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Urban Climate Resilience Master Class

Module 5

Step-by-Step Guidelines for
Delivering Climate Resilient Infrastructure

UCRMC Course Overview

Welcome to the Urban Climate Resilient Master Class! You are about to start **Module 5**.



Module 1

Introduction to
Climate
Change and
Urban
Resilience



Module 2

Understanding
Climate Risks
in Your City



Module 3

Locally Led
Adaptation for
Urban
Resilience



Module 4

Ensuring
Climate
Resilience of
Urban
Infrastructure



Module 5

Step-by-Step
Guidelines for
Delivering
Climate
Resilient
Infrastructure



Module 6

Financing
Climate
Resilient Urban
Infrastructure

Acknowledgements

Welcome to the Urban Climate Resilience Masterclass!

This training has been developed by the Global Center on Adaptation (GCA) as a learning resource under Improving Urban Governance and Infrastructure Program (IUGIP) to strengthen the capacity of municipal officials to integrate climate adaptation and resilience into urban infrastructure and planning.

Thank You!

We would like to acknowledge the following partners and funders involved in designing and delivering this training:



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Agenda

- 01 Why This Topic Matters
- 02 Learning Objectives
- 03 Entry Points for Promoting Climate Resilience
- 04 Business as Usual vs. Climate Resilient Infrastructure
- 05 Step-by-Step Guidelines for Delivering Climate Resilient Infrastructure
- 06 Decision-Making Under Uncertainty
- 07 Interactive Exercise
- 08 Summary



Photo by AFP

Housekeeping

Listen



Listen carefully, follow along and make your own notes.

Ask



Ask the trainers questions or clarifications at any time.

Share



Your own experience is valuable and we encourage you to share it.

Discuss



Share and discuss with others during exercises, breaks and reflections.

01 | Why This Topic Matters



Why This Topic Matters



Building on the introduction to climate resilient infrastructure in Module 4, this module provides you with actionable guidelines and processes to deliver climate resilient infrastructure in your city.



It outlines different entry points for integrating resilience into decision-making in your city – including policies, planning, and asset creation. It then dives deep into how to plan and deliver climate resilient infrastructure.



This module presents a series of step-by-step guidelines for you to use when making infrastructure investments to ensure they are climate resilient.



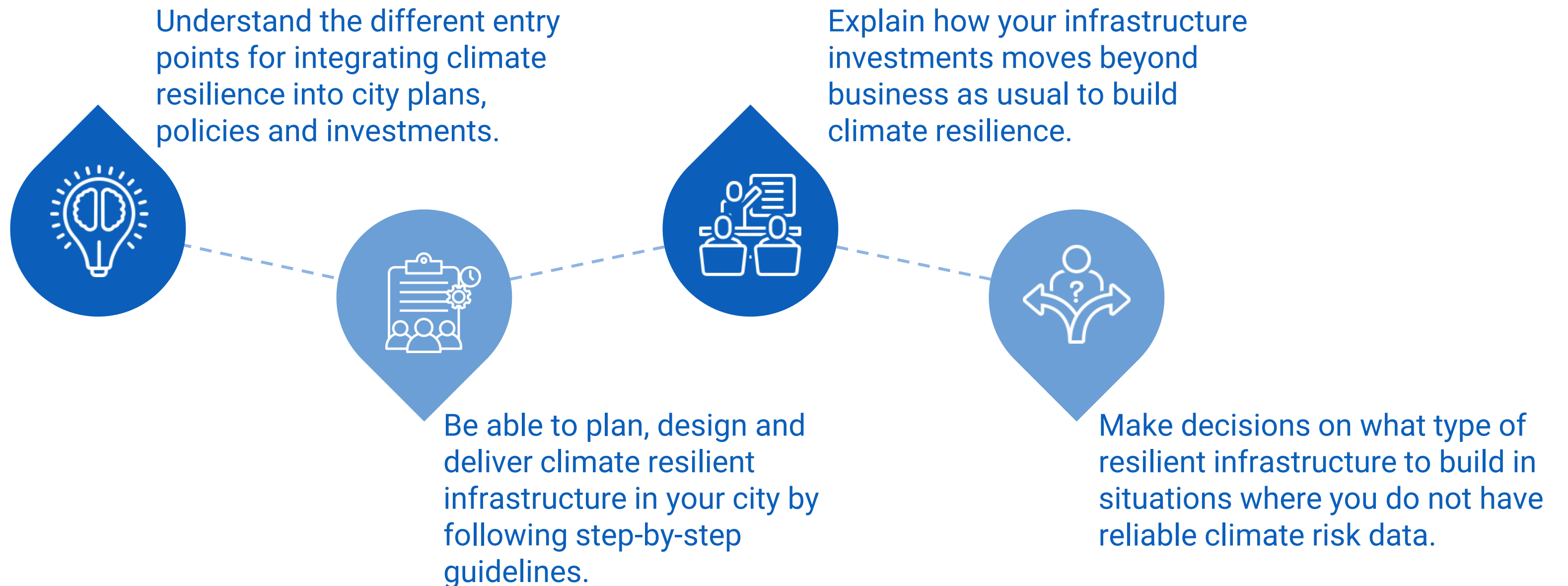
It also gives you a framework that you can use to decide what type of climate resilient infrastructure you can deliver even in situations where you do not have access to a CRA or climate risk data to guide your decision.

02 | Learning Objectives



Learning Objectives

By the end of Module 5 participants will be able to:



03 | Entry Points for Promoting Climate Resilience in Cities



Photo by Stephane Bidouze, Canva

Entry Points for Promoting Climate Resilience



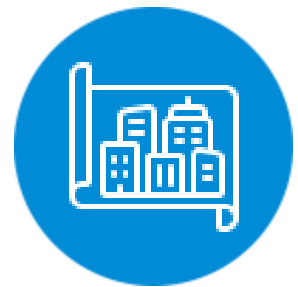
Policies & Strategies

Developing policies and strategies at national and city levels that outline how to address current and future climate risks.



Building Standards, Codes & Guidelines

Setting standards and guidelines like building codes so that infrastructure is constructed in a way that manages future climate risks.



Urban Planning

Integrating resilience into long-term urban plans such as city/urban plans, capital expenditure plans and disaster risk reduction plans.



Investing in Infrastructure

Planning and delivering climate resilient infrastructure so that it can withstand current and future climate impacts and minimizes climate risks for citizens.

Entry Point 01 | Policies & Strategies

Policies & Strategies

Many cities have developed their own climate policies, strategies, and action plans. These climate action plans work towards delivering the Paris Agreement – the international framework to combat climate change signed by all countries in the world.

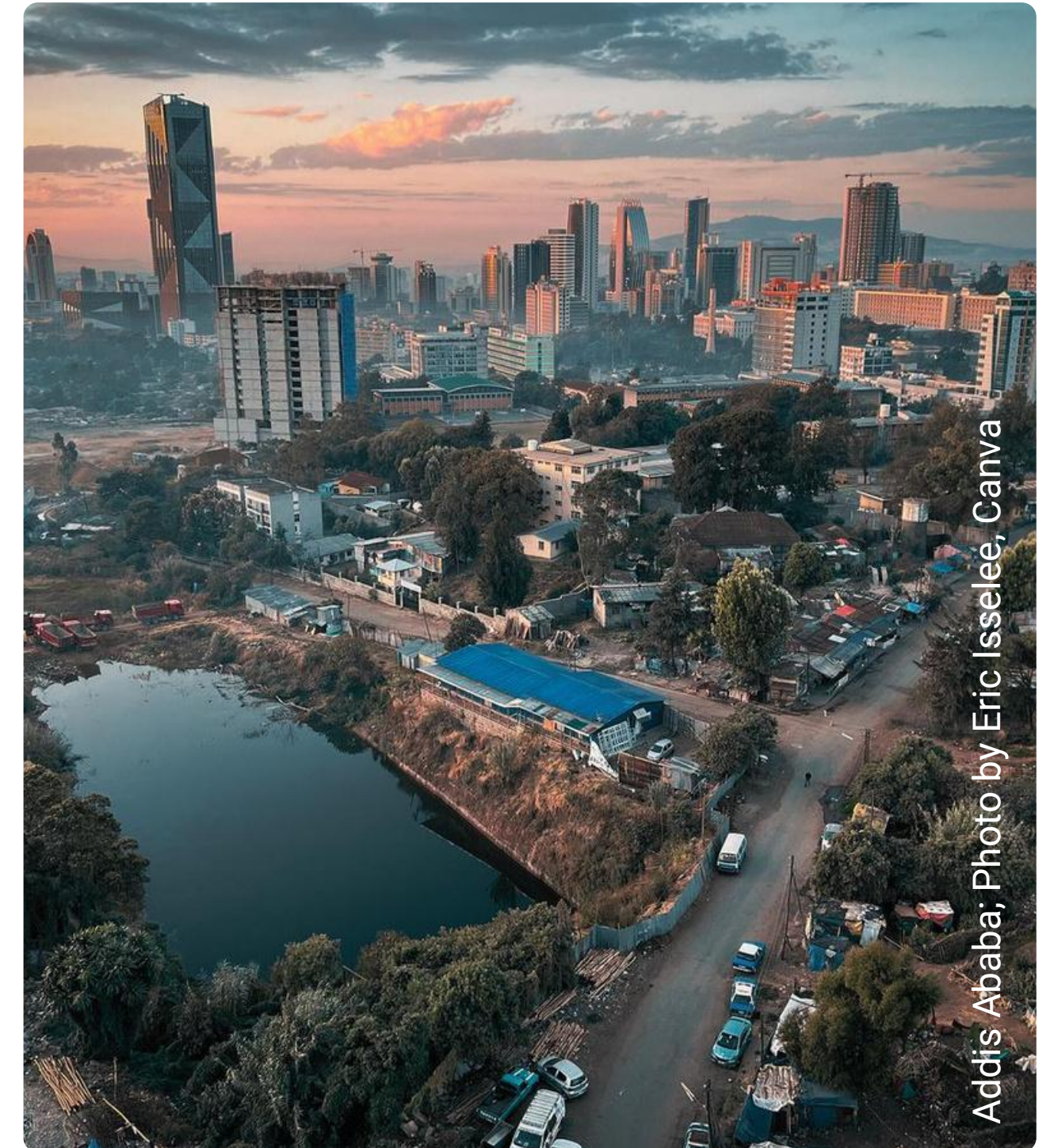
By developing a climate policy, strategy, or action plan, cities can organize their strategic approach to responding to climate change, and can set goals, timelines and investments that will promote climate resilience and reduce greenhouse gas emissions.

Case Study | Addis Ababa

Ethiopia's capital city has developed the [Addis Ababa Climate Action Plan: Towards a Climate Resilient, Inclusive, Low Carbon City by 2050](#).

The plan has an overarching resilience goal:

“To reduce the impacts of climate hazards such as flooding, heatwaves and droughts on different sectors, with targets the vulnerability to hazards by 30% in 2030, 60% in 2040 and 100% in 2050.



Entry Point 02 | Urban Planning

Urban Planning

In addition to strategic climate plans, cities can also integrate climate resilience into urban planning processes – such as urban Master Plans that guide spatial planning, and capital investment plans that guide medium-to-long-term infrastructure investments.

These are important entry points for ensuring that climate risk is systematically addressed across department silos and over longer time horizons that move beyond single government mandates.

Case Study | Cape Town

Cape Town's coastline is vital to the city's economy, but also vulnerable to climate risks such as rising sea levels, storms and erosion.

Cape Town has integrated climate risk management into spatial planning by delineating a Coastal Management Line (CML). City planners integrate climate risk data into coastal planning and regulate development within the CML to minimize risks while promoting equitable human settlements.



Cape Town; Photo by Skilpad, Canva

Entry Point 03 | Standards, Codes & Guidelines

Standards, Codes & Guidelines

The impact of climate hazards will take a toll on infrastructure in cities.

Standards, codes & guidelines can play an important role in building resilience by setting the rules to ensure that the location, design, materials, construction and operation of infrastructure all promote resilience.

Guidelines could include locating infrastructure away from flood risk areas or ensuring buildings are built with storm-resistant materials.

Case Study | New York City, USA

In 2012, Superstorm Sandy hit New York City, destroying 300 homes, killing 44 people, damaging infrastructure, leaving hundreds of thousands without power or basic services and causing USD \$44 billion in damages.

Following Superstorm Sandy, New York City upgraded its building codes to increase coastal resilience so that new buildings and retrofitted buildings are resilient to future hurricane impacts.



New York City; Photo by rabbit75_ist, Canva

Entry Point 04 | Climate Resilient Infrastructure

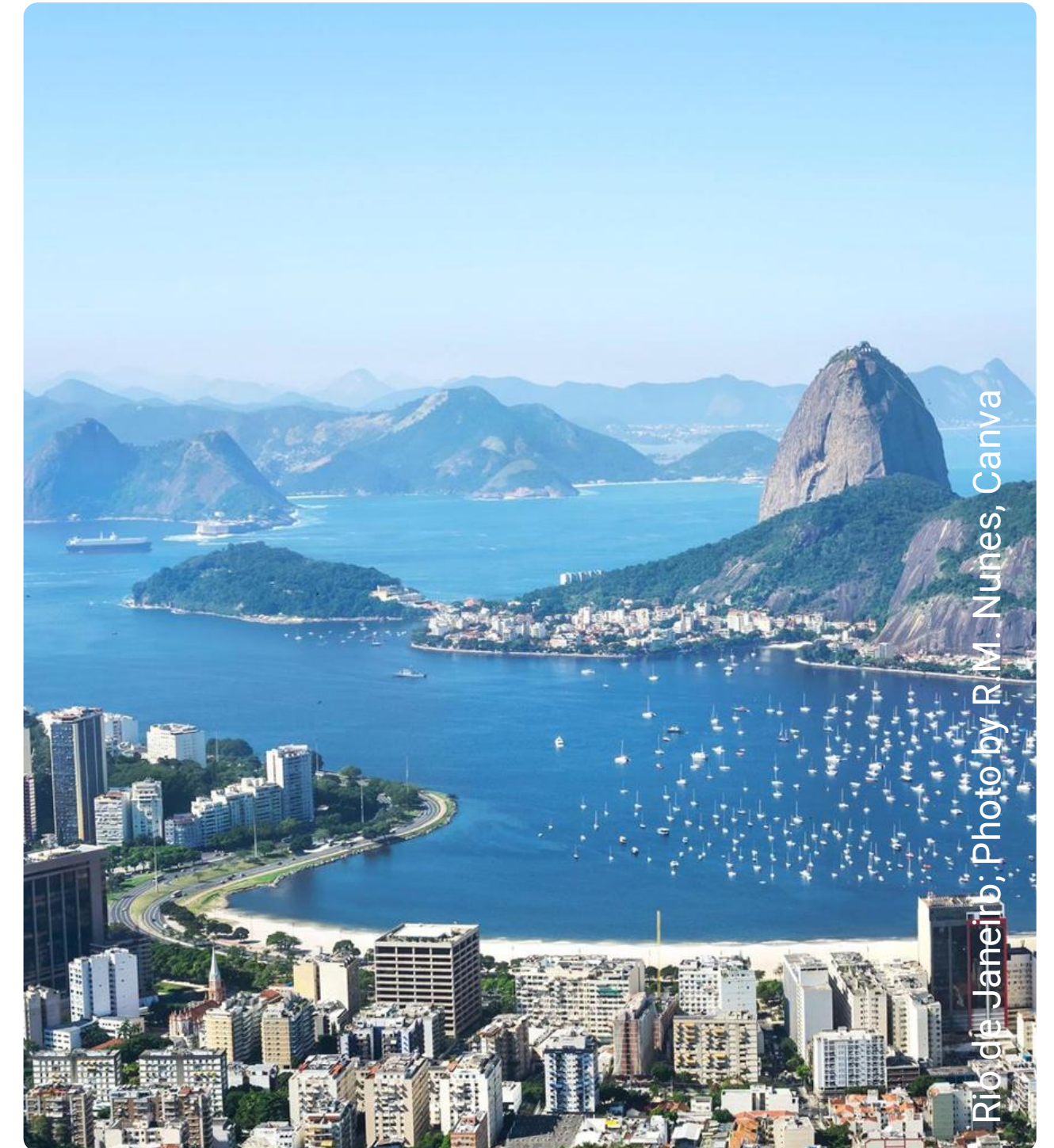
Climate Resilient Infrastructure

City officials can plan, design and deliver infrastructure and services that reduce the vulnerability and exposure of the city and its inhabitants to climate hazards.

Climate resilient infrastructure can have two facets: infrastructure can be designed so it is not negatively impacted by climate hazards (climate proofing); and the infrastructure can help reduce climate risks so that citizens are less impacted by climate change.

Case Study | Rio de Janeiro

Rio de Janeiro has built a range of flood-prevention infrastructure, including underground reservoirs and a diversion tunnel, preventing flooding into city streets, infrastructure damage, and the spread of waterborne diseases. The reservoirs are also used for recreation, demonstrating the dual functionality of infrastructure in enhancing both resilience and urban livability.





This course focuses on infrastructure investments as the main entry point.

But you may be able to contribute to building resilience in your city through other entry points too.

Review Exercise

Take 10 minutes to:

→ Write down a list of things your city is doing to promote climate resilience.

→ Discuss the list with the person beside you.

→ Share any thoughts to the wider table, and listen to what other cities are doing too.



Policies & Strategies

Developing policies and strategies at national and city levels that outline how to address current and future climate risks.



Building Standards, Codes & Guidelines

Setting standards and guidelines like building codes so that infrastructure is constructed in a way that manages future climate risks.



Urban Planning

Integrating resilience into long-term urban plans such as Master Plans, capital expenditure plans and disaster risk reduction plans.



Investing in Infrastructure

Planning and delivering climate resilient infrastructure so that it can withstand current and future climate impacts and minimizes climate risks for citizens.

04 | Business as Usual vs. Climate Resilient Infrastructure



Photo by Jim Feng, Getty Images (licensed via Canva)

BAU Infrastructure Planning & Delivery Steps

1|

Strategy

2|

Plan

3|

Design

4|

Build

5|

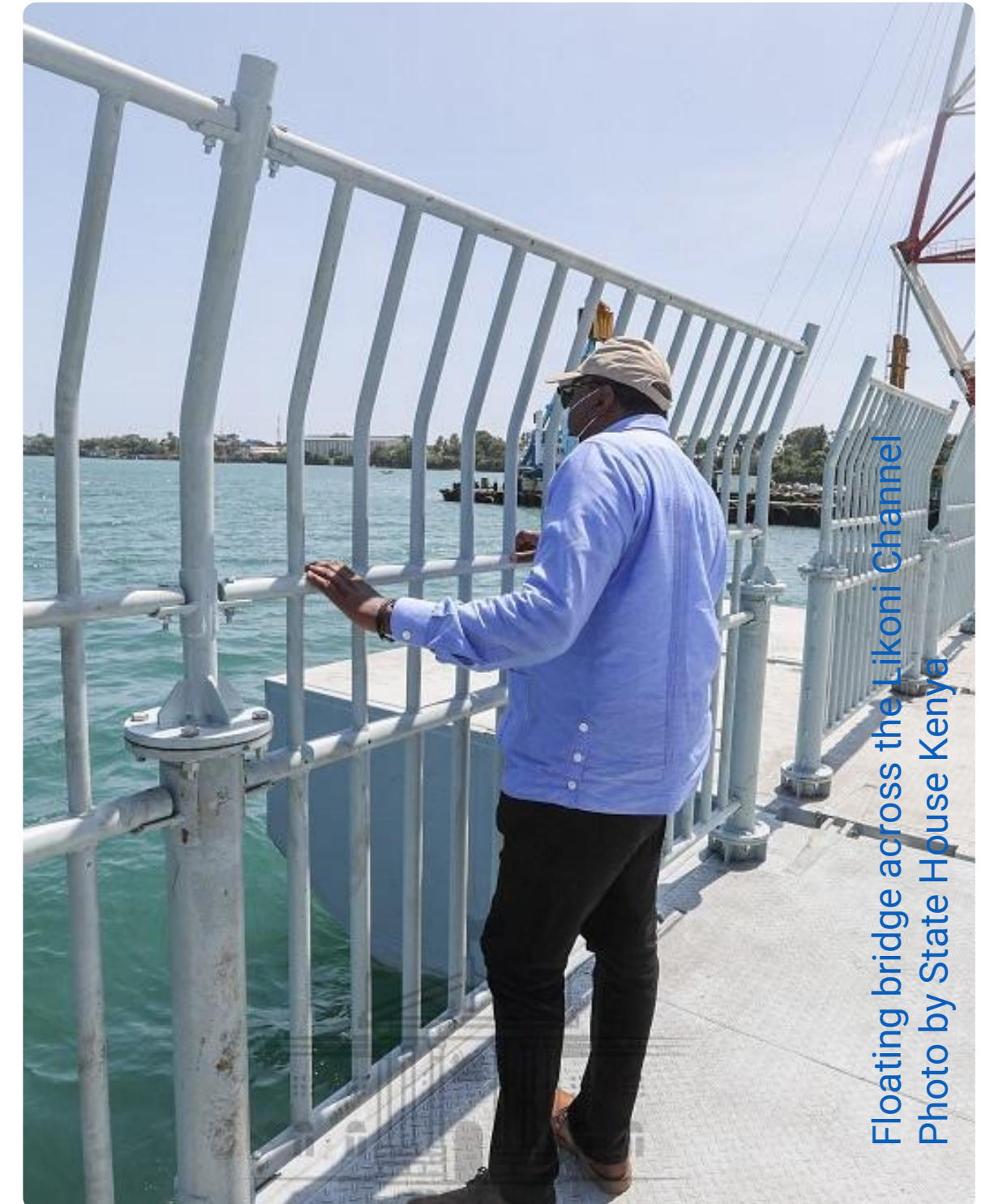
Operate & Maintain

6|

Decommission /
Upgrade

Business As Usual Approach

1. Identify long-term infrastructure investment needs in the city – e.g. through a capital investment plan or a spatial plan.
2. Conduct project feasibility study & consult with stakeholders.
3. Technical engineering design of asset.
4. Construct infrastructure asset in line with design specifications.
5. Operate infrastructure asset over its lifespan.
6. Decommission asset or upgrade with new infrastructure strategy.



Floating bridge across the Likoni Channel
Photo by State House Kenya

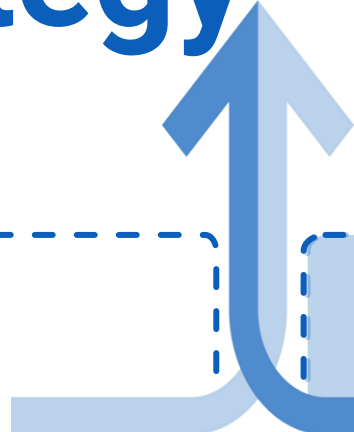
Climate Resilient Planning & Delivery Steps



05 | Step-by Step Guidelines for Delivering Climate Resilient Infrastructure in Bangladesh

Photo by John M. Woodcock, Getty Images (licensed via Canva)

Step 01 | Strategy



Business As Usual Approach

This stage involves developing a city-wide strategy or Master Plan for infrastructure and service delivery in a city corporation or pourashava.

Master Plans indicate the infrastructure development needs and their locations. Identification of the appropriate implementing agencies and tentative costing should be included in a Master Plan.

This stage can also involve a City Corporation or Pourashava developing a longer-term capital expenditure plan to determine how it will finance infrastructure delivery.

Climate Resilient Approach

Develop a municipal Climate Action Plan or city Climate Resilience Strategy.

Identify high-level climate risks in the city by using national-level guidance and planning documents, such as Climate Vulnerability Index, National Adaptation Plan and Poverty map.

Identify high-level resilience goals in line with national, county or city/municipal climate policies and plans. For example:

- Bangladesh Delta Plan 2100
- Mujib Climate Prosperity Plan 2022-2041
- National Adaptation Plan of Bangladesh: 2023 2050
- Bangladesh Climate Change Strategy and Action Plan 2009
- Nationally Determined Contributions 2021
- Climate Change Gender Action Plan

Connect climate goals with the city's capital investment/development plan - for example the Pourashava Development Plan (PDP).

Step 01 | Strategy

Case Study | City Resilience Strategy Barishal

Barishal is the sixth largest city in terms of population living in one of the smallest geographical area in the southern region of Bangladesh.

Barishal City Corporation (BCC) developed a City Resilience Strategy aligning with the national policies and the local climate and disaster context identifying three focus areas:

1. Land use
2. Water supply, Sanitation and drainage
3. Eco-system management

The strategy aimed to take on projects by BCC and other implementing agencies according to the identified priority and need for implementation; and integrate all interventions into other city level plans to avoid duplicity and enhance coordination.



Barishal; Photo by A M Hasan Nasim, Canva

Step 02 | Plan

Business As Usual Approach

This stage involves planning and preparing to deliver infrastructure projects or service delivery.

Conduct project feasibility studies. This should entail an analysis of technical, economic, legal, operational and time feasibility factors of the project.

Consult stakeholders to listen to their opinions and views but making decisions by the Pourashava leadership and Town-Level Coordination Committee (TLCC); or

Inform the stakeholders of the development initiatives through TLCC and Ward Level Coordination Committees (WLCC) and Ward Commissioners without giving citizens the opportunity to contribute.

Climate Resilient Approach

Conduct a climate risk assessment (CRA) to identify high-level climate risks in the Pourashava / City Corporation.

Substantively involve local people in the selection, design, planning and implementation of the programmes and projects that will affect them and incorporate local perception, attitudes, values and knowledge – this will support LLA.

A more holistic planning approach could include conducting Courtyard Meetings or focus group discussions with local stakeholders, involving WLCC and CSCC members in CRA activities, and involving TLCC members for verifying and approving the CRA.

Some CRAs may include a ranking or list of resilience options for the city. Based on the CRA, identify adaptation or resilience options that the Poursashave / City Corporation plans to undertake.

Step 02 | Plan

Case Study | Dhaka North City Corporation

Dhaka North City Corporation (DNCC) faces significant climate induced risks, including intense heat stress, urban flooding triggered by rivers and rainfall, and the potential impact of cyclones.

DNCC initiated its Climate Action Plan (CAP), in alignment with the Paris Agreement, starting with a GHG emissions inventory in 2018.

Using hotspot mapping, vulnerability assessments, and extensive data collection through the City Inventory Reporting and Information System (CIRIS) tool, DNCC crafted a comprehensive climate risk assessment and action framework.

The CAP seeks to decarbonize socio-economic growth, ensure urban climate resilience, and aim for low emission, reducing both GHG emissions and climate vulnerability.



Dhaka; Photo by Anadolu Agency

Step 03 | Design

Business As Usual Approach

This stage entails technical engineering design of an asset. It could be designed directly by the municipality or by a qualified engineering firm identified through a competitive procurement process.

This approach may require planners to seek relevant regulatory approvals for the technical engineering design if required.

Under BAU, the design process usually involves standard engineering solutions to design of infrastructure – often structural measures / grey infrastructure solutions, as opposed to nature-based solutions or hybrid solutions.

Climate Resilient Approach

Select preferred climate resilient infrastructure or service from options outlined in CRAs, or from national, municipal and sectoral strategic plans (e.g. Master Plans or Detailed Area Plans (DAP)).

Ensure that the technical engineering design takes into consideration current and future localized climate risks, based on data from CRAs or using the 'decision-making in contexts of uncertainty' framework.

Use existing climate resilient guidelines from national or international context (e.g. Bangladesh National Building Code).

Design options could be structural, non-structural or nature-based solutions (NbS).

Step 03 | Design

Case Study | Coastal Towns Environmental Infrastructure Project (CTEIP)

The CTEIP was an initiative implemented by LGED to strengthen climate resilience and disaster preparedness by providing climate-resilient infrastructure in 8 coastal towns across four districts in Bangladesh.

This initiative illustrates how climate risk data can be integrated into the design of infrastructure to ensure buildings are resilient to climate impacts. Some climate resilient design elements of buildings included:

- Raising public buildings (markets) on concrete base plinths to a level above the existing maximum normal monsoon high tide level, plus effective maximum SLR for the year 2050, with an additional 250mm freeboard.
- Making access roads to buildings paved with HBB or concrete with finished surface level at maximum SLR for the year 2030, plus 100mm freeboard where practicable, and with adequate drainage capacity included in the designs.



Bangladesh; Photo by Md Sariful Islam, Flickr

Step 04 | Build

Business As Usual Approach

This stage entails construction of the asset. It may be built by the city or outsourced to a qualified construction firm. If outsourced, the city should follow the proper procurement process to award the tender for construction.

The city/municipal public works team should ensure construction quality control to guarantee that project deliverables meet the standards and guidelines set by the city/municipal authority at the beginning of the construction process.

The city/municipal public works team should have a project inspection plan and conduct regular inspections as part of quality assurance plan. Corrective actions should be undertaken in case of any defects during the construction phase

A certificate of completion of works should be issued upon satisfactory completion of the construction phase

Project commissioning: the construction team should handover the asset to the city/municipal authority

Climate Resilient Approach

Incorporate the preferred adaptation / resilience options into the construction of the asset.

Construct infrastructure asset with climate resilient design option.

Integrate local building materials, where appropriate.

Step 04 | Build

Case Study | Coastal Towns Environmental Infrastructure Project (CTEIP)

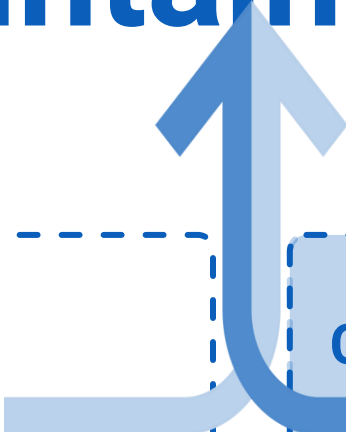
Under the CTEIP project, LGED constructed many climate-resilient buildings and infrastructure projects in 8 coastal towns. This included cyclone shelters, which incorporated a range of climate-resilient design features:

- Plinth levels were constructed at a height of 4.4m to 4.5 m to protect against flooding(PWD).
- Hand pumps were added on the 1st floor (3.90m above highest flood level).
- The discharge point of septic tank outlets and solid waste collection bins were positioned above the highest flood level to ensure sanitation was not impacted by extreme flooding after cyclones.



Patuakhali, Bangladesh; Photo by Helena Wright, Flickr

Step 05 | Operate & Maintain



Business As Usual Approach

This stage entails operation & maintenance of the asset upon commissioning.

The city/municipal authority should ensure continuous monitoring of asset performance over the lifespan of the asset.

Prepare a maintenance schedule and conduct asset repair and maintenance works.

BAU often means that operation & maintenance costs are not included in project plans or budgets, and assets fall into disrepair.

As a result, infrastructure is often not maintained, or only maintained when extra budget is available.

Climate Resilient Approach

Ensure continuous monitoring to assess performance of the asset under current & future climate conditions.

Ensure continuous monitoring of climate risk (hazard, exposure & vulnerability) to determine risk management strategy. Update climate risk registers.

Ensure technical operation and maintenance (O&M) of infrastructure at regular intervals. Ensure financing is allocated for regular O&M. Integrate monitoring outcome into annual capital budgets.

Decide whether resilience options need to be adjusted, in line with adaptive management, and request more resources for resilience if needed.

Collaborate with stakeholders that can provide technical assistance, finance & knowledge sharing.

Step 05 | Operate & Maintain

Case Study | “Paani Apa” of Southwest Bangladesh

The Bangladesh Ministry of Women and Children Affairs and UNDP have been working in Khulna and Satkhira since 2018 through Gender-responsive Coastal Adaptation (GCA) project to empower women and adolescent girls as ‘change-agents’ to plan, implement, and manage resilient livelihoods and drinking water solutions.

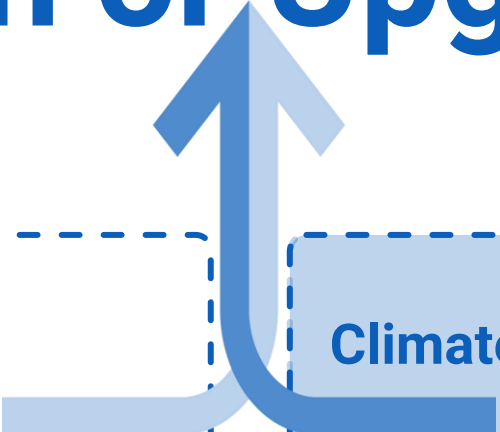
The project activities support women to manage climate risks through the installation of climate-resilient drinking water in households, communities and local institutions through 13,308 rainwater harvesting plants.

A total of 101 “Paani Apa” (women of the community) are trained to install rainwater harvesting systems and fix technical issues related to them. They charge a maintenance fee for this service adding to their household incomes.



Bangladesh; Photo by UNDP Climate, Flickr

Step 06 | Decommission or Upgrade



Business As Usual Approach

This stage entails decommissioning or upgrading the asset.

The city/municipal authority is expected to decommission the asset if it is no longer performing its function or is no longer financially viable.

The city/municipal authority is expected to upgrade the asset in line with new infrastructure strategy and investment in its urban master plan.

In Bangladesh, most infrastructure is decommissioned and new infrastructure is built to replace it, as opposed to being upgraded.

Climate Resilient Approach

Conduct a lifecycle analysis on proposed and existing investments to compare business-as-usual investments with greener alternatives for upgrading.

Decommission the asset if climate risks are so severe that it makes the asset no longer functional or financially viable.

Upgrade asset over time with new data on climate risks (if it is feasible and financially viable), in line with the principle of adaptive management. Incorporate climate resilient features during upgrading.

Undertake new Climate Action Plan, Master Plan, etc. to select new climate resilient infrastructure.

06 | Decision-Making in Contexts of Uncertainty



Photo by Genevieve French, Greenpeace

Decision-Making in Contexts of Uncertainty

In some contexts, city officials may not have access to climate data that enables them to know for certain how current or future climate change will impact their city.

This section outlines some options that city officials can take if you are not able to conduct a CRA due to lack of data or lack of technical experts to conduct a CRA.

Even without accurate data, you can still make investments in infrastructure to promote climate change resilience.



Garissa, Kenya; Photo by Luis Tato, AFP

Decision-Making in Contexts of Uncertainty

If you do not have accurate CRA data, you should reflect on two critical points:



What are the general climate hazards that impact my city now? For example, heavy rainfall, flooding, heat waves, etc.



How do these hazards impact different groups of people, especially vulnerable groups, neighbourhoods and economic sectors?



Bagerghat; Photo by World Bank

Decision-Making in Contexts of Uncertainty

You can safely make two assumptions, even without the data to back it up:



Existing climate hazards will become more frequent and more severe over time.



Climate risks will continue to affect vulnerable and marginalized groups and areas in your city as these risks become more severe in the years ahead.

You can therefore plan to invest in infrastructure or services that address current climate risks for vulnerable groups.



Barguna; Photo by Rafiqul Islam Montu, DownToEarth

Decision-Making in Contexts of Uncertainty



No Regrets investments



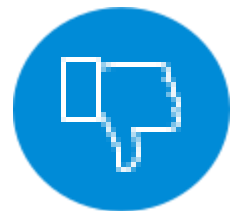
Low Regrets investments



Win-Win investments



Flexible & Adaptive investments



Investments that Avoid Maladaptation

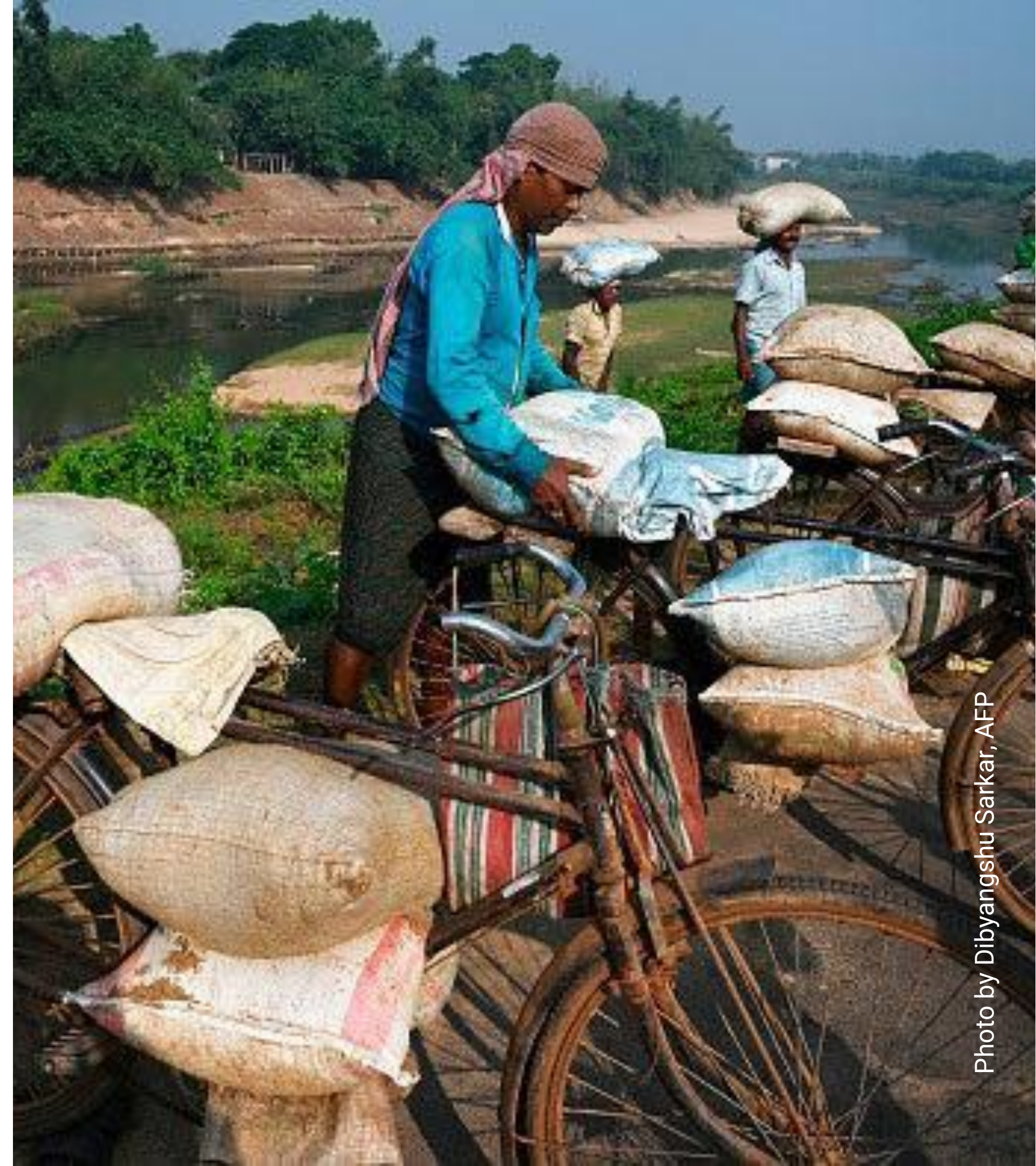


Photo by Dibyangshu Sarkar, AFP

Option 01 | No Regrets Investments



No Regrets investments are measures that deliver benefits that exceed their costs, regardless of whether climate risks turn out to be mild or severe in the future.

In contexts of uncertain data on current or future climate risks, city officials can comfortably make no regrets investments because they will provide benefits to cities no matter what impact climate change has in the future.

Examples of no regret investments include investing in water conservation measures in water constrained areas, investing in public housing for vulnerable groups, investing in climate data collection systems, and climate-proofing energy transmission infrastructure so that people have reliable access to electricity.



Photo by Cowtham AGM, Pexels

Option 01 | No Regrets Investments



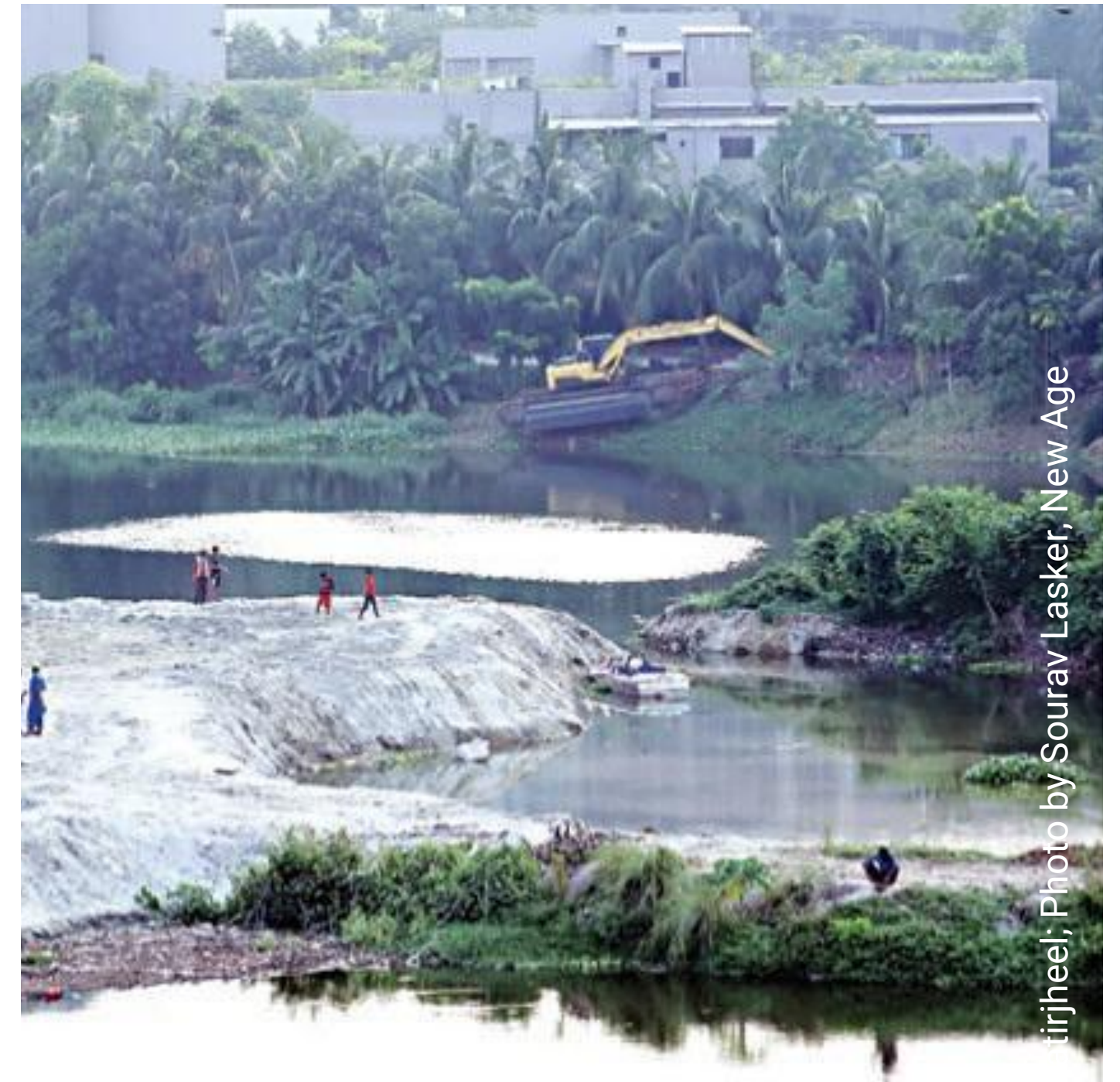
Case Study | Hatirjheel | Dhaka

The Hatirjheel area development project is a wetland restoration project spreading over 311 acres of Dhaka.

The project includes both engineered infrastructure and NbS to reintroduce water edge green space in Dhaka. The restored jheel (wetland) and Begunbari khal have improved storm-water management of Dhaka and made aquatic biodiversity better. The jheel acts as a retention pond to mitigate flash flooding in densely populated parts of the city.

The project has improved connectivity between major urban corridors and increased green and open space in the busy capital, which is accessible to diverse groups of people and can be used without any payment.

This project is an example of a no regrets investment because it provides numerous benefits to Dhaka's citizens, regardless of the severity of future climate impacts – including stormwater management and access to green space which improves public health.



Hatirjheel; Photo by Sourav Lasker, New Age

Option 02 | Low Regrets Investments



Low Regrets investments are low-cost measures with potentially large benefits for building resilience under future climate change scenarios.

The name 'low regrets' implies that even if future climate risks are less severe than predicted, a city will have little regret from spending a bit extra on infrastructure investments to ensure they are resilient – versus the higher regret they would feel if they did not make the investment and climate risks turned out to be high in the future.

An example of a low regret investment is designing drainage systems to have higher piping capacity (e.g. by making drainpipes wider) in case future extreme rainfall events increase in intensity. The extra investment on wider pipes will be less regrettable than if a city faces a serious flood in the future.



Photo by Maksim Safaniuk, Getty Images (licensed via Canva)

Option 02 | Low Regrets Investments



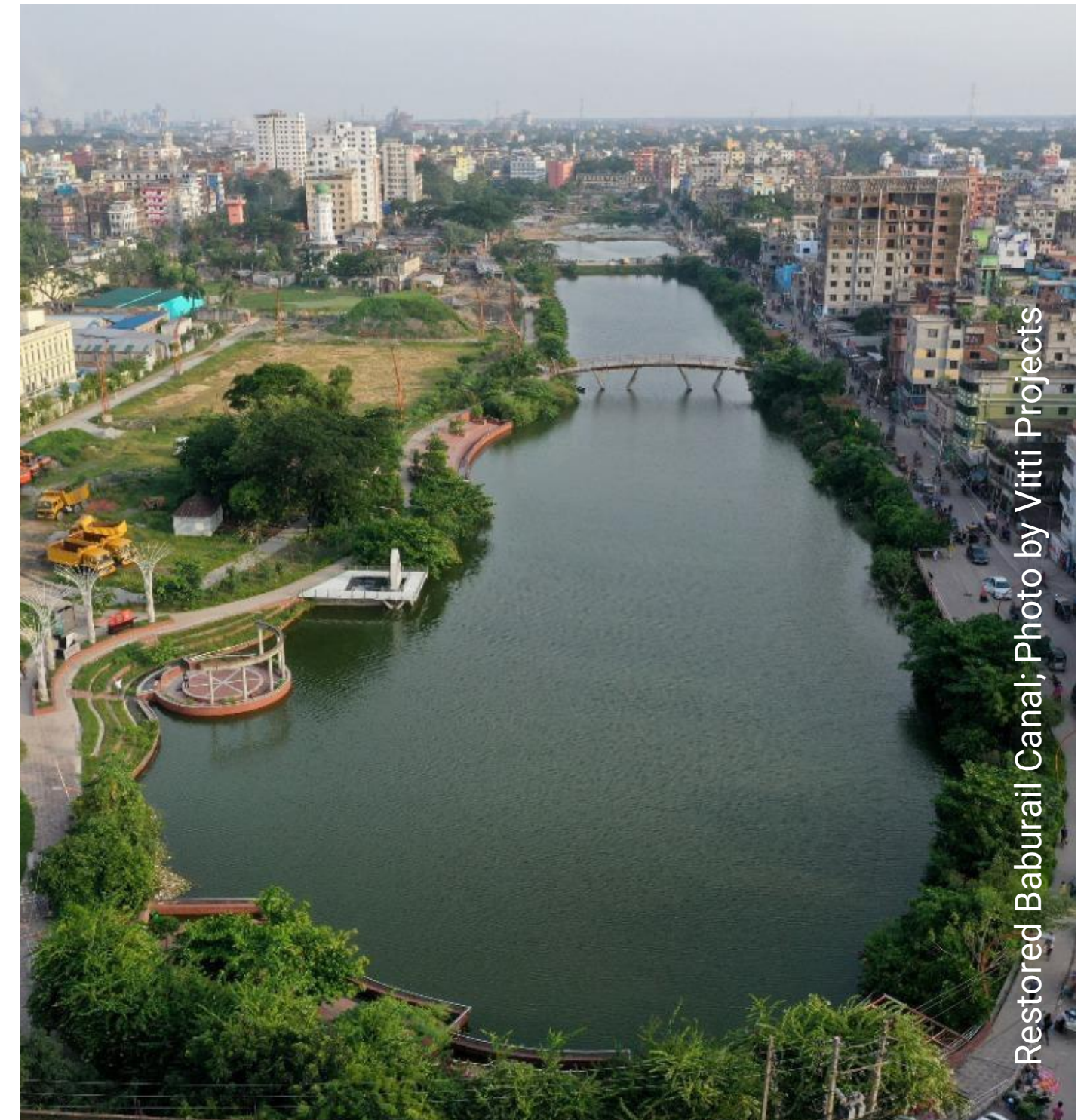
Case Study | Baburail Canal Restoration | Narayanganj

The Baburail Canal connects two major rivers, Dhaleswari and Sitalakhya, running through Narayanganj City Corporation. The canal lost its flow and navigability from the dumping of garbage and development encroachment near the canal.

The Narayanganj City Corporation implemented a restoration project of the canal with financial support from the World Bank. The development included reclaiming the lands from encroachment, re-excavation, slope protection, construction of walkways on both sides, widening of adjacent roads and lanes, planting trees, reconstruction of bridges at selected locations, adding light fixtures, street furniture, decorative elements for beautification, and constricting a sluice gate.

The canal now serves as a natural drainage channel for excess rainfall and is a public space for the citizens of Narayanganj.

This is a low regrets investment due to the benefits the project provides to Narayanganj, regardless of the severity of future climate impacts.



Option 03 | Win-Win Investments



Win-win investments contribute to climate adaptation while also delivering other benefits to people or society.

In contexts with low data on climate risks, city officials can consider making win-win investments that potentially provide resilience benefits and also provide benefits that improve general quality of living in their city.

An example of a win-win investments is expanding public parks and green spaces in cities. Nature-based solutions like public parks help improve urban air quality and can minimize water runoff that would cause urban floods during high rainfall events. But in addition to climate resilience benefits, they also improve the physical and mental wellbeing of citizens by providing access to recreation and nature, making them a win-win.



Option 03 | Win-Win Investments



Case Study | Shubornno Shorobor | Singra

Singra Pourashava, located in Natore district, has developed a lake into an open public space that provides the win-win benefits of stormwater management, public recreation and livelihoods for local people.

In 2021, the Pourashava authority completed the project following a participatory process, using local materials, techniques, and professionals within a limited budget and time. The new development introduced local trees and plants and reduced the hard surface to minimize the urban heat effect. It also, used hollow bricks in pavement to increase the permeability of rainwater, and used energy efficient lights to reduce energy consumption.

Shuborno Shorobor is now a public space used by a wide range of citizens. Adequate light and activities attracted people of different ages and gender to the lakeside. Local school children planted trees with the mayor, which has created a sense of ownership, while public art has made the space attractive and encouraged young people to visit and take photographs. The local tea-sellers have remained in the site following its redevelopment. The earnings from their rent is used for maintenance of the lake side, and they have been employed as custodians of the area.



Shurbornno Shorobor (before)



Shurbornno Shorobor (after)

Option 04 | Flexible & Adaptive Investments



Flexible & Adaptive investments are infrastructure investments which can be updated on an ongoing basis to reduce climate risks as new data on climate risks emerge.

These investments follow the principle of **adaptive management** – keeping options open for the future, regularly monitoring changes and making updates as required.

City officials working without CRA data can use this approach to make investments in climate resilient infrastructure that have the design flexibility to be upgraded in the future, when the need for specific resilience measures is less uncertain.

Example: Flood protection measures in ports which allow for future increases in storm surge defense height by building foundations fatter now, but do not build higher defenses immediately while the extent of future flood risk is still uncertain.



Photo by AP

Option 04 | Flexible & Adaptive Investments



Case Study | Submersible Road | Singra

Singra Pourashava is located in a low-lying area that is naturally flooded during monsoon. To build resilience to flooding, a 450m long submersible road made of Reinforced Cement Concrete (RCC) pavement was constructed in 2020 from Shoilmari to Ningoin Notun para funded under the UGIIP-II programme.

Other roads (e.g., Itna Mitamoin Road, Kishoreganj) are usually constructed so high that they act as embankments and exacerbate flooding impact. The road in Singra, in contrast, was built at the ground level. Consequently, the road does not block the natural flow of water and becomes usable again after the flooding.

Since its construction, the road has been flooded every year and continued to be in a good condition connecting several marginable communities to the main economic center of the municipality.

Submersible roads can be a flexible and adaptive investment in flood prone area if designed not to block natural flow of water.



Photo by Singra Municipality

Option 05 | Investments to Avoid Maladaptation



Maladaptive actions are those that attempt to address climate adaptation, but which will actually make it more difficult to cope with climate change risks in the future.

Maladaptation is the opposite of adaptation. Rather than making people, infrastructure, economic activity or governance more equipped to deal with future climate change, it makes them less able to deal with climate change and will mean that impacts will be more severe.

City officials should think about the potential consequences of their current investments under different potential climate futures and avoid maladaptive investments.

Examples of maladaptation include constructing infrastructure in potential flood risk areas or designing buildings without water conservation technologies in drought-prone areas.

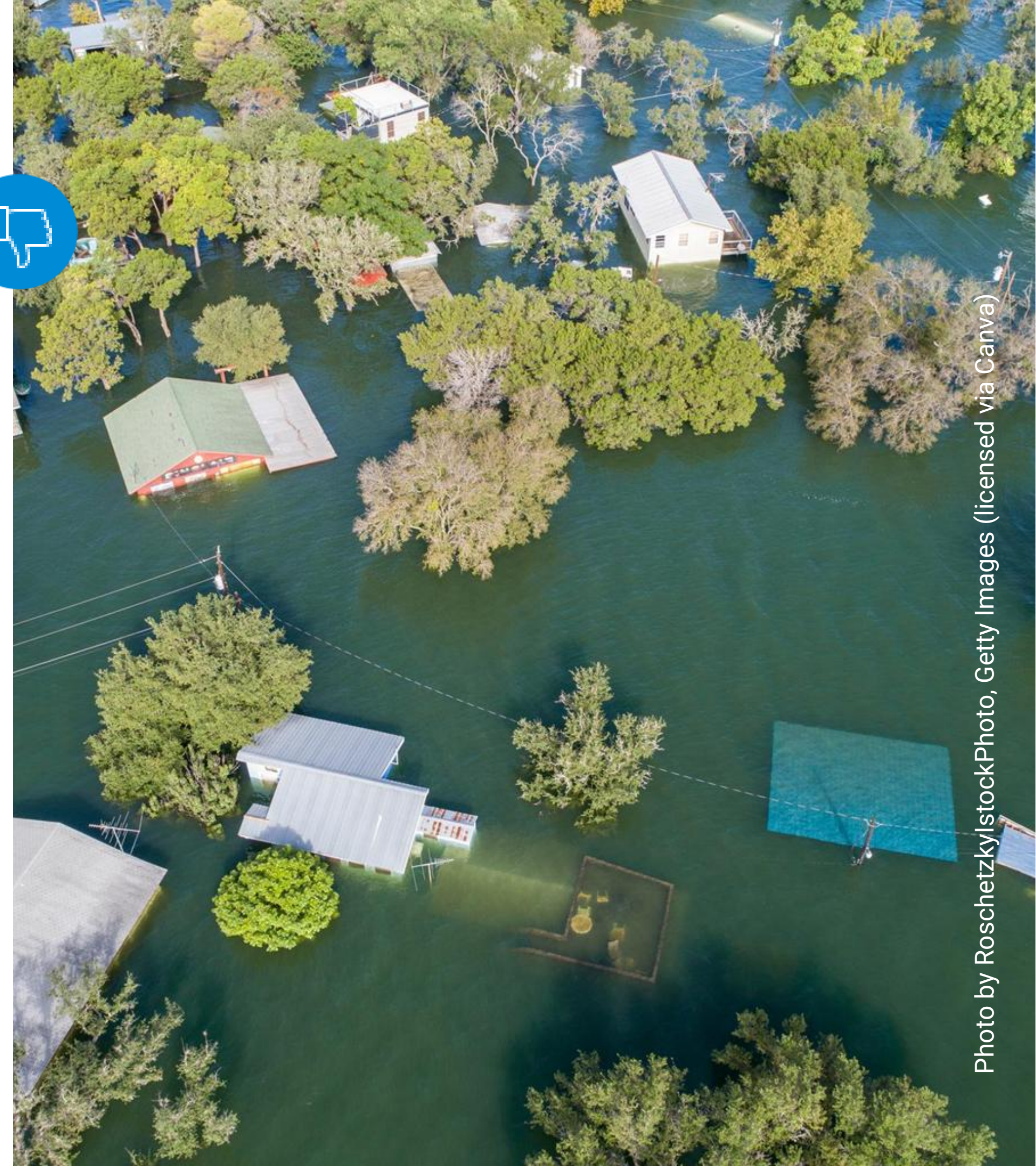
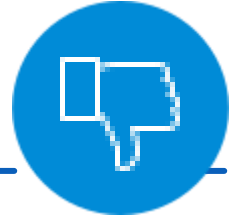


Photo by RoschetzkyStockPhoto, Getty Images (licensed via Canva)

Option 05 | Investments that Avoid Maladaptation



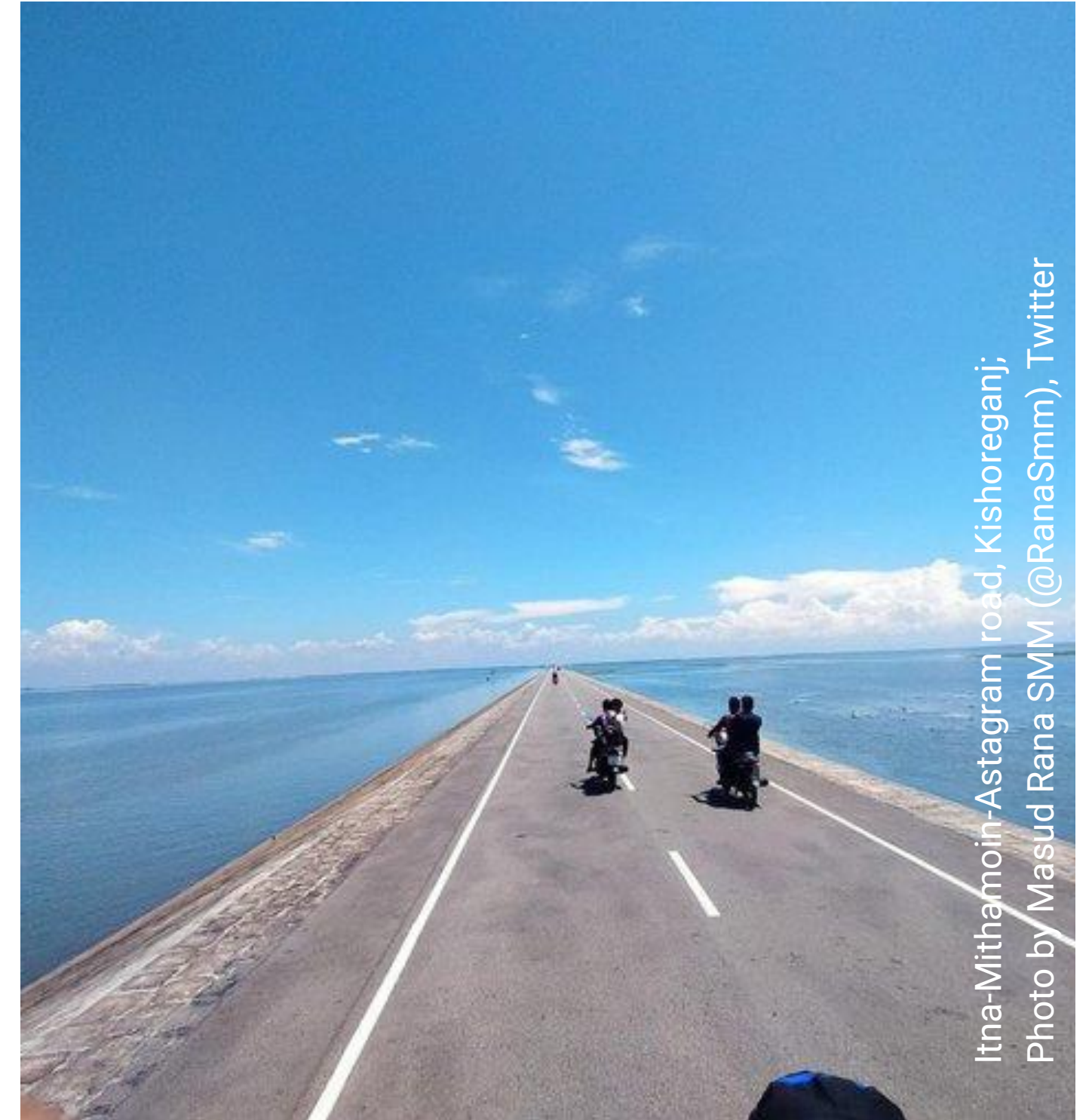
Case Study | Itna-Mithamoin-Astagram Road | Kishoreganj

The 29.73 km Itna-Mithamoin-Astagram all-weather road was built through the Haor (a bowl or saucer-shaped depression also known as backswamp) in Kishoreganj to improve connectivity of three remote regions with the key urban centre in the flood-prone district in 2020.

A total of BDT 874.08 crore (approximately USD \$74.4 million) was spent to construct the road.

The infrastructure is a significant achievement of the government, connecting the haor communities with the central regions. However there have been several complications related to the construction. According to residents, the road has been disrupting the free flow of water in the haor basin, leading to untimely floods, inundating thousands of hectares of land, and damaging the most important rice cultivation.

In April 2024, the impact of flooding in Kishoreganj on the annual boro rice cultivation was estimated to be BDT 1,000 crore (approximately USD \$85 million) – highlighting maladaptation to climate impacts.



Itna-Mithamoin-Astagram road, Kishoreganj;
Photo by Masud Rana SMM (@RanaSmm), Twitter

Review Exercise

Open floor:

- Reflect on yesterday's game - decisions for the decade. Do you have any thoughts to share?
- Think of any examples or stories you have from your own city involving decision making in contexts of uncertainty.
- Raise your hand if you have an example or story to share with the room.

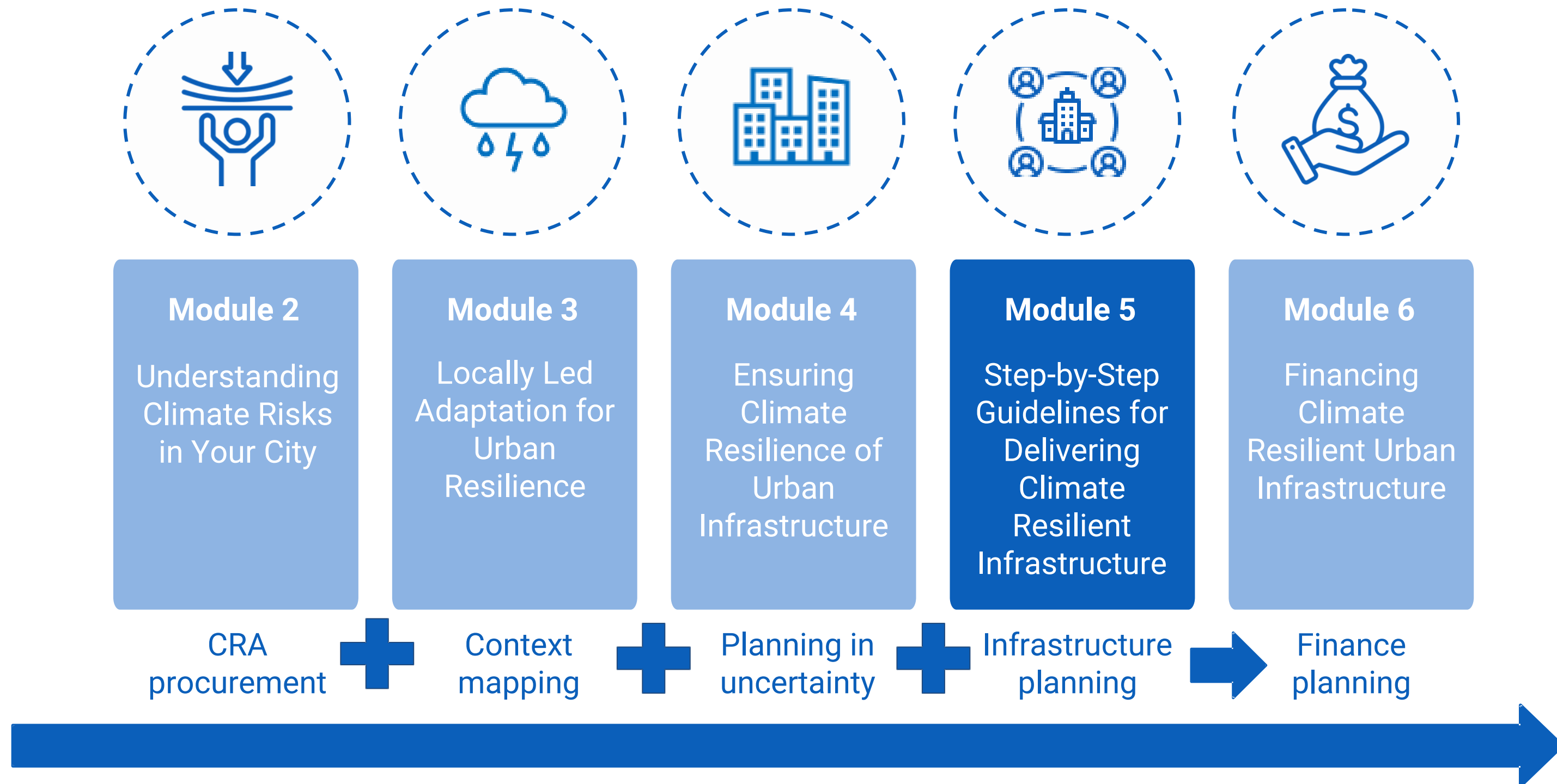


07 | Interactive Exercise



Photo by Aroax from Getty Images (licensed via Canva)

Start Your Journey



The interactive exercises build on one another to link the content and support your understanding of the process to create adaptive and resilient infrastructure.

Infrastructure Plan Canvas

The infrastructure plan canvas helps to make ideas granular whilst bringing in considerations around adaptation, equity & inclusion, and climate risk.

Strategy: Use your mission from the context map combined with ideas you may get from a CRA to write a short strategy for your mission. You may also think about linking it to any local or national policies.

Options: What are the options for infrastructure (reflecting on Module 4) that you could use to achieve your strategy?

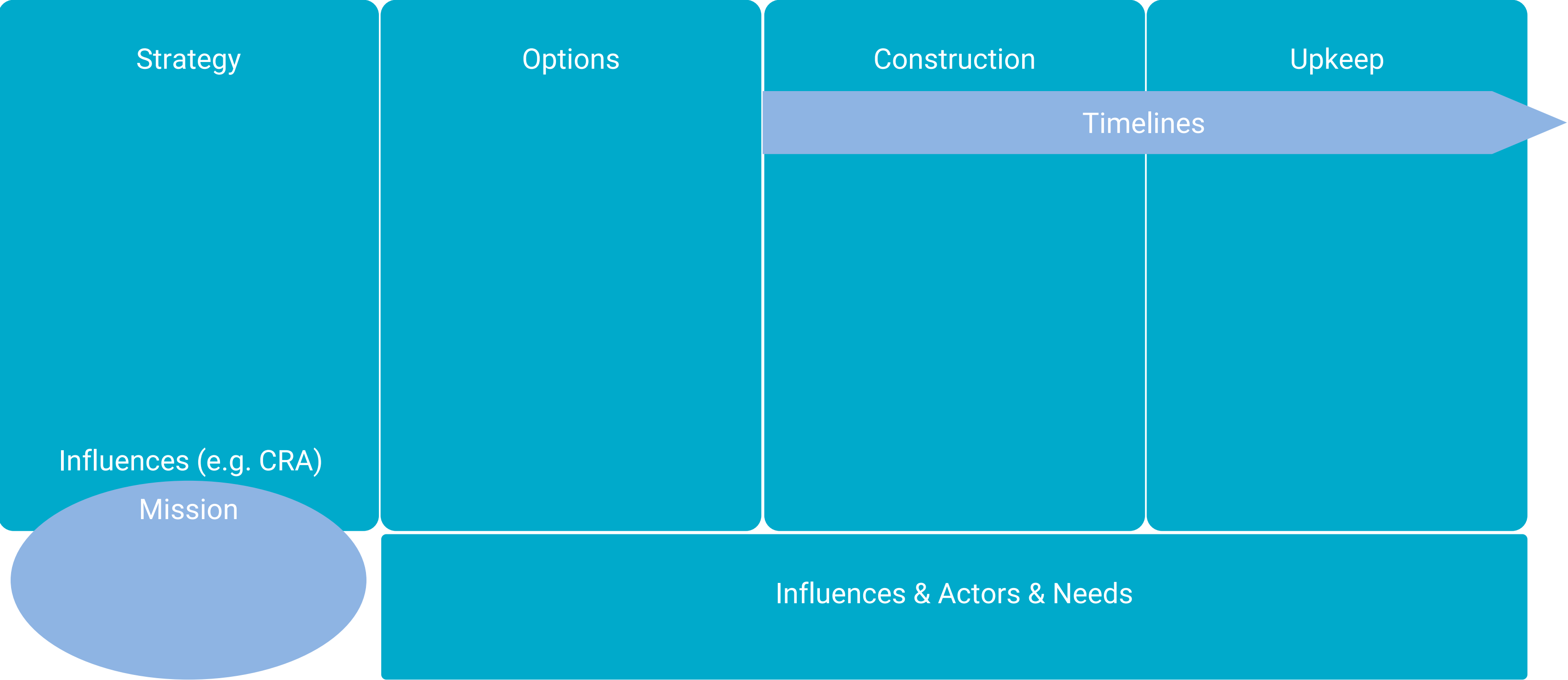
Construction: Who would construct it, where, and with what resources? Consider equity & inclusion for the chosen option.

Timeline: When would construction start, and what is the lifetime of this infrastructure?

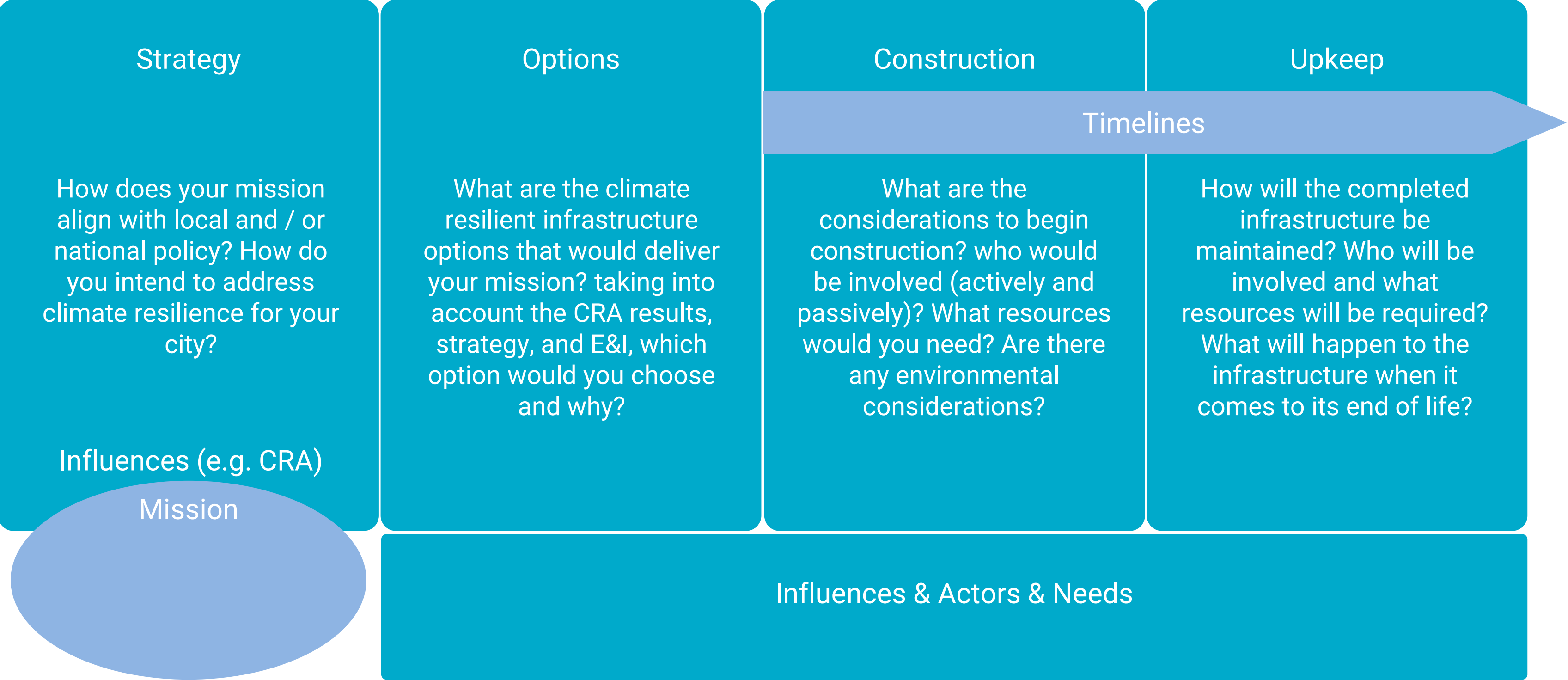


Dhaka City Skyline; Photo by Md Maruf Hassan, Getty Images (licensed via Canva)

Infrastructure Plan



Infrastructure Plan



Discussion

Share Your Infrastructure Plan

- 
- Does your strategy explain the different entry points for integrating climate resilience into city plans, policies and investments?
 - Can you explain how your chosen infrastructure investments moves beyond business as usual to build climate resilience?
 - How did you make decisions on what type of resilient infrastructure to build in situations where you do not have reliable climate risk data?
 - How do you ensure equity for those involved with, benefiting from, and living near the infrastructure?



08 | Summary



Summary

Congratulations on completing Module 5: Step-by-Step Guidelines for Delivering Climate Resilient Infrastructure!



Module 1

Introduction to
Climate
Change and
Urban
Resilience



Module 2

Understanding
Climate Risks
in Your City



Module 3

Locally Led
Adaptation for
Urban
Resilience



Module 4

Ensuring
Climate
Resilience of
Urban
Infrastructure



Module 5

Step-by-Step
Guidelines for
Delivering
Climate
Resilient
Infrastructure



Module 6

Financing
Climate
Resilient Urban
Infrastructure

The next module in the UCRMC is **Module 6: Financing Climate Resilient Infrastructure.**



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