Swiss Re

Barisal: helping a city prepare for climate change

An Economics of Climate Adaptation study in Barisal, Bangladesh

KFW

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DEUTSCHE ZUSAMMENARBEIT

Floods, cyclones and rising sea levels disrupt the lives of many people around the world. Communities will face more damage as urbanisation advances and our climate continues to change.

Many towns and cities are unprepared for this future. Their floodwalls are too low, water supplies too fragile and drainage systems inadequate to deal with the impact of extreme weather.

The question is how do we allocate the limited resources we have in the most effective way.

To address this challenge, KfW, Swiss Re and Barisal City Corporation teamed up to develop an adaptation strategy for Barisal in Bangladesh. This will help the people there adapt to the impacts a changing climate will bring.

Rising temperatures and the risks they bring

Rapid population growth and human activity have led to significant increases in greenhouse gas emissions, which, alongside natural variability, are pushing global temperatures higher. According to the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report[1], 1983 to 2012 was likely[2] the warmest 30-year period in the last 1400 years in the northern hemisphere.

The rise in global average temperatures changes the energy balance of the climate, leading to higher atmospheric humidity. This disruption will almost certainly lead to shifts in the frequency, intensity and duration of extreme weather events such as floods, heatwaves and other natural disasters. In consequence, the world faces increasing risks such as crop failure, water shortages and rising sea levels. Risks such as these can engender significant environmental, social and economic costs for communities, businesses and governments.

> "With the Economics of Climate Adaptation (ECA) study we brought all stakeholders to the same table and especially intensified our cooperation with the Local Government Division of the Bangladesh Ministry of Local Government, Rural Development and Co-operatives.
>
> **Mayor of Barisal**

How building resilience can help

Even if all emissions stopped immediately, many effects of climate change like sea level rise or shifting rainfall patterns will persist for a long time into the future. But that does not mean that nothing can be done. Risk prevention and avoidance measures as well as disaster risk management measures can be implemented to build resilience to the impacts of climate change. Initiatives like the 100 Resilient Cities[3] show this. Two kinds of measures implemented together have had the most impact in the last few years:

- Climate change mitigation – reducing greenhouse gas emissions as substantially and quickly as possible; and
- Adaptation to climate change – taking measures to deal with the impact of climate change.

Limiting climate change will require substantial and sustained reductions in greenhouse gas emissions. The consensus is that by 2050 the rise in global average temperatures should be limited to no more than 2°C.[4] In terms of global carbon emissions, limiting global warming to 2°C corresponds to a global carbon budget – the cumulative amount of greenhouse gases that can be released into the atmosphere – of 1 200 GtC (billion tonnes of carbon), of which 550 GtC has already been emitted. If implemented, such a substantial emission reduction can prevent worst case climate change impacts and still allow societies to cope with the consequences.

Nevertheless, climate change will expose local populations to the already unavoidable challenges and costs of protection against weather-related risks. If left unchecked, it is estimated that the overall costs of the effects of climate change could amount to 20% of global gross domestic product by the end of this century[5].

[1] Fifth Assessment Report: Climate Change 2013, Intergovernmental Panel on Climate Change (IPCC), 2013, http://www.climatechange2013.org
[2] "Likely" as used by the IPCC means a probability between 66% and 100%.
[3] 100 Resilient Cities, http://www.100resilientcities.org/
[4] http://unfccc.int/paris_agreement/items/9485.php
[5] Stern Review on the Economics of Climate Change, Lord Nicholas Stern, 2006, webarchive.nationalarchives.gov.uk/20080814121010/http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm

Adapting to a changing climate

The increasing frequency of storms, floods, droughts and other extreme weather events as a result of climate change threatens cities, regions and entire nations. In the past decades, we have seen costs of natural catastrophes rising at the same rate as wealth has accumulated in the world's most exposed regions – from New York City to Bangkok.[6] This trend is set to continue as people continue to move to cities. Such developments change the risk landscape of our globe considerably – putting lives and economies around the world at risk, as the Swiss Re study "Mind the risk" has shown for many global centres.[7]

If we want to keep floods at bay and drinking water flowing in the world's big centres – just to name a few of the challenges – we must adapt to the changing environment. This is why many cities across the world have joined the Rockefeller Foundation's[8] 100 Resilient Cities network. The mayors of these cities know that adaptation measures are available to make their constituencies more resilient to the impacts of climate change. Similarly, the custodians of national and local economies, such as finance and economy ministers, as well as leaders in the private sector want to better prepare for the future. Such decision-makers ask:

- What is the potential climate-related damage to our economies and societies over the coming decades?
- How much of that damage can we avert, with what measures and where?
- What investment will be required to fund those measures – and will the benefits of that investment outweigh the costs?

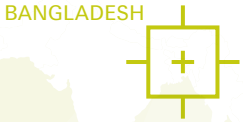
The Economics of Climate Adaptation[9] (ECA) methodology helps to answer these questions. The methodology[10] ensures decision-makers engage the right stakeholders, understand the impact of climate change on their economies and identify actions to minimise the effects at the lowest cost to society.

The result creates transparency about the costs, benefits and effectiveness of a wide range of adaptation measures. It thus allows decision-makers to select what makes most sense to them. Integrating adaptation with economic development and sustainable growth is another aspect decision-makers can consider and examine for the right action.

> "ECA helps stakeholders identify specific adaptation measures. It also delivers concrete economic facts so we can be sure investments from the German Government are helping affected populations adapt to climate change.
>
> **Project manager Climate Adaptation, KfW Development Bank**

[6] http://www.swissre.com/library/A_global_overview_of_case_studies__fast_growing_coastal_communities.html
[7] http://www.swissre.com/library/expertise-publication/Mind_the_risk_a_global_ranking_of_cities_under_threat_from_natural_disasters.html
[8] www.100resilientcities.org
[9] Economics of Climate Adaptation, www.swissre.com/eca
[10] Shaping climate resilient development , ECA Working Group, 2009, http://media.swissre.com/documents/rethinking_shaping_climate_resilent_development_en.pdf#page=122

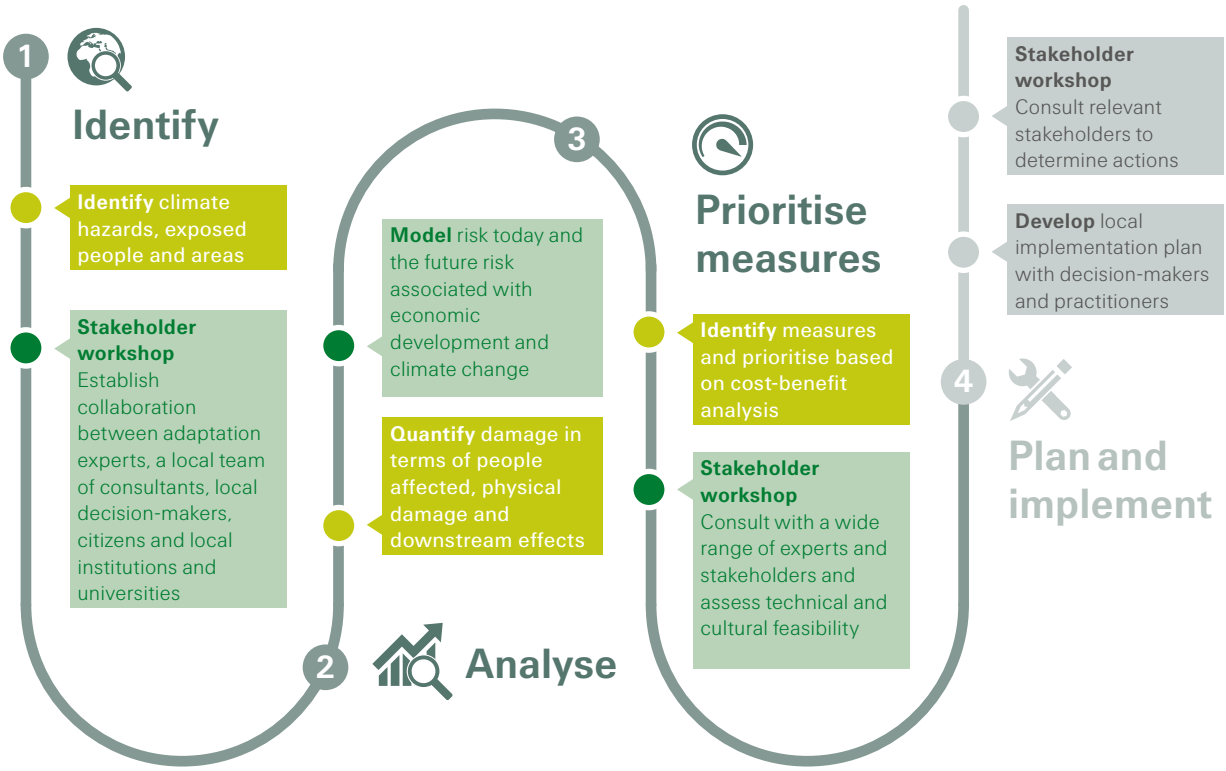
Case in point: Barisal, Bangladesh



The KfW Development Bank initiated a pilot study in Barisal, Bangladesh, using the ECA approach to identify climate change adaptation measures in urban areas. Barisal city is located on the banks of the Kirtankhola river, 115 km south of Dhaka and 106 km from the Bay of Bengal. Roughly 330 000 people live in Barisal city, which is administered by the Barisal City Corporation. In the city's urban areas, commerce, pharmaceuticals, and cement are the mainstay of the economy. In its rural areas, production of rice, fish, fruit and vegetables are important. At just one metre above sea level, the city is at greatest risk from floods and cyclones, with the businesses and people in the western parts of the city suffering most damage.

Adaptation experts, financing institutions, Barisal city officials, consultants and local stakeholders discuss the most relevant hazards: where are housing and businesses exposed to the effects of floods and cyclones in Barisal?

The ECA process



The ECA methodology in practice

The ECA study was conducted by joint forces of KfW Development Bank, Swiss Re, Barisal City Corporation and international and local consultants.

> People in my neighbourhood in western Barisal are self-sufficient farmers. We have lost a significant amount of our rice production due to monsoon floods in the last years.
>
> **Representative of neighbourhood in Barisal**

1. **IDENTIFY:** As a first step, the team brought together all relevant stakeholders to discuss the main threats to the community. This unique collaboration between local and national decision-makers, local and international adaptation experts, financing bodies, universities, consultants and engaged citizens highlighted the most relevant hazards, the most vulnerable people and the most exposed areas. Taking an inclusive approach is vital to ensure multiple perspectives are brought in early on. It also allows wide discussion of possible solutions.

> We spent several weeks on the ground in Barisal to collect data for adequate flood modelling, such as rainfall data, digital elevation model, location and characteristics of rivers and khals in the city.
>
> **Hydraulic engineer consultant, Consultancy Group**

2. **ANALYSE:** In a second stage, the team quantified the most relevant threats in terms of areas and people affected, physical damage and knock-on effects. The latter can be flood-related illness, loss of income due to a lack of work or the inability to work, eg among day labourers (rickshaw drivers, fishers, construction workers). For Barisal, low income households and the related settlements were a special focus for the team. Commercial districts in Barisal are unable to function without workers coming in from the less affluent parts of town. We extended the methodology to include damage impacts relative to annual income, so that these impacts were well reflected in the analysis.

The team also analysed present and future risks – from the threat of monsoon floods and tropical cyclones for citizens, farmers, residential and commercial buildings, to damage to crucial infrastructure such as roads, hospitals, water supplies and power lines. As part of the analysis, the team considered future risks associated with economic development and climate change – in short the total climate risk.

3. **PRIORITISE MEASURES:** For this next step, the team again consulted with a wide range of experts and stakeholders to identify adaptation measures. Measures are prioritised using a multi-criteria approach (see box).

The multi-criteria approach

Economic development is a main driver for increases in risk. Urbanisation, new and improved infrastructure such as roads, public transport and power lines, as well as rising living standards all contribute to changing risk patterns. The effects of climate change on weather-related events are, among others, prolonged droughts, sea level rise, increases in extreme precipitation or storm surge height, and greater frequency of strong hurricanes.

Scenario: Both for economic development and for climate change, the team compiled one or multiple scenarios. A scenario is a snapshot that describes a possible and plausible future. Scenario analysis is a systematic approach to anticipating a broad range of plausible future outcomes. By taking such an approach, the ECA methodology allows you to create a robust understanding of the changing risk pattern and thus identify the main driver of risks and damage reduction opportunities.

Inclusiveness is key – prioritise measures using a multi-criteria approach

Adaptation measures are prioritised using a multi-criteria approach during multiple stakeholder workshops. Criteria range from pure economics, such as cost-benefit ratios and implementation risk, to pro-poor focus, health effects, environmental aspects and cultural alignment. These factors are assessed with input from Barisal City Corporation, local and international experts as well as community representatives. The economic dimension is captured in a cost-benefit analysis, evaluating which investments and measures are the most cost-effective to adapt to the expected risk.

Wherever damage is averted, it is calculated as a benefit alongside any additional revenues. The costs, on the other hand, include capital for building infrastructure or implementing measures as well as operating expenses. Potential operating savings derived from the measures were also taken into account. The stream of costs is discounted back to today's dollars using local assumptions on inflation. Measures range from engineering (dams), ecosystem-based (reforestation) and behavioural changes (emergency shelters, awareness campaigns and improved building codes) to insurance options.

4. **PLAN AND IMPLEMENT:** Once decided, detailed planning and implementation of measures can start.

For more detailed information, see the methodology overview of Economics of Climate Adaptation[11], and take a look at the ECA Guidebook for Practitioners[12] and "climada", an open-source climate adaptation tool[13].

[11] Shaping climate resilient development , ECA Working Group, 2009, http://media.swissre.com/documents/rethinking_shaping_climate_resilent_development_en.pdf#page=122

[12] Economics of Climate Adaptation (ECA) - Guidebook for Practitioners, KfW, 2016, https://www.kfw-entwicklungsbank.de/PDF/Download-Center/Materialien/2016_No6_Guidebook_Economics-of-Climate-Adaptation_EN.pdf

[13] Open-source climate adaptation tool: https://github.com/davidnbresch/climada/wiki

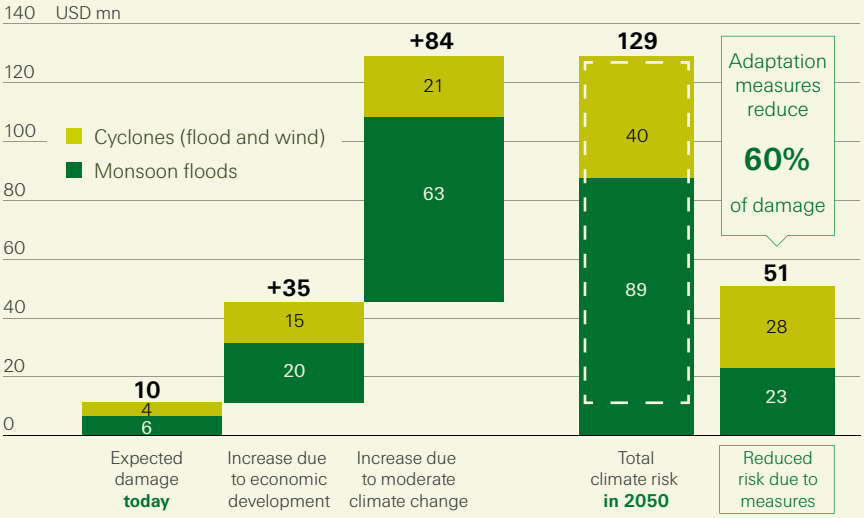
The costs and benefits of protecting the people of Barisal

The most vulnerable people live alongside the Kirthankhola river, which regularly brings high water in the monsoon season and threatens their existence.

Applying the ECA methodology, the team was able to identify the key risk drivers in Barisal: the city's annual monsoon, cyclones and sea level rise as well as urbanisation. Frequent flooding, urban sewage problems and damaging effects for low-income households are just some of the negative impacts the city has to tackle every year.

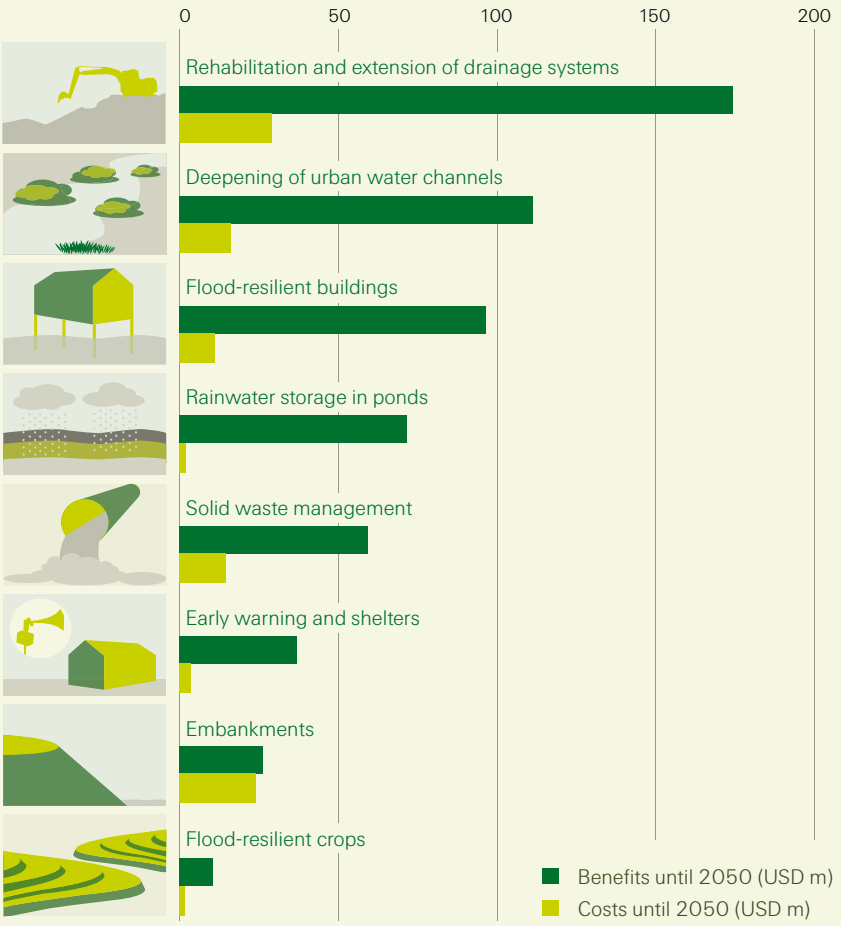
Communities in Barisal face annual damages of USD 10 million due to monsoon floods and cyclones. This number is projected to increase significantly by 2050. The total climate risk by 2050 as a result of economic development and climate change under a moderate scenario is expected to add up to roughly USD 130 million in damage per year (see graphic below). However, the pilot study found that 60% of the expected damage can be avoided by taking appropriate adaptation measures.

Annual expected damage in Barisal likely to increase dramatically from today to 2050



All figures converted from Bangladeshi Taka, BDT 100 = USD 1.27. May 2016

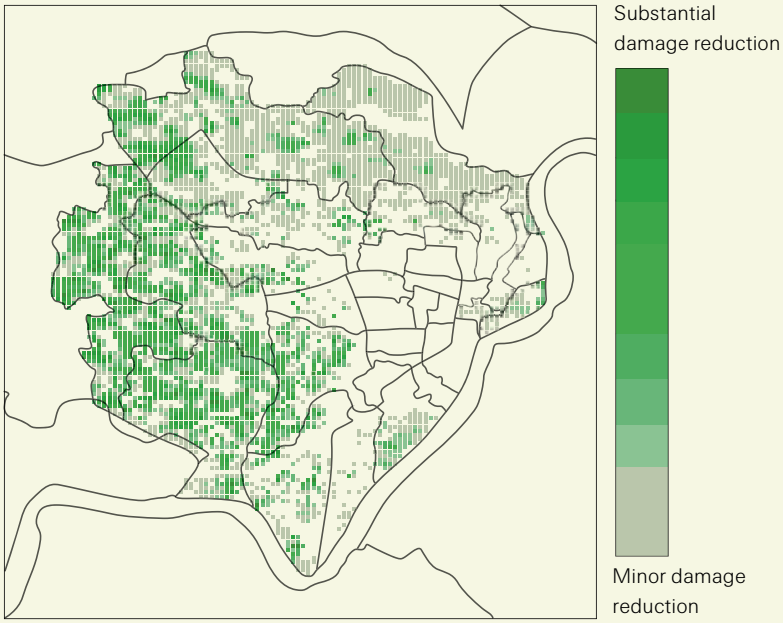
Costs and benefits of the most effective adaptation measures in Barisal



> We have identified a broad range of specific adaptation measures which combined can effectively protect our community. These measures include the rehabilitation and extension of drainage systems as well as the development of flood-resilient buildings.
>
> **Engineer, Barisal City Corporation**

All figures converted from Bangladeshi Taka, BDT 100 = USD 1.27. May 2016

Expected benefit for 2050
Example of an efficient measure: Flood-resilient crops reduce agricultural losses by 40%, mostly in the western part of the city of Barisal.



Fostering long-lasting collaboration

All the results from the ECA study in Barisal are community-owned under the lead of Barisal City Corporation. Maps and other data, such as the risk chart and the cost-benefit analysis, provide insights into what the benefits are and where damage can be avoided. What is more, the level of transparency, combined with a multi-criteria approach to prioritising measures, foster long-lasting collaboration among stakeholders and confidence in the adaptation opportunities for all parties involved.

This is important because communities have to act now, together and over a longer time span. Only by combining risk prevention, risk mitigation and risk transfer measures as part of a comprehensive adaptation strategy will urban and rural communities become more resilient to the impacts of climate change.

> Risk prevention and risk transfer are mutually reinforcing. While frequent flood events in Barisal can be prevented thanks to drainage improvements and flood-resilient buildings, at a later stage complementary insurance to manage more seldom events can provide valuable financial protection.
>
> **Natural hazards expert, Swiss Re**

Handling the risk you can avoid - now

Very rare catastrophe events can have a lasting impact on even the best prepared communities. For such rare events, insurance can provide additional protection. It helps in the recovery efforts by providing funds. Fast pay-outs not only help rebuilding, taxpayers save money too because whatever is paid out of insurance does not need to be paid out of public funding.

In Barisal, however, the key risk driver is the annual monsoon. It leads to frequent flooding, urban sewage problems and threatens low-income households in particular. Thus focusing on prevention measures first is more appropriate and cost-efficient. Only in a more advanced risk management stage can insurance efficiently provide additional protection.

Risk prevention and insurance are mutually reinforcing. Prevention does two things:

- Does everything to avoid something happening in the first place
- Minimises the impact if the unavoidable happens

Insurance companies take these two points into account when they calculate premiums. The better you are at prevention, the lower the premium will be. The ECA methodology helps to make this connection transparent, as the Barisal example shows.

It is not just in Barisal that well-targeted investments are available to protect the community. Case studies[14] in more than 20 different regions around the globe, ranging from Maharashtra in India to Florida in the US or northern England, showed that up to 65% of the expected damage from climate change can be averted using cost-effective adaptation measures.

The ECA approach presents a strong case for immediate action. Well-targeted, early investments to improve climate resilience – whether in infrastructure development, technology advances, capacity improvements, shifts in systems and behaviours, or risk transfer measures – are likely to be cheaper and more effective for the world community than complex disaster relief efforts after the event. Barisal city is a landmark example of how to implement a long-lasting adaptation strategy because it is cheaper than paying for recovery efforts.

[14] Economics of Climate Adaption, www.swissre.com/eca

KfW experience with the ECA pilot studies

The goal of the ECA pilot studies for KfW was to analyse the methodology's practicability and added value. KfW found the ECA approach to be useful, particularly for climate adaptation strategies and strategic investment plans in adaptation finance, including insurance approaches.

Applying the ECA methodology for Financial Cooperation[15] clearly demonstrated the strength of its unique scenario approach and the cost-effectiveness of adaptation measures. A further benefit was the clear structure within which stakeholders could discuss issues, thereby fostering consensus.

A key learning from the pilot is to maintain the right balance between the time and money spent to apply the ECA approach and planned investment volumes. The pilot team currently recommends selective use of the methodology for development cooperation by considering the required cost and time.

To make the ECA methodology more efficient and user-friendly, KfW has produced a detailed ECA Guidebook for Practitioners.[16]

Barisal City Corporation

Barisal City Corporation (BCC)[17] is a local government body that provides civil services and facilities to its 330 000 inhabitants. BCC operates under the Local Government Division (LGD) of the Ministry of Local Government, Rural Development and Cooperatives of the People's Republic of Bangladesh. Headed by an elected mayor, the city corporation is run by a joint staff of elected public representatives and government officials. BCC is responsible for administering and providing basic infrastructure to the city, such as water purification and supply, sewage treatment and disposal, solid waste management, building and maintenance of roads and streets and public municipal schools. It represents a strong local partner in the Economics of Climate Adaptation study. Besides hosting the workshops, BCC engineers and the town planner were in close collaboration with the international and local consultants. BCC is also the project execution agency towards KfW and thus responsible for successfully implementing the identified adaptation measures. BCC is well suited for this responsibility, as it can apply a multi-sectoral, territorial and bottom-up integrated approach while implementing measures in a coherent and effective way.

[15] Economics of Climate Adaptation (ECA) in Development Cooperation: A Climate Risk Assessment Approach, KfW, 2016, https://www.kfw-entwicklungsbank.de/PDF/Download-Center/Materialien/2016_No5_Economics-of-Adaptation_EN.pdf

[16] Economics of Climate Adaptation (ECA) - Guidebook for Practitioners, KfW, 2016, https://www.kfw-entwicklungsbank.de/PDF/Download-Center/Materialien/2016_No6_Guidebook_Economics-of-Climate-Adaptation_EN.pdf

[17] Barisal City Corporation, http://barisalcity.gov.bd/

KfW Development Bank on behalf of the German Federal Ministry for Economic Cooperation and Development

For more than 50 years the KfW Development Bank[18] (KfW) has helped the German Federal Government to reach its goals in development policy and international development cooperation. On behalf of the German Federal Government, and primarily the Federal Ministry for Economic Cooperation and Development, KfW finances and supports programmes and projects that mainly involve public sector players in developing countries and emerging economies. It is very closely involved at all stages of the programmes and projects: from conception and execution to monitoring effectiveness.

KfW initiated two pilot studies in Barisal, Bangladesh, and San Salvador, El Salvador. The pilots trial the ECA approach as a truly innovative way to identify and prioritise adaptation measures. The studies are a part of comprehensive adaptation programmes in urban areas and actively involve a broad range of stakeholders. KfW experts from the Energy and Urban Development, Latin American Sector Team, the Urban Development and Mobility, South Asia Sector Team, the Environment and Climate Competence Centre and the independent Financial Cooperation Evaluation Unit formed a KfW cross-institutional team to jointly implement the ECA pilot studies.

Swiss Re

The Swiss Re Group is a leading wholesale provider of reinsurance, insurance and other insurance-based forms of risk transfer. Dealing directly and working through brokers, its global client base consists of insurance companies, mid-to-large-sized corporations and public sector clients.

Swiss Re develops tailor-made risk transfer options, such as the CCRIF SPC[19] (formerly the Caribbean Catastrophe Risk Insurance Facility) and natural catastrophe programmes in Guangdong and Heilongjiang in China[20].

In addition to providing re/insurance covers, Swiss Re offers clients strategic expertise and integral risk assessments of natural disasters and climate adaptation. Swiss Re, as part of the Economics of Climate Adaptation working group, developed the Economics of Climate Adaptation methodology. Since then Swiss Re has conducted more than 20 case studies in more than 20 different regions around the globe. Studies ranging from Maharashtra in India to New York and northern England, showed that up to 65% of the expected loss from climate change can be averted using cost-effective adaptation measures.

[18] KfW Development Bank, https://www.kfw-entwicklungsbank.de/International-financing/KfW-Entwicklungsbank/

[19] http://www.swissre.com/global_partnerships/archive/speedy_insurance_payout_of_USD_29_million_to_support_caribbean_relief_in_wake_of_matthew.html

[20] http://www.swissre.com/reinsurance/swiss_re_reinsures_biggest_natural_disaster_insurance_programmes_in_china.html

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Title:
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Authors:
Lea Müller, Dr. Gerry Lemcke

Advisors: Dr. Silke Paulwitz, Dr. Florian Wieneke, Prof. Dr. David Bresch

Editing and realisation:
Richard Heard, Liz Kelly, Bernd Wilke

Managing Editor:
Urs Leimbacher

Graphic design and production:
Swiss Re Corporate Real Estate & Services/ Media Production, Zurich

Infographics:
Annie Wu, Swiss Re Communications

Photographs:
Getty Images, Swiss Re

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Swiss Reinsurance Company Ltd
Mythenquai 50/60
P.O. Box
8022 Zurich
Switzerland

Telephone +41 43 285 2121
Fax +41 43 285 2999
www.swissre.com

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