

Disaster Risk Reduction in Bangladesh

Status Report 2020



Asian Disaster
Preparedness Center



UNDRR

UN Office for Disaster Risk Reduction

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Status Report 2020

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About this report

The disaster risk reduction (DRR) status report provides a snapshot of the state of DRR in Bangladesh under the four priorities of the Sendai Framework for Disaster Risk Reduction 2015-2030. It also highlights progress and challenges associated with ensuring coherence among the key global frameworks at the national level; and makes recommendations for strengthening overall disaster risk management (DRM) governance by government institutions and stakeholders at national and local levels.

As this report is based on information available as of the end of the year 2019, an update on the COVID-19 impact, response and recovery using a risk-informed approach by countries is provided at the beginning of this report. This report has been prepared by the Asian Disaster Preparedness Center (ADPC) on behalf of the United Nations Office for Disaster Risk Reduction (UNDRR) through country consultations and a desk review of key documents, including legal instruments and DRR policies, plans, strategies and frameworks, etc.

The report has benefited from inputs by the Ministry of Disaster Management and Relief (MoDMR) and the government departments such as Ministry of Environment, Forest and Climate Change (MOEFCC), Ministry of Health and Family Welfare (MOHFW), Bangladesh Meteorological Department (BMD) and Flood Forecasting and Warning Centre (FFWC). The international organizations including UN Agencies, Asian Development Bank, The World Bank (WB) Group, the United States Agency for International Development (USAID), and a number of non-government organizations were consulted. The list of people and agencies met is enclosed at the end of this report. UNDRR and ADPC acknowledges the government, international organizations and stakeholder representatives who contributed their valuable input and feedback on this report.

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This report serves as a reference document for the implementation and monitoring of the Sendai Framework. The findings, interpretations, and conclusions expressed in this document are those of the author(s) and do not necessarily represent those of the United Nations, including UNDRR, or its Member States. The presentation of the material in this report concerning the legal status of any country or territory or of its authorities or concerning the delimitations of its frontiers or boundaries, as well as the text and the tables, is intended solely for statistical or analytical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. While every effort has been made to ensure the accuracy of the information, the document remains open for any corrections in facts, figures and visuals.

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UNDRR (2020). Disaster Risk Reduction in Bangladesh: Status Report 2020. Bangkok, Thailand, United Nations Office for Disaster Risk Reduction (UNDRR), Regional Office for Asia and the Pacific

Bangladesh's Response to COVID-19 and Disaster Risk Reduction

Bangladesh reported the first confirmed cases of COVID-19 on March 8, 2020. On March 23, 2020, the government declared a general holiday from March 26 to May 30, 2020, leading to the closure of government offices, private offices, and courts, and shorter operating hours for commercial banks. On April 8, the government restricted operations in Rohingya refugee camps to critical services and assistance only, citing the need to minimize risk within the camp setting. While the number of cases remains low, reluctance to be tested presents a challenge. On May 28, 2020, the authorities announced that closures and movement restrictions would be gradually lifted starting May 31, 2020. Civil servants have returned to their offices and public transport in Dhaka has resumed.

Beyond the domestic impact of the health crisis, the two main channels through which the Bangladesh economy will be impacted are remittances and exports of ready-made garments (RMG). Remittances represent over 5 percent of GDP (US\$ 16.4 billion in FY 19), and a majority of migrant workers are based in the Gulf countries that have been affected by the abrupt decline in oil prices.

The government has set up the COVID-19 Emergency Operation Center to coordinate nationwide preparedness and response activities. The Diseases Control Unit of the Directorate General of Health Services (DGHS) and the Institute of Epidemiology Disease Control and Research (IEDCR) have jointly started work. Eighteen hospitals have been prepared around the country for treating COVID-19 patients. Seventeen COVID-19 testing laboratories have been set up in various districts across the country. The government has allocated the initial amount of US \$30 million to implement the plan in 9 months, during April-December 2020, to purchase COVID-19 test kits, medical equipment and supplies, and protective equipment for medical staff.

The government prepared a National Preparedness and Response Plan (NPRP) to prevent and control COVID-19, and to reduce its impact on the health, well-being and economy of the country. The Prime Minister is leading a National Advisory Committee for planning the coordination.

The plan focuses on preventing entry of COVID-19 case in Bangladesh from affected countries. The measures proposed include limiting human-to-human transmission, to help reduce secondary infections among close contacts and healthcare workers; preventing community transmission and amplification events; identifying, isolating and caring for patients early; communicating critical risk and event information to the communities and counter misinformation; and minimizing social and economic impact through multi-sectoral partnerships.

The plan mobilizes the entire health infrastructure to reach each citizen in every village through the existing public service delivery infrastructure. It seeks to strengthen surveillance, tracking, testing, isolation, caring and treatment efforts. Guidelines and standard operating protocols and procedures are being put in place as well.

1. Introduction

The People's Republic of Bangladesh is a low-lying country in South Asia, covering an area of 147,570 square kilometers. The country shares its borders with India and Myanmar, and the land is characterized by more than 310 rivers and various tributaries sourcing mainly from the Ganges, Brahmaputra and Meghna rivers (Disaster Management Bureau, 2008). These form the world's largest delta system (GBM Delta) draining into the Bay of Bengal, which is also rendering the region among the most fertile globally. The interaction of rivers and tidal processes contributing to the fertility encompass roughly an area of 100,000 square kilometers of Bangladesh and West Bengal in India, and it has attracted a population of 156 million due to its high agricultural potential (Rogers & Sieghart, 2015). The weather is characterized by the monsoon climate and associated three seasons: hot humid summers between March and June, monsoon between June and September as well as cooler winters between October and February.

Administratively, Bangladesh is divided into six divisions (Bibhags): the Dhaka Division (where the capital city is located), Chittagong, Barishal, Mymensingh, Khulna, Rajshahi, Rangpur and Sylhet. Under them, there are 64 districts which consist of 492 sub-districts and 12 City Corporations. By assuming a top-down approach, the government has aimed to increase the localization of risk governance within the sub-districts, villages and localities by implementing the Standing Orders on Disaster (SOD) plan, in which roles and responsibilities for each stakeholder and relevant party are identified in efforts to better manage disasters at the grassroots level (Ministry of Food and Disaster Management, 2010).

In terms of economy, Bangladesh has made significant progress in sustaining prosperous growth and reducing poverty: between 1991 and 2016 the numbers of persons living below US\$ 1.90 per day was reduced from 44.2 percent to 14.8 percent (World Bank, 2019). In 2018, the country, for the first time, fulfilled all of the three criteria required to graduate from the Least Developed Country (LDC) status and is expected to graduate by 2024, driven by the GDP growth averaging over 6 percent over the past decade (World Bank, 2018). Yet, challenges persist. Rapid investments in structural reforms, human capital and labour force are required to increase the productivity of sectors, to generate jobs and to increase the resilience of systems against climate change and disasters (World Bank, 2018). Nearly 50 percent of the employed labour force remain involved with the agricultural sector (which generates 18 percent of the GDP), while service sector and industry are the biggest contributors to GDP (55 percent and 27 percent, respectively) (UNFPA, 2015).

Indeed, Bangladesh is among the most vulnerable countries in the world to the impacts of cyclones and flooding, particularly in the Ganges-Brahmaputra-Meghna (GBM) Delta region (GFDRR, 2019), and in association with the monsoon season, during which 80 percent of all the precipitation falls (Ministry of Foreign Affairs, 2018). Due to the low elevation, 25 to 30 percent of all land area is inundated during normal monsoon conditions (Hossain, 2018), and cyclones, storm surges and flooding have led to almost nearly 520,000 recorded deaths over the past 40 years (GFDRR, 2019). The country is also located in a seismically active zone, and is also affected by erosion, land degradation, landslides, fires, extreme heat and droughts, as well as potential wildfires and tsunamis. The impacts of such hazards in a particularly vulnerable context where large numbers of people are dependent on subsistence agriculture, and/or live in poverty may have catastrophic effects on maintaining the positive development pathway, even without considering the adverse impacts of climate change.

1.1 Demographic Characteristics

Bangladesh is currently the 7th most populous country in the world, with a population estimated at 149.77 million in 2011 (Bangladesh Bureau of Statistics, 2011), and now reaching over 164 million living in densities higher than 1,000 people per square kilometre (UNFPA, 2019). It is also a home to a plethora of ethnic groups and significant cultural diversity. The main ethnic groups belong to tribes of Santal, Oraon, Munda, Pahari, Rajbansi and Koch, as well as Marma, Chakma, Tanchingy and others residing in the Chittagong Hill Tracts (Salam & Aktar, 2014).

The country also hosts over 900,000 refugees and asylum seekers from Myanmar (Ahmad, et al., 2018), and over 37 percent of the population in Dhaka inhabit slums (UNFPA, 2016). Alongside these demographic stressors, the rapidly growing urban populations are estimated to increase the numbers of people inhabiting slums during the next decade, which can potentially increase prevalence of crime, environmental degradation, health hazards and pollution (UNFPA, 2016).

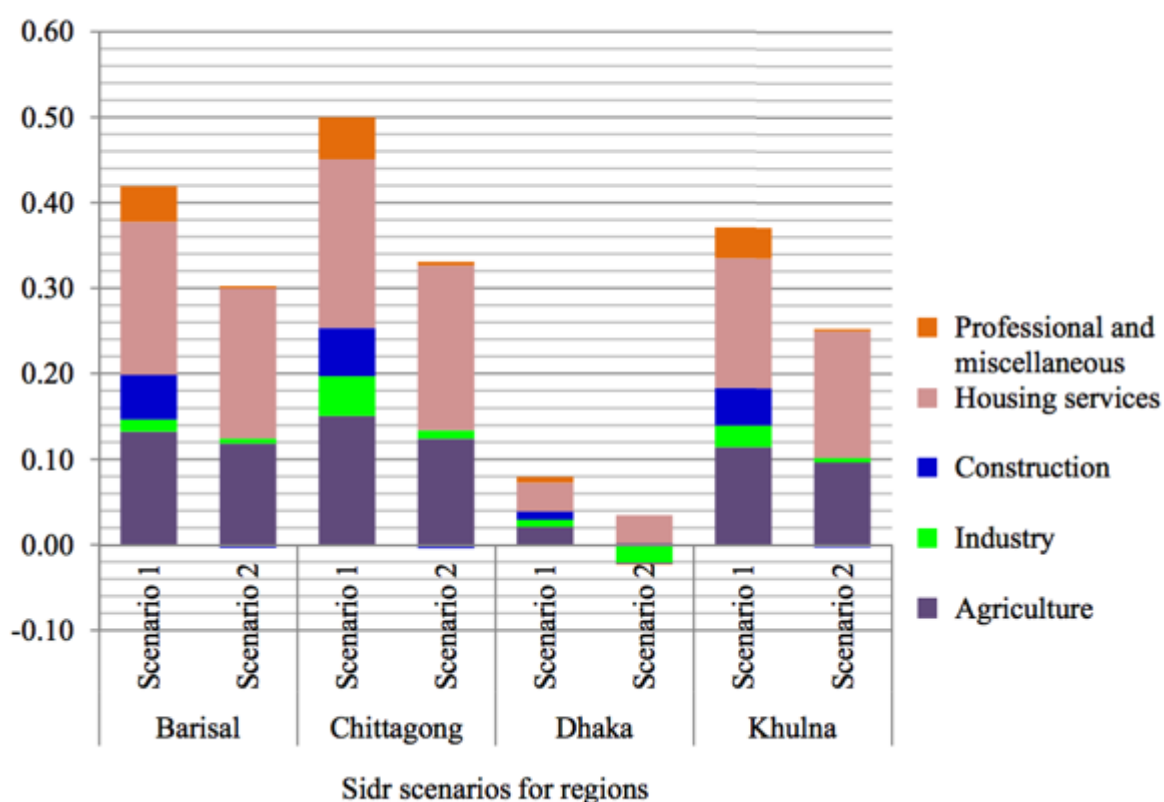
Associated with population growth, the working-age populations have increased by over 2.1 million people between 2000 and 2010. This rate of growth poses challenges to the country's transition away from LDC status and also the general socio-economic development. Children and younger working people require increasing amount of employment opportunities, education, services and infrastructure (UNFPA, 2015). While the government has invested heavily in socio-economic development, more is required to achieve the demographic dividend, which depends on three conditions: 1) improvements in health status to lessen child mortality and fertility 2) increasing the participation in education to enter labour force and 3) having an economically enabling environment which provides adequately paying jobs (UNFPA, 2019). However, on-going challenges and future potential impacts of climate change (and the resources required for impact mitigation) are likely to create significant challenges for managing the government's budget for funding social protection, Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA).

The peak of the demographic transition is estimated to be reached between 2025 and 2030 which could potentially boost the economic and social activities rapidly (Islam, 2016). However, it also coincides with the rapid, climate-driven changes in the hydrometeorological cycles. There are already more than 6 million people who are forced to migrate due to loss of livelihoods and safe spaces to flooding and extreme weather, a number which could double by 2050 (UNICEF, 2019). Thus, managing this balance will be a complex task.

1.2 Economic Impact of Disasters

History of regional differences in the economic development of Bangladesh have long roots; since the 1980's, the approach has focused on investing in growth centres which shaped regional inequalities. Industrial GDP increased three-fold and the share of agriculture in national GDP decreased from 41.77 percent to 22.83 percent between 1984 and 2004 (Haque & Jahan, 2016). During the same period, the polarization in regional development led to imbalances between concentration of population and economic activities, where economic assets and people were disproportionately focused at few specific areas (Haque & Jahan, 2016), which also increased the vulnerability of said assets to impacts of hazards.

Figure 1. Loss of output as a percent of the total national output between 2006 and 2007 (Haque & Jahan, 2016).



While industry grows, most of the workforce are still working in low-income jobs, 44 percent of whom are engaged in agriculture which only contributes to 20 percent of the GDP. Alongside agriculture (especially rice), fishing and textile industries are also very important to the economy; in 2017, they employed over 3 million people (CFE-DM, 2017). However, given the vulnerability of the concentrated industrial centers and geographical location on one of the largest deltas in the world, disasters may significantly damage the country's assets. Hazards with the highest damaging potential are storms and flooding, followed by extreme drought measured drought, expected to occur every 24 years on average (Yiev, et al., 2018). According to damages reported in the EM-DAT database, from 1904-2020, Bangladesh has experienced value of disaster damages of all records amount to US\$ 21.3 billion (including only 5 records for 2020 on riverine floods, tropical cyclone, and transport accidents) (CRED, 2020). Conversely, disasters affecting livelihoods (such as droughts and climate change-associated impacts) may endanger livelihoods of nearly half of the population engaged in small-scale agriculture, which also contributes negatively to the overall economy.

While not many comprehensive studies about the impact of disasters to the economy of Bangladesh exist (apart from Benson & Clay, 2002), Yiev, et al. (2018) established that destroyed physical capital decrease economic growth in the long-run. In more detail, Haque & Jahan (2016) explored the impacts of cyclone Sidr in 2007 to the economy, and established that the disaster caused 1.01 percent losses to the total national output, reduced national income by 1.51 percent and the employment by 1 percent (corresponding to about 1.6 million people) (Haque & Jahan, 2016). with accumulated losses and damages of US\$ 1.1 billion dollars

(Government of Bangladesh, 2008). Regional impacts were prevalent in housing services as well as construction and agricultural sectors along Bangladesh's economically active coastal areas of Chittagong, Barisal and Khulna (Figure 1). Given such evidence, it becomes clear that disasters have the potential to derail the economy and socio-economic development in Bangladesh.

Additionally, salinity issues related to sea level rise following climate change may have adverse impacts on drinking water. Rising water levels will most likely lead to severe drinking and irrigation water shortages, which will affect human wellbeing and rice production: an estimated loss of 15.6 percent in rice yields is expected (Norwegian Institute of Bioeconomy Research, 2017). Given the fact that rice is a significant contributor to the economy and remains a provider of livelihoods to subsistence farmers, climate change may cause pervasive impacts which have the potential to affect the whole country, food security and wellbeing. Approximately 44.6 metric tons of rice will be required annually to sustain an expected population of over 215 million by 2050, and it will be produced on only 8.75 hectares of agricultural land (Kabir, et al., 2015). The loss of clean water and rice output will likely contribute to overall costs of risk reduction during the upcoming decades.

1.3 Social Impacts of Disasters

Disasters also have pervasive impacts on the society and have the potential not only to destabilise the economy, but also the access to education, livelihood opportunities, food security, housing and service provision (including healthcare). In Bangladesh, the impacts of flooding, cyclones, storm surges, landslides and droughts to a geographically unique and highly vulnerable ecological and human systems have led to a large-scale destruction of housing, land and property, and loss of livelihoods alongside increasing displacement and disaster-driven migration (Displacement Solutions & YPSA, 2014). On the GBM Delta, climate change, increased storm surges, flooding and the impacts of uncontrolled or poorly managed infrastructure development are also decreasing the availability of freshwater. Increasing saline intrusion, pollution and prolonged droughts may then have adverse impacts on irrigation and fishing, followed by potential food insecurity and lack of drinking water (Bernier, et al., 2016). Given these stressors and challenges, prioritizing water availability for the upcoming decades should be high on the government's agenda to mitigate water-related social impacts.

Disasters also affect accessibility. Despite the urbanization trend and increasing infrastructure in Bangladesh, landslides, storms, flooding and earthquakes have the potential to significantly disrupt road networks, which then affects the ability to access shelters, healthcare, education and – on a wider scale – have implications on reducing poverty as poor access to markets are the cornerstones of livelihood generation (Ahmed & Eklund, 2019). Destroyed and damaged schooling facilities; or disruptions to school service also contribute to issues in guaranteeing continuity of education alongside the inability of teachers to teach or students to go to class (Akram, et al., 2012) which may lead to significant gaps in education among children. Loss of routine drastically changes ways of living and trauma related to disasters are also among the social impacts of disasters in Bangladesh (Akther, et al., 2015).

Additionally, refugees living in and around Cox Bazar's refugee camps are also heavily affected by hazards due to their high exposure, vulnerabilities and lack of coping mechanisms. In Kutupalong-Balukhali camp, inter-agency risk analysis estimated that more than 86,000 people were living on high-risk flood areas as of February 2018, while more than 23,000 lived along steep hillsides prone to landslides (Loy, 2018). Flooding and heavy precipitation is also linked to the increased prevalence of diarrheal and vector-borne diseases in conditions which lack infrastructure and the population density is high. In May 2018, UNICEF was supporting an estimated of 10,000 people suffering from acute watery diarrhoea (55 percent of whom were children), and the issue was expected to grow worse (UNICEF, 2018). In 2017, monsoon rains and associated flooding in 11 districts affected at least 1.3 million people as of July 16 (OCHA, A, 2017), which increased to 5.7 million affected with 300,000 in emergency shelters (OCHA, B, 2017), and finally to 8 million people by September 28, 2018 (UNHCTT Bangladesh, 2017). This timeline does well to illustrate the sheer magnitude of progressing disaster impacts throughout the monsoon season, and also highlights the challenges related to on-going response and recovery within refugee camps, who already struggling for safe space, shelter, livelihoods and resources.

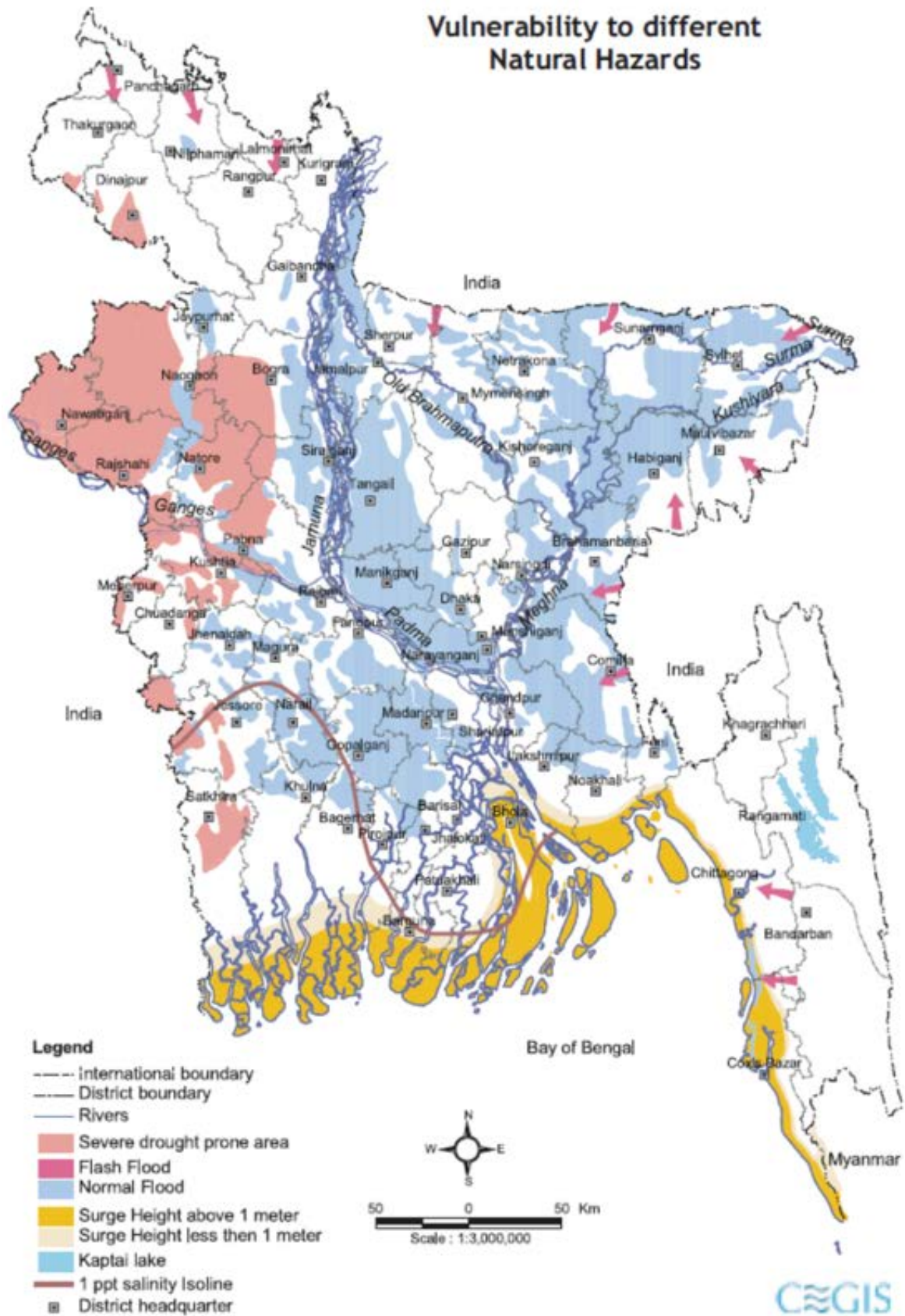
2. Disaster Risk Profile

2.1 Hazards and Climate Change

Bangladesh is considered as among the countries most vulnerable to the impacts of disasters and climate change due to the presence of frequent hydro-meteorological hazards (CFE-DM, 2017). It is classified as 7th among the most impacted countries between 1998 – 2017 on the Climate Risk Index (GermanWatch, 2019), experiencing the frequent impacts of cyclones, flooding, flash flooding, storms and periodic droughts depending on the season. Annual rainfall can reach 2,000 mm during the monsoon, which can lead to significant water logging and flooding on improperly managed wetland areas on the delta regions (CFE-DM, 2017). Other hazards include earthquakes, landslides, lighting strikes, possible tsunamis, epidemics as well as on-going riverbank erosion which constitutes to the high flood risks and increasing vulnerabilities across the settlements located in the vicinity of the coast and river catchments (Ministry of Food and Disaster Management, 2010). Bangladesh is located in the nexus of Indian, Eurasian and Burmese plates, where collision of the two formerly mentioned are driving the Himalayan orogeny, complex fault systems of which have the potential of generating large-scale seismic activity, increasing the country's significant risk to seismic hazards. Human-induced hazards cannot be overlooked either; urban fires, building collapses, chemical spills and health hazards created by the use of formalin and other industrial chemicals also constitute to the high risks present in the country (Ministry of Disaster Management and Relief, 2017).

Seasonal flooding and riverbank erosion are common on the GBM Delta, following heavy monsoonal rains and the synchronization of flood-peaks of the major rivers. Losses to erosion occur gradually, and the effects are longer-term due to permanent loss of habitable land (Disaster Management Bureau, 2010). It is suspected that parallel processes contribute to the increased impacts and risk of flooding and erosion, including sea-level rise, sediment accumulation on flood plains, soil erosion due to unmanaged tilling, deforestation of the upstream areas as well as damming of rivers causing river bed aggradation (Khalequzzaman, 1994). More recently, the glacier melt on the Hindu-Kush Himalayan (HKH) region has been estimated to increase the flooding impacts on lives due to large numbers of people residing within HKH region in eastern Bangladesh (Elalem & Pal, 2015). However, due to the fact that the Brahmaputra river sources majority of its water from rainfall, the increase in flooding following glacier melt will most likely be localized to the HKH (Elalem & Pal, 2015; Scott, et al., 2019).

Figure 2. Vulnerability to natural hazards in Bangladesh (Ministry of Foreign Affairs, 2018)



Climate change is likely to contribute to the increased frequency and impacts of hydrometeorological hazards, and Bangladesh is considered among the most vulnerable countries to such adverse effects (Ministry of Health and Family Welfare, 2018). Observed pattern already indicates more erratic weather, significant increase in rainfall north and northwest. Conversely, however, the rainy season has become shorter and heavy rainfall occurs within a shorter period in other areas (Ministry of Foreign Affairs, 2018). Rain has highly regional characteristics, which will contribute to the high variability of climate change impacts depending on the locality. The temperature has already increased approximately 0.07° C per decade during the monsoon, and up to 0.12° C during early winters. Similarly, annual sea-level rise of 4 to 8 mm has been measured annually across the country (Ministry of Foreign Affairs, 2018).

Low elevation, high population density near the coastline and inadequate infrastructure (such as for embankment, coastal-zone protection, and erosion control) combined with sea level rise, increasing salinization and agricultural losses could lead to increased migration and the displacement of over 22 million people, loss of safe water and food security among other impacts (EFJ, 2017). Landslides could also become more common due to change in regional rainfall patterns, which could also prolong droughts outside the monsoon season. Annual cyclones could also grow more severe, which can worsen inundation, prolong spells of extreme temperature, and may lead to increased prevalence of vector-borne diseases (malaria, dengue, cholera) as well as diarrheal diseases (cholera, typhoid, E.coli) where access to sanitation is lacking.

Additionally, environmental degradation associated with climate change impacts could contribute to the loss of property (cattle, houses and seeds), agricultural land, reduce availability of firewood and thus reduce the opportunities available for income generation (Bangladesh Institute of International and Strategic Studies, 2009) in a setting where nearly half of the population is engaged with subsistence agriculture. This could increase not only migration (Figure 6), but also conflicts over resources, property, and increase the risk of gender-based violence (Bangladesh Institute of International and Strategic Studies, 2009).

Most pressing issue among these will be the lack of safe water for drinking, irrigation and rice production. Increasing droughts and loss of glaciers in the Himalayan region during the following century is most likely to decrease rice and wheat yields significantly (which will have impacts on food security), made worse by the on-going salinization processes where storm-surges and flooding bring in the ocean. A simulation analysis revealed that the annual rice yields may reduce by 12.67 percent while its price may increase by 22.38 percent in a setting where rice is the staple food item for 150.6 million people (Nahar, 2016). The International Panel on Climate Change estimated that 30 percent of the food production could be affected by 2050, which in turn contributes to challenges in mitigating the impacts in a resource-stressed country. Also, while salinization is affecting the rice production on the GBM Delta, farmers are forced to turn towards activities such as shrimp production which can have significant destructive impacts on the environment when left unmanaged.

Overall, the evidence indicates that not only will the hydrometeorological hazards increase in impact and frequency, Bangladesh is also facing the surmounting tasks of balancing diminishing water resources and agricultural output, but also guaranteeing the contingency poverty reduction, sustainable development, disaster risk reduction and climate adaptation in a setting characterized by large numbers of displaced people, high prevalence of poverty and recurrent destructive hazards gnawing the achieved gains. To

fully understand the magnitude of the development issues, aspects of exposure, social and physical vulnerability are explored in the following chapter in more detail.

Figure 3. Potential migration flows from the GBM Delta towards growth centers (Bangladesh Institute of International and Strategic Studies, 2009).

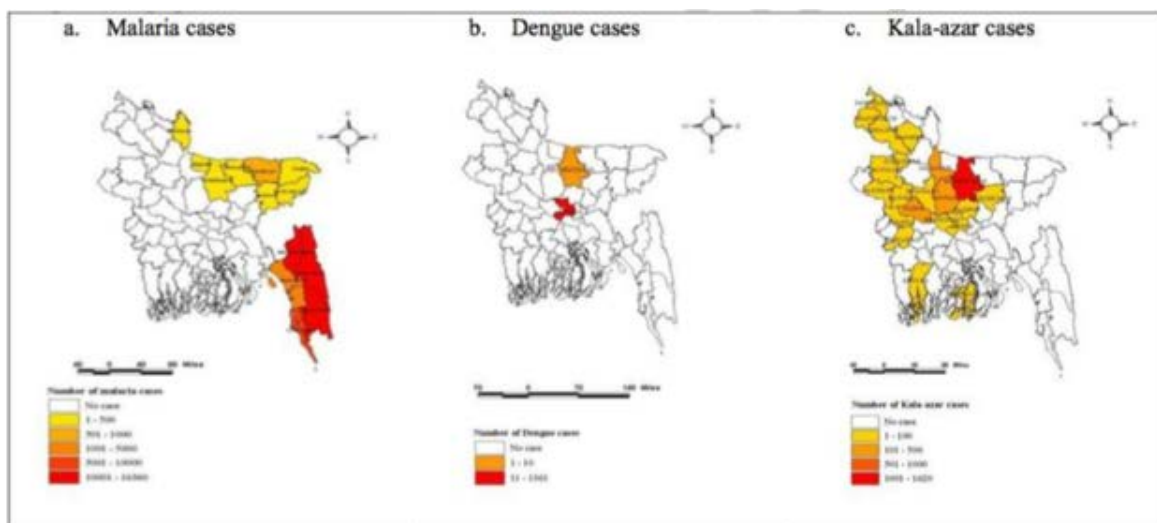


2.2 Exposure

As was explored earlier in this report, the level of exposure varies depending on the local topography, seismic conditions, regional rainfall patterns and the proximity of flood plains. Millions of people are inhabiting the GBM Delta, hosting a wide network of rivers which are also cornerstones of livelihoods for fishermen, subsistence farmers and other potentially vulnerable groups. Impacts of cyclones and flooding primarily affecting this area can then cause significant and long-term disruption to the safety of populace, housing and food security (Majumder, 2013), as was seen in the aftermath of cyclones Sidr in 2007 and subsequent Aila in 2009, for example. Cyclone impacts are often significantly (and disproportionately) higher along the coastal GDM Delta due to the shallow continental shelf, high tidal range of the region, low topography as well as high population density (Khan & Damen, 1995). Also, catastrophic flooding occurs on 5 to 10-year intervals on average, impacts of which are exacerbated due to riverbank erosion (Ministry of Disaster Management and Relief, 2017), and inadequate funding for maintaining protective embankments (Brammer, 2016).

However, exposure is usually driven by socio-economic factors, because households rarely choose to inhabit unsafe lands. Rather, poverty and landlessness drive people towards unsafe areas such as resource-rich flood plains or hillsides prone to landslides. Influx of rural migrants seeking income earning opportunities in mega cities such as Dhaka, Chittagong, and Khulna has resulted in increased densely-populated slum areas with poor quality of housing lack of utilities, and unhygienic living condition (UNFPA, 2016), which exacerbates flood risk given the cities located in geographically flood-prone location. Displacement due to flooding and coastal erosion are also found in rural areas, as people losing their land are forced to move to chars - islands or areas of land created during floods, other marginal lands, or less densely populated areas such as hillsides, as well as hazard prone and climate-stressed coastal zone (UNFPA, 2016). Often environmental instability is exacerbated by the unmanaged income generation activities causing deforestation and hill cutting (Disaster Management Bureau, 2010), which manifest as differing degrees of exposure.

Figure 4. Geographic distribution of vector-borne diseases in Bangladesh in 2011, CCHP (2014) in Ministry of Health and Family Welfare (2018).



Additionally, the incidence of vector-borne and diarrheal diseases often increases in correlation with increased precipitation in Bangladesh. For example, the cases of cholera have been suggested to increase in association with high rainfall (which may bring humans to contact with waste during flooding) and conversely, during low rainfall when the access to safe water is reduced (Hashizume, et al., 2008). Vector-borne diseases such as dengue, malaria and visceral leishmaniasis have highly seasonal characteristics as well, often occurring in association with the monsoon (Ministry of Health and Family Welfare, 2018). However, the exposure varies depending on the region (Figure 4). For example, dengue is becoming endemic in major cities such as Dhaka due to unplanned urbanization and settlement in underserved slum areas without proper access to sanitation infrastructures and water, which in turn increases breeding sites of mosquitoes in the vicinity of human habitation.

Additionally, arsenic in the groundwater of Bangladesh has been identified as a major, ongoing disaster; out of 64 districts, 61 are severely affected by contamination which exposes up to 75 million people to the risk of poisoning (Ministry of Disaster Management and Relief, 2017). Shallow tube-wells are the main source of drinking water in rural areas of which 30 percent have been deemed as unsafe for consumption (Ahmad, et al., 2018). However, the GoB has established an Arsenic Policy Support Unit under the Ministry of Local Government, Rural Development & Cooperatives in 2003 which continues to operate today.

2.3 Socio-Economic Vulnerability

The complex interaction of the environment, hazards, political and social fabrics in Bangladesh render many disproportionately vulnerable to disaster impacts due to lack of access to resources or information, social capital, or due to physical or social characteristics among other factors (Schmidlin, 2010). For example, poverty is often associated with high vulnerability due to the fact that it creates conditions where the adaptive capacity is low in terms of physical and financial capital, which may then lead to lack of coping mechanisms, or force people inhabit unsafe sites which may provide some income generation opportunities as discussed earlier. In Bangladesh, the poor are more likely to inhabit structurally weak houses closer to the shoreline, and lack access to risk transfers and employment opportunities (Akter & Mallick, 2013). Alternatively, poor subsistence farmers cannot afford irrigation, which decreases their output, which may then force people to migrate or sink further into poverty (Etzold, et al., 2014).

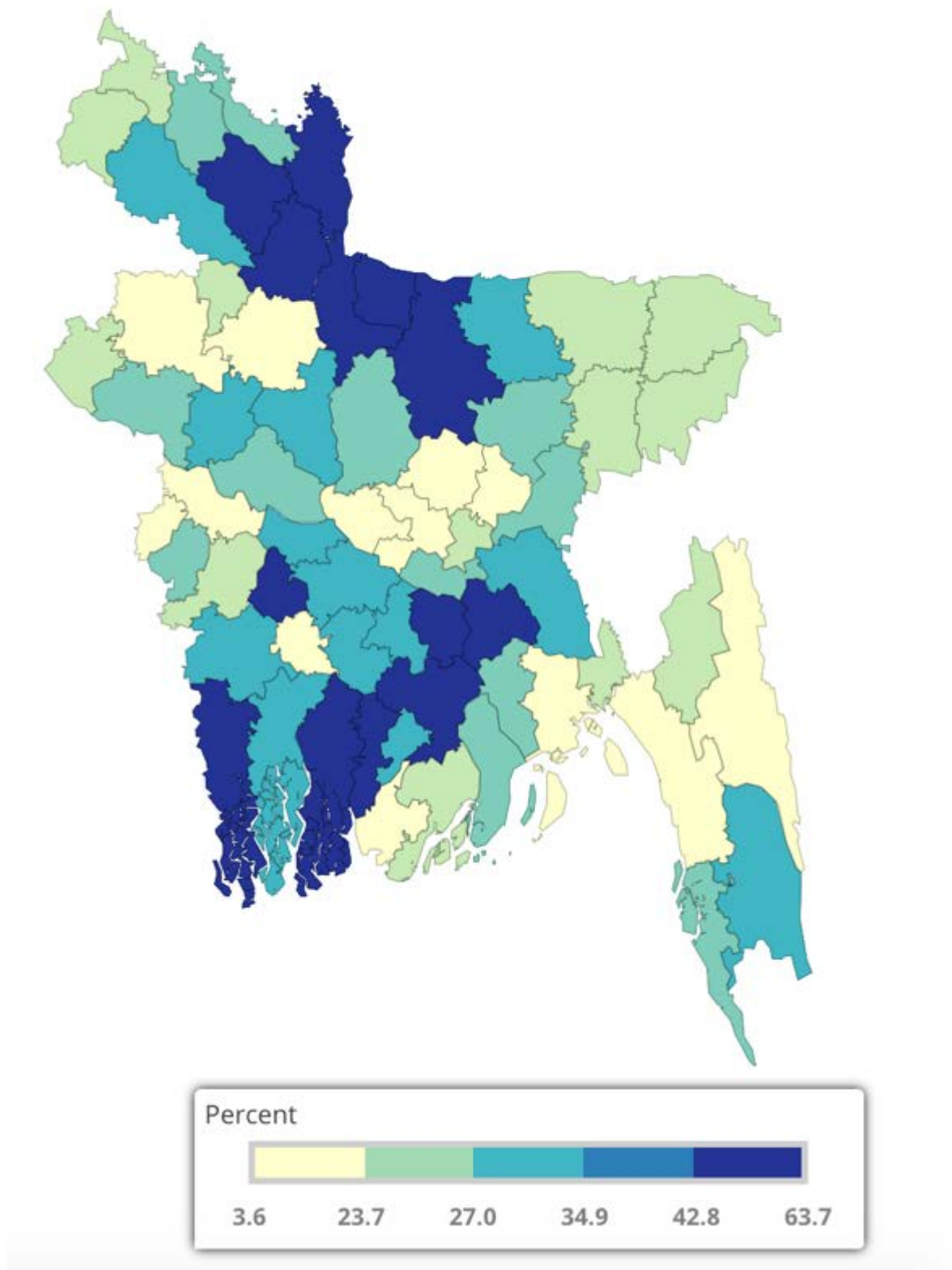
However, the issue is not straightforward: the poor may also have higher resilience than the general population due to better social networks, capacity to reconstruct and adapt their livelihoods to adverse impacts of disasters, which highlights the importance of assessing capacities alongside vulnerabilities (Akter & Mallick, 2013). Also, poverty has a high spatial variability, which requires specific attention when assessing the nexus of vulnerability and poverty in Bangladesh. Also, poverty has a high spatial variability, which need specific attention when assessing the nexus of vulnerability and poverty in Bangladesh. Different poverty levels across Zilas and Upzilas, as visualized in Bangladesh Interactive Map that link multi-dimensional poverty indicators and relevant socio-economic statistics (Figure 5), indicates pockets of poverty concentrated in the north and south-west part of the country (World Bank, 2016); the same overlap with areas identified as prone to drought and coastal hazards respectively, according to the Bangladesh Delta Plan 2100.

In Dhaka City, shortages of adequate housing, infrastructure, high cost of building materials and high prevalence of poverty (Hossain, 2006) all constitute to increasing vulnerabilities to disasters. Electricity supply, gas and fuel, water as well as waste management are all lacking in the urban slums, creating conditions which are not only inadequate socially and physically, but regularly exposed to hazards (Hossain, 2006). Yet, people rarely choose to inhabit slums; lack of other opportunities (as a result of no education, loss of livelihoods, loss of previous housing etc.) drive people towards growing centers which can provide at least the hopes of new employment. Additionally, much of the urban slums are poorly accessible for disabled and the elderly, which increases their vulnerability to hazards due to hindered evacuation and response (Rahman, et al., 2015).

Social relations, power hierarchies and systems with which a society is organized also contribute to the vulnerabilities of people. Among these, gender is an important determining factor. For example, women are disproportionately living in poverty, are more likely to have a poorer nutritional status, receive less and poorer-quality healthcare, and face domestic burdens (which limits participation to income generation opportunities) (Cannon, 2002). Additionally, local power hierarchies may affect the distribution of relief aid; in the aftermath of cyclone Sidr, more affluent members of communities were more likely to volunteer as NGO recruits, and participated more in the process of decision-making which guided prioritization of aid (Nadiruzzaman & Wrathall, 2015). Thus, relief aid ended up reinforcing existing non inclusive networks, wealth and power.

Those who are landless, or lack official status as a citizen also share disproportionate levels of vulnerabilities among the populace residing in Bangladesh. Such is the case of many Rohingya refugees still living in camps and temporary shelters. In early 2018, more than 950,000 people resided in Cox's Bazar and Bandarban, lacking access to services, shelter, and suffering from food shortages, infectious diseases, malnutrition, poor sanitation and exposure to the environment (Ahmad, et al., 2018). The camps are susceptible to landslides, flash flooding and the impacts of cyclones due to their location on low-lying areas, surrounded by muddy hillsides which have been cut back in efforts to expand and generate livelihoods (Ahmad, et al., 2018). The situation is not only a public health emergency but is also at risk of turning into a disaster in the event of a larger-scale hazard affecting these densely populated camps characterized by lack of coping capacity, infrastructure and services. Additionally, among the most vulnerable population are the Biharis, a marginalized Urdu-speaking group in Bangladesh, residing in urban refugee camps with lack of facilities and poor living conditions and at risk to be left behind.

Figure 5. Poverty map of Bangladesh (World Bank, 2016).



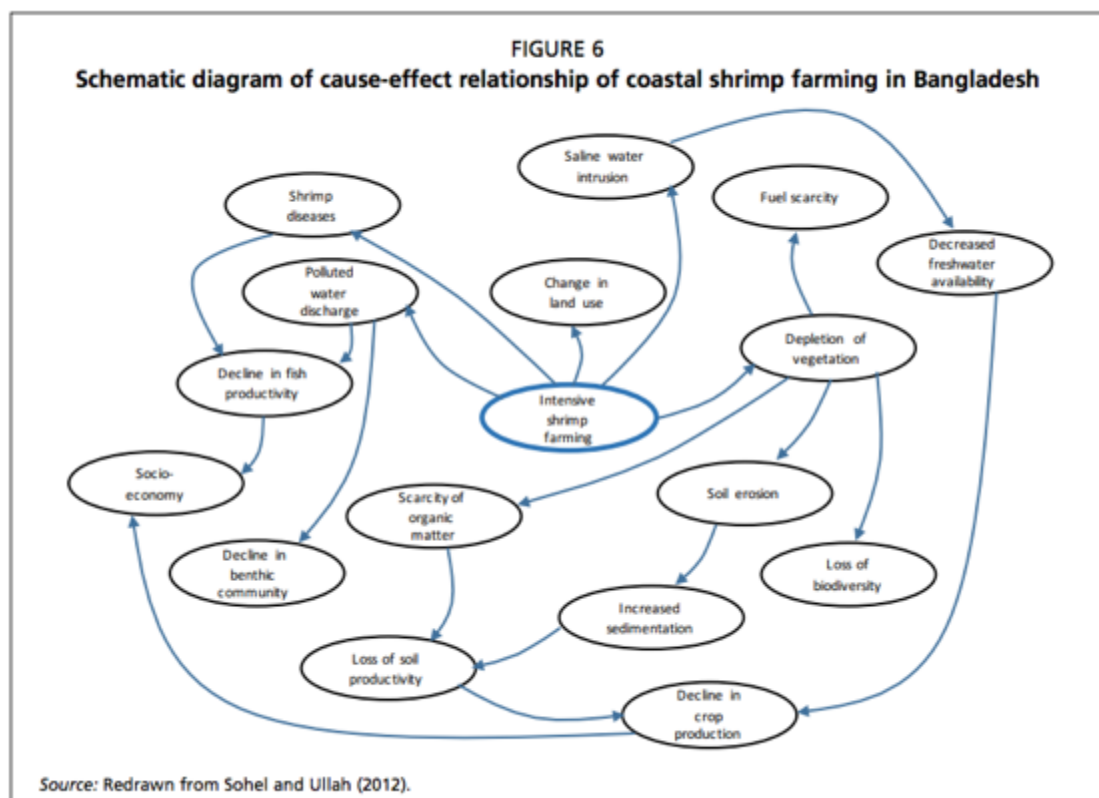
2.4 Physical Vulnerability

Unmanaged urbanisation has been found to be among the most significant reasons why vulnerability of infrastructure and ecological systems is rapidly increasing across Asia. Dhaka City, emerged as a megacity relatively recently, has maintained a growth rate higher than any other between 1974 and 2000, and is still expected to grow at an annual rate of 3.6 percent (Hossain, 2006). The growth of urban slums has caused a plethora of vulnerability related issues, especially in the case of urban fires; poor quality materials, lack of engineering, narrow roads, aging (and sometimes, informal) electric infrastructure and lack of access for response vehicles and staff are among the reasons why risks are increasing (Rahman, et al., 2015). This also increases the risk of earthquakes, and may result in widespread damages. The recently conducted comprehensive seismic risk assessments identified the cities of Bogra, Mymensingh and Rangpur as the highest at-risk in the country, based on tectonic characteristics and active faults of the area (Ministry of Disaster Management and Relief, 2015). Additionally, given that urban industrial facilities and roads are likely to be damaged and blocked by debris in a large-scale event, the impacts on the national economic growth are expected to be severe (Ministry of Disaster Management and Relief, 2017).

Lack of infrastructure, access to safe water and sanitation are also constituting to environmental degradation and spread of diseases. For instance, much of Dhaka city's sewage is untreated, and sewer systems only cover 18 percent of the area (World Bank, 2016). Furthermore, the incidence of cholera, diarrheal, dysentery and typhoid remain high due to poor access to safe water. Industrial pollution is also constituting to degradation in urban areas, which further erodes the resilience of many. People's health and wellbeing are descending in a context where access to health services may already be low (Rahman, 2011).

The ecological systems supporting subsistence livelihoods are also inherently fragile, and already suffering under anthropogenic stressors. Continued salinization of the water resources and soil also constitute to environmental degradation following inundation and regular storm surges in association with cyclones. Land affected by saline intrusion has increased from 83.3 million hectares to 105.6 million between 1973 and 2009, now affecting non-coastal areas as well as a result of tidal flooding, sea-level rise, storm surges, and human-action (Mahmuduzzaman, et al., 2014). Hence, farmers are forced to abandon crop farming (such as rice) and raising cattle on the GBM delta, and are turning towards options such as shrimp which thrive in salt ponds (FAO, 2017). However, many strive to increase their productivity by installing illegal piping to increase shrimp ponds, which not only destabilizes protective embankments and increases flood risk (ADMI, 2013), but also further increases the salinity of ground leading to loss of mangrove ecosystems (Ashton, 2008; Paul & Vogl, 2011). The industry also contribute to land degradation, loss of fish stocks and worsens pollution (Paul & Vogl, 2011; FAO, 2017). This leads to multiple self-enforcing feedback loops which are difficult to intercept (Figure 6) and require policy interventions rapidly to guarantee that the environmental degradation is not worsened by negative coping mechanisms.

Figure 6. Cause and effect relationships of coastal shrimp farming in Bangladesh (Sohel and Ullah [2012] in FAO, 2017)



2.5 Future Disaster and Climate Risks

Climate change may have severe implications to the future efforts to better manage disasters in Bangladesh. For example, it is expected that Bangladesh will be 4 percent wetter by 2050 (Ministry of Foreign Affairs, 2018), which could lead to worsened impacts of flooding and storms, and increase the prevalence of vector-borne diseases. Temperature and humidity can both affect the distribution of vectors (often mosquitoes) and the effectiveness of carried pathogens, thus increasing the incidence of diseases while the environment becomes more habitable for various vector species. In Bangladesh, dengue, visceral leishmaniasis (kala-azar) and malaria could become more common following climate change, but the issue requires more research (Rahman, 2014; Ministry of Health and Family Welfare, 2018).

Sea-level rise could also further destabilise the ecological systems, endanger food security and threaten the availability of fresh water. This is a significant issue given that Bangladesh gets over 90 percent of its water beyond its geographical boundaries, which requires the country to cooperate the upstream-downstream linkages to guarantee equity in water distribution (Scott, et al., 2019). If left unmitigated, issues related to water may rapidly exceed the coping capacities of communities and the government by end of this century. Furthermore, loss of livelihoods and habitable space could also increase migration trends as explored earlier, and a sea-level rise of only 0.5 meters would result in a loss of approximately 11 percent of the country's land area, and effectively displacing more than 15 million people (World Economic Forum, 2019).

Increasing prevalence of drought periods is potentially heightened by climate change as

well. By 2050, up to 32 percent of all wheat production may be lost due to heat stress, potato yields are expected to suffer from moisture, rain fed maize productivity could drop by 20 percent. Also sugarcane, soybeans and sorghum could face a decline of 7-10 percent during the same time period (Ministry of Foreign Affairs, 2018). This could lead to a cumulative loss of US\$ 36 billion between 2005 and 2050, which represents 3.1 percent of the annual agricultural GDP (Ministry of Foreign Affairs, 2018). Moreover, rice constitutes to 78.16 percent of all the total crop production, and is estimated to contribute to 62 percent per capita daily calorie intake from the 69.8 percent of all calories received from cereals (Nahar, 2016). Thus, loss of output could have catastrophic impacts on the food security, especially when the demand for rice and other crops is steadily growing alongside the population.

However, it is inadequate and too simplistic to assume that sea-level rise would affect the whole of Bangladesh's coastline in a uniform manner. Many areas (including Ganges Tidal and Chittagong Coastal Plains) have protective embankments, and the Sundarban mangrove forest can also act as a buffer against inundation (Brammer, 2016). While issues exist, the country is not helpless against predicted sea-level rise, and to avoid oversight, more research, institutional measures and funding are required to adequately assess the regional risks and capacities vis-à-vis rigorous scientific understanding of the physical changes in the climate (Brammer, 2016). One of the latest assessment – the risk assessment and hotspot scenarios developed for the Delta Plan 2100, provides comprehensive information on climate projection, climate-induced risks, and long-term socio-economic implications to inform long-term strategy. The assessment identified 6 hotspots with similar hydrological and climate vulnerability characteristics including Coastal Region, prone to multiple hazards (such as cyclones, floods, storm surges, sea level rise, coastal zone erosion, and saline intrusion); Haor and Flash Flood Areas, characterized with fresh water scarcity, flooding and waterlogging, drainage congestion and groundwater depletion; and Urban Area, with impending impacts of waterlogging/drainage congestion, fresh water scarcity and waste and effluent management (General Economics Division, 2019).

3. Disaster Risk and Climate Action Interventions

Given the challenges related to high risks in Bangladesh, managing disaster risk reduction and climate change adaptation remains as mountainous task, not to mention the efforts to reduce poverty, increase resilience, improve management of resources and to mitigate disaster impacts once they materialize. However, the government has made rapid progress in improving the disaster management infrastructure since the catastrophic cyclone Bhola in 1970, and has now established a robust, proactive framework for DRR, CCA and sustainable development. The following chapters provide an overview of the country's process vis-à-vis the mandates of international agreements and frameworks (Sendai Framework for Disaster Risk Reduction, Sustainable Development Goals and the Paris Climate Agreement), highlight some of the key issues and provide suggestions for improving the further implementation of DRR, CCA and sustainable development.

Priority 1. Understanding Disaster Risk For maintaining an understanding of disaster risks, gathering and analysing data related to vulnerabilities, exposure and hazards is necessary for conducting risk assessments, prioritizing investments and for improving the capacity to issue timely and appropriate early warnings. Additionally, data could facilitate analysing disaster trends, improve the efficacy of social safety net programs, and support the revision of risk reduction strategies. However, many of the existing databases have been uncoordinated and unstandardized in the past, mainly focusing on disaster losses and damages, hosted by various agencies (including the meteorological department and the bureau of statistics) (Bangladesh Bureau of Statistics, 2013). Dhaka Water Supply and Sewerage Authority (WASA), Directorate of Land Records and Surveys (DLRS), Bangladesh forest Department (BFD), Soil Resource Development Institute (SRDI) and the Agriculture Research Center (BARC) are among the organizations which maintain comprehensive, spatial and non-spatial information systems.

During the past decade, efforts have been made to combine the existing services through the establishment of the Disaster Management Information Center (DMIC), maintained by the Ministry of Disaster Management and Relief (MoDMR), to mainstream disaster risk reduction and improve data management. The role of the DMIC has continued to be highlighted in the proceeding National Plan for Disaster Management (2016 – 2020), though requiring additional investment to strengthen coherence in information sharing among multiple agencies (Ministry of Disaster Management and Relief, 2017). It connects ministries, various agencies and NGOs under an umbrella to collate risk and hazard information to support early warnings, situation reports and risk analyses at all levels of the government. Yet, gaps remain; for example, during the 2014 river floods, it was not possible to create a comprehensive overview of the situation due to regional differences in collection and presentation of consistent data following some coordination inefficiencies (van den Homberg, 2016). Harmonizing data sets remains as a challenge for practitioners not only in Bangladesh, but elsewhere as well.

To adequately address these challenges, capacity building is rapidly required at the sub-national levels of government which not only generate the most of the hazard, vulnerability, risk and disaster information required (especially when conducting post-disaster needs assessments) but also because their contextual knowledge is required when assessing local vulnerabilities, needs and gaps (van den Homberg, et al., 2018). Knowledge, capacity,

resources, monitoring and accountability are the key factors requiring strengthening at the local level to fix issues in reporting data, storing it, as well as organizing information in a coordinated manner, all of which remain inadequate to date (Ahmed, et al., 2016). The government has already identified the needs to invest in the creation of a risk repository, strengthening existing networks and capacity, to support and engage disaster risk management-related research and development institutions and research bodies, and to increase the awareness of risks through comprehensive hazard mapping leading to risk-informed planning (Ministry of Disaster Management and Relief, 2017).

Priority 2. Strengthening Disaster Risk Governance to Manage Disaster Risk Bangladesh has established a robust foundation which is required for efficient and impactful disaster governance. The legal framework is founded on the Disaster Management Act, Standing Orders on Disasters (SOP, first disaster-related document to be developed in 1999), and the National Plans for Disaster Management (NPDM), which are further supported by various other plans drafted for specific purposes at the sub-national level (Figure 7). The Act of 2012 was enacted following the implementation of the 2010-2015 NPDM to further strengthen the management and coordination of disaster operations following the disaster management cycle at all levels of government (GoB, 2012). The SOP, then, details the roles and responsibilities of various committees, ministries and other organizations (Figure 8) as mandated by the DM Act and the national plan during and after disasters, following the disaster management cycle (including detailed phases for recovery) (Ministry of Food and Disaster Management, 2010). The NPDM of 2010 to 2015 was implemented and led by the MoDMR to further identify hazards and risks, to establish understanding of disasters in Bangladesh, to prioritize action and to identify strategies to reduce aforementioned risks under the lead of National Disaster Management Council, headed by the Honourable Prime Minister (Disaster Management Bureau, 2010). The NPDM also mandated the formation of Disaster Management Act, National Disaster Management Policy, developing Bangladesh Disaster Management Model and establishing the DMIC as explored in the previous chapter (Disaster Management Bureau, 2010).

Figure 7. Bangladesh Disaster Management Planning framework (Disaster Management Bureau, 2010)

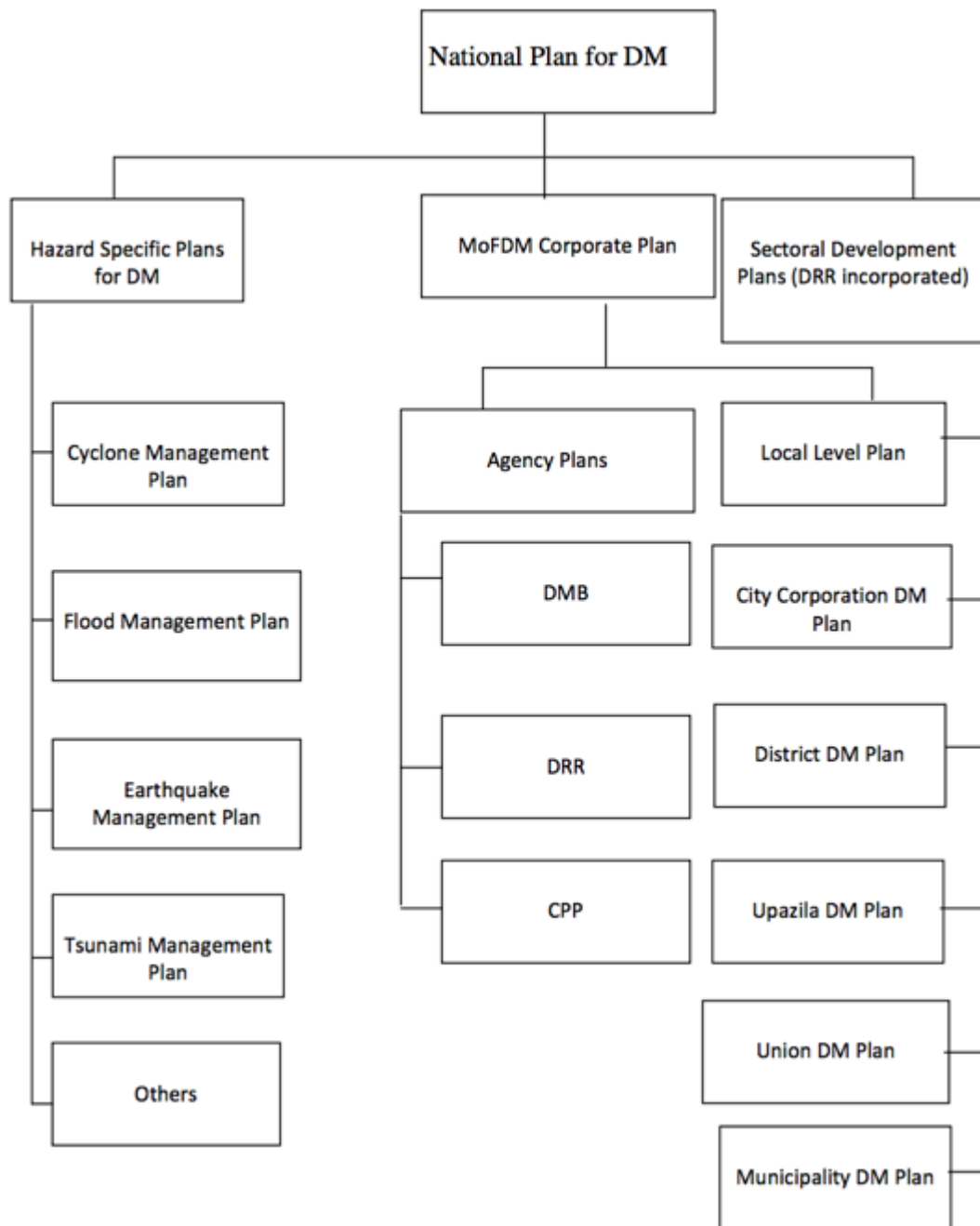
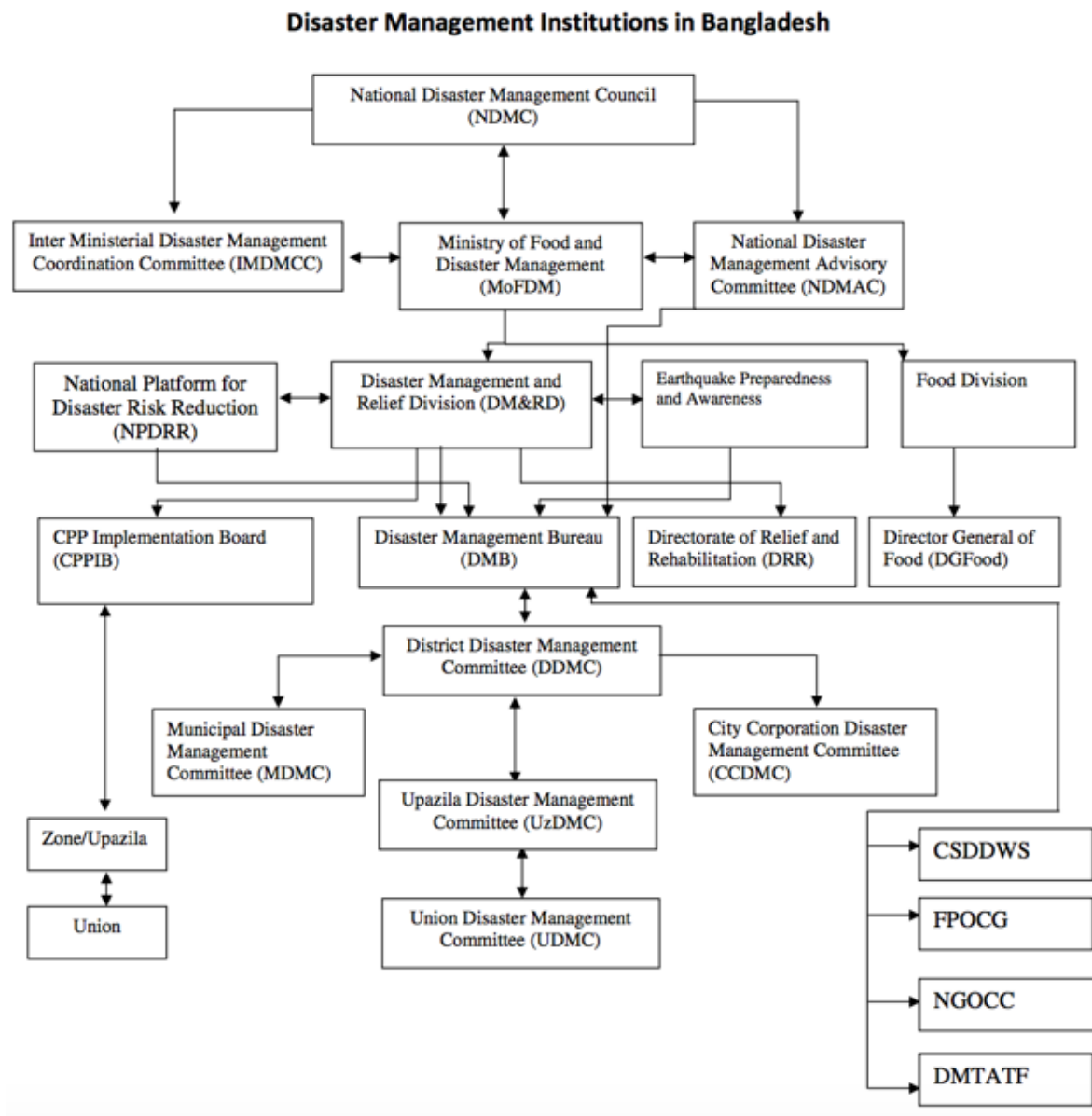


Figure 8. Disaster management Institutions in Bangladesh (Disaster Management Bureau, 2010)



Now, the NPDM has been replaced by an updated version for 2016 – 2020 building on existing work. Given the challenges hindering disaster management in Bangladesh, the document, assuming a whole-of-government approach, takes important step towards proactive risk reduction and holistic approaches (in consideration of social, political, economic and environmental context) by focusing on 1) saving lives, 2) protecting investments and 3) effective recovery and rebuilding (Ministry of Disaster Management and Relief, 2017). The updated NPDM has also made progress in terms of alignment with the Sendai Framework for Disaster Risk Reduction, Paris Climate Change Agreement and the Sustainable Development Goals, and further the national priorities and targets to reach middle-income status by 2021 (Ministry of Disaster Management and Relief, 2017). Alignment with these international policies has also been highlighted in the Dhaka Declaration 2015, which acts as a practical guideline to ensure inclusion of persons with

disabilities in recognizing their rights through a people-centred approach - reflecting significant role of Bangladesh government in promoting Disability Inclusive DRR (DiDRR) (Ministry of Disaster Management & Relief, 2018).

Yet some challenges remain in terms of disaster prevention, monitoring and progress reporting mechanism. Translating the plan into actions also requires significant investments, and is built upon the participation of key stakeholders – however, the actual implementation and institutional capacity building to support the uptake at various levels of governments remains uncertain (Ahmed, 2019).

Table 1. Bangladesh's legislative plans and policies intended to improve disaster risk reduction and climate resilience

IMPLEMENTATION	PLAN/POLICY	SCOPE	PURPOSE
MINISTRIES, DIVISIONS AND AGENCIES AT ALL LEVELS	Standing Orders on Disaster (1999/2010)	All levels of government, relevant stakeholders	Outline duties and responsibilities at all levels of government, covering all the phases of the disaster management cycle.
NATIONAL DISASTER MANAGEMENT COUNCIL	Disaster Management Act (2012)	National Level	To improve coordination of DM activities and to formulate rules for effective implementation
MINISTRY OF DISASTER MANAGEMENT AND RELIEF	National Plan for Disaster Management (2016-2020)	All levels of government	Integrated DRR under the umbrella of SFDRR, SDGs and Climate Change Agreement, aligned with the Vision 2021 to save lives, protect investment and guarantee effective recovery and rebuilding
MINISTRY OF ENVIRONMENT AND FORESTS	Bangladesh Climate Change Strategy and Action Plan (2009-2018)	National level, local government units, NGOs, CBOs, CSOs and the private sector	To improve the capacity and resilience in six core dimensions; Food security, social protection & Health, DM, Infrastructure, Research Mitigation & Low Carbon Development and Capacity building
BANGLADESH PLANNING COMMISSION	Seventh Five-year plan (2016-2021)	All levels of government, the private sector	Building on previous successes, the 7 th FYP aims to accelerate growth and empower citizens with a special focus on lowering income inequality, sustainable development and poverty reduction

IMPLEMENTATION	PLAN/POLICY	SCOPE	PURPOSE
GOVERNMENT OF BANGLADESH	Vision 2021	All levels of government, relevant stakeholders	Framework for transforming the country to one that reflects the aspirations of citizens through implementing steps to reach inclusive and accountable middle-income society by 2021. Aims towards participatory democracy, accountable governance, eradication of poverty, healthy citizens, developing human resources, improving the economy and environmental sustainability

Priority 3. Investing in Disaster Risk Reduction For Resilience Disasters have wide implications to social and economic development of a country due to their potentially wide-spread impacts – but also because they require funding to prevent risk, mitigate and manage potential impact. Disaster financing requires various options from the government (and private sector) to avoid and reduce losses and impacts to lives and livelihoods in the forms of investments into infrastructure, trainings, insurance schemes, preparedness and response, data management, and the list goes on.

Sector-specific provisions have been put in place in order to ensure a more comprehensive response to disaster impacts of various sectors, including the Framework for Disaster Risk Reduction and Education in Emergencies which provides an overview for strengthening disaster resilience through safeguarding and education sector investments (Caritas, 2016). The National Plan for Disaster Management 2015 – 2020 further highlights a need to increase resilience of national health systems through capacity building and training initiatives, alongside implementation of the International Health Regulations (2005) of the World Health Organization (Ministry of Disaster Management and Relief, 2017), as emergency preparedness of Bangladesh has been highlighted as an area that requires further investment (CFE-DM, 2017).

In Bangladesh, the Finance Division under Ministry of Finance is the agency allocating domestic disaster-related funding across the levels of government, which are divided into 1) disaster risk reduction fund, 2) emergency fund for disaster management (district levels), 3) fund for unforeseen incidents and the 4) Palli Karma-Sahayak Foundation (microfinance wholesaler, implementing climate resilience fund). Additionally, when a funding gap determined by the funds remaining when total annual losses have been deducted is experienced, the Economic Relations Division mobilizes a foreign financing mechanism involving multilateral and bilateral partners, covering areas such as infrastructure, procurement of food, sanitation, healthcare and education support (ADB, 2016).

Bangladesh's sector specific investments in DRR are underpinned by relevant frameworks and plans to guide implementation, including Framework for Disaster Risk Reduction in Education and Education in Emergency aimed towards strengthening disaster resilience through

safeguarding education investments (Government of the People's Republic of Bangladesh, 2013) as well as the Climate Smart Agriculture Investment Plans, a collaboration between the World Bank and the Government of Bangladesh. However, there is limited information available on the financial provisions in place to mobilize and implement these tools.

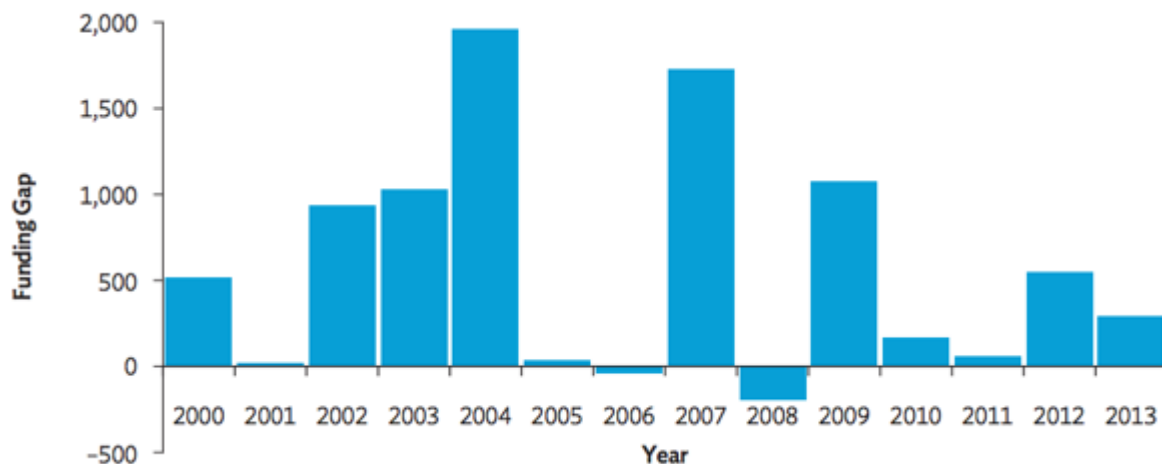
The Central Bank also has a role in disaster risk financing. It is operating Climate Risk Funds, In-house Environmental Management and Green Banking Policies, as well as issues Environmental Risk Management Guidelines to other financial institutions. Bangladesh also has two national climate change trust funds (CCTF): the Bangladesh CCTF with a funding of US\$ 390 million during the past 8 years and the Bangladesh Climate Change Resilience Fund, funded by donors and development partners with overall worth of US\$ 146.4 million (Ministry of Foreign Affairs, 2018).

The Bangladesh CCTF, funded entirely by the government, is aimed towards strengthening national capacity to cope with climate change impacts guided by the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009 and headed by a trustee board which holds administrative and directional overview of the Trust Fund. Under the CCTF, a number of projects have been implemented to strengthen infrastructural resilience including the construction of over 6000 cyclone-resilient homes, over 100 kilometres of riverbank protection, water-control measures and over 100 kilometres of drainage systems within urban areas to reduce waterlogging, among other projects (Ministry of Finance, 2014). The Climate Change Resilience Fund acts as a financial mechanism which allocates 10 percent of funding for civil society and private sector projects to be directly allocated to building resilience of communities through research and climate resilient planning (Khan, Huq, & Shamsuddoha, 2018).

Additionally, the insurance sector (dominated by the Sadharan Bima and Jiban Bima corporations) provide life, health and flood insurances in the country. However, vast majority of the population (particularly those rural poor) have no access to insurance coverage and the general awareness of insurance programs among the population remains low (ADB, 2016). Millions continue to manage their finances in informal ways – however, initiatives such as BRAC have been offering microfinance services such as loans for small enterprise, agriculture and for migrant households to mitigate the situation at the grass-root levels (BRAC, 2018). Forecast-based Financing has also played a crucial role in addressing the gap between DRR activities and post-disaster response including the unconditional cash approach in an early action initiative following floods in 2017 (IFRC, 2018).

Finally, it should be noted that there exists a significant funding gap between the disaster-related economic impacts, following funding for recovery and rehabilitation, humanitarian aid and emergency response (Figure 9). Between 2000 and 2013, the gap reached US\$ 8.1 billion despite the fact that plethora of countries, donors and NGOs were involved in the aftermath of major catastrophes providing humanitarian and foreign aid (ADB, 2016).

Figure 9. Annual funding gap of disasters in Bangladesh between 2000 and 2013 (ADB, 2016).



Priority 4. Enhancing Disaster Preparedness for Effective Response to “Build Back Better” in recovery, rehabilitation and reconstruction Due to the recently improved integrated and strategic disaster management approach, the government’s preparedness and response capacity has increased tremendously. However, vis-à-vis the scale of potential disasters, mechanisms also remain largely insufficient (Rezoane, 2016). The response mechanism (in coordination with NGOs and international organizations) follows a top-down structure which still supports District, Upazila and Union levels in which emergency response committees are established, coordinated through a center in Dhaka when relief activities are required (Disaster Management Bureau, 2010). The MoDMR (operating under the supervision of the NDMC) coordinates response among institutions and agencies at the national and sub-national levels. Furthermore, measures have been implemented to empower communities to undertake the management of response and recovery. However, the capacity to provide efficient and timely response remains inadequate due to inefficiencies within the incident command system which is easily overwhelmed in times of large-scale disasters, and due to low local capacities (Ministry of Disaster Management and Relief, 2017).

Despite the challenges, the government has greatly improved disaster preparedness and response by investing in cyclone shelters and early warning systems (EWS) during the past decades. For example, while the cyclone Bhola caused nearly 500,000 casualties in 1970, deaths due to Cyclone Sidr in 2007 were reduced to 3,406 only four decades later, which is an illustration not only of the efficacy of the programs, but also represents the scale of transformation the government has strived to maintain towards proactive disaster management (Oxfam International, 2008; GoB, 2008). Comprehensive EWS are indeed crucial given the potential magnitude of disasters materializing in Bangladesh. Cyclone warnings are disseminated by the Department of Disaster Management utilizing three different mechanisms: through cell phone broadcasting, interactive voice response (accessible to anyone by calling) and short message service, which is designed for field-level disaster management committees (Roy & Sarkar, 2015). Flood early warnings are also operational through the Flood Forecasting and Warning Center, which disseminates forecasts from national to district levels through email, website and cell phone services. Yet, they do not always reach local stakeholders, the contents are often not understood,

and insufficient follow-up of implemented activities are issues hindering the operations (Deltares, 2015). However, efforts are underway to modernize the existing hydro-meteorological information services with the support of World Bank. In 2017, the Government signed a US\$ 113 million financing agreement to improve weather forecasting, EWS and dissemination of information (World Bank, 2017).

While the future prospects in response and preparedness are positive, managing “Building Back Better” remains as one of the most pressing issues in Bangladesh. As was witnessed in the aftermath of cyclone Sidr, the lack of integration of DRR and CCA in housing reconstruction and recovery caused many government provided shelters to fail two years later during cyclone Aila (despite the fact that it was only two-thirds of the strength of Sidr) (Nadiruzzaman & Paul, 2013). Also, due to poor coordination of stakeholders and the lack of specific guidance on “how to reconstruct”, various approaches were assumed depending on the provider (GFDRR & UNDP, 2014). Thus, various housing types were constructed, large portions of which were culturally inappropriate or unsuitable to family needs (Nadiruzzaman & Paul, 2013). Owner-driven approaches should be implemented to an increasing extent to guarantee sustainability of recovery efforts in Bangladesh (Alam, 2010), otherwise the standards of housing and shelter provisions may not achieve the desired standards which people themselves have. This could be achieved by implementing a mixture of agency-led but owner-driven reconstruction and recovery to guarantee that housing conforms to social and cultural needs, and building back better must incorporate necessary considerations for DRR and CCA to guarantee disaster resilience and long-term recovery. However, given the frequent impacts of large-scale hazards, and large numbers of people inhabiting poor-quality housing (such as the refugee camps in Cox’s Bazar), managing sustainable and appropriate reconstruction and recovery are major challenges to be addressed.

4. Coherence with Sustainable Development Goals and the Paris Climate Agreement

Harmonizing the synergies among various legislative pieces, policy guiding documents, coordination mechanisms, institutional frameworks and programs and actions in the ground under the umbrella of holistic DRR, CCA and sustainable development is increasingly necessary due to the fact that all these efforts share some characteristics. By identifying synergies among major international agreements, as well as looking into co-benefits, non-regret measures, and cost savings for coherent action, it is possible to reduce overlapping responsibilities and doubled efforts through intelligent policymaking, informed by integrated data collection and information systems. However, due to the nature of rapidly evolving “best practice” and country needs, policies are often formed on ad-hoc basis which leaves gaps among these three dimensions.

Contrary to many of the assessed countries, Bangladesh has made impressive progress in recognizing these linkages between development and disasters within the country's key legislative, policy and development planning pieces. An assessment of national adaptation planning highlights Bangladesh's Vision 2021 as a key document for leveraging climate change as a core guiding vision/plan, supported by the Ministry of Environment and Forestry as the national-level coordinating entity for climate change (Zamudio & Parry, 2016). This is supported by various policies and action plans, including the National Adaptation Program of Action (NAPA) which was recognized as the first sector-specific document, drawing upon international development goals, to finalize the eight thematic areas of climate change adaptation in Bangladesh (Fatemi, Okyere, Diko, & Kita, 2020).

While the NPDM for 2016 to 2020 is based on SFDRR, it also recognises that DRR for resilience is the foundation for achieving the SDGs, and that mitigating the impacts of climate change to limit the increased severity of hydrometeorological hazards must be further enhanced through joint action as mandated by the Paris Climate Change Agreement (Ministry of Disaster Management and Relief, 2017). The efforts in the future will be supported by promoting policy coherence, by encouraging private sector engagement, capacity building and by improving social protection, in recognition of the fact that social inclusions and vulnerability reduction is another requirement for resilience (Ministry of Disaster Management and Relief, 2017).

The pathway to SDG implementation in Bangladesh is further supported by an Inter-Ministerial Committee on SDGs Monitoring and Implementation overseeing the process with the support of relevant ministries. The SDGs have been integrated into the 7th Five Year Plan, supported by a comprehensive financing strategy and “whole of society” approach – however, more data, investments, support and harmonizing of targets is required to guarantee the successful graduation by 2030 (Bangladesh Planning Commission, 2018).

For combatting climate change, the government devised the Climate Change Strategy and Action Plan of 2009 (BCCSAP), which is among the first of its kind in the world. In recognition of the fact that climate change is happening here and now, the BCCSAP was developed for a 10-year period to build capacity and resilience against climate risk for the

upcoming decades by focusing on the poorest and most vulnerable, by strengthening existing DRM system, by improving infrastructure and by investing in research and low-carbon development options (GoB, 2009). The BCCSAP was further integrated into the NPDM of 2016-2020, with increased provisions to eradicate poverty, and improve social wellbeing by pro-poor climate change strategies and climate risk-informed DRR (Ministry of Disaster Management and Relief, 2017).

Bangladesh has made progress in formulating and implementing the National Adaptation Plan (NAP) which began with a roadmap to guide the development of the plan, supported by national stakeholder dialogue on Stocktaking for Bangladesh's NAP Process to identify the current achievements, gaps and ways forward. This supported in the GCF NAP Readiness proposal which has since been approved for implementation in 2018, guided by the Climate Change wing of the Ministry of Environment and Forests.

Table 2. Some of the synergies between international agreements and different policies and commitments of Bangladesh

Sectoral Aim	Policies/programs with potential links to Sendai Framework for Disaster Risk Reduction	Policies/programs with potential links to Sustainable Development Goals	Policies/programs with potential links to the Paris Climate Agreement or Environment
National Development	7 th Five Year Plan (2016-2020)	National Sustainable Development Strategy (2010-2021) 7 th Five Year Plan (2016-2020)	7 th Five Year Plan (2016-2020)
Agriculture	National Agriculture Policy 2018	National Agriculture Policy 2018	National Agriculture Policy 2018
Disaster and Climate Risk Reduction	National Plan for Disaster Management (2016-2020) 7 th Five Year Plan (2016-2020) Standing Orders on Disaster (1999/2010)	National Plan for Disaster Management (2016-2020)	National Plan for Disaster Management (2016-2020) Bangladesh Climate Change Strategy and Action Plan 2009
Vulnerability Reduction	National Plan for Disaster Management (2016-2020) 7 th Five Year Plan (2016-2020) Joint Response Plan for Rohingya (2019)	Vision 2021 National Strategy for Economic Growth, Poverty Reduction and Social Development National Social Security Strategy (2015)	Bangladesh Health-National Adaptation Plan 2018 Bangladesh Climate Change Strategy and Action Plan 2009
Urban Development	7 th Five Year Plan (2016-2020)	No other national plans for managing urbanization (Roy, et al., 2018)	No other national plans for managing urbanization (Roy, et al., 2018)

5. Issues in Implementation of Disaster Risk Reduction and Climate Policy

Implementing the NPDM of 2016-2020 will remain challenging due to the fact that it makes no provisions for funding nor building capacity for sub-national levels in efforts to support the implementation (Ahmed, 2019). Additionally, accountability among and between stakeholders remains low, and the widespread and rapid challenges related to unplanned urbanization have created a race against time for the government agencies to keep up with in policy making (Ahmed, 2019), a process which often is following a few steps behind development.

Lack of sub-national level capacities also limits the effective implementation of DRR and CCA aspirations. To fully achieve the intended impact of various pieces of legislation and policy, the LGUs must be capable and empowered to translate guidance into tangible action. Additionally, research suggests that some of the Upazila level disaster management officials have only shallow knowledge about the existing policy framework, indicating that further support for them is required in the future (Rezoane, 2016), and the lack of financial and human resources is hindering the progress as envisioned by the national level government. Institutional setting, education for government officials, coordination, monitoring and evaluation, alongside accountability and transparency must all be improved at all levels of the government (Ahmed, et al., 2016). Ensuring that new infrastructure development is risk-informed also poses an additional challenge to various sectors already seeing infrastructural gaps that continue to widen with the increasing implications of climate change.

Also, given the rapid pace of change in the regional and global climate, the implications may overrun the capacities to manage the ensuing impacts in time. Investing in social wellbeing and physical resilience requires massive-scale investments, and as was established before, the government is already facing significant funding gaps in disaster management. Thus, the importance of stakeholders and donors to resilient development is highlighted even further.

6. Stakeholder Analysis

Development partners and donors have always been important for DRM in Bangladesh: historically, they have provided crucial assistance to efforts taking place on every step of the disaster management cycle (especially relief and long-term recovery) (Sabur, 2012). As of 2017, there were 2,554 registered NGOs and INGOs in the country from 27 countries (Muneer, 2017). However, certain discrepancies remain in the operations between NGOs and the government due to overlapping responsibilities and lack of defined roles within the government's policy. For example, due to the fact that NGOs are operating based on their funding mandates which remain unharmonized with the central government's priorities, doubled efforts may form, and there is no comprehensive platform for NGO coordination and policy dialogue (Ahmed, et al., 2016). While stakeholders play an important supplementary role, inefficiencies arise especially in the aftermath of disasters as was seen during the 2007 Sidr response, relief and long-term recovery.

To bridge the gaps, the Government and UNDP have partnered to improve the response and recovery infrastructure in accordance to the global UN cluster architecture. However, majority of NGOs remain largely in a supportive role outside the government's operational hierarchy, and their roles and responsibilities are not integrated within policy or other legislative frameworks.

Additionally, stakeholders operating outside the UN Cluster System and the OECD Development Assistance Committee (OECD-DAC) mandates may increase the miscoordination on the ground, especially in the phases of recovery and reconstruction. In the case of Cyclone Sidr, Saudi Arabia pledged US\$ 102.76 million in assistance to response and housing recovery (GoB, 2008) which corresponds to 53 percent of all the humanitarian budget. Yet, neither the government officials nor Dhaka based donors at the time knew about the timeframe of Saudi Arabia's projects, nor what exactly was funded with the amount (Oxfam International, 2008). This was due to lack of three-dimensional dialogue between stakeholders, and differences in aid transparency and conditionality which affected the stakeholders' ability to coordinate their efforts.

Finally, given the potential for massive, transboundary disasters, the governments within the South Asian Association for Regional Cooperation (SAARC) realised the need for joint efforts to improve DRM. Following the Dhaka Declaration, and by drawing learnings from the 2004 Indian ocean tsunami and the Kashmir earthquake in 2005, Comprehensive Regional Framework for Action 2006-2015 was developed and circulated among participants to mainstream DRR, to empower communities, to strengthen regional emergency response and to develop joint capacity to manage catastrophic disasters.

7. Future Priorities

7.1 Challenges

Yet, despite the institutional reforms and scale of efforts to improve proactive disaster risk management, challenges remain. There are still over 1.2 million Rohingya refugees in need of humanitarian assistance, and the situation is estimated to require over US\$ 920 million in funding in 2019 to maintain priority response efforts (such as food security, WASH and shelter) (UNHCR, 2019). Vast majority of the people inhabit congested camps characterized by lack of infrastructure, mounting vulnerabilities and high exposure to not only hazards, but diseases as well. While the situation is gradually stabilizing, the environmental degradation in these areas is on the rise and pollution is becoming increasingly prevalent in conditions where sanitation and sewage infrastructure is non-existent (UNHCR, 2019). The political situation in Myanmar remains uncertain, indicating that refugees are most likely not able to return in the near future, while their needs for support are increasing with time. The Government has developed a joint response plan for the humanitarian crisis, but the progress will be slow due to the magnitude of the situation.

Alongside social challenges, issues related to financing, capacity, coordination and accountability are prevalent as well. For example, the quality and abilities to analyse data also limit the efficacy of cyclone early warnings. Lack of computational resources, problems in integrating data across different agencies and infrequent data updates covering wind direction and speed hinder the estimation of impacts and storm surges before storms make landfall (Roy & Sarkar, 2015). Additionally, even if the population receives early warnings, they are sometimes unwilling to evacuate due to mistrust towards EWS, due to distance to shelters or because shelters are full (Roy & Sarkar, 2015). Additionally, due to the fact that killas (animal shelters) are often not built in the vicinity of cyclone shelters, people are unwilling to separate from their animals during evacuation (Paul & Dutt, 2010; Paul, 2012). The issues behind low compliance to early warnings are manifold (including attitudes, socio-demographic and economic aspects) (Saha & James, 2017), and the core reason, including issues related to resilient infrastructure, behind such challenges have not been addressed thoroughly (Ahsan, et al., 2015; Saha & James, 2017).

Finally, financing all DRM and CCA efforts requires massive investments from the Government and stakeholders. Curbing the impacts of sea-level rise and increased severity of hydrometeorological hazards will require improved resilience of infrastructure, and to achieve the aspirations to eliminate poverty, social spending must increase equally, alongside physical mitigation efforts. Yet, financing even the basic recovery now in context characterized by severe, frequent hazard impacts is notoriously difficult. In 2007, the combined funds from GoB and international donors to restore housing by 2009 had reached US\$ 126 million, which was barely a seventh of what was required – thus, the agencies continued to struggle to secure funds for carrying on reconstruction two years after the cyclone (Shelter Working Group, 2009). As of now, severe funding gaps have been established to exist in post-disaster phases, and the implications are likely to carry on into the long-term future.

7.2 Priority Issues

As has been explored throughout this report, managing all aspects of DRR, CCA and sustainable development in Bangladesh is a difficult task given the scarce resources, mounting needs in all sectors of society, on-going erosion of the ecological systems, increasing climate stressors and the frequent impact of reoccurring natural hazards. While suggesting priorities is made difficult by plethora of needs arising from this context, most urgent challenges vis-à-vis the evidence are combined and presented here.

To begin, curbing the adverse impacts of unplanned urbanization in Dhaka City and other rapidly urbanizing areas requires risk-informed management now, and in the future to reduce on-going environmental degradation, pollution and deteriorating state of urban slums in Bangladesh. Provisions for DRR and CCA must be considered within this process, and while significant progress has been made, the population will remain its steady growth which increases the needs for social protection, housing, space, food and resources exponentially. Also, given the fact that sea-level rise is likely to cause significant displacement, exploring future options for relocating most vulnerable populations from the GBM delta must begin now. Otherwise, climate-change induced migration will only worsen the problems related to urbanization as people escape their previous homes due to displacement or loss of livelihoods.

In this context, prioritizing freshwater availability should be high on the government's agenda during the upcoming decades (Bernier, et al., 2016) given the challenges related to saltwater intrusion, increasing pollution, drought risks and the growing population's needs. An increasing number of farmers on the floodplains are losing their ability to grow cattle and rice due to increasing salinization of the soil, which leads to negative coping mechanisms such as shrimp farming (which can be potentially damaging if left unmanaged). Thus, alternative income generation options or support mechanisms for farmers unable to grow crops should be identified. The Bangladesh Delta Plan 2100, a holistic plan for integrated water resource management, is envisaged to help addressing water-related issues, taking into account future demands and uncertainties of climate change, adopting 'no regret' options based on adaptive and innovative approach, while enhancing synergy among sectoral initiatives and optimize opportunities for delta development (General Economics Division, 2019).

Improving the capacity to manage, collect and analyse data is required to support the process of prioritizing investments. Without adequate information about the impacts of climate change-induced alterations in the regional weather, and how they affect hydrometeorological hazards (and thus, livelihoods and exposure), funnelling funds where they are most needed will be impossible. Data is also required to avoid oversimplification of climate-related issues. Prevailing "assumptions" about the issues around Bangladesh's vulnerability to climate change should not cloud the focus from other urgent issues such as rapid unplanned urbanization, poor land use and needs of the ever-growing population (Brammer, 2016). Many of these issues are important elements in climate change adaptation and impact mitigation, and resources are also required to manage environmental degradation now as opposed to solely concentrating to the upcoming decade.

To successfully achieve the graduation from the SDGs, and to achieve the aspirations to implement inclusive DRR and CCA through eliminating poverty, social support, education and creating employment opportunities for the growing youth bulge also require massive-scale investments to reach the demographic dividend. Boosting the economy remains difficult, and is made more difficult by the fact that growth cannot be sacrificed as a trade-off for sustainability. In association with environmental degradation and pollution, planning and design of robust structural interventions should be conducted very carefully to avoid adverse impacts on the environment (Khan, 2008), which links to the general sustainable agenda and management of trade-offs between growth and degradation. However, such aspirations are increasingly difficult to achieve in a setting constrained by impacts of climate change, frequent and large-scale hazards as well as socio-economic issues such as prevailing poverty and displacement. Greening the economy will be expensive as well. While moving towards clean energy, the cost of cutting the share of fossil fuels in primary energy by 2030 would exceed US\$ 26 billion in Bangladesh (Roy, et al., 2019).

For improving disaster preparedness and response, as well as risk prevention and mitigation, localization of the DRM is increasingly necessary by providing capacity building to sub-national level institutions, agencies and localities to guarantee that the people and their respective authorities are capable of conducting immediate response (and further, recovery). First responders such as search-and-rescue, first aid and volunteer networks must be supported by risk-informed policy and strategy to facilitate training and awareness-raising, in consideration of slow-onset disasters as well (Ministry of Disaster Management and Relief, 2017).

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9. List of People/Agencies Met

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1	Sajedul Hasan	Director, Humanitarian Programme, BRAC
2	Khondoker G. Tawhid	Head, Programme Development, KM and M&E, Humanitarian Programme, BRAC
3	Imamul Azam Shahi,	Programme Head, Humanitarian Programme, BRAC
4	Suman Ahsanul Islam	Centre Director, Humanitarian Leadership Academy (HLA), Bangladesh
5	Md. Feroz Salah Uddin	Bangladesh Red Crescent Society (BDRCS), Bangladesh
6	Md. Mohsin	Additional Secretary, Ministry of Disaster Management and Relief (MoDMR), Bangladesh
7	Naoki Matsumura	Country Programme Coordinator (Disaster Management), JICA
8	Shakeb Nabi	Country Representative, ICCO, Bangladesh
9	Shamsuddin Ahmed	Bangladesh Meteorological Department (BMD) & Flood Forecasting and Warning Centre (FFWC), Bangladesh
10	Kazi Shahidur Rahman	Humanitarian Affairs Specialist Office of the UN Resident Coordinator, Bangladesh
11	Ahmadul Haque	Director, Cyclone Preparedness Programme
12	Md. Hasanul Amin	Deputy Director, Cyclone Preparedness Programme
13	Gurav Ray	German Red Cross
14	Arif Abdullah Khan	Programme Specialist, Disaster Resilience, UNDP Bangladesh
15	Md. Rafiqul Islam	Deputy Secretary General & Chief of DRM Division, Bangladesh Red Crescent Society

