

The Political Economy of Disaster Preparedness and Risk Reduction in Bangladesh

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Executive Summary

Bangladesh is cited as the most ‘climate vulnerable country’ in the world, facing the biggest risks of being affected by heavy floods, tenuous dry seasons, massive earthquakes and catastrophic tropical cyclones. In past decades, Bangladesh’s continuous battle against numerous natural hazards have pushed the government to make disaster management a national priority. The government treats disaster management through the lens of poverty alleviation: poorer households are more vulnerable to climate change than richer households. Therefore, the government, in partnership with international organizations, have invested heavily in improving development indicators that will effectively also make local communities more resilient to natural hazards.

As a result, although Bangladesh has made great strides in tackling some of the most fatal natural disasters in the country, much of the government’s efforts have been response-centric. A central committee makes decisions – albeit the committee includes representatives from various stakeholders in disaster management – that are eventually implemented by public officials at the local level. Elected local public officials or the community has very little influence on how funds are allocated or which programs to adopt. This widens the ‘trust gap’ between the local community and the government.

Field research also suggested the government tend to over-rely on the military and support of international organizations. Therefore, the government is negligent of improving its

own institutional capacity or employing skilled professionals in implementing more advanced technologies in making more accurate estimates of risks of natural disasters or developing early warning systems.

In spite of these present challenges, the Government of Bangladesh has improved significantly in recent years in the design and implementation of robust disaster management strategies. The Standing Order on Disaster provides detailed guidelines on the role of each government department in the event of a natural disaster. Furthermore, the government is increasingly investing in earthquake and cyclone preparedness, and is in the process of revisiting the National Disaster Management Plan in order to adopt the Sendai Framework within it.

With regard to hypotheses for why governments invest in disaster preparedness, Bangladesh offers support for the importance of perceived risk: exposure to past hazards seems closely related to efforts to engage in preparedness, with recent efforts related to earthquakes offering important evidence to this end. This case also offers mixed support for hypotheses related to political development and electoral incentives. While a relatively high capacity bureaucracy is charged with substantial responsibility for disaster preparedness, this allocation of tasks combined with the centralization of policy decision-making limits the incentives for locally elected officials to participate in disaster preparedness initiatives. As a result, there is substantially less overall support for preparedness at the local level than there might be with a more integrated model of local planning and implementation.

Hypotheses related to the importance of non-state actors also receive mixed support from the experience of Bangladesh. Despite a significant role for international actors in funding a wide range of the country's disaster management activities, recent evidence suggests that the government is increasingly using its own funds to invest in preparedness. Yet, a large role for the

military in disaster response implies that an alternative form of domestic moral hazard may be threatening some possible preparedness efforts. In addition, the prominence of civil society actors in disaster preparedness activities seems associated with parallel efforts by the government, rather than substitution. Thus, overall, non-state actors are largely seen as a complement to the preparedness activities of the government in Bangladesh.

In light of this research, we recommend four policy measures to improve disaster preparedness in the country: invest in community capacity building, empower elected local public officials, acquire and adopt advanced technologies to improve risk assessment and early warning systems, and focus more aggressively on preparedness.

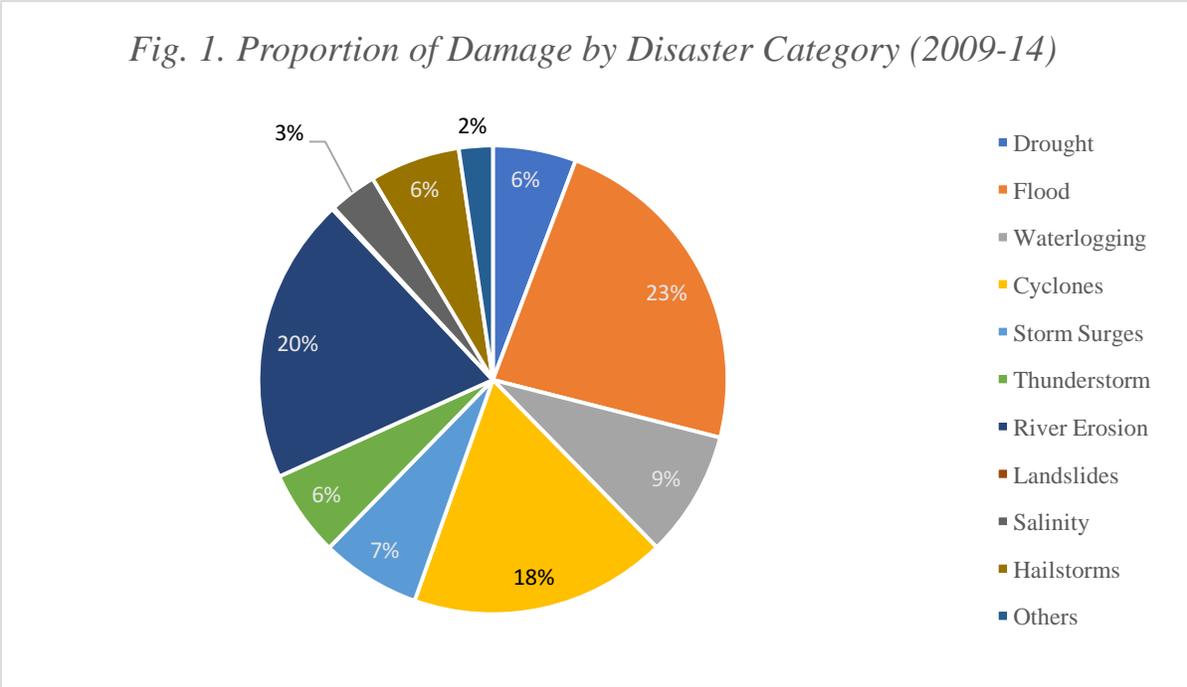
Introduction

Bangladesh is often cited as one of the countries with the greatest risk of being affected by climate change and natural disasters. In 2013, the Intergovernmental Panel on Climate Change (IPCC) ranked Bangladesh as the most ‘climate vulnerable country’ in the world¹, while Maplecrafter’s Climate Change Vulnerability Index (CVI) estimates Bangladesh to be at ‘extreme risk’ from the impacts of climate change by 2025.²

A number of demographic and geographic factors contribute to Bangladesh’s climate and natural hazard sensitivity. The country is one of the most densely populated in the world, constituting 147,570 square kilometers of area with a total population of nearly 163 million.³ The proportion of the population living in urban areas has grown steadily since 1960, estimated at 35 percent in 2016. The Bangladesh Bureau of Statistics reports a sharp increase in migration rates from rural to urban areas over the past decade, reportedly 6.7 percent between 2005 and 2015. The growing urban population is associated with an expansion in the manufacturing industry. In 2016, manufacturing contributed to 18 percent of the country’s GDP, with garments export accounting for over 80 percent of total exports and 8 percent of total GDP in 2015.^{4,5} As a result of growing manufacturing and exports industries, and in spite of being primarily an agricultural country, Bangladesh’s GDP share in agriculture has been declining since 1979. At present, agriculture contributes to 14.8 percent of the country’s GDP, a stark decrease from 52.5 percent in 1979⁶. Although the value of agriculture is declining, it employs 47 percent of the country’s total labor force and suffers heavily as a result of floods, droughts and cyclones.

Over 80 percent of Bangladesh is floodplains, situated at the Ganges Delta with numerous tributaries flowing into the Bay of Bengal. Widespread flooding in 1988 and 1998 resulted in over 3000 deaths and affected nearly 30 million people. Tropical cyclones in 1970,

1991, 2007, and 2009 are remembered as some of the worst natural calamities in the history of the country, killing nearly 500,000 people and contributing to massive financial loss.⁷ Droughts are more common in the northwestern region, where the most prolonged drought was recorded between 1995-96 and resulted in 40 percent damage to crops and heatstroke in livestock. While earthquakes are less common, the 2015 earthquake in Nepal jolted parts of Bangladesh and contributed to increasing concerns in this area for the government.



Field research conducted in December 2016 revealed that incidents of natural disasters in the past have led to more proactive responses by the government. In addition to infrastructural changes such as constructing more cyclone shelters and stronger dams, the government has heavily invested in the Bangladesh Meteorological Department, community radio, early warning systems, and disaster mapping exercises. At present, Bangladesh has two comprehensive National Disaster Management Acts and several sub-national bodies under the Ministry of

Disaster Management that exclusively tackle both disaster preparedness and response in the country. In the past decade, the country has significantly strengthened its efforts in managing cyclones, floods and droughts, developing a widely accepted Standing Order on Disaster (SOD) in accordance to the Hyogo Framework⁸ alongside more recent investments in tackling earthquakes. The government also relies on the military to take charge of emergency response to natural disasters in the country.

Following the World Conference on Disaster Risk Reduction (WCDRR) in 2015, the Government of Bangladesh adopted the Sendai Framework. Under this framework, participating countries will work towards reducing the number of deaths and people displaced as a result of natural disasters by emphasizing on locals' perception of risk and improving resilience among communities. Particular emphasis has been placed on the health sector in order to prevent, prepare for, respond to and recover from natural disasters that are highly interdependent⁹.

Background on Natural Disasters

The four major natural disasters that have historically affected Bangladesh are floods, tropical cyclones, droughts, and landslides. More recently, earthquakes have also become a concern.

1. Floods

As a result of its geographical location, Bangladesh is prone to annual flooding, primarily during the monsoon months of June through September. Located at the bottom of the Ganges-Brahmaputra-Meghan Basin, the country has a profusion of rivers and estuaries, forming five major river networks, flowing between 7,000 and 140,000 cubic meters per second during dry

and monsoon seasons respectively.¹⁰ There are about 700 rivers recorded flowing through the country forming 24,140 kilometers of waterways.

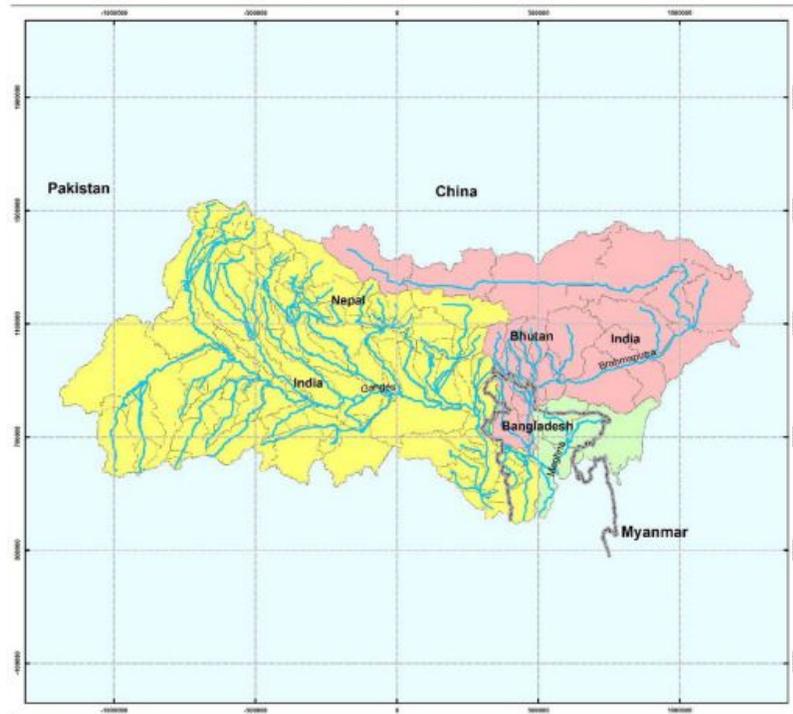


Fig.2. Location of Bangladesh within Ganges-Brahmaputra-Meghna Basin

Heavy annual rainfall inundates nearly 18 percent of the country. This precipitation is important in sustaining the agricultural industry by depositing sediments brought by the resulting floodwaters. Unfortunately, during the 1987 flood, nearly 40 percent of land was under water because of heavy rain, recording it as one of the most catastrophic events in Bangladesh's history.¹¹ 880 lives were lost and 500,000 people were displaced, accounting for nearly US\$ 1 billion in damage. In 1988, before the country could recover from the past year's floods, it was hit by a more catastrophic flood, displacing over 5 million people and costing US\$ 450 million in damages.

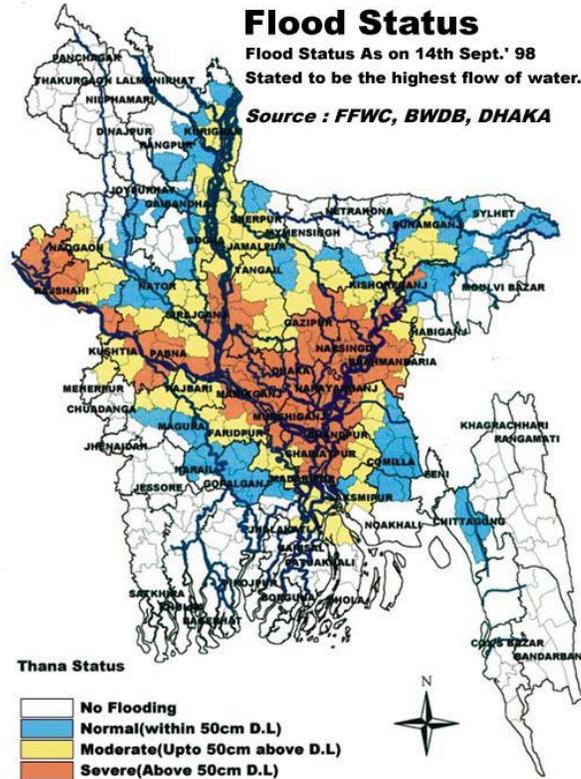


Fig. 3. Flood map of Bangladesh, 1998

The 1988 flood caught attention of international media not only because of the magnitude of damage, but also due to challenges faced by the government in facilitating large-scale evacuation.¹² The roads were mostly underwater and there was no dry surface to land helicopters, making the distribution of food packages nearly impossible.

In the aftermath of the two-month-long flood, the need for humanitarian assistance was more prolonged than anticipated. This led to international agencies such as US Agency for International Aid (USAID) and Department for International Development (DFID) developing a comprehensive roadmap that extended beyond their existing target groups. This also led to formation of civil society groups that continued to grow in the following decades and play an important role in advancing Bangladesh's risk reduction and response policies.

The 1988 flood also led to the government of Bangladesh heavily investing in infrastructure and poverty alleviation with a firm belief that general population would become more resilient against floods and other natural disasters if they were economically empowered. In 2004, the government established a cross-sectoral council to reduce flood risks in the country. In addition to the Ministry of Disaster Management and Department of Disaster Management, 900 representatives from all ministries, international aid organizations, NGOs, private sector and sub-national government bodies participated in the formulation of an extensive risk reduction plan. The recommendations outlined in the plan not only address floods, but also a range of natural disasters known regularly to affect the country.

2. Tropical Cyclones

Bangladesh has a long history of tropical cyclones, and the government estimates a severe cyclone in the coastal areas once every three years. The land area is less than 7 meters above sea level, and a study has shown that high tides in Bangladesh are rising 10 times faster than the global average.¹³ Cyclones are most common in the southwest parts of the country with the lowest-lying villages in the river deltas of the Bay of Bengal. In the past decade, Bangladesh has faced over 10 deadly cyclones, although the deadliest occurred in 1991. That storm forced a 6-meter storm surge inland over a wide area, killing at least 138,000 people and displacing 10 million people.¹⁴ A recent chronological record of cyclones in Bangladesh is given in Table 1.¹⁵

Table 1. Chronological list of major tropical cyclones in Bangladesh in recent years

Month/Year	Cyclone	Damage Caused
May 2007	Akash	14 deaths and damages amounting to US\$ 982 million
Nov 2007	Sidr	3,500 deaths and severe damage to households/livestock
Oct 2008	Rashmi	15 deaths and thousands of homes destroyed
Apr 2009	Bijli	0 deaths and some agricultural lands destroyed
May 2009	Aila	150 deaths, 200,000 houses destroyed and crop losses
May 2013	Viyaru	17 deaths and 1.3 million people displaced; crop losses amounting to US\$ 5.14 million
Jul 2015	Komen	132 deaths, 510,000 houses destroyed and over 667,221 acres of land damaged
May 2016	Roanu	26 deaths, 40,000 homesteads destroyed and severe damage to livestock, fish and shrimp farms
Aug 2016	Dianmu	0 deaths and some agricultural lands damaged
May 2017	Mora	9 deaths, 500,000 people displaced and 20,000 homes destroyed

In addition to displacing large numbers of people, cyclones have an adverse effect on the agricultural sector. During Cyclone Marian in 1991, 247,000 tons of cereal crops and 35,000 tons of vegetable, tubers and other crops were lost.¹⁶ Damage to coastal embankments, high salinity in some areas and a shortage of tools, seeds, and fertilizers made the prospects for rice crop bleak in the months following the cyclone. The port city of Chittagong suffered heavy damage and the port itself was left in shambles. The cost of reconstruction and rehabilitation was estimated at US\$ 1.78 billion by a UN task force that investigated the cyclone's impact. The Government of Bangladesh sought support of several international aid agencies that led to the formation of joint task forces to build stronger early warning systems, more cyclone shelters, coastal embankments and a more widespread community volunteers to support rehabilitation efforts.

3. Droughts

The northwestern regions of Bangladesh are primarily affected by droughts, historically occurring annually between mid-September and mid-November. Between 1960 and 1991, there

were 19 drought events in the country, with particularly severe events in 1961, 1975, 1981, 1984, 1989, 1994 and 2000.¹⁷ These relatively stronger droughts affected about 53 percent of the population with widespread damage to agricultural crops. Increased summer drying and shortage of water lead to more incidents of illnesses among children, increases in crop pests and diseases, increased energy demand, and excessive heat stress among livestock. Climate scientists estimate the dry seasons will be more prolonged by 2020 as a result of climate change, turning existing drought-affected areas into severely drought prone areas.¹⁸

Government records show that 92 percent of the water in Bangladesh comes from the river network that flows from India.¹⁹ As a result, construction of dams, barrages and structural interventions upstream obstruct the flow of water into the country. Added to relatively less rainfall during the dry season, scarcity in the flow of water leads to tremendous suffering among people in the northern districts. Unemployment peaks because of decreased rice yields during this season and results in food shortage and migration into the capital.

4. Landslides

Although landslides contributed to only 0.14 percent of the damage caused by natural disasters between 2009 and 2014, they are increasingly concerning for the government because of climate change and excessive rainfall.²⁰ Physio-geographically, only 18 percent of Bangladesh is hilly and tract area, almost all of which is concentrated in the southeast region of the country, namely Chittagong division. In 2007, Chittagong experienced one of the deadliest landslides recorded, killing over 100 people. Experts have attributed weak structure, rampant deforestation, and indiscriminate use of land to frequent and fatal landslides in the region.²¹ The following maps illustrate the most susceptible areas for landslides in the Chittagong Metropolitan Area.²²

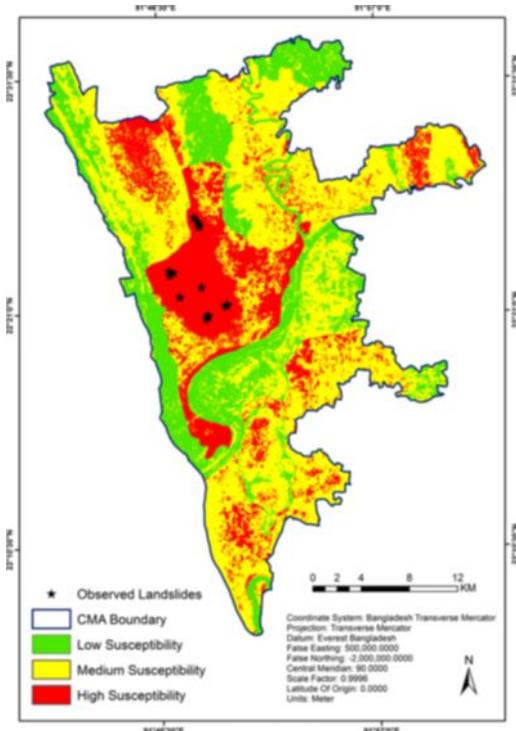


Fig. 4. Landslide susceptibility map

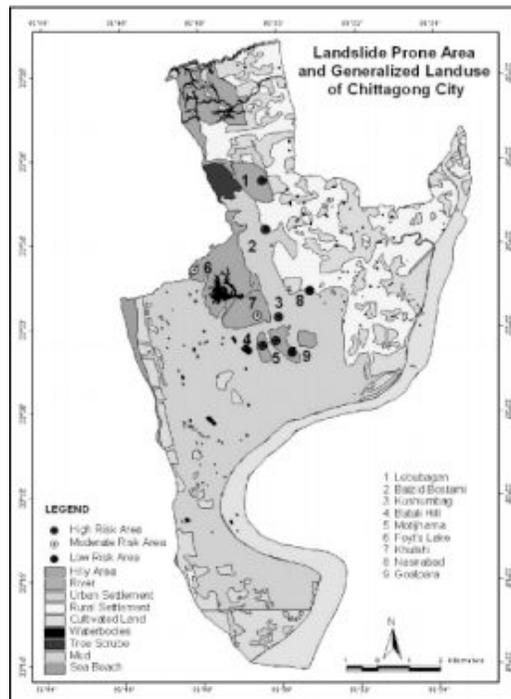


Fig. 5. Landslide vulnerability and generalized land use of Chittagong Metropolitan Area

The government is increasing efforts to conduct comprehensive and regular landslide vulnerability assessments and subsequent zoning policies. Furthermore, settlements at the bottom of hills are also being slowly relocated, however a large number of the settlers are *adivasis* (“indigenous people”) and Rohingya refugees. As a result, there has been political resistance in implementing zoning plans, to be discussed in greater detail in the following sections.

5. Earthquakes

A study published as recently as 2016 estimated that a huge earthquake might be building beneath Bangladesh as a result of a subduction zone.²³ Scientists have discovered evidence of increasing strain in the two tectonic plates that underlie the delta that have been building for at least 400 years. The anticipated earthquake is likely to be larger than 8.2 in magnitude, with the

potential to affect at least 140 million people in the region. This subduction zone is an extension of the same tectonic boundary that caused the 2004 Indian Ocean undersea quake and 2015 Nepal quake (killing 8,000 people).

This new research was published only two months after panic spread in the aftermath of a 6.7 magnitude earthquake.²⁴ Although no lives were lost, this earthquake served as a warning to the Government of Bangladesh to prepare for a stronger event that could potentially bring the country, especially the capital, to rubble. The danger not only lies with Bangladesh's high population density, but also with the rampant, unplanned urbanization with high-rise buildings that are not prepared to endure quakes.

Political Landscape

The history of Bangladesh's relevant political landscape begins after its independence from Pakistan in 1971. Sheikh Mujibur Rahman, who led the country to its independence and assumed presidency immediately afterwards, helped the country to enter into the United Nations and the Non-Aligned Movement. To build the country, he appealed for humanitarian and development assistance from the United States, European nations and the United Kingdom.²⁵ In 1973, Bangladesh held its first election and Mujib's party had a landslide victory, assuming the office of the prime minister. In 1974, the country was hit by one of the worst famines recorded in history that killed approximately 150 Bangladeshis, putting Mujib under intense pressure.

Following the famine, Bangladesh was facing increasing social and political unrest. In 1975, Mujib declared a state of emergency and approved a constitutional amendment banning all opposition political parties.²⁶ He also spearheaded the formation of Bangladesh Krishak Sramik Awami League (BAKSAL) that identified itself with rural masses and took control of

government machinery.²⁷ Disgruntled by his extraordinary powers, his colleagues at the Awami League planned a coup and Mujib was assassinated on August 15, 1975. Only his daughters, Sheikh Hasina and Sheikh Rehana survived and were banned from returning to Bangladesh. His former confidante, Khondakar Mostaq Ahmad, became his immediate successor, and the country was thrown into several years of political turmoil. In 1977, army chief Ziaur Rahman was given control following another coup and declared himself President in 1978. Rahman signed the Indemnity Ordinance, giving immunity from prosecution to the men who plotted and assassinated Mujib.²⁸

Rahman was assassinated by dissident elements of the military in 1981 and then Army Chief Hussain Mohammad Ershad assumed power in a bloodless coup in 1982. Ershad declared martial law and remained in power for nearly a decade, bringing significant changes in Bangladesh's economic and sociopolitical landscapes. During his regime, he privatized state-owned industries, encouraged foreign companies to invest in the country, and banned political parties and trade unions. He sought the participation of opposition political parties in local elections under martial law that led to controversies and public protests. A wide umbrella of political parties united against Ershad and forced him to offer his resignation.

Khaleda Zia, widow of Ziaur Rahman and leader of Bangladesh Nationalist Party (BNP), won pluralist seats in the election after Ershad's resignation and assumed the role of Prime Minister. This marked a turning point in Bangladesh's political history as it returned the parliament to its original 1972 constitution. In subsequent elections, BNP and Awami League each formed governments with different economic priorities, nevertheless co-investing in risk reduction and disaster response in rural Bangladesh. In 2008, Sheikh Hasina and the Awami League won majority vote and have since controlled the legislature. In spite of repeated attempts

to host a fair election, the ruling Awami League had strategically replaced all opposition political leaders or charged them with corruption, putting them to jail. In 2014, the 10th General Elections were held in Bangladesh, although both BNP and Jamaat-e-Islami (Bangladesh's Islamist party and allies with BNP) had boycotted the election. Awami League continues to lead the country under Sheikh Hasina.

Socioeconomic Landscape

Bangladesh has made great strides in reducing poverty from 44.2 percent in 1991 to 18.5 percent in 2010. Nearly 20.5 million people have been lifted out of poverty between 1991 and 2010.²⁹ In parallel, life expectancy, literacy, and per capita food production have significantly increased, allowing Bangladesh to reach its lower middle-income country status in 2014. In 2016, the country's GDP was estimated at US\$ 221.4 billion.³

According to the IMF, Bangladesh is the second fastest growing economy of 2016 at a rate of 7.1 percent. Per capita income is estimated at US\$ 3,840 (PPP) and US\$ 1,466 (Nominal).³⁰ The country is heavily dependent on international aid and humanitarian assistance for poverty alleviation, and is currently a member of Commonwealth of Nations, D-8 Organization for Economic Cooperation, South Asian Association for Regional Cooperation, the International Monetary Fund, the World Bank, the World Trade Organization, and the Asian Infrastructure Investment Bank.

While Bangladesh's population has been growing steadily in the past decade, the recent influx of 300,000 to 500,000 (estimated) Rohingya refugees from Myanmar in the southeastern region of the country has led to political and social unrest.

Institutional Capacity for Disaster Preparedness and Risk Reduction

Bangladesh has several bodies to address disaster preparedness, risk reduction and response. The Ministry of Disaster Management and Relief was formed in 1972 and went through several changes before becoming the leading authority on determining the policies and allocation of budget on disaster-related efforts. Under the leadership of the Prime Minister, the Ministry of Disaster Management and Relief also organizes the National Disaster Management Council that has representatives from the various institutions at national and local levels to tackle natural disasters in the country.

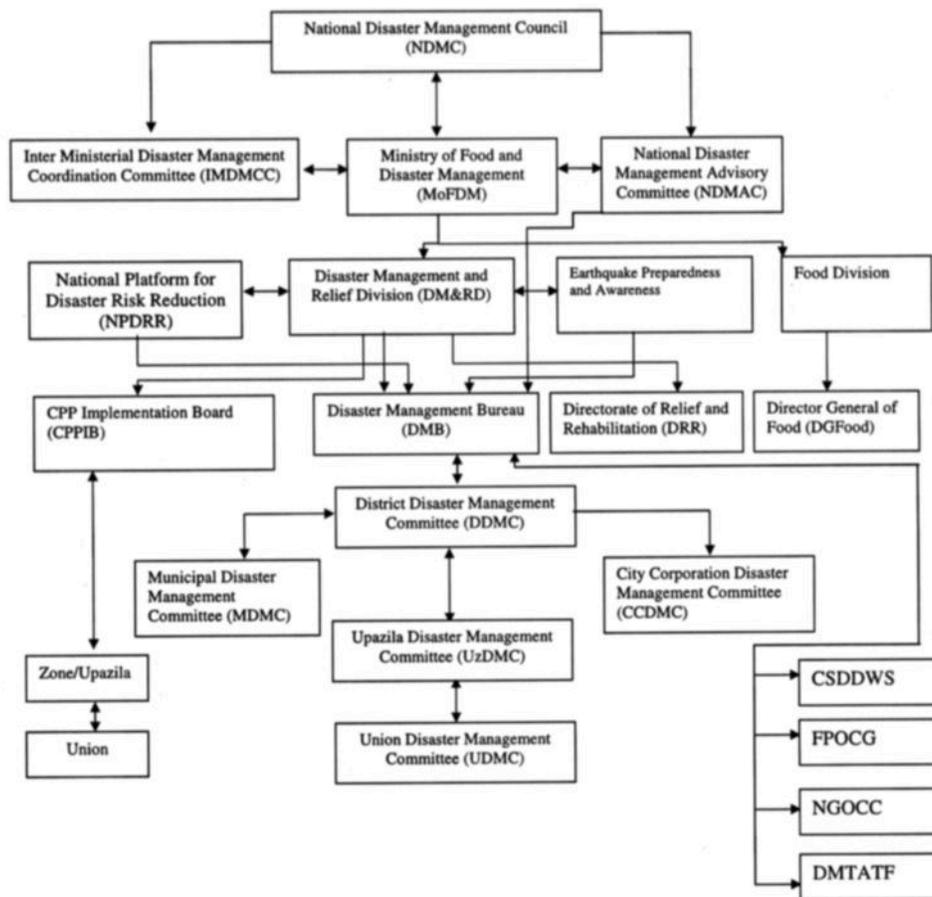


Fig. 6. Hierarchy of different disaster management institutions in Bangladesh

The National Disaster Management Regulatory Framework (NDMRF) provides a set of guidelines for disaster preparedness, risk reduction, and response. The framework was developed with the intent to mainstream risk reduction efforts within government, NGO, and private sector activities, thereby placing it on par with the framework for poverty reduction. The framework includes:

1. National Disaster Management Act, 2015-2020
2. National Disaster Management Policy
3. National Disaster Management Plan
4. Standing Order on Disaster
5. Guidelines for Government at all Levels (Best Practice Models)

In practice, the Government of Bangladesh has implemented disaster preparedness and risk reduction through the lens of poverty alleviation. Therefore, much of the country's efforts in tackling natural disasters rest heavily on the economic empowerment of its population and social safety net programs.

While Bangladesh has recently adopted the Sendai Framework for Disaster Risk Reduction, much of its past strategy and implementation has been in accordance to the Hyogo Framework for Action. As part of the analytical exercise for this case study, the Hyogo Framework provides a structure and set of priorities to evaluate Bangladesh's progress in managing natural disasters.

Priority 1: Ensure that disaster risk reduction is a national and local priority with a strong basis for implementation

The Government of Bangladesh has been lauded internationally for its comprehensive implementation strategy that extends from the central government to local public officials. In principle, the National Disaster Management Regulatory Framework involves all levels of the government as outlined in Figure 7.

In practice, however, the budget and resource distribution is determined by NDMC, and implemented through local government and institutional bodies. As a result, emphasis has been placed primarily on infrastructure instead of community awareness and capacity building; over 5000 shelters have been built till date. NDMC facilitates a tender system for the construction of shelters that has reduced community participation and transparency in local government. These construction tenders are usually ‘won’ by the military, positioning them as influential players in decision making. The military also acts as first respondents in the event of any natural disaster, although they do not have a dedicated budget for it and draw instead from the Prime Minister’s reserve fund to pay for these activities. The tender system and central decision making have disempowered elected local public officials and resulted in ‘trust gaps’ between members of the community.

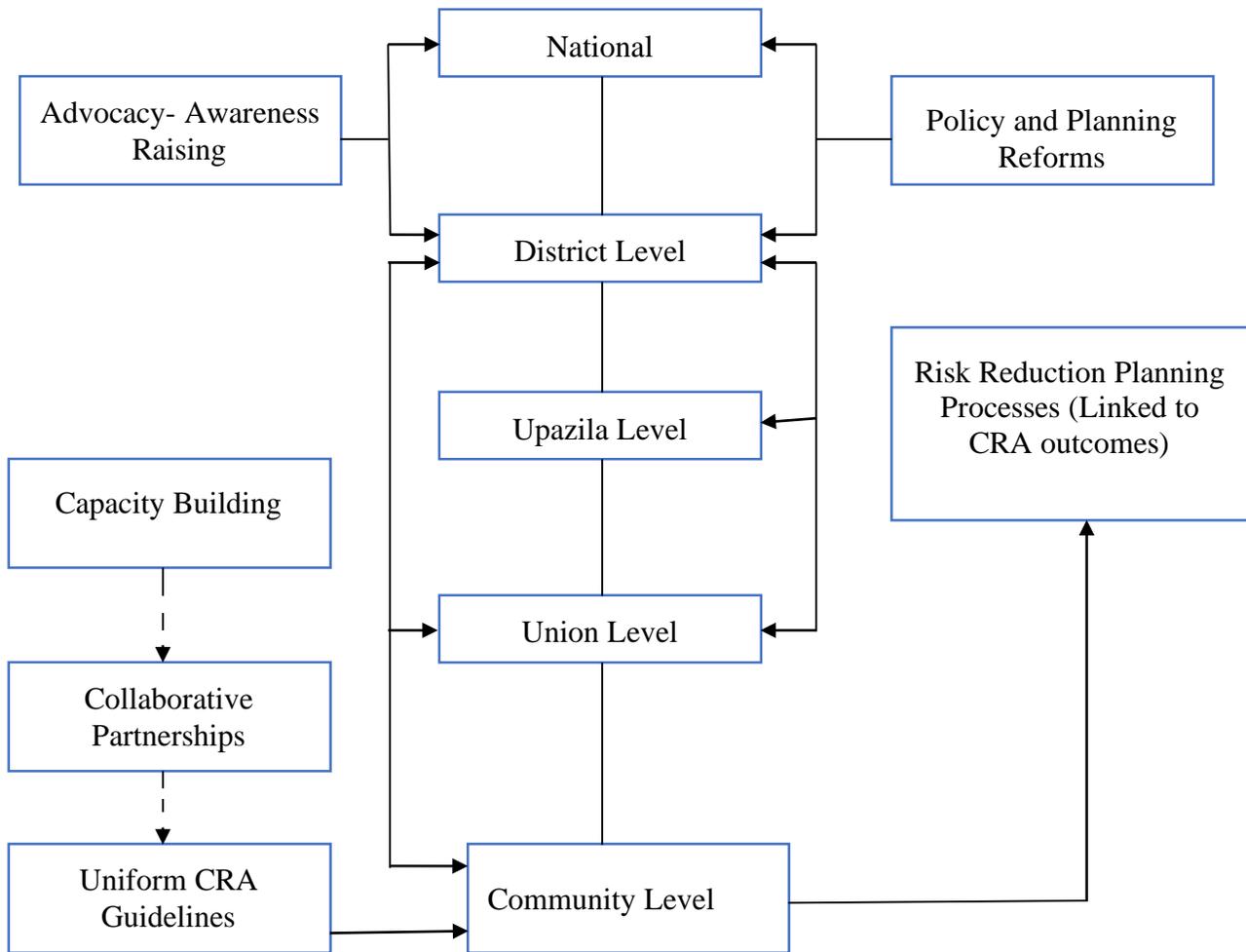


Fig. 7. Mainstreaming disaster management at all levels of the government

In addition to a top-down approach, the National Disaster Management Regulatory Framework does not account for government bodies outside of the traditional hierarchy of institutions. For example, almost all cyclone shelters in Bangladesh are primary schools built on raised ground, that effectively makes the shelters as much as a budgetary concern for Ministry of Education as it is for Ministry of Disaster Management and Relief. In the aftermath of the tornado in 2013 in Brahmanbaria, the ministries discussed an integrated plan that should include members of all ministries, however it is yet to be formulated. Field research showed that the NDMC budget is insufficient for managing large-scale disaster rehabilitation and will require a

shared fund between national government bodies in order to reconstruct, for example, buildings, schools and roads. This lack of coordination between different government verticals hit closer to home when 48,000 families were displaced after Cyclone Aila, and spent over 14 months on the streets. This was because of lag time between constructing new houses, roads and schools as each project falls under a different ministry in the government.

Much of the government's success in tackling natural disasters comes through the adoption of a key strategy: treating disaster management through the lens of poverty alleviation. Therefore, national and local bodies in addition to international aid agencies are forced to collaborate on both fronts. Poorer areas are prioritized during response and relief distribution. Climate vulnerability of a region is estimated using its poverty index, population and economic indicators, and tackled by increasing food security as means of improving resilience within communities. The World Bank in particular has been instrumental in supporting the government to respond and recover from natural disasters through infrastructure, embankments, early warning systems, and community mobilization.

In spite of such a broad strategy, there is a lack of integration between the United Nations (UN), the Government of Bangladesh and local NGOs. In principle, the government, supported by the World Bank and Asian Development Bank, leads infrastructural projects, the UN leads development initiatives, and local NGOs take charge of voluntary efforts. In reality, though, the UN, given its history in assisting Bangladesh immediately after independence, plays an authoritative role in shaping disaster management policies with the central government. The government in turn, and as a result of being heavily politicized, fails to engage local elected public officials, NGOs, and civil society organizations in the process. The participation of NGOs and civil society organizations in policymaking has not been institutionalized; they are only

involved when decisions have already been made in order to implement them. Consequently, disaster management has been tied primarily to development indicators determined by the government and the UN thus far and focused entirely on response, rather than preparation.

Priority 2: Identify, assess and monitor disaster risks and enhance early warning

Bangladesh's early warning system has improved significantly in recent years. In addition to technological advancements, the current early warning system involves a wide network of local volunteers and community radio to disseminate information (Figure 8). The success of a comprehensive early warning system depends both on the technical processes that turn meteorological data into warnings, and human factors that transform warnings into actions.³¹ The Storm Warning Center and Flood Warning Center are two specialized units of Bangladesh Meteorological Department (BMD), and are responsible for forecasting and issuing warnings for tropical cyclones and floods in Bangladesh. This data is collected and monitored by Bangladesh Space Research and Remote Sensing Organization (SPARSSO) and distributed to relevant government bodies for public consumption. At present, BMD receives meteorological data through 35 ground-based, 10 weather balloons, 5 radars and 3 radiosonde stations; while SPARSSO collects data through satellites and numerical-model-generated forecasts from other national and regional meteorological offices as a member state of World Meteorological Organization.³² Currently, BMD employs two techniques: (a) Storm Track Prediction (STP), and (b) Steering and Persistence (STEEPER) for forecasting tropical cyclones.³³ Neither STP nor STEEPER is sufficiently advanced technologically and therefore cannot produce forecasts with accuracy for more than 12 hours ahead.³⁴

In 2015, the government announced plans to expand a satellite-based forecasting and warning system developed by SERVIR to aid in improving lead time for flood warnings. The system relies on the Jason-2 satellite and was successfully able to forecast the flooding eight days in advance at nine locations of the Ganges and Brahmaputra River Basins in 2014.³⁵ The Cyclone Preparedness Program has invested heavily in training over 65,000 volunteers and building capacity at local level with support from Red Cross International and USAID. There is also reliance on local knowledge and community to disseminate information; studies have shown that recipients of warnings messages tend to respond in clusters, not as isolated individuals.³² Fishermen, for example, will not go out to the sea in certain months during the monsoon season because of their religious and mythological beliefs, and coincidentally or not, those are the same months when historically there have been more cyclones and storm surges.

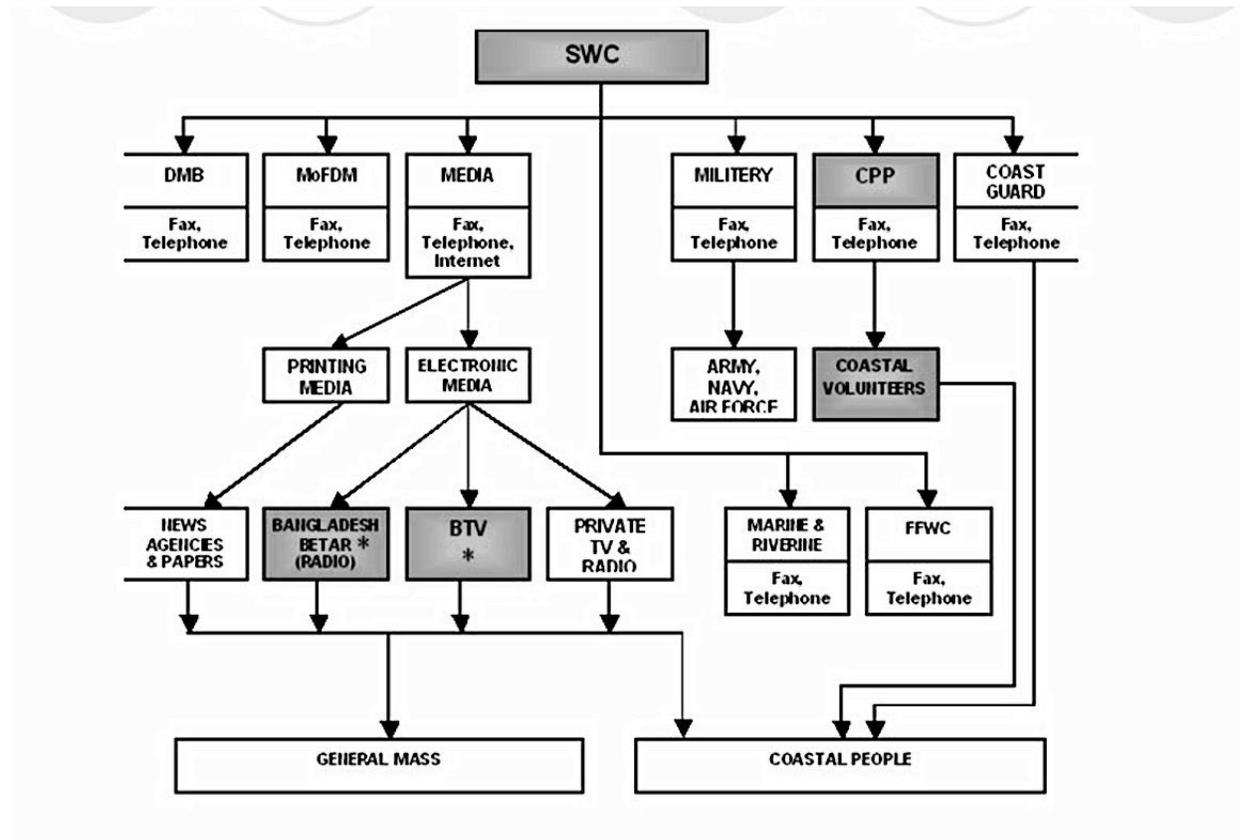


Fig. 8. Early warning dissemination system in Bangladesh; SWC now reorganized as BMD

Priority 3: Use knowledge, innovation and education to build a culture of safety and resilience at all levels

In the aftermath of the catastrophic floods in 1988 and cyclone in 1991, the Government of Bangladesh has included disaster preparedness and information on early warning systems in the national curriculum of the country. Primary schools are often built as cyclone shelters, providing children and young adults with awareness from an early age about safety and resilience. There are several community interventions spearheaded by local NGOs and international agencies that work towards improving community awareness on natural disasters.

Bangladesh has had a long and successful track record in using local knowledge to develop community-driven interventions and innovations to tackle its socioeconomic hazards. For example, water is being desalinated using rainwater and solar technology, southern regions are promoting 'floating agriculture', locals are investing towards housing on raised ground, and afforestation of tall trees is preventing more deaths by lightning strikes. At the same time, the government is also investing heavily in developing a multi-hazard disaster map that will inform policymakers about the most vulnerable areas and subsequent disaster management plans.

An ongoing draft agreement with SAARC countries allows the government to reach out to neighbors for support at the offset of a severe natural disaster. The agreement also creates opportunities for multi-country research projects to tackle climate change as a region. Japan's development corporation, JICA, was also on boarded to build a desalinization plant in Bangladesh, bringing Japanese technology and knowledge to local climate scientists.

However, much of these efforts are focused on infrastructure and little has been done to improve capacity within the government. One of the biggest challenges in tackling disasters has been the lack of skilled professionals who are innovating and implementing cutting-edge

technology to support Bangladesh's efforts in disaster preparedness. Climate change adaptation has added urgency in the need to improve the government's capacity – both at national and local levels – in responding to the community and incoming threats. Global knowledge is not being disseminated as effectively at the local level and new linkages are not being created. As a result, most efforts are still centered on response instead of preparedness.

Priority 4: Reduce the underlying risk factors

While the government is investing heavily in infrastructure and mapping of natural disasters, there seems to be lack of efforts in tackling underlying factors that contribute towards them. Landslides, for example, have been more frequent in recent years as a result of rampant deforestation and agriculture in hilly areas. Uncontrolled urbanization is contributing towards increasing risks of fatalities and widespread damage during earthquakes. This accounts for the government's negligence in addressing institutional and human resource challenges within the various verticals that are concerned with disaster management in the country.³⁶ Corruption and misallocation of funds are associated with an inability to develop preventive measures instead of responsive ones.

An ongoing challenge is the lack of coordination between international organizations, NGOs, civil society organizations, and the government in designing and implementing preparedness initiatives. There is also a gap between local communities and the government, which results in a relief-centric approach because people want to stock up on supplies to reduce risks for future disasters. Although the government has recently shifted from relief-centric disaster management into cash-based and conditional cash transfer programs, there is an ongoing

dependency on the government that has affected the locals' capacity to self-sufficiently respond to natural disasters.

Interviewees also identified the local media as a 'threat' in disaster preparedness. The traditional press and electronic media often tend to overestimate the risk of a warning and report 'falsely' or, sometimes, too early, before BMD has had a chance to evaluate the situation. Panic and distress spreads even when the risk is relatively lower and evacuation efforts do not need to be carried out. The recent shift from print to digital media has led to numerous fresh 'online news sites' on the Internet that are known to publish unverified 'news' content. As people are getting more connected through smartphones and social media, there is increasing dearth of informed and responsible news consumption.

Priority 5: Strengthen disaster preparedness for response at all levels

The government relies on local NGOs, civil society organizations, and international agencies in building capacity of communities and providing emergency relief. Smaller NGOs such as Muslim Aid build capacity at the lowest level – in villages and urban wards – on cyclone and flood preparedness using locally sourced and trained volunteers. Larger organizations, such as BRAC, provide disaster preparedness training through their numerous education programs and village-level meetings. Partnerships between the Department of Disaster Management and NGOs have led to the development and implementation of several training modules to educate and prepare local communities against floods, cyclones and major natural disasters.

In spite of these efforts, central decision making has limited the impact of training programs at local levels. There is only one Disaster Relief and Rehabilitation Officer (DRRO) appointed at each district who is in-charge of both preparing and responding to emergencies, and

does not have the necessary resources to do so effectively. The DRRO is sometimes assisted by the Project Implementation Officer (PIO) at the *upazilla* (sub-district) level in larger districts, but has no vehicle or access to the volunteer network, making dissemination of information extremely difficult. Both the DRRO and PIO are government-appointed staff at the district office who are carrying out decisions made by the central government. In other words, the local Members of Parliament (MPs) and sub-national elected officials have no influence over decisions, communicating with their communities, or determining best practices. Although disaster preparedness is essential to their election mandate, the political will at the national level does not accommodate their visions.

External actors such as international organizations have primarily set up conditional cash transfer or cash disbursement programs in the most vulnerable areas, thereby discouraging the culture of information dissemination and preparation in local communities. As a result, it becomes challenging to evacuate large masses of people at the onset of a storm or flood because people underestimate the risk, and may be too tied to their religious beliefs or land to move. This is in part because of poor governance making it difficult to reclaim land ownership after an area has been damaged during a storm or flood.

What is encouraging, however, is the government's initiative in developing thorough Standing Orders on Disasters (SOD) that provide clear guidelines on the role of different parties in the event of a major natural disaster. The guidelines are robust in the sense that they emphasize collaboration and situation-based response, and are updated annually to reflect new challenges. The limitation of the past SOD is its role in urban disaster management, primarily earthquakes, which the government intends to address in the next set of SOD, starting 2017.

Summary

The Government of Bangladesh has invested significantly on disaster management and risk reduction, primarily focusing on infrastructure and improving development indicators. Although these efforts had been focused on response in past years, increasing pressure from international partners and local communities have led to new initiatives that are most preparation-centric. There are robust and comprehensive policies that tackle disaster preparedness in the country, however lack of skilled professionals, poor governance and central decision-making has made implementation of many of these policies difficult. As a result of multiple stakeholders in disaster management, the government's biggest priority is to manage their expectations while keeping in mind that community empowerment is key to building a more resilient country.

Hypotheses

In this section, we consider a set of hypotheses on why the governments may or may not invest in disaster preparedness based on what was learnt through extensive literature review and field research in Bangladesh.

Moral Hazard

Hypothesis: If governments anticipate that other actors will spend on preparedness or response, they will spend less on preparedness.

Bangladesh's ongoing relationship with The World Bank Group began in 1970 in the aftermath of one of the country's deadliest cyclones.³⁷ Since then, the international organization has supported the government in many infrastructural projects – 15% of its overall budget for

Bangladesh is dedicated to disaster management and risk reduction. In a similar vein, the United Nations stepped in immediately after Bangladesh's independence to support rebuilding the country and has played an instrumental role shaping the country's policies in disaster preparedness. Both organizations work closely with the Ministry of Finance and Ministry of Disaster Management and Relief to support ongoing efforts in climate change adaptation.

As a result of these long-term relationships, a significant proportion of government spending on disaster management is dependent on international aid. The Annual Development Program (ADP), for example, is the basic instrument for the implementation of plans and programs for national development based on the estimates and proposals placed forward by various ministries. A significant share of the ADP has been funded through external sources.³⁸ In past years, nearly 84 percent of funding allocated for disaster management through the ADP was sourced from international organizations.

The National Plan for Disaster Management takes into account the role of the national budget in funding infrastructural projects and capacity building of the locals.³⁹ In recent years, the dependency on international aid has substantially decreased and disaster management plans are jointly funded through national budget allocations and ADP. While it is extremely difficult to quantify the effect of public finance on disaster management or separate the impact of foreign funds from national funds, it can be estimated based on the field research that Bangladesh is investing more inwards, that is, allocating more funds to disaster management in local communities and regional governments. This suggests that, despite the historical importance of international support in areas of disaster management, the government of Bangladesh may not be overly influenced by the risks of moral hazard related to international aid.

There is, however, increasing dependency on the domestic military to manage emergency situations, often expanding to military response in low-risk natural disasters. This overreliance on the military is a different category of moral hazard, which disincentivises the government from spending more to build resilience within the community and invest in preparedness.

Perceived Risk

Hypothesis: If a government perceives the risk of a disaster is high, they will invest more in preparedness.

Although traditionally the Government of Bangladesh has adopted a response-centric approach, it is increasingly investing in preparedness. This is particularly true for earthquakes. With frequent tremors in the country as a result of earthquakes in surrounding regions and studies on the growing pressure between tectonic plates beneath the country's capital, the government has put together several plans and funding requests to tackle earthquakes. Field research suggested that the Ministry of Disaster Management and Relief has purchased 1 million tents for emergencies caused by earthquake, while the World Bank and the Ministry of Finance have developed a new strategy for urban disaster management.

Cyclones have also received more government attention because of the associated risks of climate change. In National Disaster Management Plan for 2015-2020, the government has emphasized on the construction of more cyclone shelters, community capacity building programs and a comprehensive multi-hazard disaster mapping in order to allocate resources accordingly.

With these efforts, it is evident that the government is prepared to invest more if the perceived risk is high.

Political Development and Electoral Incentives

Hypothesis: If a government is more developed in terms of the quality of its politicians and the quality and independence of its bureaucrats, then it will prepare better for natural disasters.

Hypothesis: If a government perceives disaster preparedness to be electorally beneficial, then it will spend more on preparedness.

Bangladesh has a comprehensive, structured framework for disaster management, but much of it depends on a central committee. A growing concern that was reiterated during the field research is the lack of investment in human resources and institutional capacity building within the government. In particular, the limited role of elected local public officials in the allocation and distribution of disaster-specific funds, designing and dissemination training modules and response in the event of an emergency have severely crippled local government in earning the trust of the community.

Interviewees also offered support for an alternative hypothesis that combines expectations about the relevance of an independent bureaucracy and the importance of electoral incentives for investments in preparedness. The suggestion here is that an *excess* of independence within the bureaucracy can have adverse effects on building community resilience, via its effects on the perceived role of elected officials. In the Bangladesh case, a government employee, as opposed to an elected public official, acts as the local gatekeeper and key implementer of decisions made by the central government. This effectively disincentivizes elected local public officials from following through their commitment to work with communities to tackle disasters, participate in training programs, and understate the catastrophic impact of natural disasters on the most vulnerable communities. Thus, because locally elected officials cannot claim credit for implementing preparedness initiatives, they do not offer support

that would facilitate improved implementation in coordination with the bureaucracy. This dynamic also creates an information gap whereby the central government fails to maximize the use of local knowledge in mapping and managing disasters, and relies on institutional data rather than the high-resolution, qualitative data to develop and implement their plans.

Civil Society

Hypothesis: Levels of disaster preparedness may be higher with a stronger civil society presence in general and, in particular, when there are more disaster-oriented NGOs on the ground.

The civil society in Bangladesh has had an incredible impact in supporting the rehabilitation of people affected by catastrophic natural disasters. BRAC, the world's largest NGO, initiated a dedicated department, the Disaster Management and Climate Change Program, to address ongoing challenges for disaster management. The program has played a significant role in not only ensuring food security and emergency relief after a disaster, but also spearheading several innovation initiatives such as using solar energy to desalinate water in preparing the community to become resilient against natural hazards.



Fig. 9. BRAC's Disaster Management and Climate Change Program theory of change

The most important contribution through a civil society presence in Bangladesh is seen through its increasing investment in women. Conditional cash transfer or cash disbursement programs are often distributed through head of the household in a village, in which case, when a woman loses her husband or father, she can no longer avail the funds and is left behind. Through studies and policy dialogues, civil society has pushed for gender rights in disaster management and developed nationwide training programs targeted at women to grow resilience within the community.

Additionally, civil society has also been a mouthpiece for the public, criticizing government action and agendas pushed forward by international organizations. In particular, the government's response-centric approach was heavily criticized by the civil society in the aftermath of Cyclones Sidr and Aila that has resulted in the former to change its strategies and

invest more towards building cyclone shelters, adopting advanced technologies for better estimates and early warning systems.

External Actors

Hypothesis: If a government has greater exposure to disaster preparedness from the actions of external actors, then it will invest more in preparedness.

The government is heavily dependent on external actors and international funding to support disaster preparedness. International organizations primarily support cash disbursement programs after a disaster has occurred and infrastructure projects in the country, which has essentially led much of the government's efforts in disaster management to be centered on response. Furthermore, the United Nations has played a critical role since independence in shaping disaster-related policy decisions in the government and increased dependency of the public sector on international support.

Given the context, while the country has experienced incredible growth and progress in managing disasters, it needs to take a step back and re-evaluate its internal resources and institutional capacity in absence of international support. The action of external actors has disempowered elected local public officials and in order to prepare for future catastrophic events, it is instrumental for the government to invest now in building its human resources and investing more in community resilience instead of infrastructure and relief.

Conclusion

Policy Recommendations

Based on this examination of disaster preparedness and risk reduction in Bangladesh, a number of policy recommendations can be put forward.

- 1. The government needs to invest more in building institutional capacity within the public sector, in particular at the local level.** Elected public officials at the local level are the important linkage between government and communities, especially to retain trust and for future elections. By empowering elected local public officials through training and participation in national level policy decisions, the government can achieve its goal to build more resilient communities. Furthermore, human resources need to be deployed at district and local level in order to support the work of public officials prior to and after a natural hazard. An extensive evaluation of the government's internal capacity in addressing different kinds of natural hazards will be the first step towards achieving this policy recommendation.
- 2. The government needs to engage in more in community capacity building to reduce reliance on international actors and the military.** Overreliance on the military and cash disbursement programs supported by international organizations have led to a more response-centric approach in disaster management. In order to achieve the priorities set by the Sendai Framework, the government now needs to shift its attention to local NGOs and civil societies to collaboratively develop and implement nationwide programs and awareness campaigns on a number of natural disasters. These programs should take into

account gender, religion and socioeconomic factors that influence group-level and individual-level decisions within a community.

3. The government needs to support technological advancements to improve early warning systems and evaluation of perceived risk of disasters. Although the government has made some strides in adopting more advanced technologies to provide flood warnings well ahead of time, similar initiatives need to be taken in developing tools and resources to develop more robust early warning estimates for a range of natural disasters. Bangladesh's vulnerability in terms of climate change and high population density makes early learning critical to avoiding a high death toll, and at present, the reliance on Indian and Chinese satellites have delayed the process. The government needs to invest quickly and significantly on local innovations in order to provide large amounts of data for more accurate estimations of incoming hazards.

4. The government needs to make a significant shift from response to preparedness. The recent investment in preparing for earthquakes and cyclones was widely lauded in both private and public sectors, and calls for similar investment in floods, landslides and other natural disasters. This is particularly important because preparedness addresses a number of underlying factors that increase the risks of damage caused by a natural hazard, such as unplanned urbanization, rampant deforestation and lack of institutional capacity at local level. Preparedness will also entail greater collaboration between various stakeholders in order to maximize impact and create opportunities for institutionalizing the role of NGOs in developing policies for disaster management.

Future Research

The research presented here has allowed for a wider understanding of the state of disaster management and risk reduction in Bangladesh, especially in terms of the role of various stakeholders. There is, however, lack of data on evaluating the role and effect of public finance in disaster management, or investigating how Bangladesh can tackle the influx of Rohingya refugees, most of whom are in areas susceptible to landslides. Further research is also necessary to evaluate and map local NGOs who are focused on disaster management at the local level, and to provide an integrated strategy to represent their voice and experience in developing policies.

Notes

¹ Khan, A. (2013) “Bangladesh – the Most Climate Vulnerable Country.” World Bank, South Asia. Retrieved from <http://blogs.worldbank.org/endpovertyinsouthasia/bangladesh-most-climate-vulnerable-country>

² Climate Change and Environmental Risk Atlas. (2014). Maplecroft. Retrieved from <https://maplecroft.com/portfolio/new-analysis/2013/10/30/31-global-economic-output-forecast-face-high-or-extreme-climate-change-risks-2025-maplecroft-risk-atlas/>

³ World Bank Development Indicators (2016). World Bank. Retrieved from <http://data.worldbank.org/country/bangladesh>

⁴ *See id.*

⁵ CIA World Factbook (2016). Central Intelligence Agency. Retrieved from <https://www.cia.gov/library/publications/the-world-factbook/geos/bg.html>

⁶ World Bank Development Indicators (2016). World Bank. Retrieved from <http://data.worldbank.org/country/bangladesh>

⁷ Bangladesh Meteorological Department (2010)

⁸ Department of Disaster Management (2015). Retrieved from [http://www.ddm.gov.bd/site/page/08734402-38af-4c70-a954-6e4034103a05/এসওডি\(SOD\)](http://www.ddm.gov.bd/site/page/08734402-38af-4c70-a954-6e4034103a05/এসওডি(SOD))

⁹ Aitsi-Selmi, A., Egawa, S., Sasaki, H., Wannous, C., & Murray, V. (2015). The Sendai framework for disaster risk reduction: Renewing the global commitment to people’s resilience, health, and well-being. *International Journal of Disaster Risk Science*, 6(2), 164-176.

¹⁰ Islam, S. (2014) “River and Drainage System.” In *Banglapedia: National Encyclopedia of Bangladesh*. Asiatic Society of Bangladesh. Retrieved December 27, 2016 from <http://en.banglapedia.org/>

¹¹ Global Register for Extreme Flood Events (1987). Dartmouth University. Retrieved from <http://www.dartmouth.edu/~floods/Archives/1987sum.htm>

¹² Staff correspondent. (1988, July 11). “Flood relief in Bangladesh.” *The New York Times*. Retrieved from <http://www.nytimes.com/1988/07/11/world/flood-relief-in-bangladesh.html>

¹³ Pethick, J., & Orford, J. (2013). “Rapid rise in Effective Sea-Level in southwest Bangladesh: Its causes and contemporary rates.” *Global and Planetary Change*, 111, 237–245. DOI: 10.1016/j.gloplacha.2013.09.019

¹⁴ “NOAA's Top Global Weather, Water and Climate Events of the 20th Century.” (2012). *NOAA Backgrounder*. Retrieved April 1, 2017.

¹⁵ Islam, S. (2017) “Cyclones.” In *Banglapedia: National Encyclopedia of Bangladesh*. Asiatic Society of Bangladesh. Retrieved June 27, 2017 from <http://en.banglapedia.org/>

¹⁶ “The Bangladesh Cyclone of 1991”. (2003) *USAID Archives*. Retrieved on January 17, 2016 from <http://pdf.usaid.gov>

-
- ¹⁷ Dey, N. C., M. S. Alam, A. K. Sajjan, M A. Bhuiyan, L. Ghose, Y. Ibaraki and F. Karim. (2011) "Assessing Environmental and Health Impact of Drought in the Northwest Bangladesh." *J. Environ. Sci. & Natural Resources*, 4(2): 89-97.
- ¹⁸ Smakhtin, V. U., & Hughes, D. A. (2004). "Review, automated estimation and analyses of drought indices in South Asia" (*Vol. 83*). *Iwmi*.
- ¹⁹ MOEF (Ministry of Environment and Forest, G.o.t.P.s.R.o.B., (2005) "National Adaptation Programme of Action. Final Report." *UNFCCC*.
- ²⁰ "Bangladesh Disaster Related Statistics" (2015) *Bangladesh Bureau of Statistics, Ministry of Planning*. 7.1: 65-70
- ²¹ Mahmood, A. B., & Khan, M. H. (2010). "Landslide vulnerability of Bangladesh hills and sustainable management options: a case study of 2007 landslide in Chittagong City". *Messages v*.
- ²² Ahmed, B. (2015). Landslide susceptibility mapping using multi-criteria evaluation techniques in Chittagong Metropolitan Area, Bangladesh. *Landslides*, 12(6), 1077-1095. Retrieved from <https://link.springer.com/article/10.1007/s10346-014-0521-x>
- ²³ Steckler, M. S., Mondal, D. R., Akhter, S. H., Seeber, L., Feng, L., Gale, J., & Howe, M. (2016). "Locked and loading megathrust linked to active subduction beneath the Indo-Burman Ranges". *Nature Geoscience*, 9(8), 615-618.
- ²⁴ Das, B. (2016, April 1) "6.7-strong pre-dawn earthquake shakes Bangladesh, spreads panic." *Bdnews24.com*. Retrieved on January 17, 2017 from <http://bdnews24.com/bangladesh/2016/01/04/6.7-strong-pre-dawn-earthquake-shakes-bangladesh-spreads-panic>
- ²⁵ Riaz, A. (2016). "Bangladesh: A Political History since Independence." *I.B. Tauris, London*. pp. 121-23
- ²⁶ *See id.*
- ²⁷ Maniruzzaman, T. (1976). "Bangladesh in 1975: The Fall of the Mujib Regime and Its Aftermath". *Asian Survey*. 16 (2): 119-29
- ²⁸ *See id.*
- ²⁹ The World Bank in Bangladesh (2016) Country Overview. *The World Bank Group*. Retrieved from <http://www.worldbank.org/en/country/bangladesh/overview#1>
- ³⁰ Staff Correspondent. (2015, May 15) "Bangladesh's per capita income \$1,314". *The Daily Star*. 15 May 2015. Retrieved January 17, 2017.
- ³¹ Drabek, T. E. (1999). Understanding disaster warning responses. *The Social Science Journal*, 36(3), 515-523.
- ³² Roy, C., Sarkar, S. K., Åberg, J., & Kovordanyi, R. (2015). The current cyclone early warning system in Bangladesh: providers' and receivers' views. *International journal of disaster risk reduction*, 12, 285-299.
- ³³ Asian Disaster Reduction Center (2005). "Total Disaster Risk Management."
- ³⁴ Debsarma, S. K. (1999). Cyclone forecasting and its constraints for the Bay of Bengal. *SMRC, Dhaka*, 7.

³⁵ Harbaugh, J. (2015, March 09). “Bangladesh Announces Nationwide Use of SERVIR Satellite-based Flood Forecasting and Warning System”. Retrieved January 26, 2017, from https://www.nasa.gov/mission_pages/servir/bangladesh-warning-system.html

³⁶ Custers, P. (1992). Cyclones in Bangladesh: a history of mismanagement. *Economic and Political Weekly*, 327-329.

³⁷ East Pakistan - Cyclone Protection and Coastal Area Rehabilitation Project (1970, December 31). *The World Bank Group*. Retrieved on January 26, 2017 from <http://documents.worldbank.org/curated/en/749181468007254635/East-Pakistan-Cyclone-Protection-and-Coastal-Area-Rehabilitation-Project>

³⁸ Benson, C. & Clay, E., (2002) “Bangladesh: Disasters and Public Finance.” *Working Paper Series No. 6, The World Bank Group*. Retrieved on March 3, 2017 from <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/4794.pdf>

³⁹ National Plan for Disaster Management (2010) *Ministry of Disaster Management and Relief, Government of Bangladesh*. Retrieved on January 26, 2017 from <http://extwprlegs1.fao.org/docs/pdf/bgd146945.pdf>

Figures and Tables

Fig.1. “Bangladesh Disaster Related Statistics” (2015) Bangladesh Bureau of Statistics, Ministry of Planning. 7.1: 65-70

Fig.2. Zaman, A.M. et al (2016) “Impacts of River Systems under 2°C Warming: Bangladesh Case Study.” Climate Services. Web.

Fig.3. Bangladesh Meteorological Department (1988) “Flood Map of Bangladesh and Level of Inundation, 1988”

Table 1. Islam, S. (2017) “Cyclones.” In Banglapedia: National Encyclopedia of Bangladesh. Asiatic Society of Bangladesh. Retrieved June 27, 2017 from <http://en.banglapedia.org/>

Fig.4. Ahmed, B. (2015). Landslide susceptibility mapping using multi-criteria evaluation techniques in Chittagong Metropolitan Area, Bangladesh. Landslides, 12(6), 1077-1095. Retrieved from <https://link.springer.com/article/10.1007/s10346-014-0521-x>

Fig.5. Mahmood, A. B., & Khan, M. H. (2010). “Landslide vulnerability of Bangladesh hills and sustainable management options: a case study of 2007 landslide in Chittagong City”. Messages v.

Fig.6. “Bangladesh Disaster Organizations” (2015) Bangladesh Bureau of Statistics, Ministry of Planning. 4.1

Fig.7. National Plan for Disaster Management (2010) Ministry of Disaster Management and Relief, Government of Bangladesh. Retrieved on January 26, 2017 from <http://extwprlegs1.fao.org/docs/pdf/bgd146945.pdf>

Fig.8. “Bangladesh Early Warning Dissemination System” (2015) Bangladesh Bureau of Statistics, Ministry of Planning. 7.4

Fig.9. BRAC Overview on Disaster Management and Climate Change Program (2016). BRAC. Retrieved on March 26, 2017 from <http://www.brac.net/disaster-management-climate-change/item/745-overview>

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