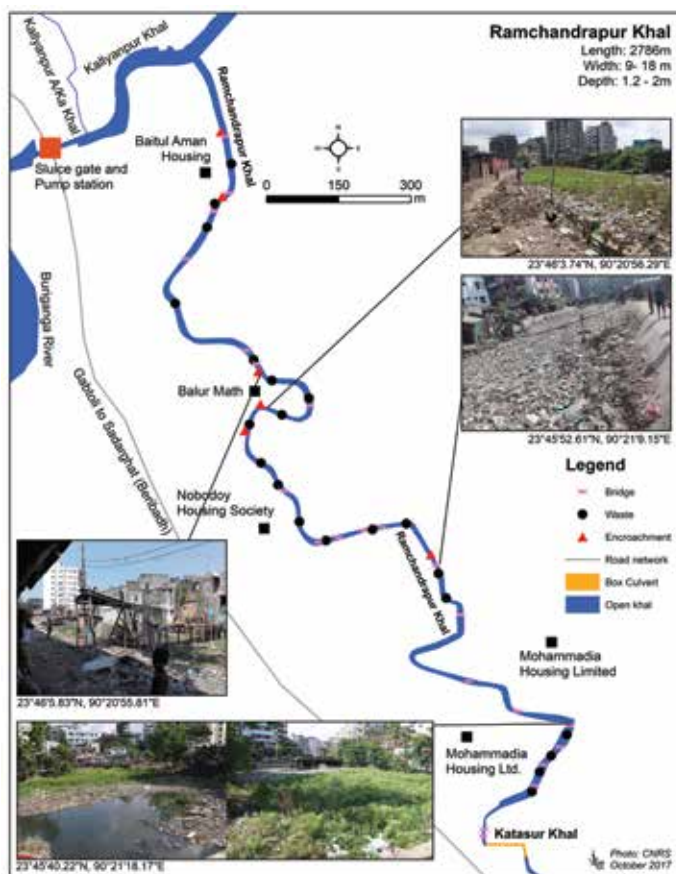
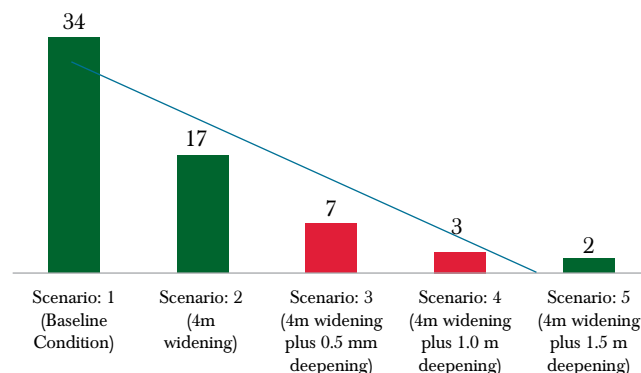


FIGURE - 3-4: DURATION OF FLOODING (HOURS) IN BASELINE AND UNDER DIFFERENT RESTORATION SCENARIOS



In addition to reducing the spatial extents of flooding, restoring the Ramchandrapur Canal in particular would also reduce the temporal extent of flooding. Figure 3-4 shows that under the baseline condition, adjacent areas of the canal, on average, remain inundated/waterlogged over a period of 34 hours following heavy rainfall. This time could be significantly reduced under the different restoration scenarios.

TABLE - 3-4: SCENARIO ANALYSIS FOR FLOOD REDUCTION AT RAMCHANDRAPUR CANAL

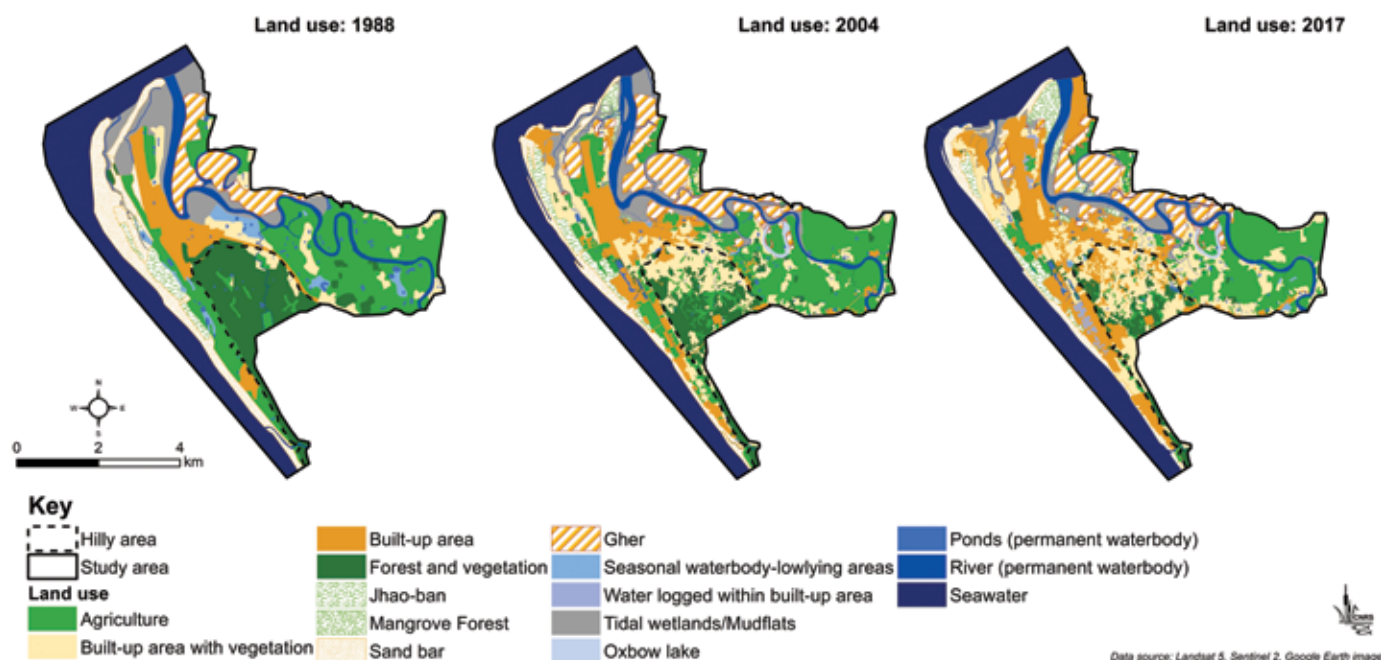
Scenario	Adjacent area flooded (ha)	Proportion of baseline (%)
1) Baseline condition	15.11	100
2) 4 m widening of the canal	14.79	98
3) 4 m widening plus 0.5 m deepening	12.84	85
4) 4 m widening plus 1 m deepening	10.91	72
5) 4 m widening plus 1.5 m deepening	9.29	61

The restoration scenario analysis suggests that wherever feasible, existing canals should be widened and deepened to reduce problems associated with drainage congestion and flooding during monsoon rainfall. This would also require measures to restore the areas of canals that have been encroached upon, with due considerations of both social and environmental impacts.

3.2.2 Cox's Bazar—A Tourist Coastal City

Bangladesh's favorite tourism city, Cox's Bazar, has seen one of the country's fastest rates of population growth in recent years, fueled primarily by growth in both domestic and international tourism and related industries (Rahman 2010; Seddique et al. 2013; Hossain and Mallik 2017). Cox's Bazar Municipality is a southeastern coastal town located on the Bay of Bengal. The urban area covers 2,081 ha (20.8 sq. km), and hosts a population of 167,477 (UDD 2011). Cox's Bazar's natural beauty is its primary draw for tourists: It has the world's longest stretch of sandy beach (120

FIGURE - 3-5: LAND USE MAP IN COX’S BAZAR, 1988/2004/2017



km) in the west and has hilly terrain covered with forests in the east (UDD 2011; Sayeda 2017). At the time of this writing, the World Bank is currently conducting a vulnerability assessment that will address the impact of refugee settlement on Cox’s Bazar’s environment. There are a few medium-to-large ponds within the municipality; of these, Lal Dighi, Gol Dighi, and Bazar Ghata Dighi are notable and managed by the municipality authority. These are leased to private parties to cultivate fish, and are thus a source of revenue for the municipality. In addition, there are some manmade institutional ponds within the town, such as two ponds on the campus of Hotel Shaibal and Motel Upal, that are managed by the Bangladesh Parjathan Corporation (BPC), and three ponds within the cricket stadium. There are about 40 small ponds within the campus of the Bangladesh Fisheries Research Institute (BFRI). Nonetheless, many of these natural assets are threatened by unplanned urbanization. The recent influx of refugees and relief agencies has put further pressure on the natural resources in and around the town.

– Environmental issues due to unplanned development and deforestation

The urban development driven by the growth in tourism has come at a high cost to the municipality’s natural resources over the last 30 years. The tourism sector constitutes a major share of Cox’s Bazar’s economy. There are over 220 hotels, motels, and guest houses, over 154 restaurants, and 54 tour operators that together employ around 8,600 people (Mamun, Hasan, and Hossain 2013). In addition, around 5,000 people serve as construction workers to build new hotels and other facilities, while thousands of others are engaged in informal sectors that support tourism. A primary field study carried out for this CEA found that seasonal wetlands/low-lying areas were reduced by 87 percent from 1989 to 2017. In the same time period, the study found that sand bar areas have been reduced by 61 percent, forested areas by 57 percent, hill areas under vegetation by 69 percent, and tidal wetlands by 44 percent, in a manner highly correlated with human-induced land conversion and urbanization. Meanwhile, settlements and urban areas were found to have significantly increased—an approximately 235 percent increase that now covers a more than 584 ha built-up area without vegetation. Figure 3-5 shows the chronological changes of land use in Cox’s Bazar.

These recent and ongoing urban development trends are coming at the expense of the services and benefits that the city's natural ecosystems (forests, mangroves, and wetlands) provide toward urban resilience. Loss and degradation of forests has increased landslide risk, reduced water retention capacity, increased siltation, and choked up drainage canals (including the Bakkhali River). Over the last 10 years, around 150 people have died in landslides in Cox's Bazar town and adjacent areas, and thousands of others are at risk (Aziz 2017). Unplanned infrastructural development has reduced water bodies/wetlands, and eventually the shrinking surface water availability will have serious implications. The waterlogging of built-up areas within the town not only affects land productivity, but also poses health risks to locals and tourists from water pollution and mosquito breeding. Health risks are further compounded when solid wastes are dumped on waterlogged lands (Rahman, Hashi, and Habib 2014). The municipality's waste disposal system is inadequate, with organic and hazardous wastes deposited in open, poorly controlled dumping sites. During heavy rains, wastes are carried downstream to the Moheshkhali Channel (Bay of Bengal) through the Bakkhali River, negatively affecting the coastal environment, fisheries, and aquatic biodiversity (including mangroves) at the intertidal zones at the mouth of the Bakkhali River.

Additionally, lack of surface water availability causes excessive extraction of groundwater, which exacerbates the salinity intrusion. In coastal cities, wetlands play a crucial role in recharging groundwater, and as such, help to maintain aquifers and prevent salt water intrusion. Based on data from shallow tube wells (<50 m in depth), Seddique et al. (2013) located a zone of higher electrical conductivity (EC) values (>200 μ S/cm with a maximum of 2200 μ S/cm) in the western and northern parts of town (Laboni, Suganda, Kalatoli, Jauitola, Nuniar Chara, and Khurushkul) and some isolated parts at the center of town, which indicates the presence of salt water in aquifers. The data also show that salinity moves toward the land. Higher EC values were also recorded in deeper wells (a maximum of 7070 μ S/cm), indicating that excessive abstraction of groundwater is likely the main cause of the saline water intrusion in Cox's Bazar (Seddique et al. 2013).

– A way forward: Mangroves in Cox's Bazar and the potential for ecotourism

In charting a path for Cox's Bazar to become a sustainable tourism hotspot, the recent efforts and investments to restore and protect mangroves provide a positive example for potential initiatives to protect and restore wetlands and forests. Historically, mangroves used to grow in intertidal mudflats at different char areas of Cox's Bazar districts, and were common in Chokoria, Moheshkhali, and Teknaf, including in some areas along the Bakkhali River and adjacent areas. Mangroves used to support productive multispecies fisheries in the Bakkhali estuary (Hena et al. 2007; Rahman et al. 2015). However, due to anthropogenic disturbances (felling, boating, fishing, encroachment, and conversions for aquaculture) mangroves became unable to grow in these areas. Seddique et al. (2013) reported that no mangrove was traceable in 1989 within Cox's Bazar Municipality. From 2007–10, the DoE started planting and protecting mangrove forests in 60.91 ha in Nuniar Chara along the Bakkhali River adjacent to the Cox's Bazar airport. The DoE continued to protect mangroves at Nuniar Chara and extended mangrove restoration in adjacent areas through projects known as Community-Based Ecologically Critical Area Management (CBAECAM). This occurred in two terms, from 2011–15 and 2016–17, with additional funding from the Embassy of the Kingdom of the Netherlands (EKN) and the Climate Change Trust Fund (CCTF), with technical assistance from the United Nations Development Programme (UNDP). The DoE also constructed a community center and watch tower to facilitate increased community engagement and encourage ecotourism. Locals also mentioned the presence of mangroves along the Bakkhali River, dominated by two species of Bain (*Avicennia* spp.). DoE officials said that without community management, mangroves could not be protected from anthropogenic disturbances.

This example of successful mangrove plantation demonstrates the importance of engaging the local community for eco-tourism promotion in Cox's Bazar. The forest is being managed by local communities organized into village conservation groups (VCGs) under various DoE projects that took place from

³⁷. Through the UNDP-supported Coastal and Wetland Biodiversity Management Project (CWBMP).

2007–17. To this end, the DoE supported the VCGs by providing two boats for ecotourism. The mangroves in Nuniar Chara are being colonized by fish, crabs, shrimps, birds, and wildlife, and are taking the shape of a full-grown forest. They provide home for 90 bird species (30 winter migrants), an endangered horseshoe crab species, and 80 fish species (Nabi et al. 2011; DoE 2015b). No comprehensive study has yet been done to assess the provisioning services that this mangrove provides to the local communities. It is believed the mangrove acted as a natural embankment during Cyclone Mora on May 30, 2017. Considering the successful community-engaged restoration of mangroves in Nuniar Chara, the DoE took up similar initiatives in different sites along the Bakkhali and Showfuldondi Rivers.

Institutional support from beyond the DoE and community awareness nonetheless need further strengthening to sustain the mangroves’ regrowth and scale up the initiative. Besides the existing sites, it is estimated that around 200 additional ha of riverside coastal land could be brought under mangrove restoration and management, which would further extend the benefits in terms of coastal protection, biodiversity, and fisheries. Yet there is a lack of institutional support by the state-level actors to restore and protect mangroves. Although the DoE demonstrated success with a mangrove plantation (with the help of the local government and community), the Bangladesh Forest Department (BFD) has the mandate, and deeper technical expertise, for any afforestation and reforestation initiative and forest and wildlife patrolling.

Meanwhile, stronger city planning and management is needed to prevent the mangrove restoration program from being undermined by further encroachment and degradation. Mangrove restoration is challenged by ongoing disturbances from cattle grazing (mainly buffalo), fishing activities, tree cutting, encroachment, land conversions, and people’s lack of awareness regarding the benefits mangroves offer. Land conversion for aquaculture (mainly shrimp farming), settlements, and other infrastructures is common in Cox’s Bazar. For example, at one corner of the Nuniar Chara forest, mangroves from a large area were cleared and converted to aquaculture farms by influential locals. This suggests either a lack of capacity, will, and/or clarity on roles/responsibilities across

city-level actors responsible for implementing and enforcing urban plans. In Cox’s Bazar, this includes the Paurashava government, the urban development authority, and the Deputy Commissioner (DC), among other institutions. Clarifying mandates and strengthening capacity and accountability on natural resource management aspects of city governance would help to ensure that the gains made under the mangrove restoration program are sustainable.

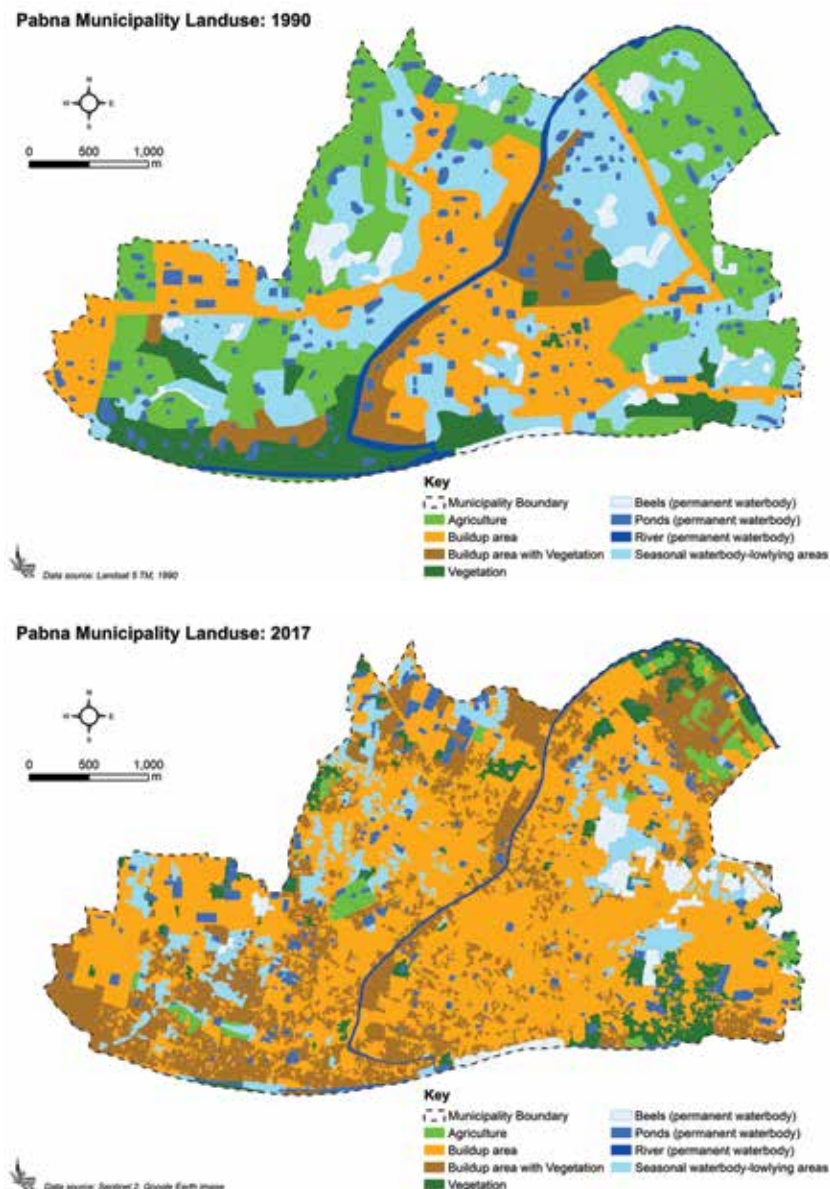
3.2.3 Environmental Management in the Municipality of Pabna

Pabna is an aspiring town where urbanization is taking place at a moderate rate but in an uncoordinated way across institutions. Pabna contains both seasonal and perennial wetlands—the former includes low-lying areas that remain inundated for around six months of the year, and the latter consists of river sections, beels, and ponds that retain water year-round. These wetlands influence the town’s livelihood opportunities and ecological importance. The Ichamati River flows through the Pabna Municipality.

– Emergent environmental issues at the beginning of unplanned development

Even at its current state of nascent urbanization, Pabna is affected by unplanned development and lack of environmental management. The primary data collection found that 54 percent of the municipality’s wetlands have been encroached upon or lost since 1990 (see Figure 3-6). In 1990 the total wetland area was 568 ha, which by 2017 had been reduced to 264 ha. Major wetlands loss has been recorded, especially in the section of the Ichamati River that flows through the middle of the town, where encroachment is taking place on both sides of the river. The study found that about 63 percent of the river’s area has been reduced over the last 27 years, while the surrounding wetland area has been reduced from 38 ha in 1990 to just 14 ha in 2017. At the field level, in all cases, ponds were found to be smaller than what is recorded by the municipality, which indicates that these ponds have been encroached upon to varying extents. Besides the municipality-managed ponds, there are more than 30 ponds within the municipality that are attached to seven different institutions and ostensibly managed and controlled by such agencies. The status of key ponds of Pabna City and pictorial evidence of flooding are presented in Annex D of the background paper.

FIGURE - 3-6: LAND USE MAP OF PABNA MUNICIPALITY, 1990/2017



Source: Developed by World Bank consultants and CNRS.

The rapid, unplanned development is not only causing waterlogging within the city, but the famous Ichamati River is dying, threatening livelihoods and ecology. Within Pabna Municipality are five settlement areas where waterlogging is causing significant problems, particularly during monsoon months: Salgaria Gorosthanpara (southwest), Choto Salgaria (southeast), Jogipara, Dilalpur, and Shibrampur. Reduction of seasonal wetlands also affects agricultural production, particularly in winter (of boro rice); reduces open spaces; and threatens wetland biodiversity, including fisheries. During

monsoon season, many poor households used to catch fish in the seasonal wetlands in Salgaria, Shibrampur, and other low-lying areas within and adjacent to Pabna Municipality, but wetlands loss has reduced these opportunities. Locals report that various resident and migratory bird species are no longer visiting the seasonal wetlands during winter. A large 15-acre khas wetland called Poddaya Kole (a section of the Padma River that got separated due to shifting of the main river course) is a closed wetland. The upazila administration leases it out to fishers' cooperatives for fishing purposes, as per the MoL's 2009 Jolmohal

Policy. However, the leaseholder reported that several drains from the town fall into this wetland, polluting the water and killing the fish. Many households use this wetland's water and are affected by the pollution.

– A way forward: Ichamati restoration and institutional coordination

Community support and engagement is needed to restore the Ichamati River. The river is officially owned by the MoL and managed by the BWDB, which constructed sluice gates at the river's mouth to control flooding in the town. The people of Pabna have been protesting to demand the river's excavation and to free it from encroachment. On July 10, 2017, BELA served a legal notice to 19 different government departments, including the Secretary of Land, Secretary of the MoEFCC, Secretary of the Ministry of Water Resources, Director General of the DoE, Director General of the BWDB, Deputy Commissioner of Pabna District, Police Super of Pabna, and Executive Engineer of the BWDB. A strong civil society platform called the Ichamati Rakkahay Committee often advocates for the river's restoration and tries to make citizens and the administration aware of the importance of urgently evicting grabbers. The Pabna district administration has been laying the groundwork to evict the illegal grabbers of the river by drawing up a list of them, but at the time of this writing they had not yet been evicted—thus the fate of the river remains undecided. If awareness-building continues and institutional support and planning is strengthened, it is expected that the dying river can be restored.

More broadly, institutional coordination and strengthening is needed to effectively implement the Wetland Conservation Act of 2000 and restore wetland-based livelihoods. The MoL, DoF (under the Ministry of Fisheries and Livestock, MoFL), and Pabna Municipal Corporation are the three key institutions for protecting and restoring Pabna's wetlands. The current execution of relevant laws and policies seems ineffective, as several ponds and low-lying areas (including khals) are encroached and used for settlements and urban infrastructure. Field observation shows that a number of private ponds have been filled up, all khals have been converted to narrow drains, and low-lying areas within the municipality are being filled up. This is despite the

fact that the Wetland Conservation Act says that no wetland, private or public, within the urban areas can be converted or filled up without permission from the appropriate authorities. While the land is under the MoL's jurisdiction, the DoF has the mandate to manage fisheries in wetlands and rivers, and the Pabna Municipal Corporation is tasked with providing urban services, including solid waste management, maintenance of urban drains, etc. To ensure effective implementation of the Wetland Conservation Act in Pabna, the following needs to be strengthened: the capacity of the DoF as the technical expert; the MoL on land ownership monitoring; the DC on land leasing; and the Pabna Municipal Corporation on effectively provisioning urban services to keep solid waste and effluents out of wetlands and to maintain drainage systems.

3.2.4 Madhabdi and Narshingdi—A Tale of Two Cities

Madhabdi and Narshingdi provide a useful comparison for understanding the roles and importance of city decision making, visionary leadership, and effective stakeholder collaboration in steering development and environmental management outcomes. While a detailed analysis of urban environmental challenges was not completed for these cities, the focus on institutions aims to complement the previous case studies' deeper dive into the environmental challenges of rapid urbanization. These two neighboring Paurashavas north of Dhaka have experienced contrasting development paths, although they are located close to each other, which is discussed further below.

– Madhabdi: An environmental management success story

Madhabdi Paurashava has experienced rapid industrialization and growth since the 1990s. The growth was fueled by industries including textiles (hand looms and power looms that supply products to Aarong), spinning mills, and dyeing and printing. Currently there are about 30 textile establishments around the Paurashava, and more upstream. According to Paurashava officials, there are currently about 27,000 registered voters and a very high population density of about 30,000 people/sq. km. However, there is a large daily influx of about 50,000–

60,000 people from surrounding areas. With growth of 8.1 percent/yr for 2001–11 (BBS 2014), land values have been increasing rapidly. Currently there are 9 wards (covering about 5 sq. km) and this is expected to expand to 12 wards (covering around 6 sq. km), likely in the north-south direction.

The city lacks an official Master Plan but benefits from active civic engagement in town management.

A Master Plan was developed for Madhabdi under the LGED's Important Towns Project in 2015; however, it was never gazetted. Madhabdi has a Town-Level Coordination Committee (TLCC), which has 50 members consisting of councilors, teachers, doctors, and so on. There are also smaller Ward Committees that review and approve development works in the Paurashavas. For the past five years, solid wastes have been collected by NGOs through annual tenders.

The city's development has been heavily influenced by notable mayoral leadership and an engaged business community, which have worked together to rehabilitate the river (locally known as the Brahmaputra) and manage pollution. The mayor, who served from 2011–16, set out a vision for the town after the river is rehabilitated; his successor has continued to implement this vision, and a 3-D model was also created to help citizens see the plan. The mayor was able to convince key commerce and industry associations (Banik Samity and Dyeing Owners' Association) to come forward and help clean up the river. These business representatives have put forward BDT 1 Crore (US\$0.12 million) to help clean up the river. Within a period of one month, the Paurashava managed to clear about 250 m of the river (out of a total target of 2,500 m) from solid wastes, sludge, and encroachment. The Paurashava plans to install two drains on either side of the river to intercept 27 outfalls that are currently polluting it. The drains will be connected to a treatment plant, which will then discharge the treated water back into the river. A key turning point in this rehabilitation initiative happened when an influential local citizen agreed to knock down a portion of his own six-story building that had encroached onto the river bank. Seeing this example, other influential businessmen also began to cooperate with the mayor and Paurashava officials.

The example of Madhabdi shows that short-term investments in town planning, setting a clear vision,

and having continuous, strong-willed local leadership can turn the tide of unplanned urbanization and pollution. Local business owners and associations have an important role to play in these efforts. Motivating them and encouraging key players to take the initial steps toward environmental stewardship can yield large dividends in urban renewal and tangible improvements in urban environments.

– Narsingdi: A contrasting development path

In contrast to Madhabdi's growth story, Narsingdi is a slow placed city with inadequate synchronization between planning and development. There are no major industries within the Narsingdi Paurashava area, although some are located several kilometers upstream. One reason for the lack of industrial growth is the city's relatively higher industrial holding tax imposed, compared to neighboring Madhabdi. Yet while free from major polluting industries, Narsingdi lacks an urban Master Plan, which has resulted in slow but disorganized growth; the Paurashava area is expected to expand from the current 10.3 sq. km to about 30 sq. km. With weak capacity at the Paurashava level, the city has failed to pace urban service provision with land development. A Drainage Master Plan has been developed, and BDT 12 Crore (US\$1.4 million) has been invested in drains. However, some of the town's drainage outlets are under threat from land development. Narsingdi collects about 75 tons of solid waste daily across the city but lacks a sanitary landfill, disposing of wastes in an open dumping site.

The differences between Madhabdi and neighboring Narsingdi point to the importance of strong leadership, civic awareness and engagement, a clear vision, public-private collaboration, and strong governance to achieve positive environmental outcomes. Stakeholders also noted Madhabdi's political stability and sense of law and order as strong contributing factors to nurturing an environment that enabled solid collaboration between businesses and city government. Stakeholders noted that even during national political turmoil in 2014, markets and businesses continued to operate normally.

3.2.5 Mymensingh—A University Town

The case of Mymensingh highlights a city where development pressure is not as acute as in other urban

areas, due to the town's historical nature and the benefits from being close to Dhaka. Mymensingh is an old town, first established in 1859. It currently consists of 21 wards and covers an area of approximately 21.73 sq. km. Although the 2011 census recorded a population of around 258,000 people, according to the Paurashava officials the current population is about 500,000. The Mymensingh Strategic Development Plan (MSDP) includes the Paurashava and 10 unions, covering an area of 292 sq. km. Although Mymensingh is being given administrative importance, the town grows more like a university town than a business hub. The city's proximity to Dhaka means that many residents own and work in businesses and industries in and around Dhaka. Hence, Mymensingh residents have good employment opportunities, but the city does not face the pollution externalities of industrial development.

Mymensingh municipality is currently in the process of transitioning from Paurashava to a City Corporation governance model, which is expected to increase its town planning manpower. However, city administrative capacity is lagging in the meantime. The future City Corporation is expected to cover an area of about 94 sq. km, or about a third of the MSDP planning area. In the meantime, the Paurashava government faces many classic challenges of mid-sized cities in terms of service provision. The Paurashava is responsible for solid waste management, but there are some technical and manpower capacity constraints. The existing dumping site has another 10 years operational capacity if managed properly, according to officials. The city also has a separate composting facility for organics that is jointly managed by the Paurashava, the DoE, and a private operator. The city is also planning a new landfill site and plans to increase its investments in solid waste management.

3.3 PRIORITIES FOR ACTION

Institutional reforms are needed in urban governance, particularly to clarify overlapping mandates in urban planning and implementation. Lack of such clarity is currently contributing to poor environmental management outcomes and creating issues with waterlogging, encroachment, deforestation, groundwater extraction, urban flooding, and more. Towns and cities are governed

by three laws passed in 2009: the City Corporations Act; the Municipalities (Paurashava) Act; and the Union Parishad Act. These acts have provisions that allow the local authorities (e.g., the City Corporations, Paurashavas, and Union Parishads, respectively) to develop urban area plans, with support from the UDD and LGED or a relevant urban development authority. For cities with development authorities, overlapping mandates are particularly problematic, especially with regards to development control, as both the City Corporations and development authorities have the mandate to evict or demolish buildings that do not follow approved plans or are deemed unsafe. A simple solution in these cases could be to transfer all powers for enforcing urban plans to the development authority with the provision of adequate resources and empowerment. Another solution could be to empower the City Corporations and the municipalities. Since these entities have staff down to the ward or union level, their mandates should be broadened as elected city/municipality governments; they should have the sole authority to protect, rehabilitate, and sustainably manage urban wetlands.

Clarifying responsibilities should be accompanied by building capacity and streamlining record-keeping systems. In the short term, all copies of necessary records could be kept with the local government authorities. In the medium term, such records (especially of new applicants) should be kept in a digital system that can be readily accessed by all relevant agencies.

The Economic Zone Act of 2010 was an important milestone for facilitating more rational industrial zoning and planning. At the same time, agglomerating industries into SEZs may also herald new challenges in terms of managing their cumulative environmental impacts, which these institutions need to plan for and monitor. Land use zoning in urban areas is normally covered under the Master Plans developed by local government authorities. Despite having such plans in urban areas, industries have continued to grow in most cities in a largely unplanned manner, resulting in the encroachment of wetlands and forests, degradation of waterways, and heightened exposure of residents to emissions, effluents, and other wastes from factories. The situation is even worse in peri-urban and rural areas where there are no such plans. In 2010 the government enacted the Economic Zone Act, which

aims to locate industries in specially developed areas around the country, and would also ease land-related problems faced by potential local and foreign investors. The act provides a legal basis for establishing economic zones throughout the country for industrial development, led and managed by BEZA. As zones get developed, it will result in more organized use of land for industry and urban growth, as well as an opportunity to bring better balance to agricultural land use by restricting economic zones to areas that are less suitable for agriculture. Dhaka is the clear-cut example of this concern, with a concentration of proposed SEZs around the city, especially toward its northern end. On the one hand, this can be beneficial for the city, as the existing industries can move to the new SEZs. However, with the concentration of SEZs around Dhaka, there is a chance of increased environmental impacts, especially in the waterways around the city. Therefore, this situation needs to be carefully managed—in terms of siting requirements/zoning, environmental and pollution management infrastructure (like CETPs) and thresholds, and natural hazard risk mitigation/flood vulnerability—and monitored as SEZs are developed in the coming years.

Building local governments' capacity to enforce environmental acts and regulations pertaining to natural resources is also critical for achieving urban eco-development. For example, the Bangladesh Biodiversity Act of 2017 mandates local urban institutions to play an active role in conservation; however, to effectively implement the act, proper rules need to be developed and the local authorities need to be strengthened if they are to fulfill their mandated roles. This act has specific directions for urban areas under clauses 15 (City Corporations) and

24 (Paurashavas). For example, clause 15a requires City Corporations to set up biodiversity management and monitoring committees chaired by the mayor that include a DoE representative as a secretary. The committees are tasked with preparing a Register of Biodiversity and including details of different uses for biological materials; supporting the implementation of an NBSAP; raising awareness; identifying and protecting biodiverse hotspots; and estimating damages caused to biodiversity. Similar arrangements are also mandated at the Paurashava level. Furthermore, the act stipulates that alternative livelihood arrangements should be arranged at the local level for communities in which biodiverse resources are affected. Although this decentralized approach is welcomed, its practical implementation will be difficult without strengthening local authorities' manpower and technical capacity, as well as that of DoE field offices.

The above analysis highlights that more attention needs to be paid to environmental management, and that implementation of the 1997 ECR should be ensured to manage urban development not only in big cities like Dhaka but also in municipalities like Pabna. Madhabdi is a success story of river restoration, and shows how citizen and private sector engagement play a critical role in urban management. The recent iconic lake restoration projects in Dhaka at Hatir Jheel, Gulshan, and Banani Lake demonstrate that city governments can effectively take action to integrate environmental management into urban development. The next chapter identifies areas of policy enhancement, institutional reform, and investment. While this chapter summarized key institutional-level interventions drawn from the case studies, the next chapter will discuss investment options.

³⁸. For more detail, see the background paper, "Towards and Clean and More Resilient Cities."

CHAPTER 4.

A WAY FORWARD

Over the last decade, Bangladesh has improved its policy regime and systems for environmental and pollution management. Since 2006, when the World Bank's first CEA for Bangladesh was published, the country has made tangible progress in further developing environmental policies, guidelines, and legislation. This progress toward mainstreaming the environmental agenda across government is especially apparent in the country's national development, environment, and climate change strategies, as well as in specific enhancements to the legal framework for pollution control, management, and accountability. Some industry-specific initiatives for scaling up cleaner production practices have also gained momentum.

Yet much more needs to be done to arrest the stark effects of pollution and environmental degradation on people's health and economic productivity. Achieving Bangladesh's objective to reach upper-middle-income status through cleaner and more resilient growth will depend on further developing and strengthening a range of complementary policies and systems for environmental protection, urban development, and industrial management. This is even more critical for Bangladesh than for most other countries at a similar income level due to its uniquely high population density and vulnerability to climate risks. Moreover, institutional reforms and capacity building will be key in all areas to ensure effective implementation of adopted strategies and policies. Based on the analysis in this CEA, priorities for reform and investment should include the following:

- i. Enhancing environmental policy and institutions at the national level
- ii. Enhancing environmental management at the local/city level
- iii. Strengthening the enforcement and accountability regime
- iv. Leveraging market-based instruments to protect the environment and unlock green financing
- v. Promoting RECP as a tool for reconciling environmental performance with competitiveness
- vi. Harnessing the power of public pressure

i. Enhance environmental policy and institutions at the national level

Additional reform measures should be considered to complement ongoing updates of core policies, regulations, and standards. These include:

- i. Require the public disclosure of all environmental information related to facilities and development projects subject to ECC.
- ii. Strengthen EQS based on a rigorous review and public consultation, which could be informed by a background paper that clearly justifies proposed changes.
- iii. Strengthen the legal and institutional framework for hazardous material management, based on data collection and analysis to better understand the issue.

Significant institutional reform is also required to enable the DoE to effectively achieve its environmental management mandate. The department needs to be modernized and decentralized, with much better information systems and a much larger local footprint outside Dhaka. Priority should be given to areas/cities with the highest levels of pollution. In particular, deploying more DoE staff to existing and additional field offices (based on a needs assessment) is necessary to improve environmental management. There is also a need to provide better incentives to attract and retain talented and competent professionals, possibly by instituting a cadre system and elevating the most senior position—DG, currently at the Additional Secretary level—to match the rank of equivalent positions in other major departments (e.g. the Forest Department at the MoEFCC, whose head has the rank of Secretary). Within the DoE, compliance and enforcement staff should be separated to distinguish and elevate core priority functional areas. There is also a need to increase the DoE’s overall budget allocation and approved headcount to allow it to effectively conduct enforcement. In addition, the revenue base could be diversified (see the later section on market-based instruments).

Mainstreaming environmental management and green development across all relevant line ministries and agencies is essential to creating an enabling environment for sustainable growth. In particular, enhancing systems and capacity to manage environmental issues is needed among the institutions responsible for urban and industrial development. Recommendations include:

- i. Promote environmental sustainability and cleaner production in land use planning and financial, industrial, and import/export policies. For example, the Ministry of Planning can integrate a Strategic Environmental Assessment (led by the MoEFCC), to zone and demarcate areas for industry across the country in environmentally appropriate locations, and require comprehensive EAs before clearing any new zones.
- ii. Amend the 1980 BEPZA Act to mandate environmental compliance requirements, as already provided for in the 2010 BEZA Act.
- iii. Create an Environmental Management Cell/Unit in relevant ministries and agencies, such as the

MoI, MoC, and Ministry of Textiles and Jute. For industrial zones, such units should be set up both at headquarters in BEPZA/BEZA and at the zone level.

- iv. Train officials at the relevant institutions on environmental management.

It is equally critical to launch a concerted effort by several ministries and agencies, the private sector, and civil society. Industrial and urban development are complex, multisectoral subjects that require coordination between different public and private stakeholders. The government should actively engage with other ministries/agencies and the private sector by leveraging existing platforms for PPD and creating new ones where they are missing.

ii. Enhance environmental management at the local/city level

Institutional reform is needed in local governance, particularly to clarify overlapping or overlooked mandates in urban planning and implementation. For example, responsibility for constructing and maintaining drainage in Dhaka is split among multiple agencies. These functions should be consolidated under the DSCC and DNCC, which are mandated for solid waste management. The capacity of both DCCs (north and south) should be strengthened as elected city governments; they should have the sole authority to protect, rehabilitate, and sustainably manage the urban wetlands within Dhaka City. This will help avoid inter-agency conflicts that contribute to destroying, rather than protecting, wetlands in urban settings. The overlapping mandates of different institutions should also be coordinated for smaller cities, such as Pabna.

Integrated urban planning is necessary for liveable city development. The UDD and the MoHPW have made a 20-year Master Plan (2011–31) for Cox’s Bazar Municipality and adjoining areas, taking into consideration the town’s rapid urbanization. Being a coastal and disaster-prone city, the plan needs to adopt a “ridge to reef” approach to coastal town planning, whereby planning covers detailed area development, from hilltops to hill slopes, to plans on the coast, where the land and water meet; and considers hydrology, ecology, economy, and society, including the current

and potential impacts of climate change and coastal hazards. Furthermore, aligning the plan with relevant international treaties, such as the Sendai Framework and the Paris Agreement, as well as with the SDGs, will facilitate green growth, protect ecosystems, and safeguard biodiversity. Cox's Bazar has a high potential to transition into an eco-city.

A major effort is needed at the local/city level to clarify institutional arrangements and strengthen capacity to more effectively implement and enforce adopted policies and plans. While Bangladesh has made good progress in terms of developing policies and acts, implementation is often limited, resulting in unplanned urban and industrial development. For example, although several low-lying areas at the Dhaka City periphery are designated as WRAs and FFZs, these are being rapidly filled up and converted (such as Ashulia's low-lying area). Short-term investments are urgently required to improve governance and transparency. RAJUK is making some effort in this direction; it introduced a digitization system to provide land use clearance and design approval. RAJUK is also piloting an online land use clearance system.

City Corporations need to assess solid waste management options, with a view toward exploring appropriate models for private sector involvement and public-private partnerships. In larger cities or urban agglomerations in particular, solid waste management must become a viable business proposition if the private sector is to play a larger role. There is also a pressing need for regional waste management facilities, including those that handle hazardous wastes that contaminate soil and increase health costs, as discussed in Chapter 1. The underlying policy regime will need to be improved to make better waste management options viable and financially sustainable.

Better planning and increased investments in secondary cities could relieve the concentrated pressure on Dhaka. For secondary towns such as Pabna that want to continue growing, and in which urbanization is taking place at a moderate rate, long-term investments are needed to develop the infrastructure in a planned way that takes into account land space and use, such as seasonal and perennial wetlands.

iii. Strengthen the enforcement and accountability regime

There is scope to increase accountability, trust, and deterrence in the environmental enforcement regime. It is necessary to replace what appears to be ad hoc application of the polluter pays principle with a transparent, rule-based system that can serve as an effective deterrent to polluters. These rules should specify a system of progressive fines that should vary with the level of violation and the type/size of industry. In line with best international practice, repeated violators should be penalized at progressively higher rates with an effective provision for closure, if repeated violations continue. Such rules could be complemented with (i) realistic and scientifically grounded emission/discharge and ambient environmental quality standards; (ii) an option to develop a monitorable and time-bound compliance plan when the current technology is unable to meet the standard and a new investment is needed; and (iii) the operationalization of a funding stream dedicated to environmental remediation.

A comprehensive information management system with automated monitoring for compliance and enforcement would help reduce the cost of enforcement and improve its effectiveness. Existing information management systems can be enhanced to become more comprehensive, serving as a database to track all ECC holders, their compliance and monitoring requirements, monitoring data, renewal timelines, past violations and penalties applied, and so on. The system should, to the extent possible, be accessible online and available to the public; this will help increase polluters' accountability. The portal could also receive automated monitoring data from industrial clusters and large industries, and track grievances or complaints related to environmental management issues on specific facilities or projects.

Outside experts should be used to support environmental clearance processes and compliance monitoring to supplement DoE's staff capacity. The proposed 2017 ECR contains a provision for constituting a clearance committee in the DoE to decide on Red category projects. It is recommended that the committee involve outside experts to

assess Red category projects and issue location and environmental clearances. The DoE should also develop an accreditation system and outsource compliance monitoring to accredited consulting firms.

A more effective environment court system would help hold polluters accountable. Internationally, the concept of easy access to a fair, equitable, timely, and inexpensive justice system has been recognized as an important facet of environmental governance.³⁹ The system in Bangladesh has proven its usefulness, but could be enhanced by:

- i. Amending the Environment Court Act of 2010 to allow direct public access to the courts; and
- ii. Setting up environment courts in more districts, prioritizing those facing the most severe environmental degradation and pollution issues.

iv. Leverage market-based instruments to protect the environment and unlock green financing

Making growth sustainable will require ensuring that the private sector and markets direct more resources toward greener activities and investments. As a complement to the adoption and enforcement of environmental regulations, getting price signals right for resources and using fiscal instruments to internalize environmental externalities would help minimize resource use and pollution from production and consumption. Moreover, Bangladesh can build on results achieved thus far to scale up financing for green investments.

Adequately pricing key resources, such as water and energy, is essential to foster their efficient use. As previously argued, an effective groundwater licensing and metering regime is key to ensure efficient water use by industries. The introduction of load-based charges on discharged pollutants may be also considered. Likewise, reducing fossil fuel subsidies to industries would promote energy efficiency and accelerate the shift toward cleaner energy sources.

Bangladesh should consider introducing fiscal instruments for promoting green growth. In particular, the environmental surcharge for heavy polluters and the carbon tax proposed in recent years could be reexamined. Such taxes could be applied gradually and designed in ways that address efficacy and competitiveness, based on best international practices. Revenue-neutral environmental tax reform, which aims to offset new taxes on environmental “bads” by reductions in existing distortive taxes on production factors such as capital and labor, could be one option to explore. Tax credits or subsidies for green investments and innovation could also be used temporarily, although they should be carefully considered to avoid inefficient, costly, and opaque use. Another way to reduce the cost of green technologies could be to reduce customs duties for environmental products (e.g., chemical products) and technologies (e.g., solar panels).

To maximize impact, sources of funding for environmental management should be diversified. While the DoE’s budget needs to be increased, it can be complemented by other revenue sources—for instance, by fees for clearances and reviews, and other services. Bangladesh could also consider establishing a national trust fund dedicated to conservation and environmental management. International experience shows that such funds can be very effective when supported by an adequate governance and management structure (see Box 4-1). As mentioned earlier, environmental taxes and charges could also be leveraged to fund environmental management activities.

It will be essential to scale up financing for green investments. Almost a decade after the BB introduced its first green scheme, there is an opportunity to take stock of progress to date on green finance and to identify remaining obstacles on both the supply and demand sides. Detailed analysis is needed to assess the scope for increasing green commercial lending, including to finance RECP investments by SMEs in

³⁹. Article 9, Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters, 1998, Johannesburg Principles on the Role of Law and Sustainable Development (adopted at the Global Judges Symposium, Johannesburg, South Africa) August 18–20, 2002, and Principle 10, Rio Declaration on Environment and Development; Agenda 21, in Report of the United Nations Conference on Environment and Development, Rio de Janeiro, UN Doc. A/CONF.151/26/Rev.1 (Vol. 1), Annex II (1992), Chapter 8, Paragraph 2.

Box 4-1. International Experience with National Environmental Funds

Environmental funds (EFs) have been established in many developed and developing countries worldwide. Such funds have proven to be a valuable policy instrument to foster conservation, environmental management, and/or climate mitigation/adaptation. Specific names and purposes vary, but an EF can generally be defined as an “independent legal entity and investment vehicle to help mobilize, blend, and oversee the collection and allocation of financial resources for environmental purposes.”

Key elements of EFs include their legal, governance, and financial structures, their resource mobilization strategy, and their grant delivery modality. Although different legal and governance models are possible, the experience shows that leaving fund management responsibility to an entity independent from government is essential for transparency and efficiency. However, government representatives often sit on EFs’ governing bodies.

A good example of an EF focused on pollution control is Poland’s National Fund for Environmental Protection and Water Management (NFOSiGW),^a which is the largest institution that finances environmental protection projects in the country. The national-level NFOSiGW was established as an independent entity in 1989 and functions in coordination with 16 regional funds, which were also granted legal personality in 1993. In addition, communal and district funds are controlled by local governments. The national and regional funds are funded through earmarked revenue from high pollution charges and fines. NFOSiGW is also used as a channel for European and other foreign funds allocated to environmental protection. The national and regional funds independently select projects to be supported through concessional loans and grants. Between 1989 and 2012, outlays from the national and regional environmental funds exceeded PLN 62 billion (around US\$16.8 billion), mostly for air and water pollution control projects.

More details on EFs’ key design elements, sample documents, and case studies can be found in the Environmental Fund Toolkit put together by the Conservation Finance Alliance,^b as well as from UNDP:^c

Notes: a. For more information, see the National Fund for Environmental Protection and Water Management, <https://nfosigw.gov.pl/en/nfepwm>; b. For more information about the Environmental Fund Toolkit, see the Conservation Finance Alliance, <http://www.conservationfinancealliance.org/environmental-funds-toolkit/>; c. For more information about environmental funds, see the UNDP, <http://www.undp.org/content/sdfinance/en/home/solutions/environmental-trust-funds.html>.

priority polluting industries, using a full range of instruments (e.g., credit risk guarantees). Beyond commercial lending, green bonds are a powerful tool with which to tap into private capital markets to finance larger green infrastructure development projects; these have generated interest in Bangladesh. The GoB could support this by introducing a policy and institutional framework on green bonds. Finally, enhanced coordination between the BB and the DoE is needed to increase synergies between green financing promotion activities, environmental policy, and the promotion of cleaner production.

v. Promote RECP as a tool for reconciling environmental performance with competitiveness

Mainstreaming RECP among polluting industries can help reconcile better environment performance with competitiveness. The adoption of RECP can be scaled up by having both industry and government address several gaps related to awareness and technical and financial capacity. Awareness campaigns on the scope of RECP and the benefits for SMEs—showcasing on actual cases—will help convince more firms to move toward greener production. In addition, collaboration

with technical institutions and industry associations on cleaner production technologies should be enhanced.

Bangladesh could consider establishing a dedicated technical institution to identify, demonstrate, and promote cleaner technologies, following the model of Cleaner Production Centers adopted in many countries. While pilot initiatives exist, most industries need more support in terms of knowledge about clean technologies and capacity building to actually implement such technologies. A technical platform is needed to help industries until these technologies become the norm. Such mandate could be taken up by an existing institution or a new one, with several possible institutional models.

To foster private investments in clean technologies, PPD needs to be strengthened among government, industry, and financial institutions. Coordination between the public and private sector is critical to strengthen environmental sustainability and promote private investments' resource efficiency. Based on early success in the textile sector, such dialogue should be promoted across all industries.

vi. Harness the power of public pressure

History shows that pressure from the public has often been a key factor to push polluters and regulators to improve environmental management. Pressure from citizens, especially those in the rapidly expanding middle class, has been a major driving force for change in tackling pollution in various countries, such as China. In 2013, citizens' outrage over Beijing's hazardous air quality forced the central government to act. It declared a "war against pollution" in 2014 and has since taken important measures, such as

shuttering coal plants in major cities and reducing the number of new cars allowed to be registered in Beijing and other metropolitan areas.

Education programs and raising awareness about the value of the environment and its function in urban setting is critical to effectively engage citizens. It is important to make urban communities, including children, more aware of the value of natural resources and the importance of including, protecting, and managing wetlands and their functions in urban settings. To this end, relevant agencies should organize events and programs on what citizens can do, and develop and disseminate various educational materials on wetlands' values, functions, and management.

Enhanced disclosure and accessibility of data on environmental degradation and pollution is key to empowering citizens. As mentioned earlier, it would be important to disclose all environmental information related to facilities and development projects subject to ECC—including IEEs/EIAs summarized in the local language, and ongoing compliance monitoring and enforcement data.

Key recommended actions, summarized earlier, have been prioritized in terms of a timeframe for implementation (short vs. medium term), as well as potential level of impact. The prioritization was based on consultation and the results of assessments. Table 4-1 was prepared to highlight immediate steps the government can take to start tackling environmental issues, while at the same time emphasizing the need for medium-term policy and institutional reforms and investments to ensure sustainable urban environmental management.

TABLE - 4-1: KEY RECOMMENDED ACTIONS

Key Message	Action	Impact	Timeline	Responsibility
i. Enhance environmental policy and institutions at the national level	As part of the 2017 ECR update, require public disclosure of all environmental information related to ECC or otherwise mandated under ECA	High	Short	DoE
	Strengthen EQS based on a rigorous review and public consultation	High	Short	DoE
	Strengthen the legal and institutional framework for hazardous material management	Medium	Medium	DoE
	DoE institutional reform: Increase the DoE’s overall budget allocation and approved headcount; deploy more staff to field offices and open additional field offices	High	Medium	MoF, DoE
	DoE institutional reform: Separate compliance and enforcement staff and distinguish/elevate core priority functional areas, institute a cadre system, and elevate the DG to the Secretary level	High	Medium	DoE
	Mainstreaming environment: Promote environmental sustainability and cleaner production in land use planning and financial, industrial, and import/export policies	High	Medium	MoP, MoC
	Mainstreaming environment: Amend the 1980 BEPZA Act	High	Short	BEPZA
	Mainstreaming environment: Create an Environmental Management Cell/Unit in relevant ministries and agencies	Medium	Medium	MoI, MoC, MoTJ, BEPZA/BEZA
	Mainstreaming environment: Train officials at relevant institutions on environmental management	High	Short	MoEFCC, DoE
	Coordination: Leverage existing platforms for PPD and create new ones as needed	High	Medium	DoE, MoI, and MoC in collaboration with business associations
ii. Enhance environmental management at the local/city level	Institutional reform: Clarify mandates in urban planning and implementation	High	Medium	City governments
	Promote integrated city development planning by integrating natural resources into cities’ wider spatial planning	High	Medium	City governments
	Strengthen capacity at the local/city level	Medium	Medium	City governments
	Solid waste management options need to be assessed to find appropriate models for private sector involvement and public-private partnerships	High	Long	City governments
	Invest in secondary cities	Medium	Long	City governments

Key Message	Action	Impact	Timeline	Responsibility
iii. Strengthen the enforcement and accountability regime	Modernizing enforcement: Develop a comprehensive information management system	Medium	Short	DoE
	Modernizing enforcement: Replace ad hoc enforcement with a rule-based system	Medium	Medium	DoE
	Use outside experts: Involve experts in proposed ECC clearance committees, develop an accreditation system, and outsource compliance monitoring to accredited consulting firms	Medium	Short	DoE
	Environment court system reform: Amend the Environment Court Act of 2010 to allow direct public access and set up environment courts in more districts	Medium	Medium	MoEFCC
iv. Leverage market-based instruments to protect the environment and unlock green financing	Energy/water use: Establish tariffs and metering to incentivize resource efficiency	High	Medium	Relevant institutions in charge of tariffs
	Introduce financial instruments to green industries (need further analysis to identify exact instruments)	High	Medium	BB in collaboration with private banks, the DoE, business associations
	Diversify sources of funding for environmental management	High	Medium	MoEFCC
	Green financing: Analyze existing financial mechanisms to identify bottlenecks and options for improvement	Medium	Short	BB in collaboration with private banks, the DoE, business associations
	Green financing: Develop a financing scheme to facilitate commercial financing of RECP investment by SMEs in polluting sectors	High	Medium	BB in collaboration with private banks, the DoE, business associations
v. Promote RECP as a tool for reconciling environmental performance with competitiveness	Technical support to firms: Strengthen technical institutions and/or establish new center(s) to identify, demonstrate, and promote cleaner technologies	High	Medium	DoE, MoI, MoC, technical institutions, business associations, academic community

Key Message	Action	Impact	Timeline	Responsibility
	PPD: Strengthen dialogue between government, industry, and financial institutions on opportunities for and constraints to cleaner production	High	Short	DoE, MoI, and MoC in collaboration with business associations
	Review and update RECP-related policies to ensure effective implementation (e.g., include resource input standards in ECC approval, etc.)	Medium	Medium	DoE, MoI, and MoC in collaboration with business associations
	Awareness campaign on RECP scope and benefits targeting SMEs	High	Short	DoE, MoI, and MoC in collaboration with business associations
vi. Harness the power of public pressure	Effectively engage local communities and relevant stakeholders in city development planning processes	High	Short	City governments
	Support education and awareness raising to empower citizens	Medium	Medium	MoE, NGOs, etc.
	Transparency: Disclose all environmental information related to facilities and development projects subject to ECC	High	Short	DoE

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ANNEX A

KEY ACHIEVEMENTS IN THE DEVELOPMENT OF BANGLADESH'S ENVIRONMENTAL LEGAL AND REGULATORY FRAMEWORK SINCE 2006

Since 2006, there has been growing attention paid to environmental issues in Bangladesh's governance principles and strategic plans; notably, the government has adopted the SDGs. In 2011, the Constitution of Bangladesh was also amended to highlight the state's role in conservation and environmental management. As Article 18A states, "The State shall endeavor to protect and improve the environment and to preserve and safeguard the natural resources, biodiversity, wetlands, forests and wild lives for the present and future citizens."

The government's Seventh Five-Year Plan also stresses the importance of both strengthening institutions for improved environmental compliance and enforcement as well as promoting and scaling up the emerging experience in greening manufacturing industries to support economic growth targets by 2021 (see Annex B).

The country is also in the process of updating its National Environmental Policy; at the time of this publication, the draft policy had been approved by the National Environmental Council and would soon be considered by the Cabinet, after which it will be gazetted. The new draft makes important improvements over the 2013 policy, especially in the following key areas related to industries and clean production: focus on industrial development (section 3.15); management of chemical substances (section 3.22); and environmentally friendly economic development, sustainable production, and consumption (section 3.24).

At the same time, there have been several additional rules and legislations related to environmental management, such as (but not limited to): the Environment Court Act (updated in 2010), the Wildlife Conservation and Security Act (2012), the Brick Manufacturing Control Act (2013), the Bangladesh Water Act (2013), the Ecological Critical Area Rules (2016), and the Bangladesh Biodiversity Act (2017).

The MoEFCC recently published its Country Investment Plan (CIP) for the 2016–21 period. The CIP was developed through a consultative process and reflects relevant policies, plans, strategies, and laws. The CIP has four pillars: (i) Sustainable Development and Management of Natural Resources; (ii) Environmental Pollution Reduction and Control; (iii) Adaptation and Resilience to, and Mitigation of, Climate Change; and (iv) Environmental Governance, Gender, and Human & Institutional Capacity Building. The CIP identified 14 programs and 43 subprograms under these four pillars. The total financing required was estimated at US\$11,679,500, of which US\$4,713,000 has already been allocated, and the remaining US\$6,966,500 requires gap financing. The programs under Pillar 2 had the largest amount of gap financing (US\$2,610,600).

Pillar 2 programs include: (i) Reduced Industrial Pollution; (ii) Reduced Municipal and Household Pollution; and (iii) Reduced Pollution from Agriculture and Other Sources. Some of the priority investment areas in these programs include: (i) establishing treatment units for toxic and hazardous wastes through public-private partnerships; (ii) creating industrial parks with CETPs; (iii) offering incentives/benefits for industries to adopt zero-discharge policies; (iv) adopting fiscal measures to discourage pollution and encourage the use of clean technology; (v) conducting real-time online monitoring of ETps; and (vi) improving municipal and medical waste, as well as e-waste management. Pillar 4 programs include: (i) an improved legislative, regulatory, and policy framework; (ii) improved stakeholder participation and gender equity in the EFCC sectors; and (iii) improved organizational capacity and processes for evidence-based decision making. Some of the priority investment areas in these programs include building the capacity of legislators; establishing a biodiversity cell, a chemical management cell, and a 3R cell in the DoE; piloting community-based pollution control enforcement at seven demonstration sites;

strengthening measures for implementing EIAs (e.g., engaging a panel of experts to review EIAs); adopting measures to enhance the DoE's enforcement, monitoring, and surveillance capacity; increasing public participation in environmental hotspots; and developing a monitoring and information system for the most polluting industries.

At the time of this writing, the government was also in the process of finalizing and gazetting a revised version of the 1997ECR, which is discussed further in Section 2.1 and Annex B.

Additional new environmental laws passed since 2006 are outlined in the table below.

TABLE - A-1: ENVIRONMENTAL LAWS PASSED SINCE 2006

Name of Act
Public Procurement Act, 2006
Chemical Weapons (Prohibition) Act, 2006
Padma Multipurpose Bridge Project (Land Acquisition) Act, 2009
Fish Feed and Animal Feed Act, 2009
National Institute of Biotechnology Act, 2010
Bangladesh National Scientific and Technical Documentation Center (BANSDOC) Act, 2010
Fish Hatchery Act, 2010
Bangladesh Tourism Restricted Area and Special Tourism Zone Act, 2010
Bangladesh Tourism Board Act, 2010
Bangladesh Gas Act, 2010
Bangladesh Economic Zone Act, 2010
Real Estate Development and Management Act, 2010
Compulsory Use of Jute Packets for Goods Act, 2010
Quick Increase of Electricity and Fuel Supply Act (Special Provision), 2010
Environment Court Act, 2010
Bangladesh Climate Change Trust Act, 2010
Balu Mahal & Soil Management Act, 2010
Plant Quarantine Act, 2011
Dhaka Elevated Expressway Project (Land Acquisition Act), 2011
Animal Slaughter & Meat Quality Assurance Act, 2011
Science & Technology Development Trust Act, 2011
Bangladesh Agricultural Research Council Act, 2012
Bangladesh Atomic Energy Regulator Act, 2012
Wild Animals (Conservation & Protection) Act, 2012
Disaster Management Act, 2012
Sustainable & Renewable Energy Development Authority Act, 2012
Bangladesh Water Act, 2013
National River Conservation Act, 2013
Payra Port Authority Act, 2013
Hilly Chittagong Development Board Act, 2014
DNA Act, 2014
Bangladesh Hotel & Restaurant Act, 2014
Metro Rail Act, 2015

Name of Act
Bangladesh Energy & Electricity Research Council Act, 2015
Formalin Control Act, 2015
Bangladesh Oceanographic Research Institute Act, 2015
Atomic Energy Plant Act, 2015
Payra Port Authority (Land Acquisition) Act, 2016
Cox's Bazar Development Authority Act, 2016
Petroleum Act, 2016
Bangladesh Bridge Authority Act, 2016
Railway Property (Illegal Settlement Elimination) Act, 2016
Bangladesh Investment Development Authority Act, 2016
Tea Act, 2016
Bangladesh Biodiversity Act, 2017
Jute Act, 2017
Bangladesh Development Research Institute Act, 2017
Bangladesh Atomic Agricultural Research Institute (BINA) Act, 2017
Bangladesh Agricultural Research Institute (BARI) Act, 2017
Bangladesh Jute Research Institute Act, 2017
Bangladesh Road Transport Authority Act, 2017
Bangladesh Rice Research Institute Act, 2017

UPCOMING POLICIES, LAWS, RULES, AND GUIDELINES

At the time of this writing, the following important environmental policies and rules were in the process of being developed and approved:

- Draft National Environmental Policy
- Draft Clean Air Act
- Draft (updated) Environment Conservation Rules
- EIA guidelines for the following sectors: cement, coal mine, industries, roads and bridges, gas downstream, gas upstream, pharmaceuticals, and textiles

ANNEX B

KEY OBSERVATIONS AND RECOMMENDATIONS FOR THE DRAFT 2017 ECR

There are some operational limitations in the 1997 ECR, most of which are addressed in the proposed 2017 ECR (draft). An account of these differences and key recommendations are provided in Table B-1.

TABLE - B-1: COMPARISON BETWEEN THE 1997 ECR AND 2017 ECR (DRAFT)

ECR 1997	ECR 2017 (draft)	Comments and Recommendations
Industry categorization: Green, Orange-A, Orange-B, and Red. There was no direction for industries or projects that did not fall under these four categories.	Industry categorization: Green, Yellow, Orange, and Red. If an industry is not listed in any of the categories, the DG of the DoE will decide on its category and EA requirement via committee recommendation.	The current practice for EA requirement for non-listed industries or projects is determined on an ad hoc basis. A formal structure will now be established.
There is no requirement for ECC at the zone level for special industrial zones like SEZs and EPZs; only at the individual industry level.	This has not been addressed in the new rules.	Requiring ECC at the SEZ/EPZ level would ensure that an alternatives analysis is carried out before siting the zones, and would also allow for effective capturing of cumulative impacts, which are not normally adequately assessed or mitigated through industry-level IEEs/EIAs.
While the requirement that potentially polluting industries renew their ECC every year is justified, it may not be suitable for certain non-industrial projects (including, for example, bridges, roads, or dams). This creates ambiguities in the application of the 1997 ECR.	This has not been addressed in the new rules.	EA for non-industrial projects is under the same umbrella as the 1995 ECA. Therefore, a specific direction for ECC renewal for such projects would be useful.

ECR 1997	ECR 2017 (draft)	Comments and Recommendations
<p>Public participation or consultation is not a condition in the 1997 ECR; however, the DoE prefers the proponent to engage in public participation during EIA preparation, as stated in the "EIA Guidelines for Industries" (DoE 1997).</p>	<p>The proposed 2017 ECR has set new clauses detailing the requirement and nature of public consultation to be conducted for Red category projects. There is a requirement in schedule 15 to consult with stakeholders during project planning and feasibility to draft the ToR for the EIA and to state whether the ToR approved by the DoE has been used to prepare the EIA. Public consultation has been made mandatory (and is therefore legally binding) for project proponents to obtain site and environmental clearance. There is now a requirement to involve DoE officers in the public consultation process and to conduct national-level consultations for large/nationally important Red category projects.</p>	<p>This is a very important and positive amendment to the ECR. Public consultation has now become a legally binding prerequisite to obtain ECC. However, the DoE could do more in this regard by mandating public disclosure of the EIA report's findings. Opportunities for the public to review the EIA report are under the discretion of the DG of the DoE. The DoE does not officially disclose EIA report findings publicly on its website unless project implementing agencies do so either on their own accord or because they are subject to disclosure requirements of donor agencies.</p>
<p>According to the 1997 ECR, the DoE approves site clearance for the project before issuing the ECC, which is done after the EIA report has been reviewed. As per the 1997 ECR, the project proponent is allowed to develop the land on the project site when the site clearance is issued. This means that the proponent is allowed to invest resources to some extent before the EIA is approved and the ECC is issued. This undermines the importance of the ECC, and any analysis presented in the EIA (or any analysis of alternate sites) would only exist to justify the site already selected for the project. This greatly diminishes the value of any analysis of alternatives.</p>	<p>The new ECR has addressed this issue specifically for Red category projects. Article 13 mentions that an EIA approval (including a resettlement plan and public consultation report) is required to obtain site clearance, and subsequently environmental clearance. As a result, the analysis of alternatives will have to be carried out a priori in order to obtain site clearance.</p>	<p>The DoE is already practicing a similar procedure for environmental clearance in recent times, although the new rules are not yet effective. As a first step, they issue an EIA approval before site/environmental clearance. Only when they are convinced that the project proponent has taken all pollution control measures do they issue the ECC. The new rules therefore codify this existing practice.</p>

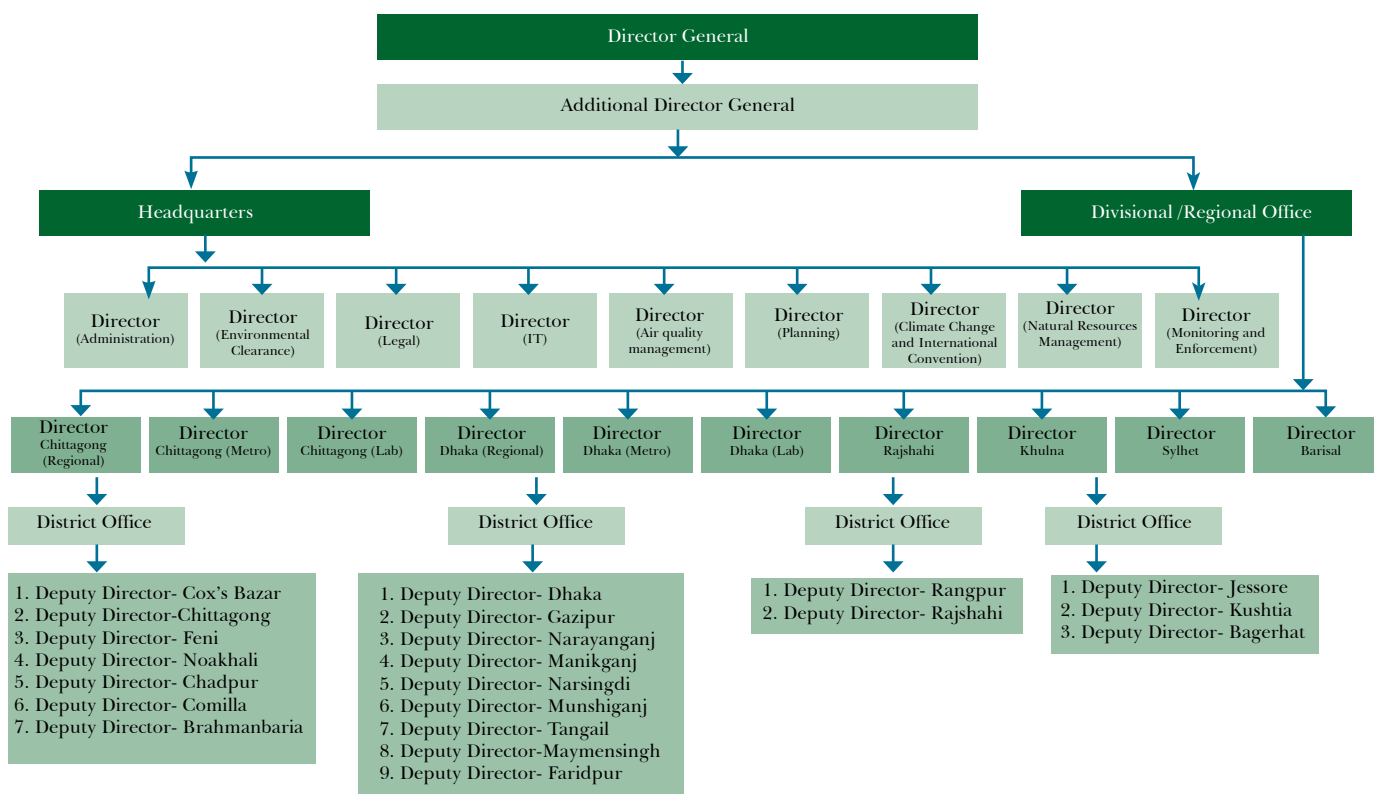
ECR 1997	ECR 2017 (draft)	Comments and Recommendations
<p>The DoE has no procedural provision for registration and no requirement for consultants' or consulting firms' qualifications.</p>	<p>The proposed ECR offers detailed procedural provisions for enlisting consultants and consulting firms that would be competent to prepare EIAs/IEEs/EMPs. Procedures have been laid out for the selection criteria, qualification requirements, and eligibility of such consulting entities.</p>	<p>This is a useful amendment as it will encourage the development of a competent private sector for carrying out EAs. The role of enlisted firms can be further expanded to environmental monitoring activities where the DoE may delegate these firms to carry out environmental monitoring on their behalf.</p>
<p>Did not have a guideline for EIA preparation.</p>	<p>Schedule 15: A guideline for EIA preparation is provided.</p>	<p>In Bangladesh, consultants usually prepare EIA reports based on sectoral guidelines, donor agency, guidelines, and so on. However, a unified framework for preparing EIAs will always be helpful.</p>
<p>DoE officials are not involved in verifying project information after the project proponent applies for environmental clearance.</p>	<p>In the proposed ECR, DoE officials need to verify project/industry information and the adoption of pollution control measures by making site visits. For Yellow, Orange, and Red category projects, the DoE verifies the project location shortly after the application is submitted for site clearance. When the site clearance is issued and after the project proponent finishes construction, the DoE official visits the site again to verify the conditions and EMP commitments (i.e., ETP installation), and based on that, environmental clearance is issued. For Red category projects, the DoE official is also invited to attend public consultation meetings.</p>	<p>The new ECR will certainly seek additional commitments from the project proponent in applying environmental safeguards to their projects. But it also demands additional oversight on behalf of the DoE. This might require additional staff for regulatory purposes.</p>

ANNEX C

COMPARISON OF THE DOE'S ORGANIZATIONAL STRUCTURE WITH THOSE OF OTHER COUNTRIES

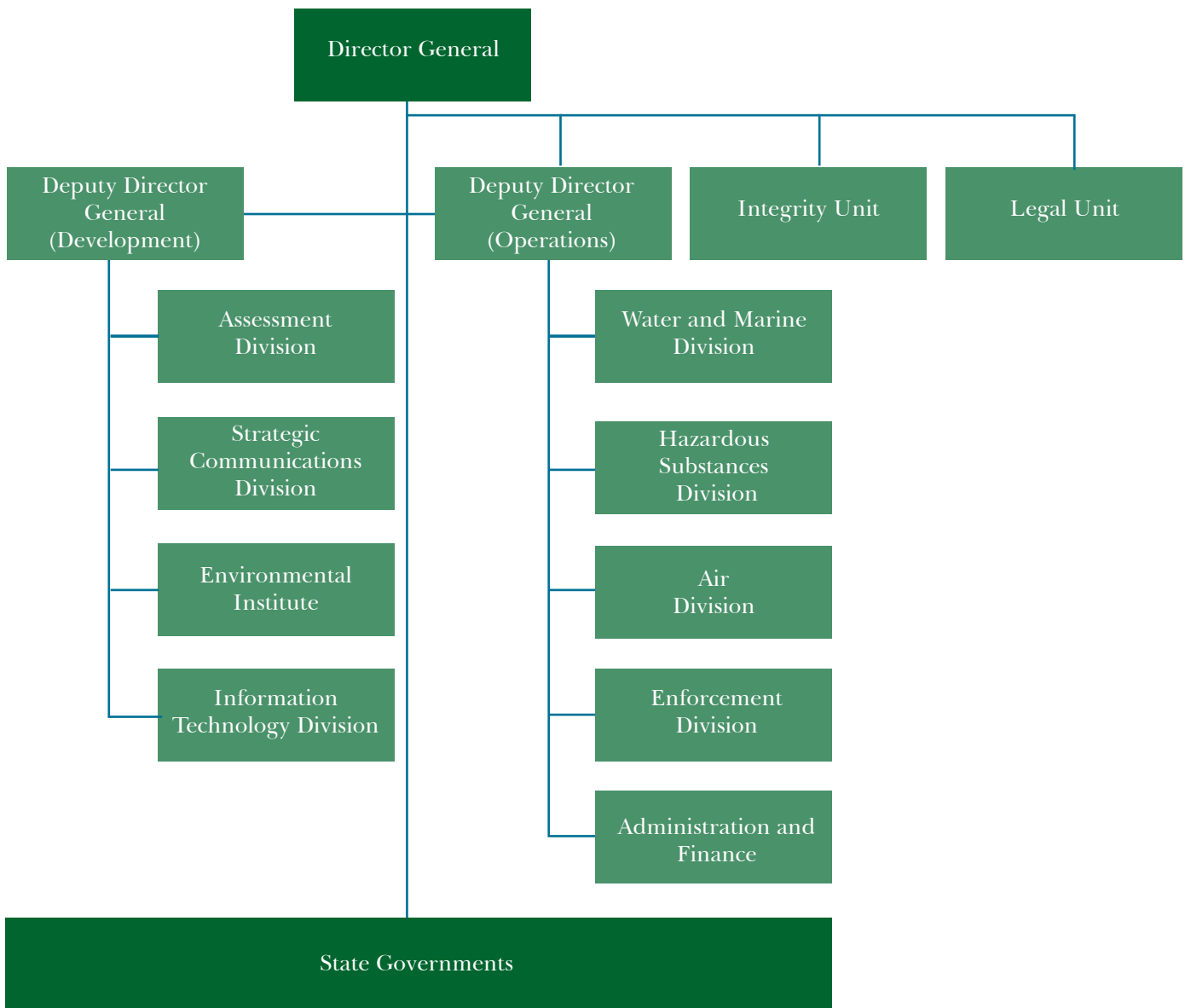
Figure C-1 shows Bangladesh's DoE organogram. It is important to notice that Air Quality Management and Climate Change are the only functional directorates. However, the current structure does not have specialized entities that are responsible for other priority environmental issues, including water or soil pollution, and management of chemicals. Also, while Environmental Clearance and Monitoring and Enforcement are separate directorates, the staff under them are not separate, which can potentially result in an unclear division of responsibilities and limited accountability.

FIGURE - C-1: ORGANOGRAM OF BANGLADESH'S DEPARTMENT OF ENVIRONMENT



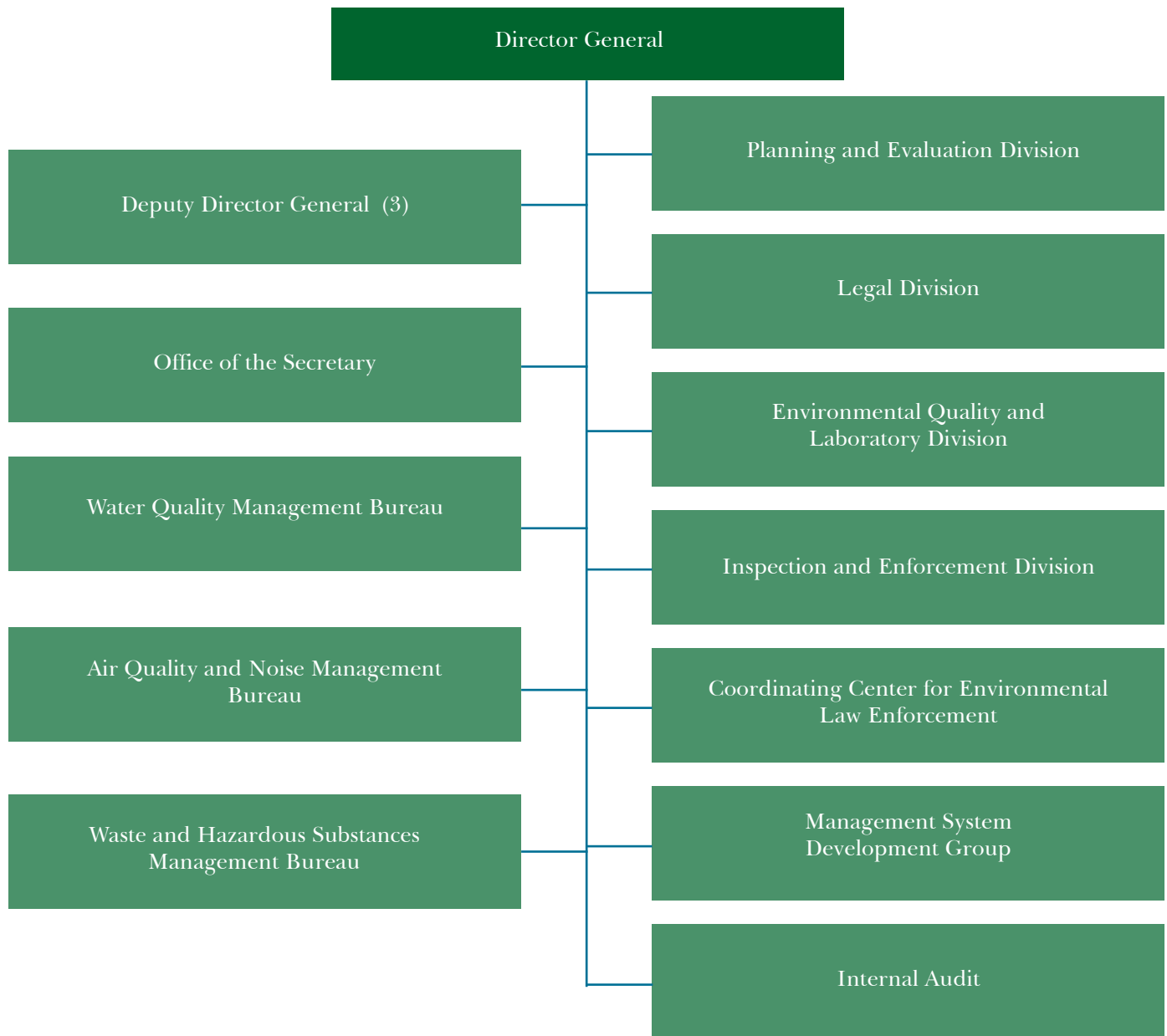
In contrast with Bangladesh's DoE, Malaysia's Department of Environment and Thailand's Pollution Control Department are largely structured around functional areas (see Figures C-2 and C-3). In both of these cases, specialized divisions are responsible for managing air quality, water pollution, and hazardous substances. These agencies show potential organizational arrangements from which the DoE could draw and customize as needed to fit the Bangladeshi legal and administrative structure and requirements.

FIGURE - C-2: ORGANOGRAM OF MALAYSIA'S DEPARTMENT OF ENVIRONMENT



Source: Based on information from the DoE website at <https://www.doe.gov.my/portalv1/en/tentang-jas/struktur-organisasi/bahagian-ibu-pejabat>.

FIGURE - C-3: ORGANOGRAM OF THAILAND’S POLLUTION CONTROL DEPARTMENT



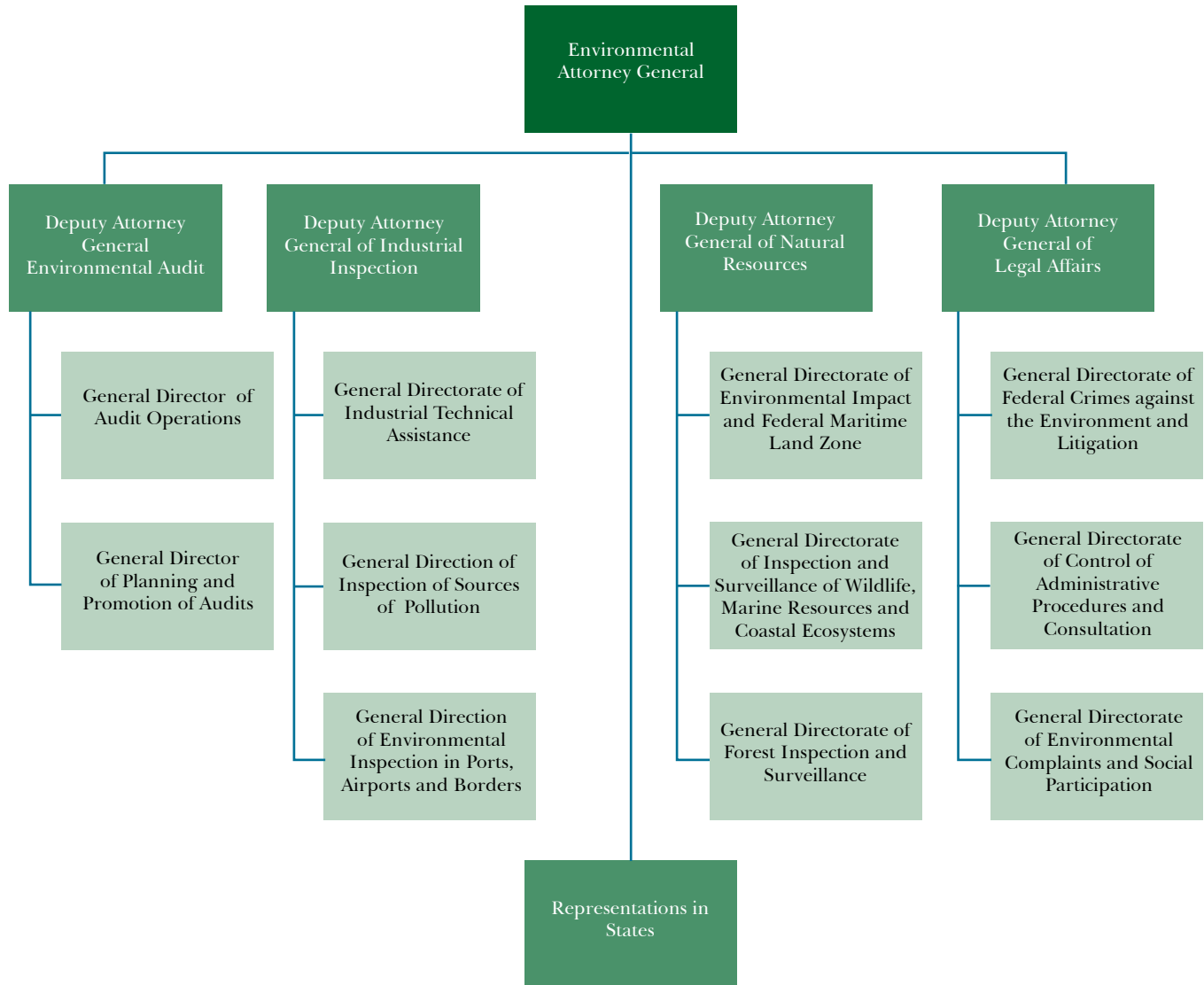
Source: Pollution Control Department, n.d.

In the middle to longer term, the GoB might consider establishing separate, specialized agencies with mandates for environmental enforcement and approving environmental licenses, respectively. Countries outside the Asia region—such as Mexico and Peru—provide examples of how these agencies might operate.

In Mexico, the environmental enforcement agency PROFEPA has contributed to the environmental sector’s legitimacy by providing efficient, neutral, and unbiased enforcement while eliminating potential conflicts of interest within sectors. This agency can also implement incentives for public-private partnerships to improve environmental management systems and programs to disclose environmental performance indicators that promote demand-driven environmental improvement in the private sector. For 2018, PROFEPA had a staff of 2,242 and a budget of approximately US\$52.6 million (GoM 2018). PROFEPA’s organizational structure

includes specialized units in charge of environmental audits, industrial inspections, and enforcement of laws and regulations governing natural resource management (see Figure C-4). PROFEPA has offices in each of Mexico's states.

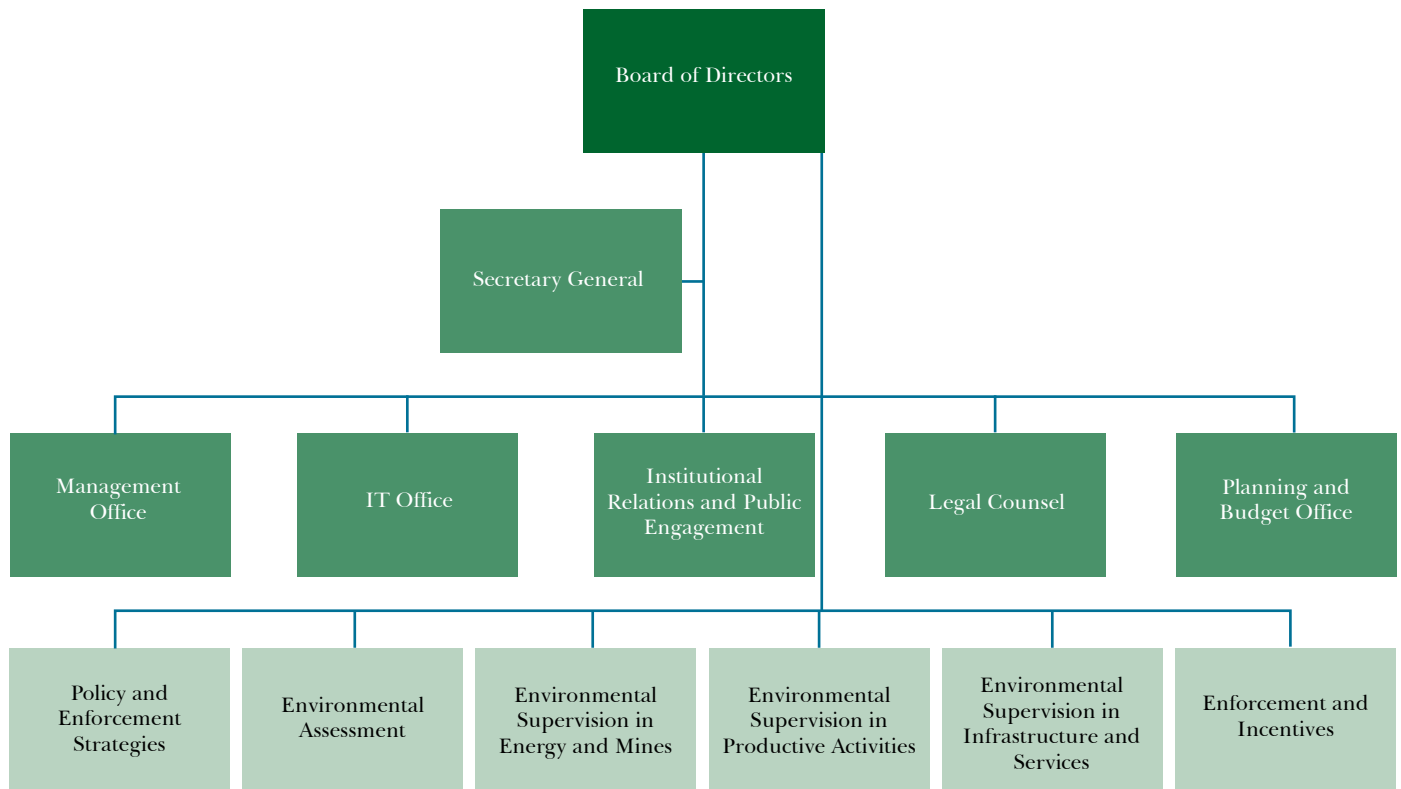
FIGURE - C-4: ORGANOGRAM OF MEXICO'S ENVIRONMENTAL ENFORCEMENT AGENCY



Source: SEMARNAT 2017.

Peru provides a second example of institutional separation of environmental enforcement from licensing/certification functions. Environmental oversight and enforcement is looked after by the Agency for Environmental Assessment and Enforcement (Organismo de Evaluación y Fiscalización Ambiental—OEFA), which was established in 2008 as a specialized agency. OEFA's organizational structure includes units that focus on environmental oversight policies and strategies, and assessment of environmental quality; it has separate, functional units for energy and mines, productive activities, and infrastructure and services (see Figure C-5).

FIGURE - C-5: ORGANOGRAM OF PERU'S ENVIRONMENTAL ENFORCEMENT AGENCY



Source: OEFA 2017.

Meanwhile, in 2012 Peru's government created the National Service for Environmental Certification of Sustainable Investments (Servicio Nacional para la Certificación Ambiental de Inversiones Sostenibles—SENACE) as a technical agency in charge of reviewing and approving detailed EIAs for projects with a national or regional scope that have potentially significant environmental impacts.⁴⁰ SENACE's creation aimed to address citizens' lack of trust in EIAs, and EIAs' long and bureaucratic procedures (SENACE 2018a). SENACE's organization includes two functional units responsible for EIAs of natural resources and productive projects, and for those for infrastructure (see Figure C-6).

⁴⁰ Law 29,968 dated December 19, 2012.

FIGURE - C-6: ORGANOGRAM OF PERU'S NATIONAL SERVICE FOR ENVIRONMENTAL CERTIFICATION OF SUSTAINABLE INVESTMENTS

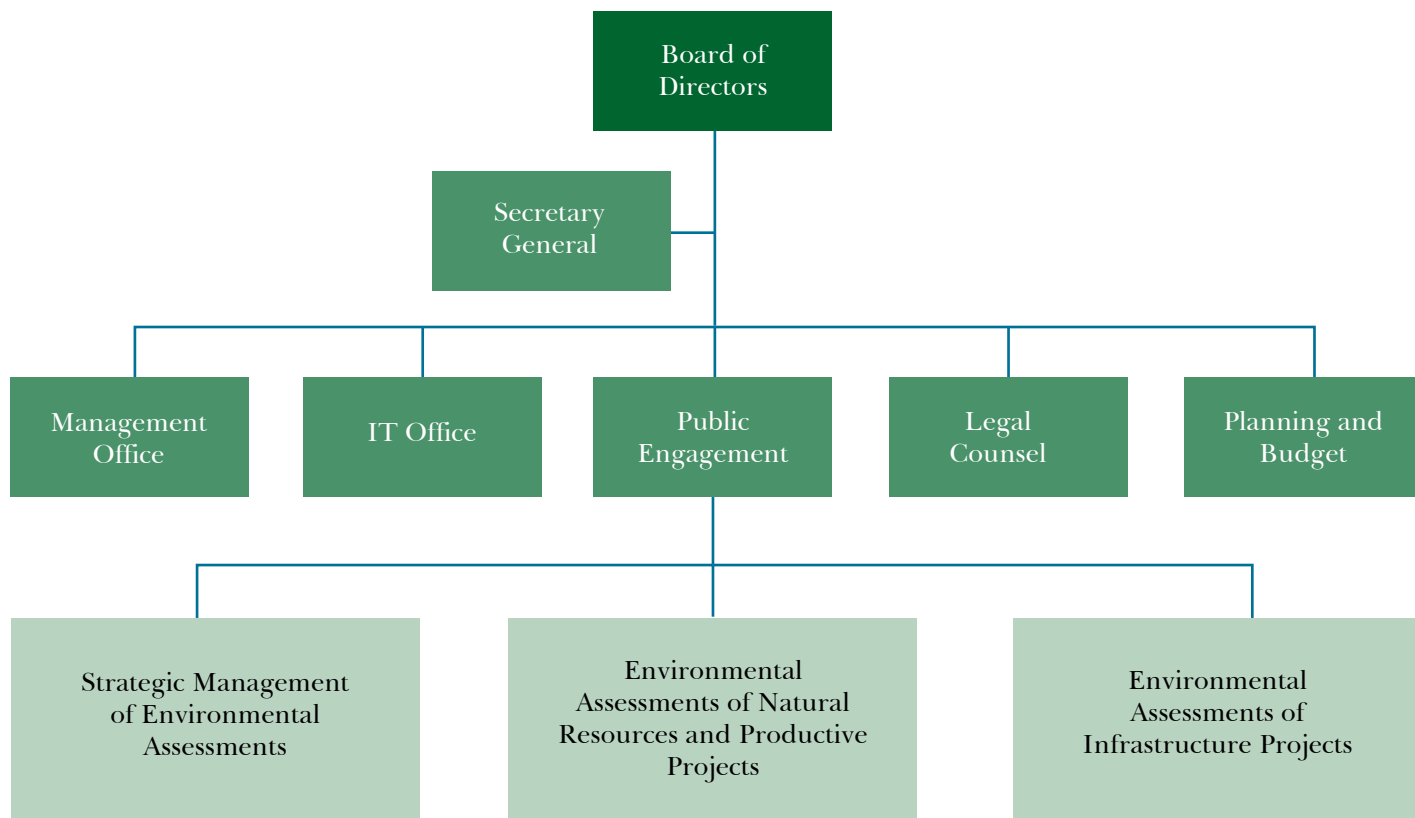
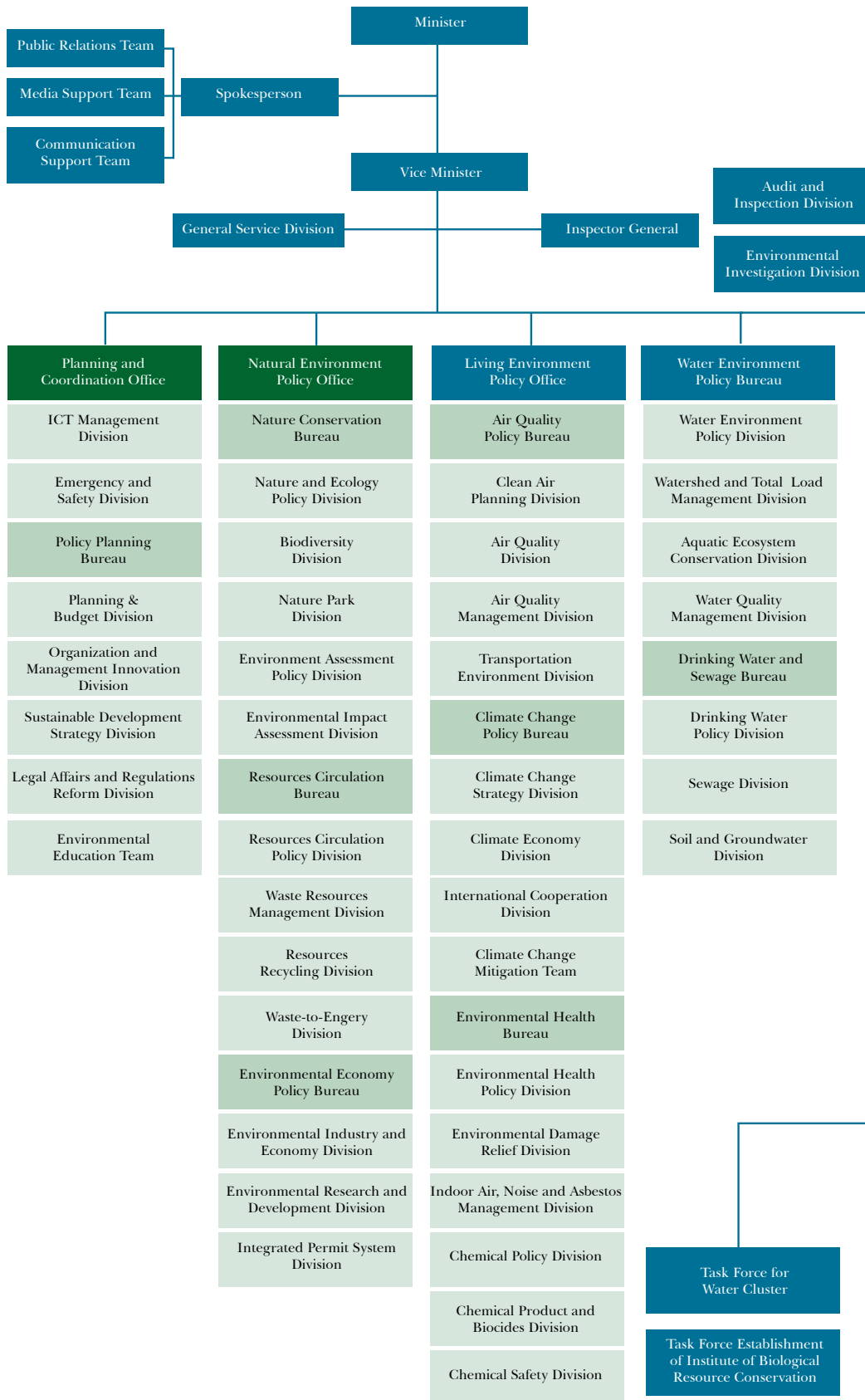


Figure C-7 depicts the organogram for the Republic of Korea’s Ministry of Environment. Given that this organogram is for the entire ministry of a high-income country, it should not be directly compared with the DoE. However, the organogram might provide insights into how Bangladesh’s MoEFCC could be restructured in the medium to long term, with increasingly specialized units that can tackle the country’s environmental priorities. In the case of the Republic of Korea, different bureaus focus on functional areas. A relevant example is the Environmental Health Bureau, which includes an Indoor Air Pollution, Noise and Asbestos Division that tackles serious environmental health risks that receive little attention in most middle- or low-income countries.

FIGURE - C-7: ORGANOGRAM OF THE REPUBLIC OF KOREA'S MINISTRY OF ENVIRONMENT



Source: Ministry of Environment of Korea 2017.

ANNEX D

HAZARDOUS WASTES IN BANGLADESH

—POLICY NOTE

Hazardous waste is waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment. Hazardous waste is generated from many sources, ranging from industrial manufacturing process wastes to batteries. Hazardous waste management in Bangladesh comes under the regulatory purview of the Hazardous Waste and Shipbreaking Waste Management Rules of 2011, promulgated under the ECA of 1995 (amended). Hazardous materials (hazmats) encompass both hazardous wastes as well as useful products of a hazardous nature; they are defined in these rules as materials with physical, chemical, reactive, toxic, inflammable, explosive, or corrosive properties that can damage health or the environment. Hazardous materials are classified into five categories (A–E) based on erstwhile BAGA (the Hazardous Waste Designation Decree of the Netherlands) list of Hazardous Substances in Schedule 3 of the rules, as shown in Table D-1.

TABLE - D-1: LIST OF HAZARDOUS WASTE CONSTITUENTS WITH CONCENTRATION LIMITS

Category	Types of Substance	Concentration Limit
Class A	20	50 mg/kg (20)
Class B	30	5,000 mg/kg (30)
Class C	17	20,000 mg/kg
Class D	9	50,000 mg/kg
Class E	-	Regardless of concentration limit; classified as hazardous waste if the waste exhibits any of the following characteristics:
E1		Flammable: Wastes with a flash point of 65.6 degrees Celsius or below.
E2		Explosive: Wastes that may explode under the effect of flame, heat, or photochemical conditions. Any other waste of explosive materials included in the Explosive Act.
E3		Corrosive: Wastes that may be corrosive, by chemical action, that will cause severe damage when in contact with living tissue.
E4		Toxic: Wastes containing or contaminated with established toxic and or eco-toxic constituents.
E5		Carcinogenicity, mutagenicity, and endocrine disruptivity: Wastes contaminated with or containing established carcinogens, mutagens, and endocrine disruptors.

Source: Hazardous Waste and Shipbreaking Waste Management Rules of 2011, Schedule 3.

The 684 specific hazardous chemicals identified are listed in Schedule 1, and a list of 36 industrial processes that produce 109 different types of hazardous wastes are provided in Schedule 2 of the rules. However, Basel classifications are more commonly used now. Bangladesh is a signatory of the Basel Convention (Secretariat of the Basel Convention 1989) and the Stockholm Convention, but hazardous waste management remains a relatively unpublicized aspect of the country's industrial development. Bangladesh joined the Basel Convention on April 1, 1993, and its 1996 Import Policy Order banned the import of all sorts of waste.

Nature and Extent of Hazmat Production and its Fate in Bangladesh

Data on hazmats were compiled in the regional technical assistance-supported study by the ADB (ADB 2010) on managing hazardous wastes in Bangladesh, Bhutan, Nepal, and India, in which data were mostly from 2007 or earlier. A more comprehensive review of the production and disposal of hazmats in Bangladesh was carried out by the DoE in 2010 (DoE 2010a). Although the report is dated 2010, it provides projected hazmat data for 2012 in some cases. An important finding of this study is the geographical concentration of the industries that produce hazmats in Bangladesh. It clearly emerged from mapping their locations and overlaying—that is, superimposing—one map with the location of one type of industry upon another until locations for all types of hazmat could be seen at a glance. The exercise showed that the Dhaka and Chittagong regions have the highest concentration of hazardous waste-generating industries. Within the Dhaka region, the largest concentration is in the Ghazipur district, followed by Dhaka, Narsingdi, and Narayanganj districts. Data on hazmats available from different sources are listed in Table D-2.

TABLE - D-2: INDUSTRIAL HAZARDOUS WASTE IN BANGLADESH FROM SELECTED SECTORS

SN	Industry Sector	Est. Qty. Solid Waste (ton/year)	Year	Basel/ USEPA Category	Comments
1.	Plastic waste ²	633,127	2016	-	About 51% recycled informally
2.	Textiles ²	2,810,000	2012	-	
3.	Medical waste ²	19,578	2012	Y1, Y2, H6.2	
4.	Tannery ²	33,502	2012	Y21	
5.	Pesticide formulation ²	460		Class 1B, II, III (USEPA)	
6.	Fertilizer	1,248	2012	Y22, Y23	
7.	ULABs ^a	3,420	2006	-	Quantity is for hard lead recovered; major expansion has taken place in this sector since the report, with 59 battery manufacturing units in the country
8.	E-waste (excluding shipbreaking) ^b	310,000	2006	-	This sector has also undergone major expansion in recent years

Notes: ^a DoE 2010b; ^b Islam 2016.

It is quite apparent that most of the data are not recent and need updating. It is likely that most of the data are also underestimates, as recent industry growth has not been considered. Some data also do not cover the whole country (e.g., in the case of plastics) and some high pollution sectors have been left out (e.g., paper and pulp, where a number of toxic chlorine compounds are used, or stocks of hazmat from earlier use—e.g., PCBs from the power sector are reportedly around 100,000 tons).

The nature of hazards in waste is also changing. It has now been more than 50 years since Bangladesh's building industry started to use PVC pipes in large scale; these are now coming into the waste stream. Burning PVCs can produce dioxin, which is one of the most poisonous substances known to humans. Overall, the quantity of hazmats produced is quite substantial and causing considerable economic externalities, as can be guessed from the examples in other countries.

Currently, some hazardous wastes are being recycled in Bangladesh. ULABs are by far the most widely recycled hazardous waste category, with an estimated 90 percent being recycled (SEMP 2006). However, informal ULAB recycling facilities, estimated at more than 1,100 across Bangladesh, are a major source of soil and air pollution, while there are only a few large formal plants with adequate environmental management (SEMP 2006). In a recent survey, reportedly more than 50 sites contaminated with lead have been found. There are reportedly more than 3,000 small factories that recycle plastics and solid waste from the textile sector. Recycling hazardous wastes has a lot of benefits, including reducing the consumption of raw materials and reducing the volume of waste materials. Such treatments also reduce the threat from harmful chemicals. Meanwhile, in many developing countries, including Bangladesh, hazardous wastes that are not recycled are disposed in regular landfills, most of which are not properly designed or secured. This results in considerable amounts of hazardous materials seeping into the ground and entering the natural hydrologic system. Hazmat landfills must have impervious linings to avoid groundwater contamination. In many cases, such wastes are being dumped in rivers and unoccupied or fallow lands, contributing to environmental degradation and health issues. In some cases, they are burned in open fires, producing toxic fumes.

Standard global practice for handling hazmats is to process them in treatment, storage, and disposal facilities (TSDFs), where they undergo different treatments to stabilize them before disposal. TSDFs can be equipped to recycle flammable materials (e.g., plastics) into industrial fuels. Some hazardous waste types may be eliminated using pyrolysis in ultra-high temperature electrical arcs, in inert conditions to avoid combustion. This treatment method may be preferable to high temperature incineration in some circumstances, such as in the destruction of chlorinated organic waste types, including PVC, PCBs, and pesticides, expired drugs/antibiotics, and other persistent organic pollutants.

A review of the situation in India shows that TSDFs can be sustainably operated in the private sector by charging hazmat-producing industries processing fees, which is actually an application of the polluter pays principle. Considering Bangladesh's geographical distribution, as noted above, there is a clear need for at least two TSDFs in the country—one each in the Dhaka and Chittagong zones. Going by the Indian experience, a TSDF will need about 50 or more acres of land, which is a major constraint in Bangladesh. According to the Environmental Information System (ENVIS) Centre on Control of Pollution Water, Air and Noise under the Indian Central Pollution Control Board, there are currently 26 general purpose TSDFs in India, all of which are in the private sector, probably under some sort of public-private partnership. As this is a new line of business in Bangladesh, support from the GoB in the form of land allocation and lower cost financing may help kickstart the establishment of TSDFs; this is much needed for both protection the environment and reducing the economic externalities of hazmats.

Recommendations

In the light of data on hazmat wastes in Bangladesh and other issues discussed above, the following recommendations can be made:

1. **Study the current status of hazmat production.** The discussions here show major gaps in terms of knowledge about the issue. As such, a comprehensive study to update knowledge on the current status and trends related to hazmats in Bangladesh—including their nature, quantity, treatment, and disposal—is urgently needed.

2. **Set up common TSDFs.** Even without any further study, the need for two TSDFs—one each in the Dhaka and Chittagong regions—can be foreseen. Going by the Indian experience, a public-private initiative with service charges for hazmat processing may be sustainable. As this is going to be a new line of business in Bangladesh, support from the GoB in the form of land allocation and lower cost financing may help kickstart the establishment of TSDFs. Donor support may also be sought to this end. Smaller TSDFs may be needed in industrial estates/EPZs, and feasibility studies for such TSDFs may be conducted.
3. **Review and further develop a legal framework.** Although the current Hazardous Waste and Shipbreaking Waste Management Rules of 2011 are a good basis for hazmat waste management activities in the country, further development will be needed for the sector’s optimal operation and management. The classification system for hazmat based on BAGA needs to be changed to make it compatible with Basel. Although the DoE advocates the 3R system, it has no clear link to any existing law. Adopting something like the U.S. Resource Conservation and Recovery Act could provide a link to waste generators with the hazardous waste management system. Including some provision of public funds to address legacy pollution clean-up and remediation of closed and abandoned hazardous waste sites, similar to that of the U.S. Comprehensive Environmental Response, Compensation, and Liability Act, may also be useful. Rules for operational guidelines for TSDFs and fee structures may also be needed. As such, it may ultimately be necessary to replace the current rules under ECA to a stand-alone hazmat and 3R law.



THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

1818 H Street, NW
Washington, D.C. 20433 USA
Telephone: 202-473-1000
Internet: www.worldbank.org/environment