

# Institutionalizing Climate Risk into Infrastructure Decision-making

Adaptation Knowledge Brief:  
Lessons from Implementation experience

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Authors: [Laura Kuhl](#), [Tanvir Chowdhury](#) and [Abu Touhid Hossain](#)

## Overview

The Global Center on Adaptation (GCA) provides technical assistance to governments and international financial institutions (IFIs) to support the integration of climate risk analyses and resilience measures into major infrastructure investments, with the goal of scaling infrastructure that is resilient, accessible, and performs reliably under climate stress.

Experience shows that many factors beyond technical modeling need to converge for this institutionalization to occur. GCA engages early in the project cycle, typically during project preparation, to identify opportunities to strengthen investment decisions and project design. It conducts climate risk analyses and infrastructure stress testing and delivers actionable recommendations to embed adaptation and resilience into project design. GCA complements this technical analysis with capacity building. This is intended to enable institutions to mainstream climate risks into institutional decision-making and systematically integrate climate resilience considerations into current and future investments.

This brief draws on GCA's experiences with the Green Railway Transport Project in Bangladesh,<sup>1</sup> a USD 400 million World Bank–financed initiative, to highlight key enabling factors and good practices for institutionalizing climate risk into infrastructure decision-making.

## The Green Railway Transport Project

The Green Rail Transport Project is a project being prepared by the World Bank at the request of the Bangladesh government to invest in several critical areas on the Dhaka-Chattogram Rail Corridor. The project will support freight service improvements and railway station redevelopment initiatives, including extending the existing rail corridor to link with new port investments including the Bay Terminal project. Other partners, including the Asian Development Bank, are also planning

<sup>1</sup> This brief discusses lessons learned from a pilot project implemented by the Global Center on Adaptation (GCA) in Bangladesh under the “Scaling up Investments in Nature-based Solutions for Climate Resilience” project funded by Global Affairs Canada from 2023- 2026.

complementary investments in the Corridor; GCA analyses therefore addresses the entire corridor while also providing more detailed analyses on those sections planned under the World Bank investment.

GCA technical support to the project consisted of a) a comprehensive high-resolution climate risk analysis, analyzing the vulnerabilities of the railway corridor and associated system to key climate hazards (storm surge, flooding, and extreme temperatures) under a range of future climate scenarios, and b) identification and prioritization of adaptation solutions with financial rationales to address these impacts. The analysis identified particularly vulnerable areas, modeled the potential of adaptation strategies, particularly Nature-based Solutions, and used multi-criteria analysis to offer priority recommendations.

To complement this technical assistance, GCA delivered training through a Masterclass on Gender-responsive Climate Resilient Infrastructure to the Bangladesh Railway as well as other infrastructure agencies including the Chittagong Port Authority and the Local Government Engineering Department (LGED). It also produced targeted guidelines on the integration of adaptation and resilience interventions to support both the specific project and broader future investments.

**Although the project is still in the early phases of development, the World Bank and Bangladesh Railway have confirmed that GCA's support will be a key input for the Green Railway feasibility study.**



Figure 1: Map of Dhaka-Chattogram Freight Railway Corridor

## Critical enabling factors and good practices

The GCA experience suggests that several good practices are critical enabling factors for institutionalizing climate risk into infrastructure decision-making.

### Identifying windows of opportunity for transformational change

The value of GCA's support stems from the depth of technical analysis and integration into institutional decision-making it offers partners. Rather than a model designed for scale through breadth, GCA's model depends on the demonstration value that emerges from the engagement. Therefore, careful targeting and selectivity is critical, as it is not possible to provide this level of support individually to every potentially climate-vulnerable investment being made in the country. Each engagement requires careful relationship management to build trust.

**A key lesson from the Green Railway project is that aligning GCA support with windows of opportunity can create high potential for transformational change that goes far beyond influencing one individual investment.**

Several features of the Green Railway project made it a particularly good choice for the GCA model:

#### *Emphasis on systems thinking*

The Bangladesh Railway and the World Bank approached the design of the investment project from a systems perspective. The project proposal includes upgrading of specific sections of the track, but the World Bank and Bangladesh Railway requested that GCA conduct a vulnerability assessment across the entire corridor, enabling a systems view of vulnerabilities and modeling of adaptation strategies at a landscape scale.

As one example of both the importance of the findings and the value of a systems approach, a representative from the World Bank described the findings. Overall, she found the results of the climate risk analysis quite illuminating, and even “mind-boggling.”

*“In most of the cases, the railway bridges were not above the flood level. That was quite shocking to me...in our investment we will definitely push for the resilience features to be added but the overall corridor is still vulnerable. We are not working on the full corridor, we are working on the gaps...but this is something we need to consider going forward.”*

**- Representative, World Bank**

This landscape scale analysis enabled the identification of important adaptation strategies such as Nature-based Solutions, that would not have emerged if analysis was only conducted as a more local scale.

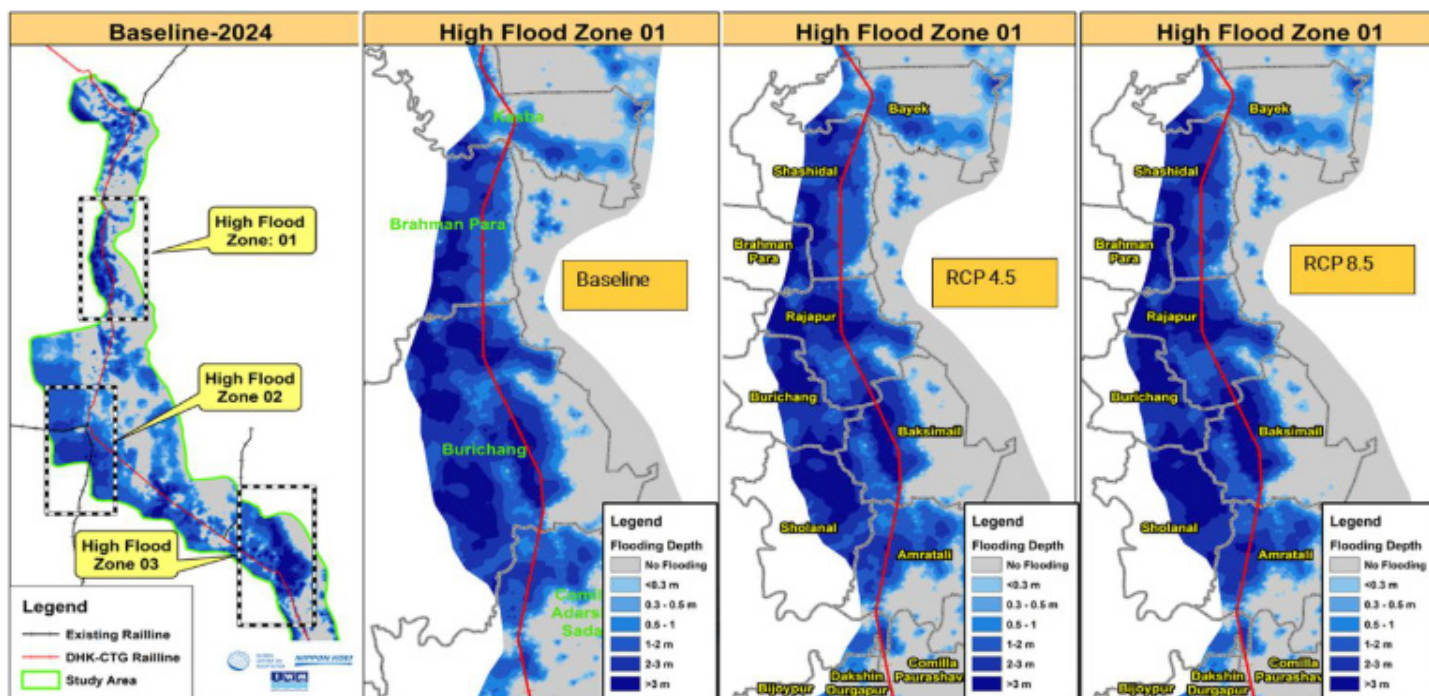


Figure 2: Example of climate impact mapping (in this case coastal flooding) under different climate scenarios

This broad vulnerability analysis enabled GCA to identify relatively modest investments that will have outsized influences on the resilience of the entire system. Complementing this large-scale analysis, GCA also identified several critical points for upgrades, such as the Chattogram Port Terminal. While not uniquely vulnerable to climate hazards, a systems analysis identified that there was the potential for catastrophic failures at these sites with cascading impacts across the system.

### Connection to other investments

The Green Railways project was a strategic choice because of the strong connections to other planned infrastructure investments, particularly the Bay Terminal project, which also received GCA support. Similarly, other port projects are planned that will connect with the rail corridor. Realizing the full benefits of these investments requires that that railway corridor is resilient, increasing the relevance of investing in climate resilience for this critical infrastructure.

### Institutional readiness

This was the first project to introduce climate risks into the design of railways infrastructure in

*"We got some new ideas here, because usually we have implemented investment projects with conventional methods where the climate adaptation or resilience aspects did not come in so elaborately. Before this project, we did not have climate aspects to such a large extent—we had environmental impact assessments... Here the difference is that we surveyed the climate hazards in advance and we measured the extent of the climate hazard and GCA recommended the adaptive measures so that if in the future we can implement these measures, our infrastructure will be more resilient and durable."*

**- Representative, Bangladesh Railway**

Bangladesh. Unlike other infrastructure sectors, such as roads, the Bangladesh Railway did not have any prior experience with “risk-informed” climate-resilient design.

The lack of prior attention to climate-resilient railways infrastructure provided a unique opportunity for GCA to introduce climate risk-informed decision-making into an important institution that had not previously considered these issues.

**Despite the novelty of the issue, there was strong institutional support from both the Bangladesh Railway and the World Bank to champion the project. The experience of the project highlights the importance of institutional champions to pilot new initiatives and promote innovative approaches.**

## Making the financial case for climate resilient infrastructure

One of the largest challenges for integrating climate risk into infrastructure investments is that in most cases increasing the climate-resilience of infrastructure leads to additional incurred costs. GCA's climate risk modeling provided critical data and analysis that allowed stakeholders to advocate for these additional costs, effectively translating climate risk into information that would be useful for decision-making.

Key to the success were the following strategies:

### ***Reframing the additional costs as avoided losses***

GCA's climate risk modeling began with a spatially-explicit modeling of climate impacts across key areas on the rail corridor, which was very helpful for identifying priority areas for intervention. It went beyond this, however, to link the physical data to damage estimates. Using established damage

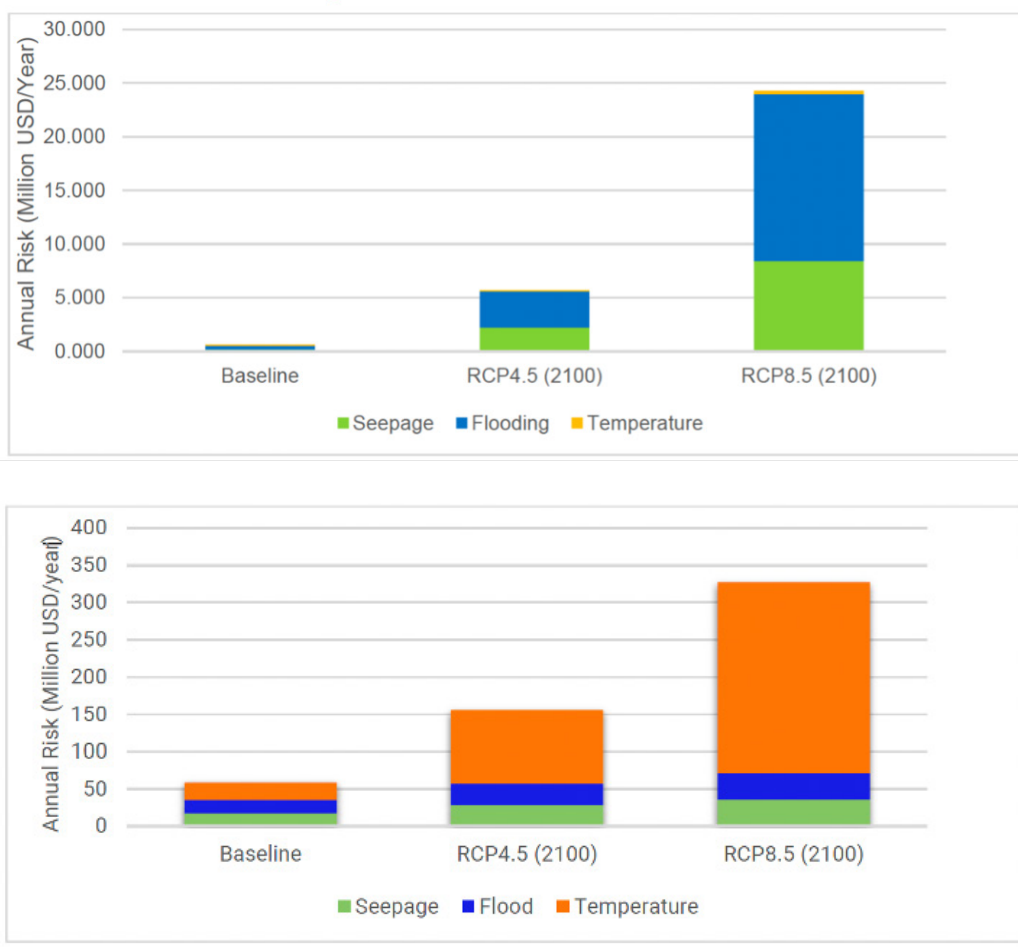


**Figure 3: Modeling of direct (a) and indirect (b) damages under current and future scenarios due to different climate hazards**

curves for the Bangladesh context, validated with data from Bangladesh Railway's own operations, GCA translated climate impacts into expected financial losses for the railway.

Damages were presented as both direct (damages to infrastructure assets) and indirect damages (economic losses from service disruptions). A key finding from the analysis, and one which stakeholders at both the World Bank and Bangladesh Railway found particularly valuable, was that indirect damages outweighed the direct damages. In other words, the losses due to service disruptions outweighed damages to infrastructure.

The analysis also found that temperature increases led to the highest damages under future scenarios, a different outcome compared to the current scenario where flooding is responsible for the largest proportion of damages. Such findings demonstrate the importance of climate modeling, as past experience is not a good heuristic for future decision-making.

This analysis provided stakeholders with the information needed to advocate for the additional costs of investment. It will also directly feed into the feasibility studies required for the planned investment project financed by the World Bank. Additionally, it is available for proposals to other potential future funders.

### *Distinguishing between capital vs O&M costs*

A persistent challenge plaguing infrastructure investments is that while it is often possible to secure financing for the capital investments to construct infrastructure, long-term operation and maintenance costs are not addressed through project-based finance. As a result, many infrastructure investments quickly fall into disrepair and the long-term sustainability suffers.

GCA's analysis explicitly connected climate risks to operation and maintenance costs, demonstrating how investments in climate resilience lead to lower operation and maintenance costs over time compared to scenarios without adaptation, by reducing the need for costly repairs, as well as minimizing service disruptions. Such information is critically important when planning for the long-term sustainability of infrastructure investments after project finance has concluded.

### *Utilizing data from the Bangladesh Railway's own operations*

It can be challenging to communicate the relevance of climate risk information to stakeholders who are not familiar with highly technical data. Rather than relying on theoretical risks or costs, GCA utilized the Bangladesh Railway's own data to develop its analysis. Without dedication and commitment on the part of all actors, it was unlikely that this would have occurred, as sharing this data required a high degree of trust due to the potentially sensitive nature of the operational data, but the effort to do so was highly valuable.

To model the impacts of increased heat on railway operations, GCA utilized data from the Bangladesh Railway on slow-downs and closures due to extreme heat. Although the Bangladesh Railway had this data, it was not in a format that enabled the type of trend analysis that GCA conducted. The data was in the form of daily logs by stationmasters that documented time periods when the rail speeds were

reduced. This data needed to be digitized and linked to temperature records to document the trends in the impact of temperature on railway operations.

Even under relatively moderate periods of increased heat, speed reductions were common, leading to lost revenue and service disruptions. These impacts disrupted current operations, but the analysis identified that under future climate scenarios, the damages would exceed even flooding.

This increased ownership over the modeling process and ensured that the analysis was context-specific and locally-relevant. This process also helped translate impacts that the Bangladesh Railway was aware of into an evidence-base for decision-making.

## Government ownership and uptake

Although GCA works directly with IFIs to shape their investment proposals, ultimately these programs must be responsive to national priorities and have significant government buy-in. The long-term success of GCA's work is also dependent on the institutionalization of climate- risk informed decision-making beyond specific IFI investments into government operations. Several strategies helped ensure government ownership and uptake.

### *Aligning with government priorities*

Expanding rail is a top government priority, and the Dhaka-Chattogram rail corridor is the most important rail corridor in the country. Expanding rail was identified as a priority by the interim government, and the newly elected government reaffirmed this priority.

### *Capacity-building and transfer to government institutions*

Crucially, none of the analysis conducted by the GCA or products developed under the project were designed solely with only one investment project in mind. Tools and datasets have been shared with the Bangladesh Railway for future use. All underlying data, including excel spreadsheets for calculations, have been shared with the World Bank and Bangladesh Railway so that they can be used and modified for future planning purposes

## Holistic approaches to financing climate-resilient investments

Leveraging GCA expertise across pillars: While the primary entry point for engagement for the Green Railways project was the infrastructure team at GCA, this project represents a strong example of the value that emerges by leveraging GCA expertise across pillars.

The landscape approach to analysis enabled GCA to identify Nature-based Solutions that were more

cost effective and had higher social value than purely engineered approaches. In both its training and technical guidance, the project introduced gender-responsive elements. While there was initially institutional resistance to the emphasis on gender-responsive training due to the lack of exposure to the concepts within male-dominated, technical agencies like the Bangladesh Railway, GCA's approach, built on relationships and trust and framed around risk and vulnerability, led to significant institutional buy-in and new insights by stakeholders about how gender-responsive design would support their work.

The project also benefited from the expertise within GCA on climate finance. The climate finance team supported the delivery of specialized training on public-private partnerships for resilient infrastructure.

In addition, after seeing the analysis conducted by the GCA, the Director of the Bangladesh Railway requested support to explore the potential for an application to the Green Climate Fund.

## Conclusion

Crucially, none of the enabling factors and good practices identified would be possible without the investments that GCA has made in relationship-building and trust. As a “solutions broker,” a key role that GCA plays is to bring different groups of stakeholders together and “socialize” new approaches. Translating climate risk analysis into decision-making requires a high level of trust in the process, and GCA has invested significant efforts to ensure those relationships are developed that enable the institutional changes that bring about transformation.

## About the authors

**Laura Kuhl** is an Associate Professor of Public Policy, Urban Affairs and International Affairs at Northeastern University in Boston, USA. [l.kuhl@northeastern.edu](mailto:l.kuhl@northeastern.edu)

**Tanvir Chowdhury** is a Senior Program Officer, Infrastructure & Nature-Based Solutions at the Global Center on Adaptation

**Abu Touhid Hossain** is a Program Officer, Infrastructure & Nature-Based Solutions at the Global Center on Adaptation