THE BANGLADESH DELTA

A Lighthouse Case Study

Ingrid Pakulski, Virginie Laroche, Swarna Kazi, Ahmed Shawky, A.T.M. Khaleduzzaman, Ignacio Urrutia,
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Chapter 1
Bangladesh's Evolution in Managing Water and Disaster Risks

Bangladesh consistently ranks as one of the most vulnerable countries to climate change. About two-thirds of the country's land area is prone to river and rainwater flooding, and its coastlines are exposed to storm surges and tidal flooding. As a result, the country is particularly vulnerable to sea level rise, higher precipitation during the monsoon season, tropical cyclones, and glacial retreat in the Himalayas, all projected to be exacerbated by climate change. While Bangladesh's approaches to managing water and water-related risks have evolved over time, climate shocks have continually hindered its socioeconomic development—by undermining the productivity of economic sectors such as agriculture and negatively affecting water and food security, as well as human health.

A formal institutional structure and planning process for water management emerged only after the floods of 1954, 1955, and 1956. These disasters led to the creation, in 1959, of the East Pakistan Water and Power Development Authority (WAPDA). WAPDA published the first 20-year Master Plan for Water Management in 1964, marking the beginning of water sector planning in what is now Bangladesh. The plan was based on a strategy for flood control and drainage improvement to increase agricultural production.

A defining event for the Bangladesh Delta and the country as a whole was Cyclone Bhola, which made landfall in coastal Bangladesh (at the time still known as East Pakistan) in November 1970. With an estimated 300,000 to 500,000 victims, Bhola remains the world's deadliest tropical cyclone in recorded history. Analyses of the catastrophe led to substantial improvements in disaster response planning and public health preparedness. Soon after, the newly independent country started investing in risk-reducing measures to never again suffer such devastating consequences from a natural disaster. While the Bay of Bengal has since been hit by cyclones of similar intensity, there has been a 100-fold decline in the number of fatalities. What is more, 50 years after the "Great Bhola Cyclone," Bangladesh is recognized as a leader in disaster risk reduction (DRR).

Bangladesh became a World Bank member country in 1972. The first project it implemented with World Bank support was the Cyclone Protection and Coastal Area Rehabilitation Project. From the outset, Bangladesh invested in resilience—protecting lives, livelihoods, and assets. It accomplished this by elaborating plans for DRR, regulatory frameworks, and climate change strategies; constructing shelters; strengthening early warning systems, disaster preparedness, and institutions; and supporting communities through investments in climate-resilient infrastructure and innovative technologies.

The wide range of actions taken by the Bangladeshi government to reduce disaster risks and build resilience has not only saved lives, but also reduced economic losses and protected development gains. This success is often cited by parties arguing, in international forums, for proactively investing in disaster risk management (DRM). In Bangladesh today, the concepts of DRM and climate change adaptation are closely interwoven with integrated water resources management (WRM) and adaptative delta management, as explained in chapter 3.

In 2001, the government prepared a National Water Management Plan (NWMP). The plan provided a national- and regional-level framework for line agencies, local governments, and other stakeholders to plan and implement their activities and projects in a coordinated manner, consistent with national and sectoral objectives. At the time, climate risks were not yet fully integrated into all sectoral policies. Today, Bangladesh systematically considers climate change in its policy making and planning.

Bangladesh has long been a front-runner in climate adaptation; it was one of the first countries to prepare a National Adaptation Programme of Action, adopted in 2005 and revised in 2009, and to establish institutions and funds focused on climate change. Bangladesh was also among the first countries to develop, in 2009, a comprehensive strategy for sustainable, low-carbon development—the Bangladesh Climate Change Strategy and Action Plan. In 2010 it established the nationally resourced Bangladesh Climate Change Trust Fund.

Being endowed with the world's largest river delta and inspired by the success of the Dutch Delta Programme, around 2012, the government started developing a comprehensive development plan for the delta region that would integrate WRM and DRM and spur economic growth—the Bangladesh Delta Plan 2100 (BDP 2100).

In June 2020, Bangladesh took up the presidency of the Climate Vulnerable Forum, where it represents the interests of the most vulnerable developing countries. Bangladesh will lead this global forum's efforts to map out a sustainable and climate-resilient pathway. And in September 2020, the Prime Minister of Bangladesh inaugurated the first South Asian regional office of the Global Centre on Adaptation in Dhaka. This further reinforces Bangladesh's critical role in climate adaptation.

The case study is structured as follows. Chapter 2 gives a quick overview of the Bangladesh Delta. Chapter 3 discusses the country's current development strategy, which reflects an integrated approach to DRM and WRM. In this context, special attention is given to the BDP 2100 and the role of the World Bank in the country's transition toward sustainable, climate-resilient development. Chapter 4 goes over key building blocks of the government's current delta management, and Chapter 5 highlights some aspects of the BDP 2100 that may also be relevant to other deltas. Chapter 6 summarizes the study's main conclusions.

Chapter 2
Profile of the Ganges-Brahmaputra-Meghna (GBM) Delta

As a country located largely in a delta formed by three major rivers—the Ganges, the Brahmaputra,[1] and the Meghna—and being extremely vulnerable to climate change, Bangladesh's economic growth prospects depend on how well it manages its water resources and its delta. The government has an ambitious annual growth target for its gross domestic product (GDP) of 8 percent through 2041. This target will only be achievable if the delta is turned into an engine of growth for the entire country. The COVID-19 pandemic has made this target even more ambitious, at least in the short term.

The Ganges-Brahmaputra-Meghna (GBM) Delta is the world's largest, home to nearly 200 million people. Its rivers and floodplains support life, livelihoods, and the economy; it covers two-thirds of Bangladesh (about 100,000 square kilometers [km^2]) and part of West Bengal and Assam, in India (map 2.1). This low-lying delta plain has one of the highest population densities in the world (1,000 people/km^2).

Because of Bangladesh's high vulnerability to climate change, extreme weather events often result in the loss of human lives, land, property, and infrastructure. While it ranks as the sixth most vulnerable country for floods and the first for tropical cyclones, it also experiences severe regional water deficits during the dry season (October–May). Natural disasters tend to hit the poor the hardest, which partly accounts for the incidence of poverty remaining high in the poorest areas. And as climate change is increasing the frequency and intensity of natural disasters, many who managed to escape poverty will be pushed back into it by yet another natural disaster.

Yet, climate change is not the only factor affecting the delta's development. Other drivers of change are the country's economic development (irrigation, industry, fisheries, navigation, and road transport); technological development (especially in agriculture, civil engineering, information and communication technology, and energy); upstream activities (especially the construction of dams and barrages, and water withdrawals/diversions by upstream countries); demographic trends (population growth, urbanization, and migration); and land subsidence (both natural and human-induced). These factors account for the growing pressures on the delta's residents, sectors, and geographic areas—sea level rise, seasonal flooding and waterlogging, droughts, river and coastal erosion, landslides, sedimentation, soil and water salinization, deteriorating surface water quality, groundwater stress and pollution, environmental degradation, unreliable water supply and sanitation services, and weak transboundary water management. These pressures affect the country's natural resources directly and its use of land and water as well as its vital infrastructure and systems indirectly. In addition, the country's highly centralized system of government and limited resources largely account for its relatively weak governance and institutional capacity.

MAP 2.1. The GBM Delta

Faced with these challenges and recognizing that its WRM required a major course correction, Bangladesh developed a comprehensive development strategy for its delta that is introduced in section 3.2.

Note

1. The Brahmaputra River is known as the Jamuna River in Bangladesh.

Chapter 3
Development through a Comprehensive and Adaptive WRM Approach

The government has come a long way in terms of mainstreaming coastal development, WRM, DRM, and climate change adaptation in its major development strategies. This process culminated with the adoption of an integrated, long-term development strategy for the entire country, anchored in the development of its delta—the BDP 2100. In the lead-up to this milestone, the Bank supported the government through various initiatives, mainly to increase coastal and urban climate resilience. These Bank-supported initiatives helped shape some of the key principles underlying the BDP 2100.

The Bank further supports the government by bringing together development partners (DPs) to coordinate activities and financial assistance; identifying and disseminating best practices; and strengthening the government's capacity for planning, implementation, coordination, and monitoring and evaluation (M&E) of works and activities.

3.1 World Bank Support for Sustainable, Climate-Resilient Development

This subsection reviews ongoing Bank operations in Bangladesh involving DRM and/or WRM, and not necessarily focused on the GBM Delta. Most of these projects were designed, and are often also implemented, by multidisciplinary teams—representing sectors such as agriculture, water, transport, environment, and urban development. These teams cover aspects ranging from finance and trade to innovation and resilience (DRM and climate change). The dollar figure added in parentheses for each operation represents the financial assistance provided by the World Bank.

Coastal Embankment Improvement Project (CEIP)—Phase I ($400 million). This project supports (1) the rehabilitation and upgrading of polders—reclaimed, low-lying land areas protected by embankments—to guard the coastal areas against tidal flooding and storm surges; and (2) the enhancement of agricultural production by reducing saltwater intrusion in selected polders, using climate data and projections. The long-term objective of CEIP is to increase the coastal population's resilience by upgrading and protecting the polders' water management infrastructure—embankments, riverbanks and river slopes, and drainage canals and structures. In this context, the project also seeks to develop a framework for polder design and an investment plan, based on an enhanced understanding of the large-scale dynamics of the delta. The project is implementing a participatory management scheme for operation and maintenance (O&M) by involving local communities in project planning, implementation, and monitoring. CEIP also includes nature-based afforestation initiatives following a social forestry approach.

In view of the objectives mentioned above, the project requires a multiphased approach.[1] Phase II is under discussion and the government is working on expanding its coastal resilience program by scaling

up investments (based on enhanced nature-based designs) and improving investment planning through the use of risk-based decision support systems (DSSs).

CEIP has helped the government attenuate the impacts of cyclones and flooding, improve its emergency response in the coastal region, increase agricultural productivity and food security in the coastal areas, and create employment opportunities.

Bangladesh Weather and Climate Services Regional Project ($89 million). This project seeks to strengthen the government's capacity to deliver reliable weather, water, and climate information services and improve priority sectors' and communities' access to those services. Through investments in systems for weather monitoring, forecasting, and services (including agromet services), the project will help strengthen disaster preparedness and climate resilience.

Multipurpose Disaster Shelter Project ($375 million). This project aims to reduce the vulnerability of the coastal population to climate change and natural disasters across nine coastal districts of cyclone-prone areas. It entails the construction of 550 new cyclone shelters, improvement of 450 existing shelters, and construction or rehabilitation of 182 kilometers of roads with bridges/culverts and protective works to connect cyclone shelters. These new or improved disaster shelters are multipurpose in a simple yet innovative way—they normally serve as schools but become safe havens during disasters. In May 2020, during Cyclone Amphan, over 2 million people were safely evacuated to disaster shelters.

Urban Resilience Project ($173 million). This project aims to strengthen the capacity of government agencies to respond to emergency events and reduce the vulnerability of new buildings to disasters in Dhaka and Sylhet—through improved construction, urban planning, and development. The project seeks to create an enabling environment for coordinated, locally managed DRM based on three core pillars of disaster resilience in an urban setting: (1) responding effectively to urban disasters, (2) reinforcing existing infrastructure, and (3) ensuring resilient construction. The project is part of an urban resilience program being coordinated with the Japan International Cooperation Agency, which is in parallel implementing the $116 million Urban Building Safety Project.

Climate Adaptation and Resilience for South Asia (CARE) Project ($39.5 million). This regional project aims to enable climate resilience policies and investments in water, transport, agriculture, finance, and planning sectors across South Asia. It promotes evidence-based, climate-smart decision making through a regional resilience data and analytics portal and national DSSs in key sectors. It also provides financing to develop regional standards, guidelines, policies, and capacities for climate-resilient development at the national and local level in Bangladesh, Nepal, and Pakistan. In addition, the project finances the crowdsourcing and adoption of innovative and disruptive technology solutions for climate adaptation and resilience.

Bangladesh Regional Waterway Transport Project ($360 million). This project aims to improve inland water transport (IWT) efficiency and the safety of passengers and cargo along the Chittagong-Dhaka-Ashuganj regional corridor as well as enhance the sector's sustainability.[2] Both this project and the Jamuna River Project (section 3.2) invest in navigation channel development.[3]

Bangladesh Water Platform (BWP). This broad, technical assistance program provides policy advice to the government, coordinates the activities of stakeholders and DPs to improve WRM, and develops and advances pipeline projects. It also seeks to promote the dialogue on transboundary water collaboration among riparian states (Bangladesh, Bhutan, India, and Nepal).

South Asia Water Initiative (SAWI). This multidonor trust fund is financed by the United Kingdom, Australia, and Norway, and administered by the World Bank. It supports various activities to enhance regional cooperation in sustainably managing major Himalayan river systems. SAWI's activities in the GBM Delta pertain to the Ganges and Brahmaputra River Basins and the Sundarbans, a mangrove area in the delta. Support is also given to activities that are not basin-specific (e.g., groundwater management).

3.2 BDP 2100: Delta Development through Integrated WRM and DRM

Bangladesh aspires to reach upper-middle-income status and eliminate extreme poverty by 2030. These ambitions could be thwarted by the recurrent natural disasters and climate change. On the other hand, the Bangladesh Delta—if properly developed—could serve as the country's engine of growth. This realization led to the development of the BDP 2100,[4] approved in September 2018. Through this plan, Bangladesh aims to achieve both its medium-term objectives and its longer-term aspiration of sustainably managing water, ecological, environmental, and land resources against the backdrop of natural disasters and climate change and considering the interconnectedness of all these factors.

While the BDP 2100 focuses on an agenda up to 2050, the government recognizes that today's decisions have implications through 2050 and beyond. Thus, the plan outlines a long-term (year 2100) vision for the delta, followed by the short- and medium-term goals that will lead to that vision.

The BDP 2100 represents a break with the country's traditional approach to WRM—focused on food security, flood protection, and groundwater management. At its core are a strategy based on a comprehensive, integrated, multisectoral, adaptive, and sustainable approach to water and land management, and the vision of a safe, climate-resilient, and prosperous delta. To make this vision come true, the BDP 2100 seeks to "ensure long-term water and food security, economic growth, and environmental sustainability, while effectively reducing vulnerability to natural disasters and building resilience to climate change and other delta challenges through robust, adaptive, and integrated strategies, and equitable water governance." The General Economics Division of the Bangladesh Planning Commission (GED) is responsible for overall coordination and monitoring of the BDP 2100's implementation.

The BDP 2100 includes an investment plan (BDP/IP) for the delta—a portfolio of programs and projects built around river infrastructure investments and institutional reforms—prepared by the government with World Bank support. The investments required to achieve the BDP 2100's long-term vision will be informed by shorter-term strategies based on the adaptive delta management (ADM) approach (box 3.1).

An important initiative in support of the BDP 2100's implementation is the **2030 Water Resources Group (2030 WRG)**—a public, private, civil society partnership hosted by the World Bank Group that supports

BOX 3.1. Adaptive Delta Management (ADM) Approach in a Nutshell

The purpose of ADM is to ensure that the right investments are made at the right time. ADM aims to avoid both "too little, too late" and "too much, too early" by identifying tipping points that signal a change in approach is needed—for instance, switching from improving existing embankments to building new ones with greater safety provisions. Thus, flexible approaches built around smaller interventions phased over time are preferred to large, one-off projects that are irreversible; no-regret investments are prioritized; and projects that do not stand up under realistic climate scenarios are avoided.

ADM considers the interactions between projects, land use, and water management. It prefers working in harmony with natural hydrological systems rather than attempting to change such systems; it promotes the efficient use of resources (based on cost-benefit analyses) and prioritizes investments that protect from water-related disasters. Broad participation, investments in knowledge, and innovation are key to successful ADM.

country-level collaboration among groups (such as the Bangladesh Water Multi-Stakeholder Platform) toward sustainable WRM.[5] The 2030 WRG signed an MoU with the government and other partners to assist with the planning and implementation of the BDP 2100. It could serve as a model—in terms of setup and agenda—for promoting stakeholder dialogue and collaboration in other countries.

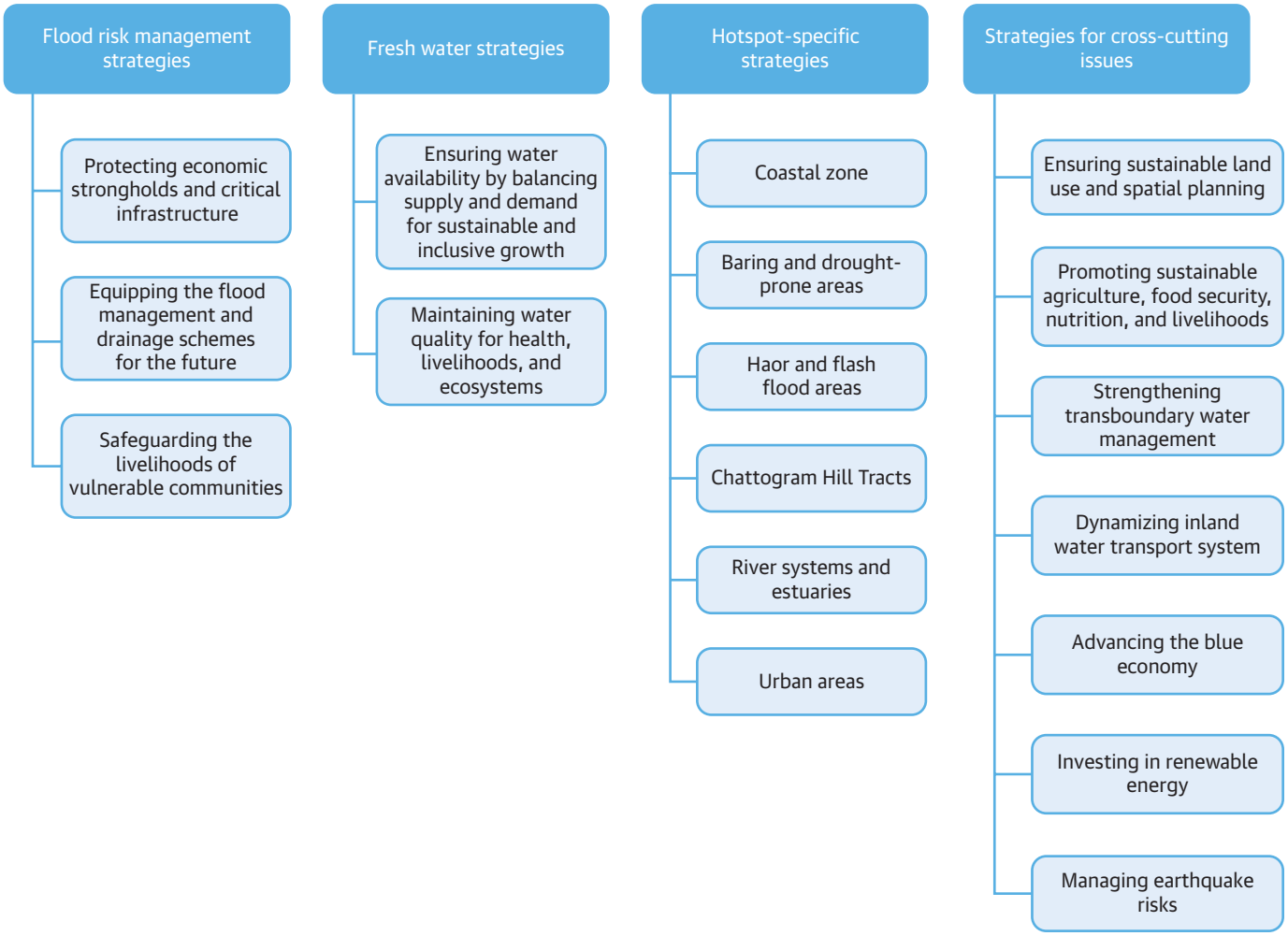
Applying the ADM principles in the planning process means that the BDP/IP considers the impacts of individual projects and their combined impacts. As the BDP/IP is implemented, changing circumstances may require adjustments in the design, selection, prioritization,[6] and phasing of projects. These changing circumstances may stem from uncertainties in exogenous drivers such as climate change, demographic changes, and economic growth. The BDP/IP also includes financing arrangements and mechanisms. The government's successive five-year plans will include funding for specific BDP 2100/IP projects and programs.

To achieve its goals, the BDP 2100 includes national-level strategies and strategies directed at hotspots—groupings of districts and areas with similar hydrology, facing similar natural hazards and climate change risks. These strategies were tested for robustness to climate change and built around four pillars (figure 3.1).

The first two pillars deal with nationwide challenges. The third pillar covers the hotspot-specific strategies, while the fourth pillar includes multisectoral strategies relevant to more than one hotspot (map 3.1).

The current BDP/IP has a planning horizon through 2030 and comprises the first selection of projects to start implementing the BDP 2100. It identifies 80 investment priorities up to 2030 (worth $38 billion)—65 infrastructure projects and 15 institutional and knowledge development projects. While all infrastructure projects could start within the next eight years, construction may extend over decades because of the scale and programmatic nature of investments.

FIGURE 3.1. BDP 2100 Strategies

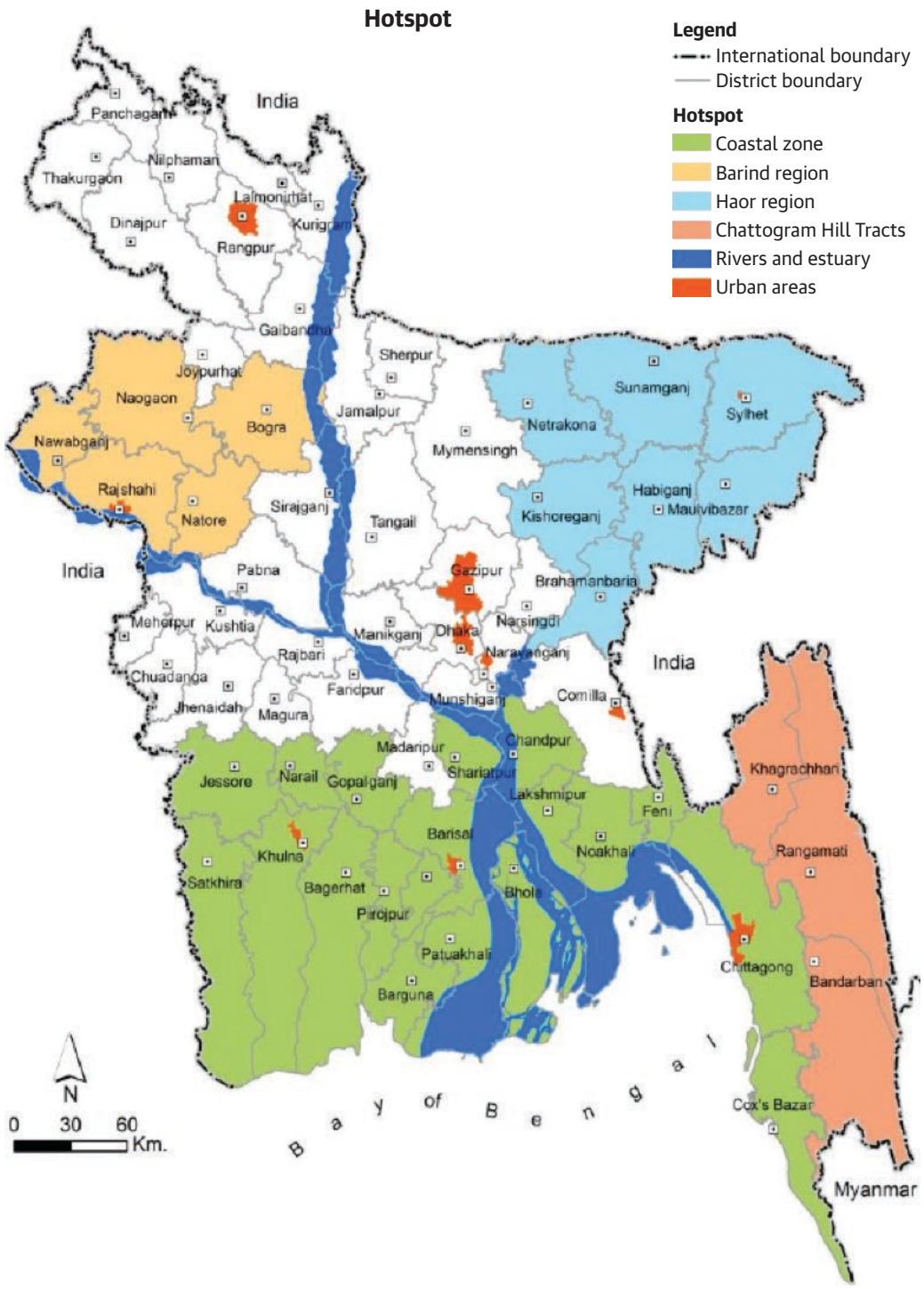


Source: World Bank (based on BDP 2100).

These 80 projects are categorized by their respective hotspots, and similar projects in each hotspot are grouped into a subprogram that integrates infrastructure projects with essential knowledge gathering, capacity building, and policy reforms. The largest overall investment planned relates to flood control, riverbank erosion, and river management (under River Systems and Estuaries[2]), absorbing 35 percent of the priority project expenditures. These kinds of investments will lay the basis for further economic growth—through greater resilience to climate change, land reclamation and its enhanced economic use, job creation, and the revitalization of IWT. They thus deserve top priority, alongside essential institutional reforms.

The government is preparing, with World Bank support, the first investment project to be implemented under the BDP/IP: the **Jamuna River Economic Corridor Development Program (JARECDP)**. JARECDP will

MAP 3.1. BDP 2100 Hotspots



Source: BDP 2100.

create river-based opportunities for economic growth by stabilizing the Jamuna River's course along a stretch of 205 kilometers between Sirajganj and the Indian border—making that section of the river navigable year-round. IWT will benefit from the predictable water course, minimum water flow, and innovative river training structures meant to prevent flooding and riverbank erosion (box 3.2). The significant reduction in disaster-related impacts (relocations and loss of land, crops, and livelihoods) will boost the basin's economic development. More IWT will foster regional trade (among Bangladesh, India, Nepal, and Bhutan) and growth; give landlocked Nepal and Bhutan and the Indian state of Assam access to the Bay of Bengal; enhance transboundary economic cooperation; and reduce transport costs and greenhouse gas (GHG) emissions (through the modal shift from road and rail transport to IWT). The program will also strengthen the water sector's institutional capacity. Follow-on investments are foreseen in various economic sectors.

The **Dhaka Rivers Ecological Restoration Project** is another priority project under the BDP/IP through 2030 that will be supported by the World Bank. It aims to enhance the ecological condition and transport capacity of the rivers and canals around Dhaka. Being the hub of the textile industry, the capital's success comes at a high environmental price, in part because groundwater use is not regulated and water itself is not adequately priced. And while the Bangladesh economy relies heavily on water-intensive sectors such as the textile industry, there is a serious knowledge and data gap regarding water, water use, and water wastage. Moreover, water is undervalued and the "shadow costs" associated with water-related disasters and groundwater deterioration are not factored into the price of water—even though the textile industry is among the most polluting sectors and its demand for water is projected to more than double by 2030. Compounding this issue is Dhaka's growing sanitation crisis, the result of about 98 percent of human waste being discharged into the environment untreated.

BOX 3.2. Innovation and Disruptive Technologies in River Basin Management

While the building-with-nature concept is central to adaptive delta management, the potential role of disruptive technologies should not be overlooked. Embracing disruptive technologies—for data collection and management, (waste)water plant management, production methods, and business-client interaction platforms—can help increase water use efficiency across sectors and transform best practices for water planning and management. Development of innovative approaches can be facilitated by the digital sharing of water data among development partners.[a]

The Jamuna River Economic Corridor Development Program intends to use innovative approaches (priority for no-regret river protection projects and building with nature) and structures for river training (e.g., top-blocked permeable groins); decision support systems (to support water accounting and actuarial analyses for flood insurance); disaster risk financing; dredging; and inland water transport (e.g., fuel-efficient vessels and smart aids for navigation).

a. Based on "Disruptive Technology for Water Resources Management at all Scales," a presentation given by Eileen Burke, World Bank Global Lead for Water Resources, during the 2019 Water Week.

Another priority BDP/IP project under preparation is the **Resilient Infrastructure Building Project ($400 million).** This project will provide early warning, community preparedness, and safe shelter to the villages most vulnerable to flooding, in support of goal 1 of the BDP: "Ensure safety from floods and climate change related disasters." It represents a shift from a sectoral to a spatial approach, using risk assessment tools to prioritize sites and investments. Applying lessons learned from successful cyclone protection, the project will finance shelters and associated community infrastructure, last-mile connectivity, local emergency preparedness and response, and community-based DRM.

The **BWP** (section 3.1) has prioritized support for the implementation of the BDP 2100. It conducted analytical studies, including a water sector public expenditure review (PER) and a Bangladesh Water Sector Diagnostic (BWSD).[8] The BWSD identifies the main water challenges and priorities of the next decade (all of which are addressed in the BDP 2100) and incorporates the results of the water sector PER.

Over the last decade, the government spent 0.6–0.8 percent of GDP on the water sector. Based on the recommendations of the BWSD and the agenda outlined in the BDP 2100, the government plans to raise water sector spending to 2.5 percent of GDP by 2030. To yield the greatest benefit, this increased spending also needs to be wiser (that is, informed by data and regular assessments).

While WRM received about 70 percent of total funding for the water sector, most of it was spent on capital expenditures and very little on O&M. Future budgets should include funds earmarked for O&M activities and for the collection of the data necessary for water accounting—an analysis of the status and trends in water supply and demand as well as water use by sector.

The BDP/IP's overall funding requirement through 2030 is about $38 billion (three to four times what is currently available). The planned budget increase for the water sector will not be enough to cover the financing gap, even when estimated available official development assistance is factored in. The government will thus have to attract more private funding, which requires major policy reforms. These include introducing a comprehensive water risk management framework, letting water accounting guide the distribution of water sector resources, and adopting cost recovery for public services (based on the principles of "the user pays" and "the polluter pays").

Notes

1. Engaging for the long haul signals the World Bank's commitment to supporting the delta's development and makes it easier for the government to engage other DPs in delta-related endeavors. A programmatic approach will also facilitate collaboration among WRM-DRM ministries and agencies and coordination of their policies and activities.
2. IWT is the second major means of transport, accounting for 25 percent of the passenger market and 16 percent of the cargo market. The IWT sector thus plays a major role in the country's development by maintaining communication between remote areas that are inaccessible by other transport modes, particularly during the monsoon season; it is also vital for regional trade.
3. The Brahmaputra-Jamuna system is among the rivers with the highest sediment load in the world. Without adequate dredging and sediment management, the water becomes too shallow for navigation.
4. The BDP 2100 was developed by the government with support from the Netherlands and the World Bank Group, based on a memorandum of understanding (MoU) signed by these three parties in June 2015 for cooperation to strengthen management of the GBM Delta.

5. The World Bank has supported Bangladesh since 1972, when it became a member, providing more than $30 billion in support. Details on this long-time relationship are available at: The World Bank in Bangladesh (https://www.worldbank.org/en/country/bangladesh).
6. As the projects assessed for inclusion in the BDP/IP were at different stages of development, early project concepts were first evaluated through a multicriteria analysis.
7. This is the largest single-strategy hotspot area and the one most vulnerable to climate change. As rivers form the backbone of the delta and the delta is key to the country's development, the strategy for this hotspot is of national importance.
8. For the study's findings, conclusions, and recommendations, see World Bank (2020a).

Chapter 4
Key Building Blocks of a New Approach to Delta Management

This chapter hones in on central aspects of the government's new approach to the GBM Delta, as crystallized into the BDP 2100.

- **Prioritizing the implementation of investment projects and institutional reforms that are key to realizing the government's vision for the GBM Delta, given their:**
  - ***Safety-first approach.*** Investing in erosion and flood control (through riverbank and coastal protection) and interagency coordination of water-related policies (including DRM) sets the stage for cost-effective, follow-on investments and for crowding in the private sector; in addition, by protecting livelihoods in disaster-prone areas, socioeconomic development gets a boost.
  - ***Sustainable and climate-resilient nature.*** Activities planned and implemented for flood and erosion control increasingly prioritize nature-based solutions (NBS), reflect the participation of multiple stakeholders and sectors, secure funding for projects, and allocate resources to O&M.
  - ***Comprehensive approach to adaptation.*** Investing not only in protecting against climate-related disasters and strengthening central and local governments—through policy reforms and institutional changes—but also in disaster prevention and preparation accelerates adaptation.
  - ***Multisectoral approach.*** Sectors/areas specifically addressed by the BDP 2100 (through national or multisectoral strategies) are flood risk management; fresh water; sustainable land use and spatial planning; agriculture, food security, and livelihood; transboundary WRM; dynamic IWT; blue economy; renewable energy; and earthquake risks.
  - ***Flexible approach.*** Basing the BDP 2100 on ADM automatically ensures the flexibility necessary to consider different climate scenarios and other uncertain exogeneous factors when updating the rolling medium-term strategies and five-year plans.
  - ***Inclusive design.*** Depending on the specifics of a given project or program, the government will consult with a range of stakeholders—possibly including polder and riverbank communities, local government institutions, civil society and the media, water and land transport associations, traders and trade bodies, academia and research institutions, and environmental nongovernmental organizations.
  - ***High economic returns.*** Investments in river course improvements—especially those aimed at reducing the flood and riverbank erosion risks, thereby improving navigability—tend to have high economic returns because they increase resilience to climate change and benefit multiple sectors.
- **Promoting conjunctive water use in agriculture.** Increasing the use of surface water in irrigation helps address groundwater depletion. Gravity-fed irrigation will also be promoted, thus contributing to GHG mitigation. The BDP/IP identifies several priority surface water projects but none of them is

planned in the short term. Given the projected water demand and economic growth rates, the country may need to invest in some of these projects sooner than anticipated.

- **Creating jobs and rehabilitating climate migrants.** The GBM Delta's climate-resilient development is expected to create huge employment opportunities (among others, in fisheries and irrigation), of special importance for climate migrants from coastal areas and for river erosion victims who ended up in the city slums. This economic boom will also help make abandoned coastal areas habitable again through natural sedimentation processes, which had stopped because of the creation of polders. The latter exacerbated land subsidence, waterlogging, and riverbed upgradation in the coastal areas.
- **Developing an innovative water risk management framework.** The government is keen to develop, with World Bank support, a comprehensive, water-related risk management framework that layers risk management responsibilities in line with the BDP 2100's recommendations. The first step is getting communities to reduce the risks of local floods, groundwater depletion, and coastal erosion through local actions, before turning to national agencies for help.[1] The risks that cannot be dealt with at the community level are addressed through water adaptation plans by districts, divisions, and finally national ministries. The government transfers some of the higher-level risks to the insurance market and bears the residual risk (of very rare but highest-impact disasters) itself.

4.1 Government Challenges Related to BDP 2100 Implementation

The BDP/IP infrastructure investments will require years to identify and many more years to build. As these investments are interconnected, their full economic benefits will only be derived if the BDP 2100's implementation momentum is maintained. Moreover, managing these investments; ensuring planning, implementation, and financing activities are aligned with the BDP 2100; improving interagency and intersectoral coordination; and designing adequate financing modalities for public-private partnership (PPP) projects will require a sustained, long-term effort by the government.

Improving BDP 2100 governance and planning requires a road map for institutional change and policy reforms. Given the Netherlands' prominent role in the development of the BDP 2100, it is assisting Bangladesh through the **Support to Implementation of BDP 2100 Program (SIBDP)**, signed by the Bangladesh and Dutch governments in 2019. SIBDP aims to create an enabling environment for the BDP 2100's long-term implementation, and support institutional reforms. Several BDP 2100 institutions have already been established but some are still pending,[2] as is the adoption of the Delta Act. The World Bank will help the government identify BDP/IP high-priority reforms for medium- to long-term support.

While the BDP 2100 includes a Strategy for Better Regional Cooperation, which stresses the need for riparian countries to cooperate on water and other matters,[3] transboundary collaboration remains challenging. In line with plan provisions, the World Bank Group is prepared to act as an honest broker to promote regional cooperation through water-sharing agreements and river basin development that improve regional connectivity (through increased navigation and port access, development and sharing of hydropower, etc.) and water quality; and strengthen DRM, the blue economy, and climate resilience.

Some of the issues identified in the NWMP are not fully addressed by the BDP 2100. These include the need to fully consider climate change impacts in project design; and the need for government decentralization, civil service reforms, and (national) land use plans based on spatial planning. Moreover, the ADM principles could not be fully applied to the design of BDP/IP investment programs because of time and resource constraints.

Notes

1. The Bank can help local communities evaluate, for instance, the trade-offs between strengthening polders or adapting with nature—by allowing sediments to accumulate during monsoons and increasing agriculture and aquaculture production in the dry months.
2. The Delta Wing, under the GED, is tasked with coordinating, facilitating, and monitoring progress toward the BDP 2100's objectives. The Delta Governance Council is an interministerial forum that gives strategic direction and makes major policy decisions. Still to be established are the Project/Programme Selection Committee, which will select the BDP/IP projects to be implemented, and the Delta Commission, to be tasked with preparing an annual spending program and updating it each year.
3. As 93 percent of Bangladesh's total renewable water resources originate in India, Nepal, and China, regional cooperation is a key element of the country's WRM. Yet, so far, a transboundary water-sharing arrangement between Bangladesh and the countries it shares river basins with only exists for the Ganges River.

Chapter 5
Scalability and Replicability of BDP 2100 Design Elements

Given the complexity of deltas and uncertainty of climate change impacts, delta development plans need to be based on flexible, long-term, and comprehensive strategies. Many aspects of the BDP 2100's design can serve as a model for other deltas, provided they are adjusted to reflect local customs and conditions.

BDP 2100 design elements that could be scaled up and/or replicated in other deltas include the following:

- Securing high political buy-in and broad stakeholder support—based on extensive consultations from the design stage onward
- Adopting innovative, nature-friendly approaches based on the concept of "giving more space to water" by designing solutions that not only seek to enhance safety, but also to garner social, environmental, and economic benefits (such as multipurpose dikes)
- Identifying the delta's main drivers of change and their resulting pressures and taking these as the starting point for the development of adaptive strategies
- Conducting baseline studies on thematic areas relevant to the delta in question
- Basing investment and policy decisions on evidence, considering trade-offs and climate change; a climate-smart DSS,[1] a water data portal,[2] geospatial technologies, and economic/sectoral studies can facilitate climate scenario analysis and decision making under uncertainty
- Developing strategies for specific hotspots and for cross-cutting aspects of delta development
- Earmarking funds for O&M of water infrastructure in a delta and for delta governance.

However, some potentially challenging factors will have to be considered, among others:

- Difficulty of "folding" existing development policies and sectoral plans into one comprehensive, multisectoral plan that addresses climate change, the environment, biodiversity, agriculture, fisheries, forestry, IWT, energy, and land management as well as their interaction with water
- Impacts of downstream investments on upstream (transboundary) users and vice versa
- Impacts of transboundary water projects (e.g., hydropower or multipurpose dams) on the delta
- Unforeseen, undesirable long-term landscape changes associated with erosion and sedimentation caused by interventions in the delta (such as river course stabilization and land reclamation)

- Need to downscale global circulation models to generate locally relevant, high-resolution, and reliable data, as the basis for climate-informed design and planning of investments.

Delta planning is a never-ending process that requires data to be continually collected and analyzed, to support research and modeling in areas such as:

- Hydrological and geomorphological modeling, with special attention to river flow and quality; siltation and sedimentation; and sea level rise and other climate change impacts
- Possible long-term implications of land reclamation from major rivers and the sea
- Polder management and significant land governance/reforms
- Nature and extent of land subsidence and ways to slow it down
- Development of crop varieties that are resilient to salinity and waterlogging.

Notes

1. Some examples of climate-smart DSSs are a flood exposure mapping portal, an urban climate adaptation tool, a green infrastructure for coastal resilience DSS, and a water supply stress index.
2. This would consist of a series of web-based water datasets that make it easier to quantify the risks derived from factors such as increasing water stress and aging infrastructure, and to make sound water management and investment decisions.

Chapter 6
Conclusions

Over the years, Bangladesh has invested in climate change adaptation and DRM to complement its development investments; the World Bank–supported CEIP embodies this two-pronged approach. In recent years, the country has embraced climate resilience based on adaptive management and integrated WRM/DRM as its long-term development strategy. The recently adopted BDP 2100 and its priority investment programs form the core of this strategy.

While the implementation of the BDP 2100 is only just starting, putting ADM into practice will pose new challenges. First, the ADM principles will need to be adjusted to reflect local conditions and the country's investment capability. Second, an enabling environment will have to be created. This entails setting up a legislative, governance, and M&E framework, based on clearly defined tasks and responsibilities and a mechanism for coordinating policies and activities across relevant agencies and ministries.

In addition, adequate and predictable financing will be essential for the successful implementation of the BDP 2100 or any other delta plan. This has many dimensions: (1) the overall amount available and financing sources for the plan; (2) the distribution of total funds over the plan's shorter-term strategies, climate change mitigation and adaptation, O&M, and pollution control; (3) the resources set aside for ADM-related investments (e.g., modeling); and (4) the funds reserved for supporting vital delta institutions such as governance bodies, water user groups, and stakeholder forums.

But meeting all the above requirements will not be enough. While integrated WRM addresses potential supply-side issues, cooperation among users is necessary to resolve demand-side issues. Bangladesh has developed mandatory provisions for community participation in water management (National Water Policy 1999 and Participatory Water Management Regulations 2014) and offers some examples of effective community participation. However, this approach needs further handholding and nurturing for it to become sustainable.

Moreover, water demand in a delta is often not determined by domestic uses alone. When transboundary river basins are involved, as in the case of the Bangladesh Delta, regional coordination is in the interest of all delta region countries. Their potential benefits include improved regional navigation, port access (especially beneficial for landlocked riparian countries), shared development and use of hydropower, and more timely and accurate forecasting of floods and droughts.

As the objectives pursued by delta management are generally considered public goods, the public sector typically takes the lead in this area. Yet the potential role of the private sector, particularly PPPs, in this context should not be overlooked. These partnerships have proven effective in various aspects of delta management, including pollution control, O&M of polders and embankments, and water supply service provision in urban and rural areas.

Several DPs—the Netherlands, Japan, Germany, the United Kingdom, France, Canada, the United Nations Development Programme, the Food and Agriculture Organization, and various multilateral development banks—have pledged their support for the implementation of the BDP 2100. The World Bank is ready to help convene and coordinate the activities under the BDP 2100, drawing on its global expertise and experience.

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