DISASTER RISK FINANCING IN BANGLADESH

Mayumi Ozaki

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ABSTRACT

Disasters pose considerable challenges not only to livelihoods but also to economy. Financial protection from disasters, i.e., disaster risk financing, has increasingly been applied in developed countries. However, the application of *ex ante* disaster risk financing is very scarce in developing countries including Bangladesh. Bangladesh is disaster-prone, with floods and cyclones being the most frequent and severe danger. Based on historical data, natural hazard events in Bangladesh cost more than $10 billion economic losses from 2000 to 2013, but the total funding available for relief, rehabilitation, and reconstruction for the same period was $2 billion only. It is estimated that Bangladesh will incur a financial impact of about $3.2 billion on average per year due to cyclone and flood, or about 2.2% of gross domestic product. Bangladesh urgently needs to develop *ex ante* disaster risk financing solutions to minimize economic impacts of catastrophes. Currently, three disaster risk finance solutions are considered effective in Bangladesh: sovereign disaster risk contingent credit, parametric sovereign risk insurance, and disaster risk microfinance portfolio insurance.

ACKNOWLEDGMENT

To develop a strategy for effective *ex ante* disaster risk financing solutions for Bangladesh, the Asian Development Bank (ADB) provided a technical assistance (TA) for Capacity Building for Disaster Risk Finance (TA 8144-BAN) in August 2012 to the Government of Bangladesh. The TA work was carried out by the team from AIR Worldwide, which comprised of Akshay Gupta (disaster risk finance specialist and team leader), Mehmet Ulubasoglu (public disaster risk finance specialist), Peeranan Towashiraporn (disaster risk profiling specialist), Simon Young (financial sector and capital market specialist), Mosleh Uddin Ahmed (financial sector and capital market specialist), Khondoker Tawhid (capacity development and knowledge management specialist), Md. Rahman (public management and disaster risk management specialist), and S.M. Rahman (financial and capital market specialist). This report is drawn from the final TA report produced by the team. The report was also peer-reviewed by Charlotte Benson, principal disaster risk management specialist, Sustainable Development and Climate Change Department, ADB and Bidyut Saha, senior project officer (financial sector), South Asia Department, ADB.

ABBREVIATIONS

ADB	Asian Development Bank
MFI	microfinance institution
NGO	nongovernment organization
PKSF	Palli Karma-Sahayak Foundation
TA	technical assistance

I. INTRODUCTION

1. Disaster risk has broad social and developmental implications. However, in many countries, financial protection in disaster risk management is still limited, causing delayed recovery and reconstruction and worsening their socioeconomic impacts. Disaster risk financing requires developing different options according to the nature of the disaster; the probability of occurrence; and the potential loss of, or impact on, life and physical capital. Take-up rates for disaster risk financing options are minimum in many developing countries. Adequate market-based disaster risk mitigation products do not exist for certain perils in many countries, including Bangladesh.

2. Uncovered or unfunded catastrophe losses do not simply dissipate after a catastrophe, but instead are paid by domestic taxpayers or international donors in the form of *ex post* (after the fact) relief, recovery, and reconstruction expenses. Closing the gap between funded and unfunded catastrophe losses using the combination of appropriately designed disaster risk financing mechanisms is crucial for robust disaster risk management and, in many disaster-prone countries, sustainable development itself. This is especially true for Bangladesh, which has limited budgetary resources and limited markets to support the proactive transfer of catastrophe risk. Sovereign entities should pay due consideration to the aggregate economic exposure to catastrophes. Due to the recent socioeconomic changes, including rapid urbanization and climate change, a holistic approach to disaster risk management, including disaster risk financing, becomes even more important.

3. For Bangladesh, natural catastrophe risk is a considerable problem due to the population's low level of resilience and the high exposure to multiple hydrometeorological hazards, including tropical cyclones and extreme high rainfall leading to flooding.

4. Added to the high risk is the lack of disaster insurance mechanisms among the general population. In Bangladesh, like in many developing countries, only a few of the country's assets are insured, thus leaving a huge burden on the government to fund postdisaster response and recovery. Again, in the case of Bangladesh, formal insurance mechanisms for catastrophes are very poorly developed, and traditional informal mechanism of risk-sharing is unable to respond when major natural disasters occur.

5. One of the challenges in natural catastrophe risk management is climate change. In many places around the world, particularly in low-lying coastal countries such as Bangladesh, increasing global air and ocean temperatures will inevitably lead to greater impacts of hydrometeorological events. While tropical cyclone activity itself may not increase, increased sea level will lead to greater storm surge. Climate change may not be responsible for much of the current exposure to hydrometeorological hazards in Bangladesh, but it will contribute to an increased risk and should serve as a call for action. Effective risk management strategies put in place early will provide a strong platform for managing the increasing risk already being felt in other parts of Asia.

II. DISASTERS AND THEIR IMPACTS IN BANGLADESH

A. Overview

6. Bangladesh is one of the most at-risk countries in the world to natural hazards, mainly due to its high population density, low-lying topography, and geographical location (active monsoon and

tropical cyclone basin). Bangladesh is regularly exposed to different hazards, including tropical cyclones, floods, earthquakes, severe storms, and others. The severity, frequency, and location of these hazards vary, as do the corresponding socioeconomic impact (Table 1).

Table 1: List of Major Hazards in Bangladesh

Peril	Potential Severity	Relative Frequency
Tropical cyclone	High	High
Flood	High	High
Earthquake	High	Low
Severe storm	Moderate	High
Extreme temperature	Low	Moderate
Drought	High	Moderate
Fire	Local	Moderate
Building collapse	Local	Low
Landslide	Local	Low
Arsenic contamination	...	...
Riverbank erosion	...	...
Saltwater intrusion	...	...
Climate change	...	...

... = not applicable.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

7. In general, floods and tropical cyclones most adversely impact Bangladesh, based on the number of people affected and the number of people killed. The majority of reported economic loss is due to both floods and tropical cyclones. Severe storms, while very frequent, are typically local events and have a smaller effect on Bangladesh as a whole. Although the frequency of damaging earthquakes in Bangladesh has been relatively low, the potential for catastrophic damage and destruction is very high (Table 2).

Table 2: General Hazard Consequence in Bangladesh (%)

Peril	People Killed	People Affected	Estimated Damage
Flood	7	75	68
Tropical cyclone	89	18	27
Severe storm	1	1	5
Earthquake	<1	<1	...[a]
Others[b]	2	6	...

< = less than, ... = not available.

[a] It does not include $500 million damage reported for the 2004 Indian Ocean earthquake and tsunami.

[b] It includes building collapse, drought, extreme temperature, significant fire disasters, landslides, and significant transport or industrial or miscellaneous accidents. It does not include the 1943 Bengal famine (1.9 million reported killed) or epidemics (0.40 million reported killed and 3.04 million reported affected).

Source: Emergency Events Database (EM-DAT). http://www.emdat.be/

B. Tropical Cyclone

8. Bangladesh is within the active north Indian Ocean tropical cyclone basin, and more locally within the Bay of Bengal subbasin. The historical record indicates that an average of about five tropical cyclones with at least tropical storm strength (storms with maximum 10-minute sustained winds of at least 34 knots) occur in the Bay of Bengal subbasin every year, with about one per year passing directly through Bangladesh boarders. Tropical cyclone activity in Bangladesh is typically higher during May, June, October, and November. The impact of tropical cyclones in Bangladesh can lead to many hazards, including but not limited to high winds, torrential rain, flooding, storm surge, and landslides. Cyclones in Bangladesh are typically associated with severe storm surge.

9. According to the International Disaster Database, 5 of the 10 deadliest tropical cyclones in the world since 1900 occurred in Bangladesh.[1] The 1970 Bhola cyclone is considered to be the deadliest ever recorded, with estimated over 500,000 people killed. The 1991 Bangladesh cyclone caused an estimated $1.8 billion–$3.0 billion in economic impact and over 138,000 deaths. More recently, tropical cyclone Sidr in 2007 caused significant economic impact, estimated at $1.7 billion–$3.8 billion, although life loss was less than 5,000 people, illustrating the success of recent advancement in disaster risk management in Bangladesh (e.g., disaster shelters, early warning systems, and timely evacuations).

10. Overall, available reports indicate that tropical cyclone events in Bangladesh since 1900 have resulted in 0.75 million–1.23 million lives lost, 61.6 million people affected, and $4.7 billion–$9.0 billion in damages. Due to data gaps in some years, the actual historical impact is probably more severe. The costliest tropical cyclones on record are tropical cyclone Sidr in 2007 ($3.8 billion maximum) and the 1991 Bangladesh cyclone ($3.0 billion maximum). Table 3 illustrates damages from tropical cyclones by decade.

Table 3: Summary of the Tropical Cyclone Consequence by Decade

Decade	No. of Events	Dwellings Damaged	Dwellings Destroyed	People Affected	Injuries	Life Loss		Economic Loss ($ million)	
						Minimum	Maximum	Minimum	Maximum
Pre-1900s	12	...	...	...	...	844,270	1,637,270	...	...
1900s	2	...	...	...	...	315	841	...	...
1910s	6	...	...	...	...	234,432	270,932	...	...
1920s	2	...	8,000	25,000	...	606	2,700	...	...
1930s	...	...	...	...	...	...	...	...	...
1940s	4	...	...	...	...	67,700	69,700	...	...
1950s	4	...	...	...	12	17,070	28,570	63	63
1960s	16	347,361	1,004,493	1,660,000	...	74,697	152,059	130	130
1970s	10	400,000	2,300	4,740,000	50	211,957	515,186	63	86
1980s	11	921,902	894,919	14,968,547	430	7,008	30,129	360	360
1990s	12	1,746,086	1,357,680	24,048,514	1,407,953	140,235	155,942	1,911	3,200
2000s	11	1,436,217	838,389	14,682,507	62,401	3,862	5,698	1,945	4,924
2010s	3	130,726	29,786	1,461,925	1,802	142	142	200	200
Total	**93**	**4,982,292**	**4,135,567**	**61,586,493**	**1,472,648**	**1,602,294**	**2,869,169**	**4,672**	**8,963**

... = not available.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh*. Consultant's report. Manila (TA 8144-BAN).

[1] Emergency Events Database (EM-DAT). International Disaster Database. http://www.emdat.be/ (accessed 25 December 2015).

C. Flood

11. Flooding in Bangladesh is an annual phenomenon, with the most severe occurring during July and August. While most of the country is flood prone, four general types of flooding occur: (i) flash floods caused by overflowing of hilly rivers in the eastern and northern regions, typically during April to May and September to November; (ii) floods caused by heavy rains and drainage congestion; (iii) monsoon floods caused by flooding of major rivers, typically during June to September; and (iv) coastal floods caused by storm surges. The situation is exacerbated as Bangladesh is a low-lying, riverine country (about 50% of the country is within 7 meters of mean sea level) and most of the country is on a delta plain at the confluence of the Ganges (Padma), Brahmaputra (Jamuna), and Meghna rivers. (Uddin Ahmed 2005)

12. Statistically, about 20% of the country is affected by floods on average per year, although there is high distribution in interannual variability of flood-affected areas. Since 1954, the largest reported area affected by flood was 68.0% in 1998, and the smallest reported area was 0.2% in 1994 (Table 4). Depending on rainfall variability within the country and catchment flows, the location and timing of flooding can vary from one part of the country to another, although flooding risk is greatest on the coast and around the Ganges–Brahmaputra–Meghna catchment area.

Table 4: Yearly Flood-Affected Area in Bangladesh, 1990–2013

	Flood-Affected Area	
Year	km²	%
1990	3,500	2.4
1991	28,600	19.0
1992	2,000	1.4
1993	28,742	20.0
1994	419	0.2
1995	32,000	22.0
1996	35,800	24.0
1997	...	...
1998	100,250	68.0
1999	3,200	22.0
2000	35,700	24.0
2001	4,000	2.8
2002	15,000	10.0
2003	21,500	14.0
2004	55,000	38.0
2005	17,850	12.0
2006	16,175	11.0
2007	62,300	42.0
2008	33,655	23.0
2009	28,593	19.0
2010	26,530	18.0
2011	29,800	20.0
2012	17,700	12.0
2013	15,650	10.6

... = not available, km² = square kilometer.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh*. Consultant's report. Manila (TA 8144-BAN).

Table 5: Flood Consequence Database—Preferred Loss Estimates

Year	Country Affected (%)	Economic Loss ($ million)	GDP (2014 $ million)	Loss Normalized by GDP (%)
1962	25.0	116.66	5,081	2.30
1963	29.0	120.82	5,319	2.27
1964	21.0	5.00	5,386	0.02
1966	23.0	1.00	6,440	0.00
1968	25.0	241.67	7,484	3.23
1970	29.0	229.17	8,993	2.55
1974	36.0	579.20	12,459	4.65
1980	22.0	150.00	18,115	0.83
1984	19.0	180.72	19,670	0.92
1987	39.0	1,143.77	23,781	4.81
1988	61.0	2,137.00	25,639	8.34
1991	19.0	150.00	30,957	0.48
1995	22.0	375.30	37,940	0.99
1996	24.0	15.00	40,666	0.04
1998	68.0	4,300.00	44,092	9.75
2000	24.0	500.00	47,125	1.06
2004	38.0	2,280.00	56,561	4.03
2007	21.5	1,066.70	68,415	1.56

GDP = gross domestic product.

Note: Economic losses are expressed in 2014 dollars to estimate the relative economic impact of events over the years.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

13. Table 5 presents a summary of economic loss estimates extracted from the consequence database.

14. The strong correlation between the scale of economic losses and flood-affected areas in Bangladesh can be used to infer the overall economic risk due to flooding. Table 6 lists the approximate return period of flood-affected area. Given the flood-affected area, the linear trend derived in Figure 1 can be used to infer the approximate return period of losses due to flooding. Overall, Bangladesh is expected to incur losses equivalent to 1.5% of gross domestic product (GDP)—$2.2 billion in 2014 dollars—on average per year due to floods. In the recent decades, Bangladesh has experienced several devastating floods in 1987, 1988, 1998, and 2004. The floods of 1988 and 1998 were particularly catastrophic, each affected over 60% of Bangladesh and caused losses equivalent to more than 8% of GDP (over $12 billion in 2014 dollars).

Table 6: Flooded Areas of Bangladesh for Different Return Periods

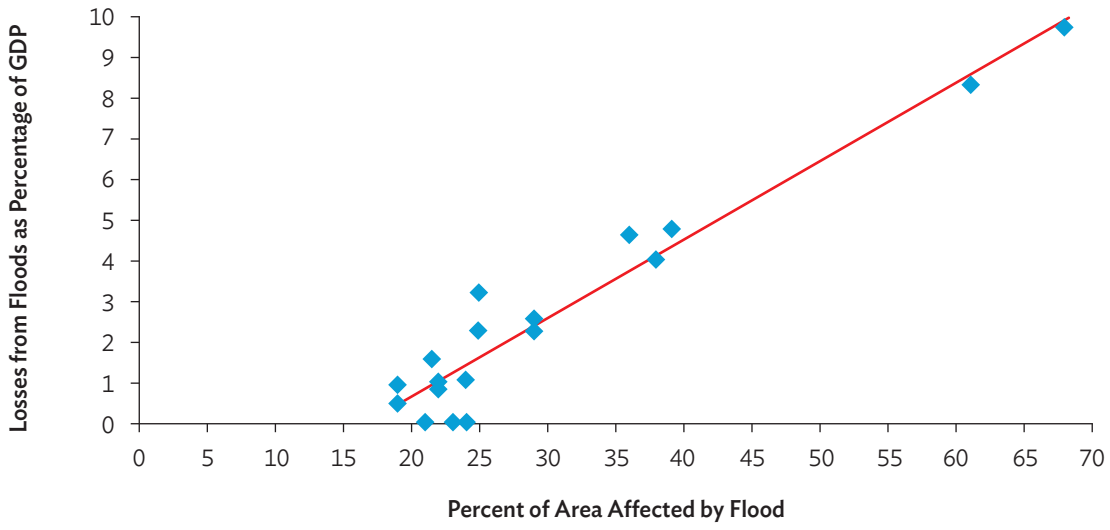
Return Period (years)	Country Affected (%)	Loss Normalized by GDP (%)	Loss ($ million)[a]
2	20	0.68	1,002
5	30	2.62	3,861
10	37	3.98	5,862
20	43	5.14	7,577
50	52	6.89	10,149
100	60	8.44	12,436
500	70	10.38	15,295
Annual average	**...**	**1.50**	**2,210**

... = data not available, GDP = gross domestic product.

[a] 2014 GDP is estimated at $147.3 billion.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

Figure 1: Losses from Floods versus Percent of Area Affected by Floods as Percentage of GDP



GDP = gross domestic product.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA8144-BAN).

D. Earthquake

15. Devastating tropical cyclones and floods occur frequently in Bangladesh, but no major earthquake has affected Bangladesh in recent decades. This has created a feeling of false security among the public and some decision makers to think that earthquake is not a major hazard for Bangladesh.[2] However, Bangladesh is surrounded by regions of high seismicity with numerous active faults, including the Dauki Fault system. Inadequate detailed design drawings, poor quality of construction, lack of proper supervision, and lack of enforcement of building codes and regulations have made areas in Bangladesh vulnerable to earthquake.[3] In particular, there is a growing apprehension that a moderate to severe earthquake in any of the major cities of Bangladesh may result in a devastating loss of life and property.

16. Table 7 lists the number of earthquakes (both main shocks and total events) from variety of sources, including counts of events within Bangladesh borders (both during the entire reported history and within the last 100 years, i.e., 1913–2013). The impact of earthquake in Bangladesh can lead to many hazards, including ground shaking, liquefaction, fire following earthquake, ground subsidence, tsunamis, seiches, and landslides. Primarily due to its low-lying deltaic geography, the main hazard from earthquake in Bangladesh is ground shaking. In general, for many parts of Bangladesh, in particular the north and east, the seismic hazard is considered to be high.

17. Table 8 presents the event-by-event summary of the consequence database of earthquake events. The database contains information for 36 earthquake events spanning from 1548 to 2011. In summary, earthquake events in Bangladesh have reportedly resulted in about 129 lives lost, over 1,850 buildings damaged or destroyed, and over $91 million in damages since 1900.

Table 7: Number of Reported Events in the Historical Earthquake Database

Magnitude	Total Catalog		Within 50 km of Bangladesh Borders (Entire Record)		Within 50 km of Bangladesh Borders (1913–2013)	
M_w	Main shock	Total	Main shock	Total	Main shock	Total
4.0–4.5	284	2,566	38	206	32	198
4.5–5.0	320	1,438	38	106	35	101
5.0–5.5	295	680	36	55	29	44
5.5–6.0	149	282	21	30	15	23
6.0–6.5	58	131	17	20	9	9
6.5–7.0	30	45	3	3	1	1
7.0–7.5	19	22	5	5	2	2
7.5–8.0	7	8	2	2	0	0
≥8.0	9	9	1	1	0	0
Total	**1,171**	**5,181**	**161**	**428**	**123**	**378**

km = kilometer, M_w = moment magnitude.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

[2] Choudhury, J. R. 1993. Seismicity in Bangladesh. In K. Meguro and T. Katayama, eds. *Seismic Risk Management for Countries of the Asia Pacific Region.* Proc. WSSI Workshop. Bangkok. 8–11 February.

[3] Ahmed, Z., S. A. Siddiquee, and S. Khan. 2012. Reliability and Construction Practices in Building Construction Industry of Bangladesh. Third International Conference on Construction in Developing Countries. Bangkok. 4–6 July.

Table 8: Summary of Earthquake Consequence by Decade

Decade	Number of Events	Estimated Dwellings Damaged or Destroyed	Estimated People Injured	Estimated Life Loss	Estimated Damage ($ million)
Pre-1900s	12	>3,050	100	1,116	>207
1900s	0	...	...	...	...
1910s	1	...	1,000	9	5
1920s	1	...	...	50	1
1930s	2	...	...	1	26
1940s	0	...	...	...	...
1950s	1	...	...	...	1
1960s	0	...	...	...	...
1970s	1	...	100	...	1
1980s	4	...	230	35	12
1990s	3	850	500	29	31
2000s	9	950	233	5	12
2010s	2	50	1	...	2
Total	**36**	**>4,900**	**2,164**	**1,245**	**>298**

... = data not available, > = more than.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh*. Consultant's report. Manila (TA 8144-BAN).

E. Severe Storm

18. In addition to weather-related hazards such as tropical cyclones and floods, Bangladesh is frequently exposed to severe storms, which are typically local thunderstorms known as kal-baishakhi. They occur from late February to early June, and the frequency of severe kal-baishakhi usually reaches a maximum in April. Kal-baishakhi are generally associated with squalls (strong winds), torrential rain, tornadoes, hail, and lightning. Overall, the frequency of severe storms in Bangladesh is high, with an average of over 150 events estimated per year. The majority of severe storms have been reported in central Bangladesh, although occurrence is generally well distributed throughout the country.

19. Since 1951, at least 20 severe storm events in Bangladesh have resulted in 100 or more reported lives lost. Of these, three events have reportedly caused 1,000 or more lives lost, including the tornadoes in 1964, 1973, and 1989. The destructive Daulatpur–Saturia tornado in 1989 that occurred in the Manikganj District on 26 April is considered one of the deadliest tornadoes in Bangladesh's history with around 1,300 lives lost. The most severe event in terms of people affected was thunderstorms with hailstorm and rain on 7–8 January 1993 in the northern region of Bangladesh, which affected 750,000 people. Most events are very localized and thus affect smaller population size relative to tropical cyclones and floods. The most severe event in terms of reported economic damage is a tornado that struck Madaripur and Faridpur on 1 April 1977, with a reported estimated damage of $50 million.

F. Historic Economic Impact of Major Disasters Since 2000

20. In total, significant sudden-onset natural hazard events in Bangladesh during 2000–2013 are estimated to have affected 99.7 million people, resulted in 8,351 lives lost, and caused $10.8 billion in economic impact with damages and losses to all sectors (Table 9). In terms of economic impact and people affected, floods contribute to the majority of the consequence—about 66% of economic impact and 83% of people affected. The majority of life loss (63%) is due to tropical cyclones. Although the impact of severe storms is less than that of tropical cyclones and floods, severe storms occur frequently and have contributed to about 12% of the total life loss. No major earthquake happened during this period.

Table 9: Estimated Disaster Consequence in Bangladesh, 2000–2013

	Flood			Tropical Cyclone			Earthquake			Severe Storm			Total		
Year	Economic Impact ($ million)	People Affected	Life Loss	Economic Impact ($ million)	People Affected	Life Loss	Economic Impact ($ million)	People Affected	Life Loss	Economic Impact ($ million)	People Affected	Life Loss	Economic Impact ($ million)	People Affected	Life Loss
2000	500	3,244,576	37	2	15,000	253	1	500	...	78	156,399	84	581	3,416,475	374
2001	70	700,000	19	...	...	...	1	500	...	14	28,750	238	85	729,250	257
2002	1,015	7,608,837	26	1	5,000	182	1	500	...	56	111,400	73	1,073	7,725,737	281
2003	970	7,874,465	104	62	312,817	11	5	2,500	3	5	10,420	60	1,042	8,200,202	178
2004	2,280	40,955,375	765	46	116,269	89	...	...	2	9	18,200	239	2,335	41,089,844	1,095
2005	122	1,220,000	60	...	...	...	...	...	...	17	33,606	161	139	1,253,606	221
2006	21	211,775	105	...	...	...	1	500	...	5	9,014	39	27	221,289	144
2007	1,067	10,655,564	594	1,676	9,003,259	4,410	1	250	...	...	...	...	2,744	19,659,073	5,004
2008	126	975,096	28	17	321,839	13	2	1,000	...	0	200	12	145	1,298,135	53
2009	50	500,000	16	1,156	4,919,188	195	...	...	...	...	...	...	1,206	5,419,188	211
2010	124	1,240,000	119	...	...	...	1	500	...	129	257,160	26	254	1,497,660	145
2011	185	1,853,000	53	...	...	...	1	250	...	0	121	13	186	1,853,371	66
2012	573	5,398,475	139	26	133,688	108	...	...	...	28	55,121	25	627	5,587,284	272
2013	42	415,250	...	276	1,328,237	17	...	...	...	33	33,563	33	351	1,777,050	50
Total	**7,145**	**82,852,413**	**2,065**	**3,262**	**16,155,297**	**5,278**	**14**	**6,500**	**5**	**374**	**713,954**	**1,003**	**10,795**	**99,728,164**	**8,351**

... = not available.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh*. Consultant's report. Manila (TA 8144-BAN).

21. The major disaster years during 2000–2013 are 2004 and 2007, with over $2 billion in estimated economic impact, about 20 million or more people affected, and over 1,000 lives lost during each of these 2 years. These years were characterized by catastrophic floods in 2004 and tropical cyclone Sidr in 2007. In terms of major disasters, 2006 was the least significant with less than $30 million in damages and about 220,000 people affected. Major disasters in Bangladesh during 2000–2013 have resulted in about $771 million in losses, 7.1 million people affected, and 600 lives lost on average per year.

III. TROPICAL CYCLONE AND FLOOD RISK MODEL OF BANGLADESH

22. To estimate the financial impact of disasters, the technical assistance (TA) developed risk models of tropical cyclones and floods in Bangladesh. The risk models in Table 10 and Figure 2 estimate the financial impact due to damage and loss for all sectors in Bangladesh. The flood losses were inferred from an analysis of historical flood data. The tropical cyclone losses are derived from the detailed probabilistic AIR tropical cyclone risk model.[4]

23. As shown in Table 10 and Figure 2, Bangladesh is expected to incur a financial impact of about $3.2 billion on average per year due to cyclone and flood, or about 2.2% of the 2014 GDP. Furthermore, there is a 1% chance that the financial impact from cyclones will exceed $7.2 billion in any year, and a 1% chance that the financial impact from floods will exceed $12.4 billion in any year. It is expected that the financial risk from other perils such as severe storm and earthquake is much less severe than that of cyclone and flood.

24. Based on the estimated risk profile, the flooding in 2004 represents a 10-year event (i.e., the level of loss incurred by the 2004 floods is expected to be exceeded on average once every 10 years). The 2007 tropical cyclone Sidr is expected to be a 20-year event, 2009 cyclone Aila a 5-year event, and 2013 cyclone Mahasen a 2-year event. The 1991 cyclone and 1998 floods are expected to be each greater than a 100-year event.

Table 10: Qualitative Tropical Cyclone and Flood Risk Model of Bangladesh

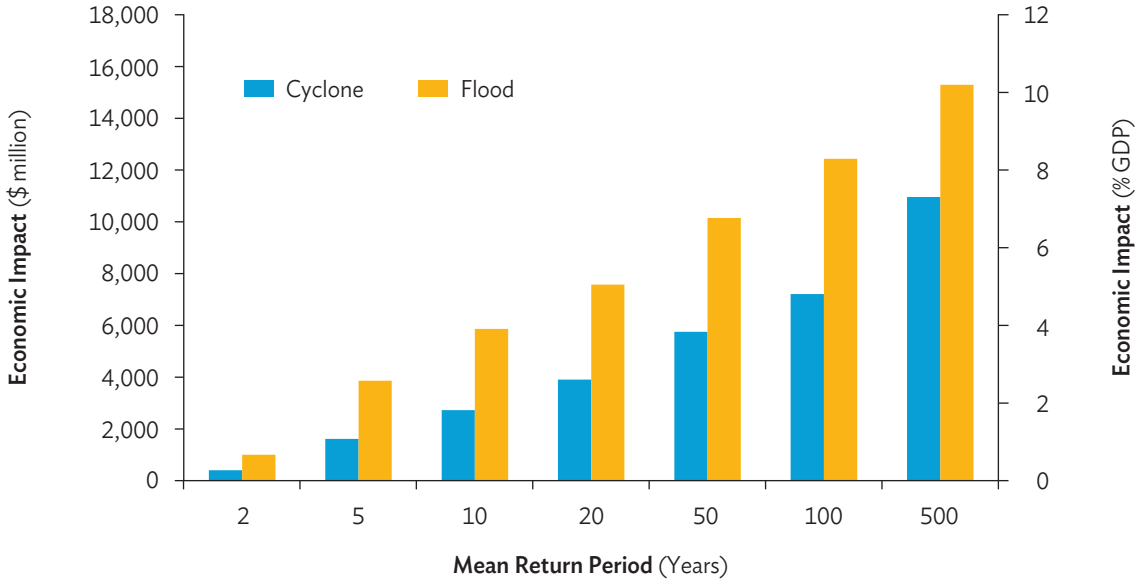
		Economic Impact			
		Cyclone		Flood	
EP (%)	**MRP** (year)	**($ million)**	**(% GDP)**	**($ million)**	**(% GDP)**
0.5	2	403	0.3	1,002	0.7
0.2	5	1,617	1.1	3,861	2.6
0.1	10	2,727	1.9	5,864	4.0
0.05	20	3,907	2.7	7,574	5.1
0.02	50	5,752	3.9	10,152	6.9
0.01	100	7,209	4.9	12,436	8.4
0.002	500	10,958	7.4	15,295	10.4
Average annual loss		994	0.7	2,210	1.5

EP = exceedance probability, GDP = gross domestic product, MRP = mean return period.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

[4] In addition to analyses of historical events, the TA developed a probabilistic catastrophe risk model specifically for the peril of tropical cyclone in Bangladesh. Probabilistic risk models provide information on the risk of natural hazards, since they quantify the likelihood of future catastrophe events and consequences by computing loss potentials that go beyond the available historical record. Information derived from catastrophe risk models can also overcome the limitations and data gaps of reported observations of past events. The AIR tropical cyclone model for Bangladesh captures the effects of tropical cyclone-induced winds and flooding from tropical cyclone-induced precipitation on properties in Bangladesh. It is a stochastic, event-based model designed for portfolio risk assessment. Details of the AIR tropical cyclone model are in ADB. 2015. *Capacity Building for Disaster Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN). http://www.adb.org/sites/default/files/project-document/173391/42249-013-tacr-01.pdf

Figure 2: Tropical Cyclone Modeled Risk Model of Bangladesh



GDP = gross domestic product.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh*. Consultant's report. Manila (TA8144-BAN).

IV. FUNDING GAP ANALYSIS

A. Methodology

25. One of the TA's key questions is whether losses and damages from disasters were adequately funded, and if so, from what sources. To answer the question, the TA conducted a funding gap analysis. A funding gap is defined as the residual between total annual losses incurred as a consequence of disasters and funding available to meet those losses. Full identification of the resources allocated to disaster risk is assessed, which can be shown to encourage the government and private sector that greater investment in risk reduction in general and *ex ante* disaster finance instruments in particular is economically rational.

26. The funding gap analysis presented here relies on the data related to the catastrophes in Bangladesh from 2000 to 2013. The damage information relates to reported monetary damages caused by four different types of perils—tropical cyclones, earthquakes, storms, and floods. The damage data represent the total economic loss sustained by all sectors; the resulting funding gap illustrates total gap borne by both private and public sectors.[5]

27. The funding information is comprised of three components of funding for (i) recovery and rehabilitation projects, (ii) humanitarian aid, and (iii) foreign aid on disaster-related emergency response.

[5] There was no reliable data available to provide a clear distinction of responsibility between public and private losses. Based on some experts polled in this report, the public sector damage is, in general, approximated at 85% of the total damage and could potentially be used to infer the portion of the government's catastrophe responsibility.

B. Funding for Recovery and Rehabilitation Projects

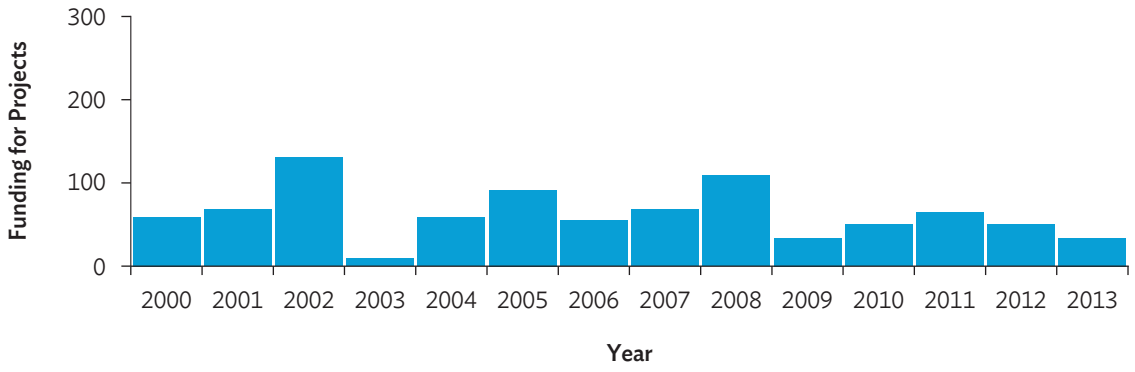
28. The projects for recovery, rehabilitation, and prevention cover a variety of areas including

- maintenance, rehabilitation, and restoration of flood-affected educational building (e.g., primary, secondary, higher secondary schools) and other urban infrastructure;
- house construction for flood-affected landless people;
- recovery and restoration projects for agricultural crops; and
- other emergency cyclone recovery and rehabilitation projects.[6]

29. The total procurement cost of those 55 projects during 2000–2013 is $897 million. Of those, 29 are supported by international donors and aid agencies. Foreign contributors financed 61% of the procurement cost; the rest was domestically financed.

30. Focusing on each year, Figure 3 demonstrates that the total amount of recovery and rehabilitation funding for the damages caused by the major perils of 2002, 2003, 2004, 2007, and 2009 remained extremely modest, i.e., below $100 million per year in most cases. The 2010–2013 period witnessed an average funding allocations of about $50 million per year despite the absence of any major peril. The available information on projects suggests that this is because some of the recovery and rehabilitation efforts following the 2007 tropical cyclone Sidr and 2009 cyclone Aila spilled over to 2010–2013.

Figure 3: Funding for Recovery and Rehabilitation Projects in Bangladesh, 2000–2013
($ million)



Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

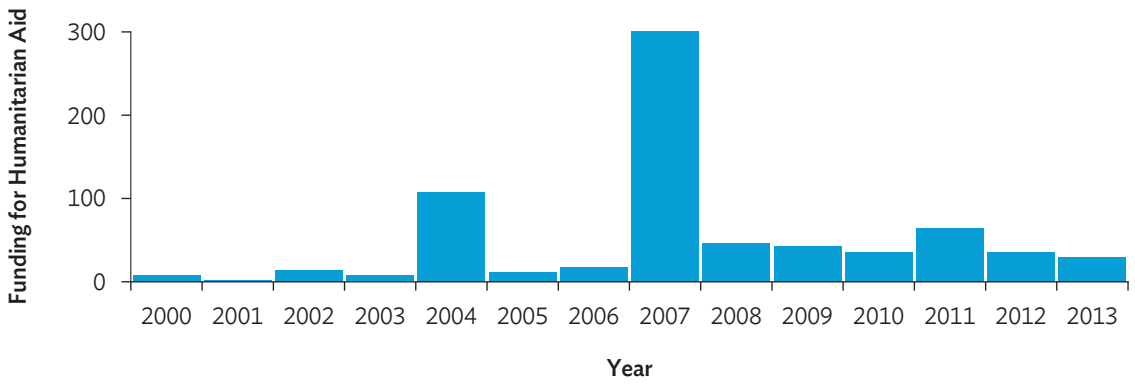
[6] The information is drawn from the Annual Development Plan of the Planning Commission of the Government of Bangladesh for 55 projects implemented from 2000 to 2013.

C. Humanitarian Aid

31. An important component of available funding in the case of catastrophes is humanitarian aid.[7] The information compiled by Financial Tracking Service of the United Nations Office for the Coordination of Humanitarian Affairs suggests that more than 95% of the humanitarian aid that flows into Bangladesh is in response to natural hazards.[8]

32. Figure 4 indicates that 2007 had the highest amount of humanitarian aid, i.e., almost $300 million, followed by 2004 with around $100 million. Other years, including 2009 (cyclone Aila), saw relatively low amounts of humanitarian aid. The available information suggests that the pre-2007 humanitarian aid average was $20.5 million per annum, while post-2007 average nearly doubled to $37 million per annum. The long-term humanitarian aid corresponds to a total of $679 million during 2000–2013.

Figure 4: Humanitarian Aid into Bangladesh, 2000–2013
($ million)



Sources: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh*. Consultant's report. Manila (TA 8144-BAN); Financial Tracking Service of the United Nations Office for the Coordination of Humanitarian Affairs.

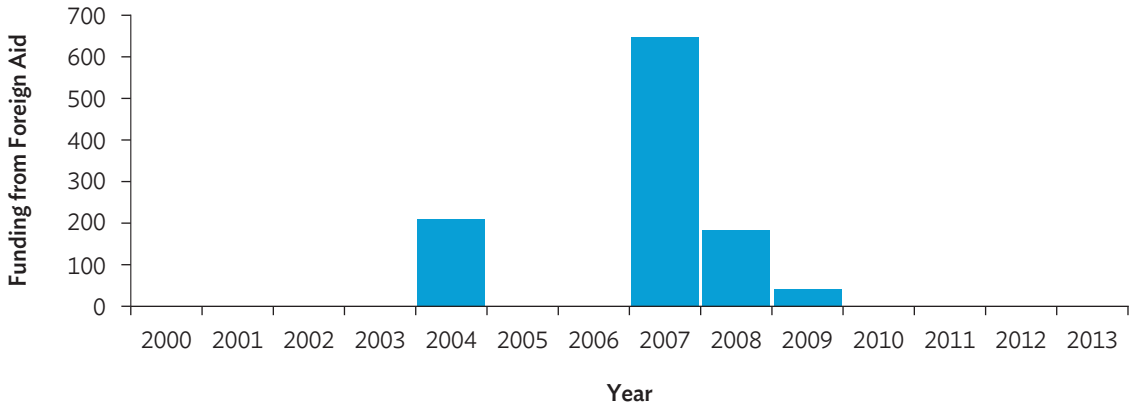
D. Funding from Foreign Aid on Disaster-Related Emergency Response

33. Bangladesh receives one of the highest amounts of foreign aid on disaster-related emergency response in the world. Figure 5 portrays the annual foreign aid on disaster-related emergency response for Bangladesh for 2002 and 2013. It is evident that emergency-related foreign aid is significant only in major disaster years. The 2007 tropical cyclone Sidr witnessed more than $600 million worth of foreign aid mainly for rehabilitation and reconstruction assistance, and several supplemental financing for floods and municipal services. Turning to the other years, 2004 saw $209 million in disaster-related foreign aid, while 2008 had $186 million and 2009 had $52 million. Other years during 2002–2012 had no significant foreign aid in emergency support.

[7] Humanitarian aid into Bangladesh typically included food, medical aid, water and water purification tablets, hygiene materials, clothing, family kits, shelter, and other relief materials for disaster victims.

[8] Financial Tracking Service. https://fts.unocha.org/

Figure 5: Foreign Aid on Disaster-Related Emergency Response into Bangladesh, 2000–2013
($ million)



Sources: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN); Government of Bangladesh, Ministry of Finance, Economic Relations Division.

34. The total disaster-related foreign aid into Bangladesh during 2002–2012 is $1.1 billion. The foreign aid figures on disaster-related emergency support for 2000, 2001, and 2013 were not available; however, the unavailability of data for these years is unlikely to make a difference to the key conclusions given that there were no major disasters in those years.

E. Funding Gap

35. Table 11 summarizes the disaster-related economic loses, available funding, and disparity between the two. It consists of total annual economic costs (loss and damage) for flood, severe storm, earthquake, and tropical cyclone. The table documents the funding amounts for recovery and rehabilitation projects, the humanitarian aid into Bangladesh, and foreign aid on disaster-related emergency response. The sum of these three funding components makes up the total funding available to Bangladesh in the case of catastrophes. Finally, the disparity between total damage and total funding constitutes the funding gap.

36. Figure 6 presents the sum of funding amounts for recovery and rehabilitation projects, humanitarian aid, and foreign aid on disaster-related emergency response. The total funding for over 14 years from 2000 to 2013 is $2.7 billion.

37. Figure 7 documents the funding gap of $8.1 billion in Bangladesh during 2000–2013. Concomitant with the sizeable economic impacts, the funding gap was $2 billion in 2004, $1.7 billion in 2007, and $1 billion in 2009. Even 2000 and 2012 experienced sizeable funding gaps of slightly more than $500 million each. The funding gap was close to zero in 2001, 2005, and 2011, and even negative in 2006 and 2008 as Bangladesh experienced an average funding surplus of $119 million.

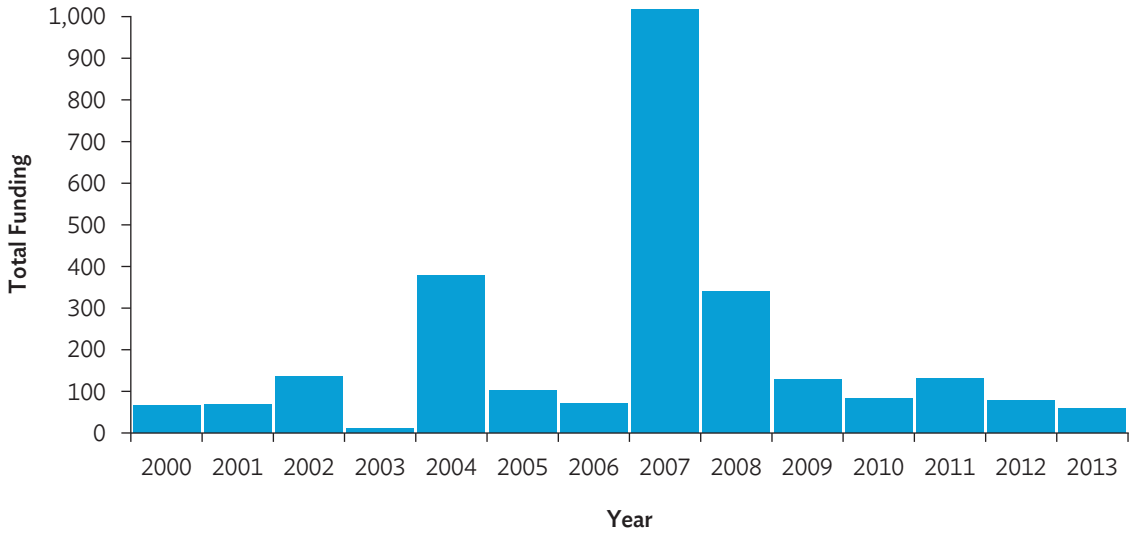
Table 11: Disaster-Related Economic Impact and Funding Gap in Bangladesh, 2000–2013
($ million)

Year	Disaster-Related Economic Impact	Disaster-Related Funding				
		Funding for Recovery and Rehabilitation Projects	Humanitarian Aid	Foreign Aid on Disaster-Related Emergency Response	Total Funding	Funding Gap
2000	582	61	5	...	66	516
2001	85	67	2	...	69	16
2002	1,072	129	6	0	135	937
2003	1,042	8	4	0	11	1,030
2004	2,335	60	109	209	378	1,957
2005	139	95	6	0	101	38
2006	27	58	12	0	71	(44)
2007	2,744	73	300	645	1,018	1,726
2008	145	111	43	186	339	(194)
2009	1,206	38	37	52	128	1,078
2010	254	52	31	1	84	170
2011	186	64	66	0	131	55
2012	626	47	32	0.2	79	547
2013	350	34	26	...	60	290
Total	**10,793**	**897**	**679**	**1,093**	**2,670**	**8,122**

( ) = negative, ... = not available.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

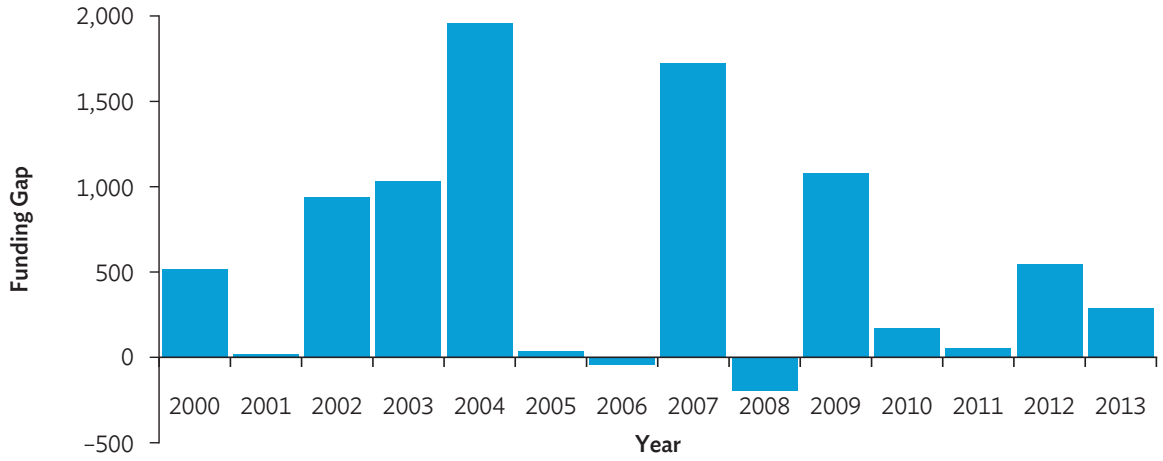
Figure 6: Total Available Funding, 2000–2013
($ million)



Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

38. The funding gap analysis concludes that Bangladesh is vulnerable to major catastrophes in terms of sizeable funding gaps in major disaster years. Although the country runs small funding deficits or surpluses in the years without major disasters, the long-run funding gap is very substantial, amounting to more than $8 billion during 2000–2013 (Figure 7). This funding deficit arose because only around a quarter of the $10.8 billion total disaster-related damage is covered by the total available funding in the said period. Of the $2.7 billion total available funding that has been reliably identified, $897 million came from recovery and rehabilitation projects, $679 million from humanitarian aid, and $1,093 million from foreign aid on disaster-related emergency response. Only 13% of the total available funding was generated internally. It is estimated that there may have been additional expenditure that was not identified due to data gaps. Thus, the total disaster-related expenditure could have been higher.

Figure 7: Funding Gap of Catastrophes in Bangladesh, 2000–2013
($ million)



Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

V. INSTITUTIONAL FRAMEWORK FOR DISASTER RISK FINANCING IN BANGLADESH

A. Government

39. The Finance Division in the Ministry of Finance is the core body that allocates the domestic disaster-related funding across different governmental and nongovernmental layers.[9] Budgetary matters including allocations are outlined in the annual budget document at the beginning of each financial year. In particular, the Finance Division allocates the required budget to each line ministry, which adds up to the central government budget.

[9] Disaster risk financing in this section refers to both *ex ante* and *ex post* financing instruments for disasters.

40. The budgetary system in Bangladesh involves several small pockets of money dedicated to disaster management. Some of the identified pockets are as follows:

(i) **Disaster Risk Reduction Fund.** It is dedicated specifically for disaster risk reduction. The amount available could not be identified but is likely to be modest.
(ii) **Emergency Fund Disaster Management.** It is allocated to Deputy Commissioner at the district level. The amount is confirmed to be small.
(iii) **Fund for Unforeseen Incidents.** It is available each year amounting to one billion taka (approximately $14.28 million). This funding can be allocated for any purpose in an ordinary year.
(iv) **Palli Karma-Sahayak Foundation.** It is a microfinance wholesaler and implements Climate Resilience Fund under the Ministry of Finance. Headed by the Ministry, a high-level committee decides on the distribution of funds to participating nongovernment organizations (NGOs).

41. When there is a domestic funding gap following catastrophes, typically the foreign financing mechanism is initiated. The Economic Relations Division of the Ministry of Finance mobilizes foreign financing through multilateral and bilateral development partners. The process works in a way in which line ministries approach the Economic Relations Division for emergency financing, which then activates bilateral links to meet the requirements. The coverage of foreign aid includes infrastructure projects; procurement of food; social, sanitation, healthcare, and education support projects; and cyclone shelters program.

B. Bangladesh Bank (Central Bank)

42. The role of Bangladesh Bank in disaster risk management is related to its environmental and socially responsible central banking approach. It issued Green Banking Policy covering Green Finance, Climate Risk Fund, In-house Environmental Management, and Green Banking Policy at strategic level of banks and financial institutions. Bangladesh Bank issued Environmental Risk Management Guidelines to banks and financial institutions to assess environmental risk in their credit portfolio.

43. As a pioneering initiative, Bangladesh Bank created a separate fund named Bangladesh Bank Disaster Management and Corporate Social Responsibility Fund in 2013. This fund is utilized for capacity building in different disaster risk management and socially responsible projects. Under this fund, it is envisaged that each of the 88 institutions deposit Tk50 million, potentially adding to Tk4.5 billion (approximately $64.3 million), that could be made available for postdisaster response, disaster risk management, and capacity building.

C. Insurance Sector

44. Bangladesh insurance market is dominated by two state-owned corporations—Sadharan Bima Corporation for general insurance and Jiban Bima Corporation for life insurance. A total of 31 private life and 46 private general insurance companies also operate in this market, and 12 life insurers and 2 general insurers offer microinsurance. The microinsurance products offered by the general insurance companies are health and flood insurance.

45. Currently, a vast majority of the population, especially in rural areas, is left outside the insurance coverage in Bangladesh due to lack of awareness. However, there have been recent developments to improve access among poor and vulnerable communities to financing tools that promote resilience and reduce (O'Donnell 2009) economic losses due to disasters. Several leading microfinance institutions (MFIs), including Grameen Bank and Proshika, have implemented small-scale livestock microinsurance programs to protect their investment loans for dairy cattle and water buffalo livestock producers. Typically the insurance provides all risk mortality cover during the 2–3-year loan repayment period, and the sum insured is fixed in accordance with the loan amount. The MFIs operate their own internal livestock indemnity funds without any form of catastrophe reinsurance protection (FAO 2011).

46. There is a "meso-level" index-based flood insurance being piloted in Sirajganj area by Swiss Agency for Development and Cooperation, Oxfam, Pragati General Insurance, Palli Karma-Sahayak Foundation (PKSF), Manab Mukti Sangstha and Swiss Re. The insurance coverage is for the peak flood period (16 August–30 September), and maximum payout is Tk8,000. There are four levels of payout depending on the flood water level and the number of days the water level remains high. The project was launched in 2013 and covers 1,661 households. The premium is paid by the Swiss Agency for Development and Cooperation. The insurers have made a payout in 2014, but details are not available. A few other index-based products are being piloted by international donors.

D. Microfinance Sector

47. MFIs can potentially play significant roles in disaster risk management. MFIs offer a number of services, which can help clients in coping with the impact of catastrophes. The services include provision of temporary loans, loan forgiveness, rescheduling of loan, asset replacement, housing loans, and loans for starting new activities.

48. Currently, there are 742 registered MFIs with the Microcredit Regulatory Authority. MFIs have over 26.4 million members and 19.7 million borrowers. As of May 2014, loans amounted to Tk257.01 billion (approximately $3.3 billion) and savings amounted to Tk94 billion (approximately $1.2 billion). The total number of cooperatives was 164,536 with over 8.6 million members and deposits in excess of Tk29.4 billion (approximately $378.3 million).

49. Disasters can have a profound impact on microcredit operations. For example, during the 1998 floods, 1.2 million members of Grameen Bank were affected, of which 0.8 million were seriously affected. Activities funded through loans were destroyed, and Grameen Bank faced severe liquidity issue and had to take Tk1 billion (approximately $12.9 million) loan from Bangladesh Bank to cope with the events. Grameen Bank members who received housing loan before were given Tk5,000 (approximately $64.4) again if their houses suffered damages. Those members who did not receive housing loans before were given Tk2,500 (approximately $32.20).

50. BRAC, a microfinance NGO, has made specific arrangements for flood disasters: (i) clients can withdraw savings up to a specific pre-established amount; (ii) regular loan repayments can be suspended; (iii) interest rates can be reduced for up to 2 months; (iv) loans can be restructured for clients with marginal disaster losses; (v) loans can be refinanced for clients with high disaster losses; (vi) new loans are offered for productive asset replacement of up to 12 months at 15% interest; and (vii) an option of disbursement in the form of seeds, animals, and other in-kind materials is also available. After the 1998 floods, BRAC extended loans to 240,000 families for repairing and rebuilding homes.

51. PKSF has seven microinsurance programs including credit life, livestock, hospital cash plan, and parametric healthcare. PKSF has established a Covariant Risk Fund to protect partner organizations that do not have any insurance or reinsurance coverage. PKSF has also set up a Disaster Management Program under which it waives the entire outstanding loan amount if the income-earning person in the household is killed due to a disaster. This is an important risk management approach because PKSF's microcredit programs have a total outreach of 35 million people. To help them cope with and recover from disasters, PKSF has created a fund called SAHOS ("courage" in Bangla) under its Disaster Management Program to provide quick financial assistance to the poor families. SAHOS provides emergency medical services, water, and sanitation. As of June 2014, 149 partner organizations participated in this program, and they disbursed Tk5.0 billion (approximately $63 million) to 120,698 borrowers. Most of the loans were made during tropical cyclone Sidr (2007) and cyclone Aila (2009).

52. BURO Tangail, an NGO, has a contingency fund for major disaster events or other emergencies. For example, if a borrower dies or becomes permanently incapacitated, the fund can be used to write off the outstanding debt. Also, the fund can be used to provide supplemental loans to borrowers when their productive assets are damaged or stolen. Finally, when a loan is more than 6 months overdue, the reserve fund can be applied to the balance.

VI. DISASTER RISK FINANCE OPTIONS FOR BANGLADESH

A. Analyzing Risk and Identifying Needs

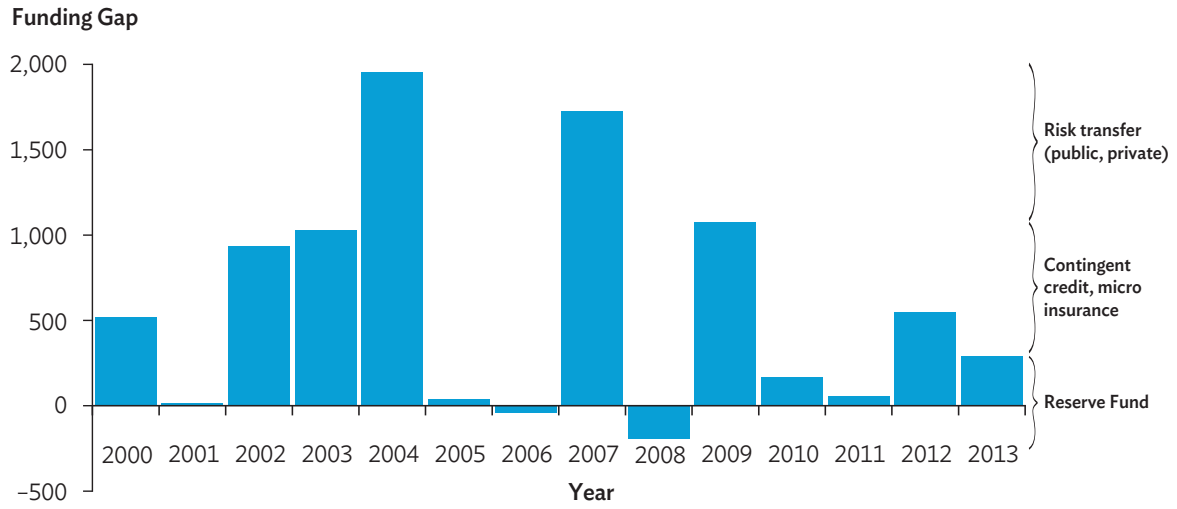
53. Catastrophes have a significant impact on Bangladesh's GDP growth. The 100-year loss (a loss expected to happen once every 100 years) for flood is equivalent to 8%–9% of GDP, and for tropical cyclone around 5% of GDP. Given the low penetration rate of individual and business insurance and the lack of alternative financial coping mechanisms for catastrophes, the sovereign responsibility and the amount of risk which needs to be financed by the state are large.

54. With Figure 7 in the previous section, one can differentiate various levels of need and suitable financing mechanisms. In Figure 8, the lower area covers the funding gap which is best managed through internal budgetary and reserve mechanisms. In some years, a more significant funding gap occurs (i.e., greater than $250 million), requiring an alternative risk financing mechanism such as contingent credit (middle part). Then finally once every 5–10 years or more, major disaster events will require some sort of risk transfer mechanism as the quantum of losses will be too large to be financed through reserve or contingent credit mechanisms. Such risk transfer can be in both public and private sectors.

B. Breaking Down the Funding Gap

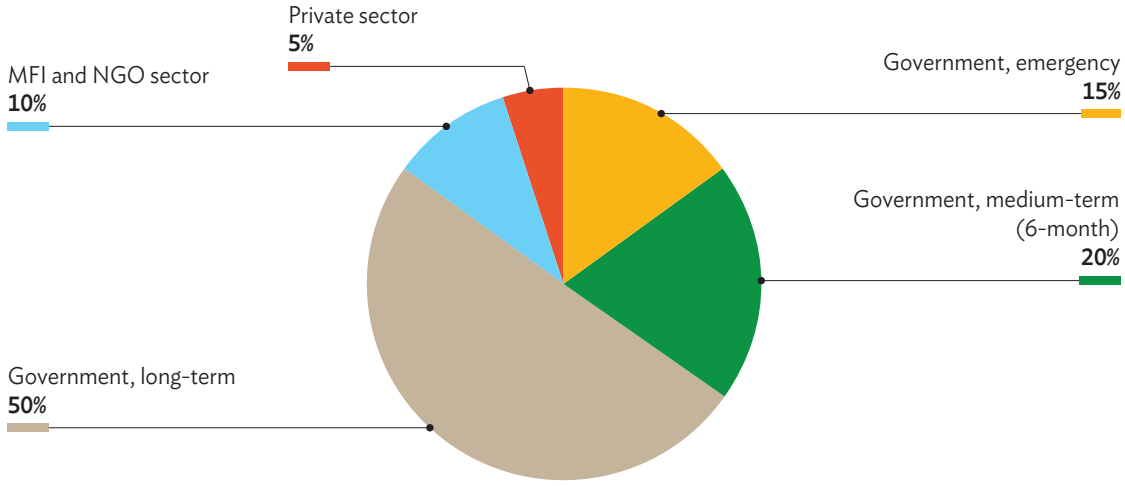
55. Building on the analysis above, Figure 9 shows the relative contribution of government and nongovernment sectors to the 1-in-100-year cyclone loss estimate from the cyclone model. Government losses are further split into emergency (i.e., immediate), medium term (up to 6 months), and long-term. The 6-month time frame is generally taken as the transition from recovery to long-term rebuilding phases, and coincides with the minimum time generally taken to mobilize rebuilding financing from the international development financing institutions. NGO and MFI damage and loss is addressed predominantly in medium-term response while the private sector covers both medium and long-term response.

Figure 8: Funding Gap Results Summary with Risk Financing Options
($ million)



Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

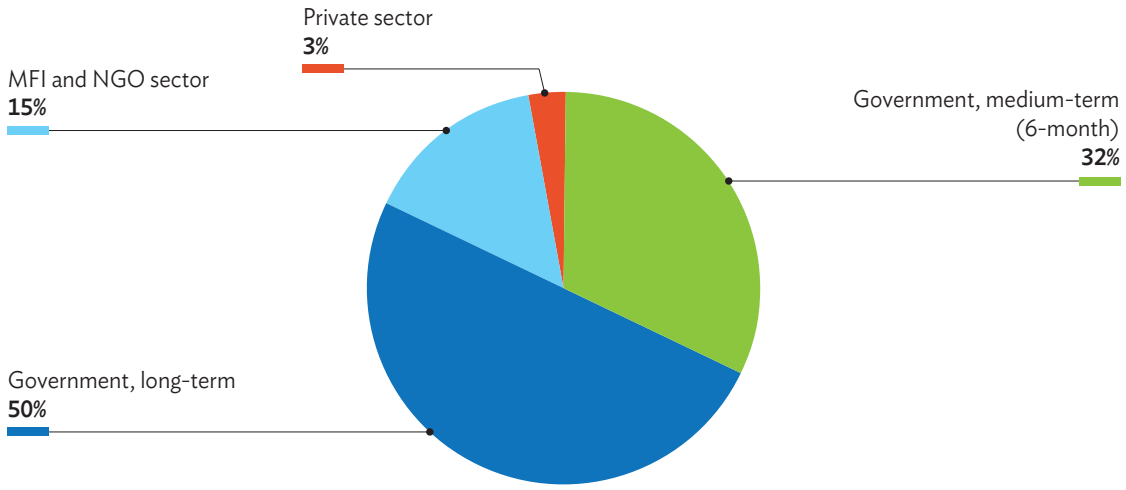
Figure 9: Relative Share of Government and Nongovernment, and Short-, Medium-, and Long-Term Postdisaster Costs
(%)



MFI = microfinance institution, NGO = nongovernment organization.

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

Figure 10: Share of Government and Nongovernment, and Short-, Medium-, and Long-Term Postdisaster Costs Relative to Estimated Funding Gap
(%)



MFI = microfinance institution, NGO = nongovernment organization.
Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

56. As shown in Figure 9, around 50% of the financing is required for long-term rebuilding, and around 30%–35% for medium-term recovery investment.

57. Taking this analysis a step further, the project estimated the relative portion of the funding gap of the five categories identified above. Figure 10 provides the relative breakdown of the total funding gap for a 1-in-100-year cyclone event, assuming that the funding gap is 50% of the total modeled loss.

58. This analysis suggests that the funding gap is predominantly focused on the medium-term sovereign needs and the needs of the NGO and MFI sector, which are also in the medium term. This suggests that risk financing solution for the government and NGO and MFI sector in the 1–6 months postdisaster period are most appropriate.

C. Practical Implementable Solutions

1. Sovereign Options

59. Two sovereign disaster risk financing options are most practical for the short to medium term in Bangladesh—contingent credit and parametric risk transfer for cyclone or flood. Contingent credit would be deployed to complement internal budgetary mechanisms for response to more frequent events, while parametric risk transfer would deal with less frequent events (i.e., 1 in 10 annualized probability and less frequent) and could provide rapid liquidity to support early recovery.

a. Contingent Credit

60. A contingent credit line on pre-agreed terms, which can be made rapidly available using a trigger, could provide a useful complement to emergency response funds set aside as budget contingencies at the national level. It will also reduce the uncertainty associated with international donor-driven emergency response mechanisms. For better risk management, a contingent credit line can be combined with capacity building in disaster preparedness and early warning, including development of pre-agreed contingency and recovery plans.

61. The key likely elements of a contingent credit line are the following:

(i) **Stand-alone or contingent extension.** The credit line is structured as a stand-alone or contingent extension of a normal funding window, likely a loan for investment in disaster risk management.
(ii) **Pre-agreed trigger.** An example of this trigger is a declaration of emergency by the national government.
(iii) **Cap on contingent credit amount.** A $250 million credit facility would approximately match the Government of Bangladesh's capacity in the form of reserve funds and budget reallocations, and these together could cover around half of the funding gap for medium-term recovery for a 1-in-100-year tropical cyclone disaster (Figure 8). Partial drawdown would be allowable.

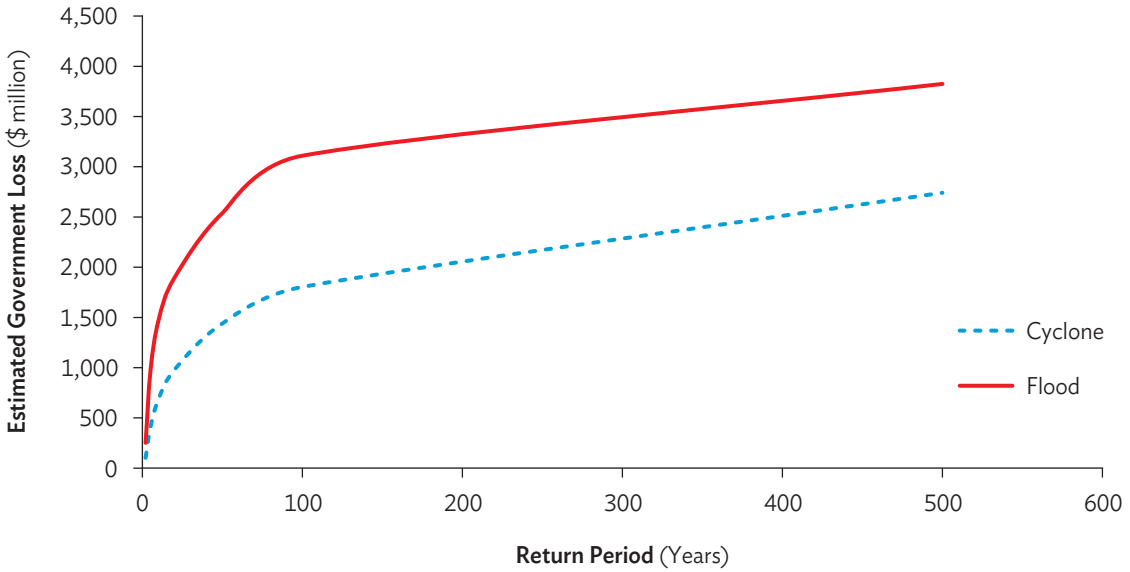
b. Parametric Sovereign Risk Transfer

62. A risk transfer product would be appropriate for relatively infrequent but large-impact events. The TA developed an example in which the insurance policy trigger is set at the 1-in-10-year loss level (for each of the covered perils separately), and payout will increase pro-rate basis until the coverage limit reaches to the paid out level for a 1-in-100-year event. This is a typical structure for a sovereign parametric product, maximizing the relative cost-effectiveness of risk transfer but also allowing for a payout probability acceptable at the political level.

63. For simplicity, the two perils, flood and cyclone, are treated as independent perils and have stand-alone policies and stand-alone pricing. It should also be noted that while flood cover is addressed here based on the risk profile presented above, there is currently no sovereign parametric flood model in existence anywhere in the world, and it will take several years before one is developed and accepted by the markets.

64. Given the stated target for a sovereign risk transfer product, the full national loss profile has been downscaled to 25% of the total losses, which approximates the portion of losses requiring financing during the medium-term recovery phase (Figure 9). Figure 11 shows the full exceedance probability curves for flood and cyclone used as a basis for structuring the risk transfer product.

Figure 11: Exceedance Probability Curves for Government Response Costs Representing 25% of the Full Modeled National Loss



Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

65. The characteristics of the example risk transfer product are provided in Table 12.

Table 12: Key Characteristics of Possible Parametric Insurance Products for Bangladesh
($ million)

Characteristics	Cyclone	Flood
Full expected loss (EL)	245.3	551.1
Standard deviation of EL	379.2	679.5
Attachment (10-yr loss)	680.1	1,448.6
Exhaustion (100-yr loss)	1,787.8	3,017.4
Premium	20.0	20.0
Estimated ceding rate (%)	32.18	21.69
Estimated coverage limit	356.5	340.3
Estimated rate on limit (%)	5.61	5.88

Source: ADB. 2015. *Capacity Building for Disaster Risk Finance in Bangladesh.* Consultant's report. Manila (TA 8144-BAN).

66. In this example, premium has been fixed at $20 million per peril, giving a coverage limit of $340 million for flood and $357 million for cyclone. Doubling premium will double not only the coverage limit but also the payout for any event which triggers the policy (i.e., losses greater than the attachment point).

67. Actual pricing of a product will depend on a variety of structuring and market factors which can be better determined only once a product is developed and placement is considered. However, the pricing range utilized above is felt to be reasonably stable—certainly in the coming few years—and

there is high confidence of global market appetite for sovereign risk from countries such as Bangladesh, assuming that the underlying parametric model is well-understood and accepted and the product is structured appropriately.

2. Nonsovereign Options

68. Helping the population to help themselves is a highly efficient way of reducing the burden on the government when disaster strikes. Traditional property, and catastrophe and agricultural insurance markets are not well developed in Bangladesh and appear unlikely to scale up quickly. However, the relatively strong microfinance sector means that microinsurance, particularly weather index insurance, is likely to be the most appropriate tools for expanding markets in Bangladesh.

69. Building on the microfinance platform, index-based weather products at the individual and especially at the portfolio level should be primary targets for support. While piloting and eventual expansion of individual microinsurance products such as Oxfam's index-based flood insurance program are worthy of support, experience from around the world demonstrates that reaching scale and economic sustainability is a long process. A more direct route to supporting large portions of the low-income population is through meso-level coverage, of portfolios of micro-loans.

70. Substantial natural catastrophe risk resides in the loan portfolios of the MFI sector. Appropriate management of this risk provides dual benefits—it protects against low-income individuals sliding into greater hardship after a major disaster, while also potentially catalyzing economic activity through providing additional financing to MFI clients.

71. The MFI sector in Bangladesh already has an established insurance element and can thus be a strong partner in disaster risk financing, although the catastrophe exposure of MFIs must be managed very differently to credit life or health insurance, which are the predominant forms of insurance currently offered by MFIs. Portfolio protection for MFIs would bring a rapid influx of new liquidity after major loan-stressing events. This would enable not only restructuring of existing loans but, more importantly, distribution of new loans. New capital influx through existing channels to existing (good) MFI clients has a large multiplying effect in generating economic activity and allowing the long-term reconstruction financing to run through local markets, not bypass them.

72. The total outstanding loan balance in the MFI sector is estimated around $3.5 billion. Assuming that 90% of the loans are climate-exposed, there is an overall exposure of $3.15 billion. The national modeled loss rate relative to GDP for a 1-in-100-year event is just under 5% for cyclone and almost 8.5% for flood. Taking into account the relatively higher vulnerability of NGO and MFI clients against national exposure, a loss rate of 10% for a 1-in-100-year event seems reasonable, leading to a loss or impairment against the national NGO and MFI loan portfolio of $315 million. If fully covered, this would comprise around 60% of the identified funding gap for the MFIs and NGOs (Figure 10).

73. However, a number of elements would need to be in place for such a scheme to be viable, including

(i) compulsory participation of all MFIs with climate-exposed loan portfolios, implemented alongside a simple risk assessment process to identify and quantify the covariant weather risk of each MFI;

(ii) a simple parametric product structure at the MFI level, such that the particular vulnerabilities and geographic distribution of the loan portfolio can be captured but without the detailed and costly risk analysis;
(iii) a constant rating structure and an efficient vehicle to underwrite cover and pool the risk;
(iv) capitalization of the risk pool; and
(v) technical assistance program and required contingency planning for MFIs to ensure that benefits of risk transfer are passed on to clients.

74. PKSF's Covariant Risk Fund would appear to provide a significant head start on a number of these critical components of a portfolio microinsurance pool, although experience from elsewhere in the region and globally would need to be closely investigated to ensure that any program would be sustainable in the medium to long term.

VII. RECOMMENDATIONS

75. Uncovered financial risk from disasters places a significant downward pressure on the country's economic growth. Financial costs from disasters are sudden and catastrophic and aggravate direct disaster impacts. Thus, it is necessary to integrate disaster risk financing strategies into the overall disaster risk management and public finance management to minimize the financial and economic consequences of disasters for the households, the private sectors, and the government.

76. Based on the risk profiles and present institutional and policy context, three specific disaster risk finance options are identified for Bangladesh—sovereign contingency credit, direct sovereign risk transfer to the international market, and microfinance portfolio protection to provide risk financing for the low-income population.

77. Policy makers, regulators, and private sectors are strongly recommended to consider adopting disaster risk financing options that are suitable to each institution's mandate and capacity. The three options are recommended as feasible options that can be implemented with little or moderate investment under the present Bangladesh environment.

78. In addition to the options, policy makers, in particular budget policy makers, are recommended to develop appropriate financial management policies for disasters, including

(i) ensuring integrating disaster risk financing strategies into the overall disaster risk management and public finance management;
(ii) assessing the fiscal impacts of disaster risks;
(iii) developing clear rules and systems on postdisaster financial arrangements, including rapid and accountable relief, recovery, and reconstruction resource distribution;
(iv) promoting sound financial sector and microfinance sector development with respect to disaster risks including proper regulation, business continuity, and contingency planning; and
(v) providing continuous information dissemination and training activities on disaster risks to various stakeholders, such as disaster risk management related agencies, banks, financial institutions, NGOs, and MFIs.

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Disaster Risk Financing in Bangladesh

From 2000 to 2013, natural disasters caused more than $10 billion in economic losses to Bangladesh. However, the available funding for relief, rehabilitation, and reconstruction for the same period was only $2 billion, or $8 billion in unfunded losses. This funding gap is partly attributed to insufficient financial preparedness in disaster risk management. The limited postdisaster funding negatively affected the economy in terms of lowered economic growth and increased poverty. Applying appropriate disaster risk financing is key to minimizing economic impacts from disasters and sustain the country's development.

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