

Mainstreaming Water Climate Adaptation Scoping study

Draft report

Prepared for The Global Center on Adaptation (GCA)

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28 June 2022

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1 EXECUTIVE SUMMARY

2 OBJECTIVES, METHODOLOGY, AND DEFINITIONS

2.1 OBJECTIVES OF THE STUDY

Adaptation in response to current climate change, as stated in the recent summary for policy makers of the IPCC- Climate Change 2022 report, is reducing climate risks and vulnerability, mostly via adjustment of existing systems. (...) Progress in adaptation planning and implementation has been observed across all sectors and regions, generating multiple benefits (very high confidence). However, adaptation progress is unevenly distributed with observed adaptation gaps (high confidence). Many initiatives prioritize immediate and near-term climate risk reduction which reduces the opportunity for transformational adaptation (high confidence).

As stated in the Terms of References (ToR) of this scoping study “water plays a fundamental role in our world and needs to be better mainstreamed to provide climate water resilience. Water adaptation must be done across a range of diverse sectors and become a more prominent focus of successful climate adaptation strategies. Mainstreaming water and climate adaptation and water resilience is therefore key as it entails to systematically include climate risk and adaptation consideration in decision-making and planning processes instead of only implementing stand-alone adaptation measures”.

As described in the same ToR, the main objectives of this scoping study are twofold:

- To identify and to develop 4 country and 4 related cities case studies to identify and document existing good practices related to mainstreaming water climate adaptation at national level
- Based on these case studies, relevant conceptual frameworks and guiding principles and a road map that enables mainstreaming of water climate adaptation will be identified and described.

This is translated in 4 sub-objectives

- Identify and briefly describe conceptual frameworks that could support & guide mainstreaming national water adaptation
- Identify and concisely document 8 case studies
- Identify and describe the key success factors in these case studies
- Develop a detailed guideline and framework for a series of in-depth case studies

2.2 METHODOLOGY

Literature survey related to the frameworks and cases, interviews, and analysis

This in-depth literature survey and the interviews will allow to make a good analysis of the frameworks, their overlaps, and the possible gaps in the perspective of the mainstreaming. It will build on the preliminary analysis presented above. It will be completed by semi-structured interviews with some active and knowledgeable strategic advisors and stakeholders. This will allow to identify success factors and issues that limited the mainstreaming and its implementation. Special attention will be given to the stakeholder engagement/social inclusion dimension.

Selection of the case studies

The objectives of this assignment are:

- to Identify and concisely document 8 case studies
- Identify and describe the key success factors in these case studies

At this point, from experience, we can also anticipate that independently of the fact that water climate adaptation has been mainstreamed in any policy or not, there are worldwide many adaptation

initiatives already implemented in the field, not always being documented and often independent of any national mainstreaming. But for the purpose and the limited number of days available of this preliminary study it was chosen to start working this analysis with the case studies mentioned in the ToR and that are already partly documented. Main conclusion was that The Netherlands, Mozambique, and Bangladesh were good examples, worth to explore further. Brazil and Singapore have been left out, at this stage.

After discussion with GCA, it was decided to exclude earlier ideas to extent the study too examples of transboundary river basins. GCA opted for a dedicated study for this level of institutions. If opportune, coordination with this component maybe considered when both concept reports are available.

A preliminary literature survey demonstrated several examples of adaptation documented for countries in West Africa (Benin and Burkina Faso for example), indicating the potential to explore experiences in this part of the world, that tends to be underrepresented in international information gathering and studies due of language barriers as scientific literature in French may be less accessible for English speaking researchers. For this reason, Benin and The Grand Nokoué region are proposed as a case study.

Finally, we proposed to put some emphasis on studying the combination of national and cities cases as more adaptation stories are available at city level that at country level and institutional barriers between national and local levels are relevant for the purpose of the mainstreaming. This was not anticipated in the original ToR. As a result, 4 case studies of cities (Beira, Khulna, Dordrecht and Grand Nokoué), related to the national case studies (Mozambique, Bangladesh, The Netherlands, and Benin) were included in this study.

Interviews and description of the cases

To prepare the description of the cases, semi-structured interviews of relevant stakeholders (for the cases) allowed to understand better the processes that took place. Special attention was given to the connection between national and cities planning. It should be noted that because of the limited time available descriptions are based on empirical observations and not the results of in-depth research. As there are already some descriptions of the cases, the added value of the work done in this study is in the description of processes related to mainstreaming and lessons learned related to lock-ins, when identified. Descriptions of the case study have been based on literature references, complemented by the related interviews of key actors. All within the time available in this preliminary phase.

2.3 DEFINITIONS

Mitigation

Mitigation is a human intervention that reduces the sources of GHG emissions and/or enhances the sinks. In the field of **Disaster Risk Management** however, mitigation encompasses activities that reduce or eliminate (or prevent) the three key disaster components: hazard, exposure, and vulnerability.

Risk is the potential for adverse consequence for human or ecological systems triggered by climate-related hazards in combination with other hazards, leading to cascading potential impacts. Risk is also determined by exposure and vulnerability. The term **disaster risk reduction** (DRR) is sometimes used instead of **mitigation**. Once a hazard event takes place or is imminent, subsequent actions are considered response actions and are not called “mitigation”. Disaster mitigation is thus different from climate mitigation.

Water scarcity and drought

	Water scarcity	Drought
Length	Long-term to permanent	Temporary (weeks to multiyear)
Driving forces	Demand–supply imbalance, human-driven, and/or natural (overexploitation, pollution). Climate change can impact both supply and demand	Natural climate variability which can be modified/amplified by climate change
Potential impacts	Restricted water availability, environmental degradation, desertification, exacerbated inequalities in access to water resources, potential competition	Water shortages, competition, environmental degradation
Measures	Long-term IWRM to bring supply and demand back into sustainable balance	Integrated drought management, including: (1) monitoring and early warning; (2) vulnerability and impact assessment; and (3) risk mitigation, preparedness and response

Source: adapted from Hohenwallner et al. (2011)

Adaptation

The IPCC defines **adaptation** as “*the process of adjustment to actual or expected climate and its effects.*” Adaptation means anticipating the adverse effects of climate change and taking appropriate action to prevent or minimize the damage they can cause or taking advantage of opportunities that may arise. Water is one of the main factors allowing adaptation.

Mitigation vs adaptation

Mitigation means making the impacts of climate change less severe by preventing or reducing the emission of greenhouse gases (GHG) into the atmosphere. In short, mitigation is a human intervention that reduces the sources of GHG emissions and/or enhances the sinks.

As the IPCC made clear in many reports: “*Many adaptation and mitigation options can help address climate change, but no single option is sufficient by itself. Effective implementation depends on policies and cooperation at all scales and can be enhanced through integrated responses that link mitigation and adaptation.*” In other words, adaptation without mitigation is not enough to reduce the impacts of climate change.

Incremental vs transformative adaptation

Adaptation is often observed as an **incremental** process, as step by step adjustment to changing circumstances. But in the face of major shifts in climate parameter like temperature and precipitation, conventional strategies to cope with- or incrementally adapt to- climate change may prove insufficient in the long-term. **Transformative adaptation**, i.e., fundamental systems’ changes that address root causes of vulnerability may be needed. Since 2010, the concept of societal transformation or **transformative adaptation** has been increasingly used in policymaking, research, and media to point out that small adjustments of present habits, technologies and policies does not suffice to meet the environmental, climate and sustainable development goals.

It is not always clear how transformative adaptation looks like in social-ecological systems and how and when it can be implemented intentionally. But recent research¹ suggests that *transformative adaptation is characterized as being restructuring, path-shifting, innovative, multiscale, systemwide, and persistent. Despite several barriers to implement transformative adaptation, policy makers and practitioners consider this option in adaptation plans to help societies to anticipate, guide, or recover from radical climate change impact. Using transformative adaptation to navigate shifts driven by climate change can increase the efficiency and sustainability of climate solutions.*

Transition and transformation

This report uses the term **transition** as the process, and **transformation** as the overall change or outcome, of large-scale shifts in technological, economic, and social systems, called socio-technical systems in the innovation literature.

Adaptive management

Adaptive management, also known as adaptive resource management or adaptive environmental assessment and management, is a structured, iterative process of robust decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring. In this way, decision making simultaneously meets one or more resource management objectives and, either passively or actively, accrues information needed to improve future management. Adaptive management is a tool which should be used not only to change a system, but also to learn about the system. Because adaptive management is based on a learning process, it improves long-run management outcomes. The challenge in using the adaptive management approach lies in finding the correct balance between gaining knowledge to improve management in the future and achieving the best short-term outcome based on current knowledge.

Mainstreaming

Mainstreaming water climate adaptation (MCWA) is understood as an iterative process of integrating considerations of water and climate adaptation into design, budgeting, implementation, monitoring and evaluation of policies and programmes in all relevant and related political, economic, societal, and environmental spheres, at national, sector and subnational levels. If implemented, it is a multi-year and multi-stakeholder effort.

Mainstreaming adaptation into policy processes focuses on integrating water climate adaptation issues into on-going policy processes such as a national development plan or national or sector strategy. It takes as its starting point a thorough and rigorous analysis of the development situation, rather than a-priori assumptions or focus on individual problems. Mainstreaming adaptation is underlain by situation-specific evidence and analysis from the socio-economic, environmental, impact, vulnerability, and risks domains. and may be very context specific, both in space and time. Mainstreaming water climate adaptation refers intentionally linking policy objectives. It is about integrating adaptation into decision making across a range of policy areas, rather than through the implementation of standalone adaptation measures. As such, it refers to bringing something into standard practice by linking multiple policy objectives within projects.

Additionally, at the city level mainstreaming approaches can unfold in various ways: 1) mainstreaming as a precondition for spatial (re)development; 2) mainstreaming as a byproduct of spatial (re)development; and 3) mainstreaming as one or more means to implement a vision.

¹ <https://www.sciencedirect.com/science/article/pii/S1462901119305337>

2.4 READER

Chapter 3 presents the various existing frameworks, guidelines, tools, and portals developed in recent years to help coping with water climate adaptation. Selection and analysis are based on the literature review, complemented by the interviews held to describe the case studies. It is an empirical exploratory work and has no intention to be seen as in-depth research. A differentiation is made between the frameworks officially agreed by governments and other guidelines proposed by international bodies.

Chapter 4 details the main findings of the chosen eight case studies. The detailed descriptions of these cases are to be found in annexes xx to zz).

Based on the information presented in Chapters 3 and 4, chapter 5 analyses of what emerges as effective, non-effective, missed, or needed during the process of mainstreaming water climate adaptation. It also presents main conclusions and next steps for a series of in-depth case studies.

Chapter 6 presents some recommendations in the context of mainstreaming water climate adaptation.

3 FINDINGS RELATED TO MAINSTREAMING WATER CLIMATE ADAPTATION

3.1 GENERAL CONCEPTUAL FRAMEWORKS AND GUIDELINES

3.1.1 Integrated Water Resources Management principles

Integrated Water Resources Management (IWRM) can be defined as “a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems”. IWRM is based on the three principles: social equity, economic efficiency, and environmental sustainability.

Social equity means ensuring equal access for all users (particularly marginalized and poorer user groups) to an adequate quantity and quality of water necessary to sustain human well-being. The right of all users to the benefits gained from the use of water also needs to be considered when making water allocations. Benefits may also include enjoyment of resources through recreational use or the financial benefits generated from the use of water for economic purposes.

Economic efficiency means bringing the greatest benefit to the greatest number of users possible with the available financial and water resources. This requires that the most economically efficient option is selected. The economic value is not only about price or current costs – it should also consider future social and environmental costs and benefits.

Ecological sustainability requires that all, including aquatic ecosystems are acknowledged as users and that adequate allocation is made to sustain their natural functioning. Achieving this criterion also requires that land uses and developments that negatively impact these systems are avoided or limited.

The IWRM principles has been applied in many countries since 1992 (based on the Dublin statement on water and Sustainable development) and offer a **natural resources perspective** to the mainstreaming of water climate adaptation, considering the various water users/sectors (agriculture/food systems, energy & transport, urban development, etc.). Application of the IWRM principles is facilitated by various tools on IWRM, e.g. those developed by the Global Water Partnership.

Additionally, because water is inherently cross-sectoral and tied to economic prosperity and development, national climate change planning is strengthened when all aspects of climate action are based on **resilient water management**, herein defined as the practice of working to address climate impacts that have already occurred or are highly likely to occur (robust policies and actions), as well as maintaining the ability to respond to less-certain impacts over time, envisioned through alternative futures (flexible policies and actions). Failure to integrate water throughout the formal processes of the Paris Agreement puts many of the actions and targets described within the NDCs at significant risk of failure. A recent report “Watering the NDCs²”, presents the key guiding principles of resilient water management. These principles are aligned with the OECD water governance framework. Acknowledgment of the guiding principles enumerated here after is the starting point for incorporating water into national climate planning:

- Climate change uncertainty means water uncertainty – Climate change will continue to fundamentally alter the hydrological cycle for decades, which requires the systematic inclusion of climate resilience into water decision making.

2

<https://static1.squarespace.com/static/5e8397698c906c4df39838f5/t/5f2aee39607e4764ba34c212/1596649018195/WtNDCs-Key-Messages-May-2020.pdf>

- Robustness and flexibility are the best strategies to address uncertainties within and between sectors. Given ongoing changes to water demand and availability, trade-offs between water uses must be addressed with robustness and flexibility when determining the how, where and when of water allocation.
- Meeting mitigation and adaptation goals demands cross-sectoral water management – Resilient water management can provide coherence within and across sectoral, regional, and institutional goals.
- Robust and flexible water management solutions enable economic growth – Resilient water management implemented across sectors can provide an “adaptation dividend,” ensuring resilient economic growth even as the climate continues to shift.

In Benin, Bangladesh, Mozambique, and The Netherlands (the four countries of the case studies), IWRM is a well-recognized framework with its principles already well included in the relevant national, regional, and local policies and plans. In some cases, Municipal water plans exist, based on these principles.

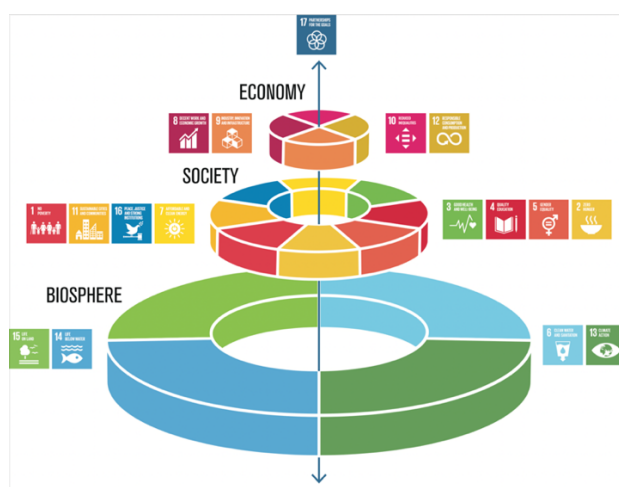
3.1.2 Sustainable development Goals (2015-2030)

The Sustainable Development Goals (SDGs) were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. For countries they are the entry point for any development actions, concretized in national implementation plans. Multi-annual and sectoral plans should contribute to the SDGs. UNDP defines the 17 SDGs as integrated, recognizing that action in one area will affect outcomes in others, and that development must balance social, economic, and environmental sustainability.

The four countries of the case studies have agreed to the SDGs (2015-2030). They are included in the various multi-year strategy documents of the countries.

Water has a bearing on food production, human health, sanitation, social well-being, ecosystem services, industrial production, and many other facets of socio-economic development. (...) While SDG6 is specifically focused on addressing water related challenges, it has the potential to support the attainment of the other 16 SDGs”. Water is both directly and indirectly connected to most if not of all the other SDG’s.

As such, the SDGs framework offers an opportunity to look at mainstreaming of water climate adaptation from a **sustainable development perspective** (see figure here below) showing the relation between the SDGs belonging mostly to the biosphere and the others related to society and economy, direct or indirect users/beneficiaries/clients of water as shown in the figure below ³.



³ <https://www.stockholmresilience.org/research/research-news/2016-06-14-the-sdgs-wedding-cake.html>

3.1.3 Sendai-DRR framework (2015-2030)

The Sendai Framework for Disaster Risk Reduction 2015-2030⁴ was the first major agreement of the post-2015 SDG development agenda and provides Member States with concrete actions to protect development gains from the risk of disaster. It was endorsed by the UN General Assembly following the 2015 Third UN World Conference on Disaster Risk Reduction (WCDRR), and advocates for:

The substantial reduction of disaster risk and losses in lives, livelihoods, and health and in the economic, physical, social, cultural, and environmental assets of persons, businesses, communities, and countries.

The Sendai DRR framework, as its name clearly indicates, adopts a risk perspective. It recognizes that the State has the primary role to prevent and reduce disaster risk, including cooperation and that responsibility should be shared with other stakeholders including local government, the private sector, and other stakeholders, as appropriate to national circumstances. Engagement from all of society is also a guiding principle.

States agree to address disaster risk reduction and the building of resilience to disasters within the context of sustainable development and poverty eradication in general, and to appropriately integrate disaster risk reduction and improved resiliency into policies, plans, programmes, and budgets at all levels and to consider both within relevant (development?) frameworks. The Sendai Framework is supposed to be dovetailed/harmonized with other 2030 Agenda agreements, including The Paris Agreement on Climate Change, The Addis Ababa Action Agenda on Financing for Development, the New Urban Agenda, and ultimately the Sustainable Development Goals.

As a result, the main goal of the Sendai Disaster Risk Reduction framework (2015-2030) is to prevent reduce future and present disaster risks, through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that 1) prevent and reduce hazard exposure and the vulnerability to disaster, 2) increase preparedness for response and recovery, and 3) thus strengthen resilience.

The 2022 Global Assessment report⁵ on disaster risk reduction: *Our world at Risk, transforming governance for a resilient future*, calls for actions to accelerate essential risk reduction and resilience building. Identified actions are as follow: 1) measure what we value, 2) design systems to factor in how human minds make decisions about risk and 3) reconfigure governance and financial systems to work across silos and design in consultation with affected people.

Also in 2022, UNDRR and GIZ released a “*Technical guidance⁶ on comprehensive Risk assessment and planning in the context of climate change*”. This document provides orientation on how risks in the context of climate change can be comprehensively and systematically addressed and assessed. The guidance paper addresses decision making-, planning-, and integrating disaster risk reduction- (DRR) and climate change adaptation- (CCA) perspectives while, simultaneously, linking those to other goals and targets (e.g., the Sustainable Development goals SDG’s). More importantly, the paper recognizes the fact that use and application of such guidance can and should be made context and country specific as generalized frameworks often do not immediately match country realities.

The four countries involved in the case studies are signatory of the Sendai DRR framework (2015-2030).

⁴ <https://www.preventionweb.net/files/resolutions/N1516716.pdf>

⁵ <https://www.undrr.org/gar2022-our-world-risk>

⁶ <https://www.undrr.org/publication/technical-guidance-comprehensive-risk-assessment-and-planning-context-climate-change>

3.1.4 OECD water governance principles (from 2015)

The OECD guidelines on water governance ⁷, adopted in June 2015, offers a perspective from the governance of water. Compared to the other frameworks, these principles give more attention and room to the human dimension of water climate adaptation. The twelve water governance principles cover effectiveness, efficiency, and trust and engagement components. They are fully described in annex and summarized in the box here after.

Effectiveness

Principle 1. Clearly allocate and distinguish roles and responsibilities for water policymaking, policy implementation, operational management and regulation, and foster co-ordination across these responsible authorities.

Principle 2. Manage water at the appropriate scale(s) within integrated basin governance systems to reflect local conditions, and foster co-ordination between the different scales.

Principle 3. Encourage policy coherence through effective cross-sectoral co-ordination, especially between policies for water and the environment, health, energy, agriculture, industry, spatial planning, and land use.

Principle 4. Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties.

Efficiency

Principle 5. Produce, update, and share timely, consistent, comparable, and policy-relevant water and water-related data and information, and use it to guide, assess and improve water policy.

Principle 6. Ensure that governance arrangements help mobilise water finance and allocate financial resources in an efficient, transparent, and timely manner.

Principle 7. Ensure that sound water management regulatory frameworks are effectively implemented and enforced in pursuit of the public interest.

Principle 8. Promote the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders.

Trust and engagement

Principle 9. Mainstream integrity and transparency practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making.

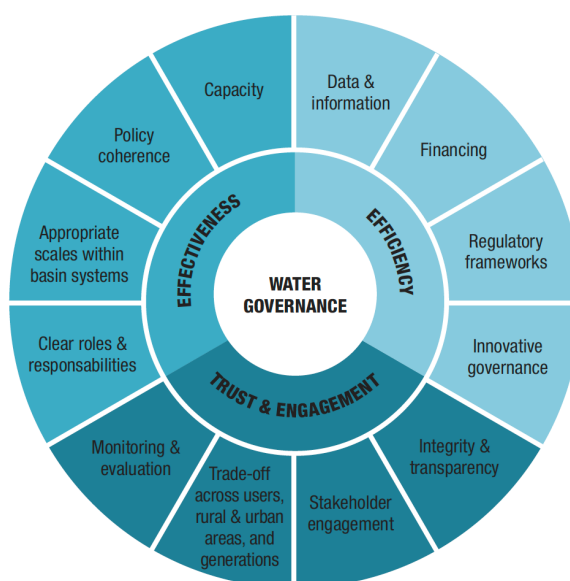
Principle 10. Promote stakeholder engagement for informed and outcome-oriented contributions to water policy design and implementation.

Principle 11. Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations.

Principle 12. Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public and make adjustments when needed.

⁷ <https://www.oecd.org/governance/oecd-principles-on-water-governance.htm>

OECD Principles on Water Governance



Source: OECD (2015), OECD Principles on Water Governance, www.oecd.org/governance/oecd-principles-on-water-governance.htm.

An additional interesting OECD report was presented in Dakar at the World Water Forum, in March 2022: “How to assess water governance: a methodology based on the OECD principles on water governance”⁸. It offers practical guidance and tips to apply the water governance principles. This document, partly based on the experience gained during recent years by OECD when assessing the water governance in several countries and cities, is very useful to understand the principles and explore how far they are applied. In the following chapter main results of the assessment for the city of Cotonou (Benin) are presented.

The March 2021 guideline⁹ builds upon the OECD guidelines and provides a tool for governments and development cooperation to strengthen the resilience of human and natural systems to the impact of climate change, highlighting the importance of country ownership, inclusiveness, and environmental and social sustainability when planning and implementing climate resilience.

The March 2022] OECD report “*Financing a water secure future*”¹⁰ presents key challenges and opportunities for financing contributions to water security and sustainable growth, distilling insights from the Roundtable on Financing Water (date, year ??). Covering a broad range of related to water and sanitation services, water resources management, agricultural water-use and managing water-related risks, it summarizes 1) analysis of investments needs and financing capacities, 2) trends in water-related financial instruments and 3) explores the financial impacts of water risks on businesses and corporates. The report calls for strengthening the enabling environment for investment, making the best use of existing sources of finance, strategic investment planning and mobilizing additional finance via a range of financing approaches.

The OECD principles should be applied to the overarching water policy cycle and should be implemented in a systemic and inclusive manner: integration is essential. They do not make distinctions across:

- water management functions (e.g., drinking water supply, sanitation, flood protection, water quality, water quantity, rainwater, and stormwater).
- water uses (e.g., domestic, industry, agriculture, energy, and environment), and
- ownership of water management, resources, and assets (e.g., public, private, mixed).

⁸ <https://www.oecd.org/cfe/cities/HowToAssessWaterGovernance.pdf>

⁹ https://www.oecd-ilibrary.org/environment/strengthening-climate-resilience_4b08b7be-en

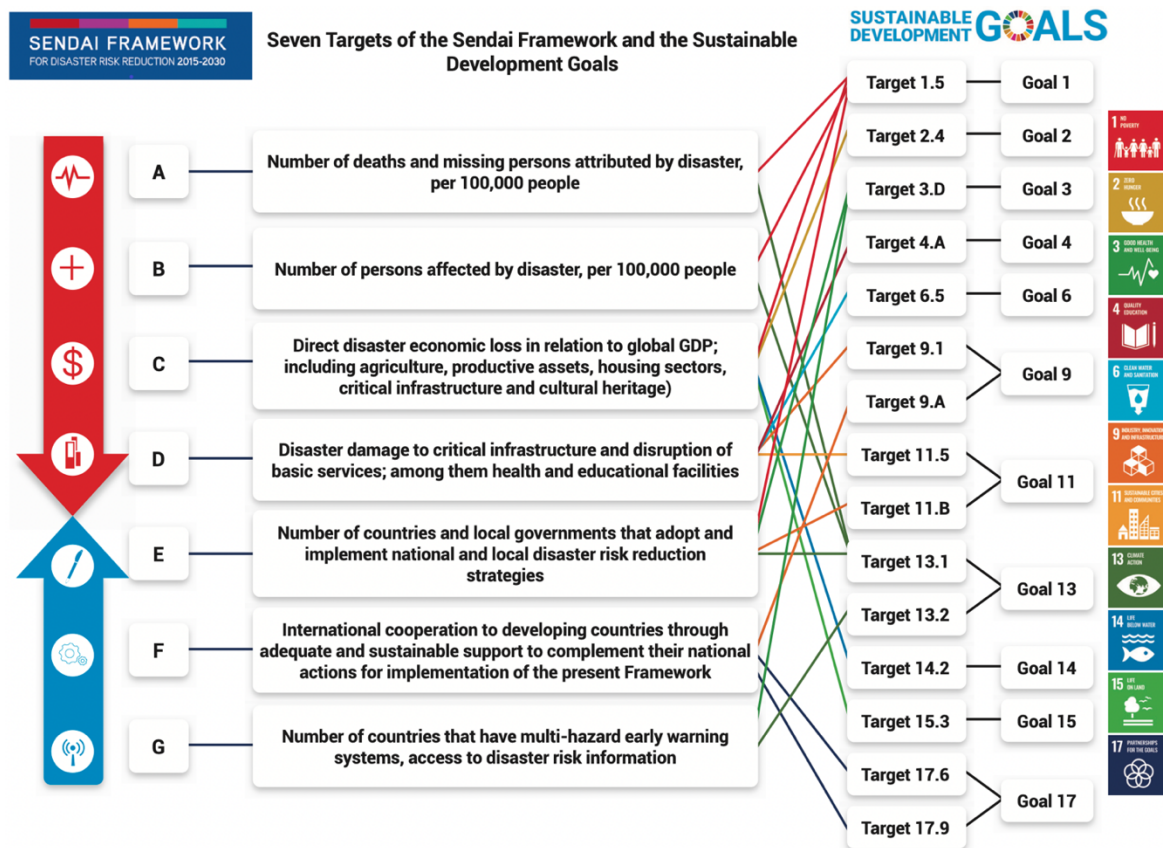
¹⁰ <https://www.oecd.org/environment/resources/policy-highlights-financing-a-water-secure-future.pdf>

3.1.5 Common ground between the various frameworks

As already said, countries are faced with the growing challenge of managing increasing risks from climate variability, putting development and the achievement of the Sustainable Development at risk. The COVID-19 pandemic (from 2020) further exacerbated this risk. It is even stated that without increased action to build resilience to systemic risk, the achievements until data can be reversed and UN Sustainable Development Goals cannot be achieved.

The DRR-Sendai, SDG's and OECD water governance guidelines presented above were developed and presented at the same time (around 2015) and target a similar time span (15-20 years, until 2030, as was the Paris Climate Agreement (end of 2015). The four countries of the case studies have ratified the Paris Agreement and presented their second National Determined Contribution in 2021. **These frameworks and guidelines are agreed and/or officially supported by governments worldwide and provide kind of backbone for MWCA efforts.**

The figure ¹¹ here below indicates major connections between Sendai and SDG's.



Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) are the common ground between the Paris Agreement and the Sendai Framework. Interventions to adapt to climate change and reduce disaster risks share common objectives but too often they are developed and deployed due to administrative silos. For this reason, potential synergies are missed, and efforts duplicated.

Governments increasingly recognize the benefits of greater coherence in climate change adaptation and disaster risk reduction. Coherence could be achieved through development of joint strategies and/or facilitated coordination across the two policies areas. Coherence is recognized to be a mean to integrate the pursuit of CCA and DRR in sustainable development, as described in the SDG's. Coherence is needed at macro-, meso-, and micro levels, with macro level focusing on the country governing bodies, the meso-level on the relevant

¹¹ <https://apps.who.int/iris/bitstream/handle/10665/336262/9789240003712-eng.pdf>

actors and stakeholders (universities, academia, chamber of commerce, private sector, civil society organizations, etc.) and the micro-levels on the organizations active in the field and communities.

In this context, strategic coherence means aligned visions, goals, and priorities on CCA and DRR in national development plans and strategies (under a unifying coherent umbrella. This is vital to further promote coherence at the operational level. Operational coherence means policy frameworks and institutional arrangements supportive of the implementation of aligned objectives on CCA and DRR. **This operational coherence is expected to open the way for the implementation of water climate adaptation in the field, at communities' level.**

As said continuous efforts to further increase coherence between CCA and DRR is fundamental for the realization of the water- and climate relevant SDGs. Acknowledgement and application of the OECD water governance principles will improve the mainstreaming of water climate adaptation, not only at the strategic but also at the operational level. From the analyzed case studies (see following chapters) it should be noted that the original OECD water governance guidelines could be further evolved to specifically address a) uncertainty, b) the risk-based- and c) long-term orientation of water governance in times of climate change.

Finally, in addition to these broad-spectrum frameworks, more local or national guidelines and frameworks have been developed over the years, by international organizations (UNDP, UNEP, WB, etc.). Although not formally and officially recognized at a global scale they have proved to be useful to support governments in the preparation of their MWCA visions, strategies, and plans.

3.2 Others relevant frameworks, guidelines, and approaches

3.2.1 Mainstreaming climate change adaptation into development planning guides

In 2011 UNDP-UNEP published a development planning guide for practitioners¹² that consists of 3 components (what kind of?), each of which involves a set of activities or modules for (OR FROM?) which a range of tactics, methodologies and tools can be used.

- Know the momentum: Finding the entry points (for what?) and making the case (for what?) is concerned with understanding and setting the stage for mainstreaming (of what?)
- Integrate rather than specify: Mainstreaming adaptation into policy processes focuses on integrating adaptation issues into on-going policy processes.
- Make it standard procedure: Meeting the implementation challenge aims to ensure mainstreaming of climate change adaptation into budgeting, financing, implementation, and monitoring by actively defining and establishing mainstreaming as an operational standard.

UNDP-UNEP stresses the importance of stakeholder engagements in all steps of the integration- and policy development-process, including development, implementation, and monitoring phases.

3.2.2 Valuing water principles (VWP)

In April 2016 the United Nations and the World Bank Group convened the High-Level Panel on Water (HLPW) to champion a more comprehensive, inclusive, and collaborative way of developing and managing water resources and improving water and sanitation related services.

In March 2018, the High-Level Panel on Water (HLPW) released its outcome document 'Making Every Drop Count'¹³ and recommended the acceptance and implementation of 5 valuing water principles that, if put into practice, would lead to better understanding, valuing, and managing of

¹² <https://www.undp.org/publications/mainstreaming-climate-change-adaptation-development-planning-guide-practitioners>

¹³ https://sustainabledevelopment.un.org/content/documents/17825HLPW_Outcome.pdf

water. The Valuing Water Initiative (VWI¹⁴) was established in 2018 to facilitate dissemination and acceptance of the principles.

The **5 Valuing Water Principles**¹⁵ include:

- **Recognize and embrace water's multiple values** to different groups and interests in all decisions affecting water.
- **Reconcile values and build trust** – conduct all processes to reconcile values in ways that are equitable, transparent, and inclusive.
- **Protect the sources**, including watersheds, rivers, aquifers, associated ecosystems, and used water flows for current and future generations.
- **Educate to empower** – promote education and awareness among all stakeholders about the intrinsic value of water and its essential role in all aspects of life.
- **Invest and innovate** – ensure adequate investment in institutions, infrastructure, information, and innovation to realize the many benefits derived from water and reduce risks.

3.2.3 World Bank: The adaptation principles

This WB report (2020)¹⁶ provides a comprehensive guideline for designing strategies for climate change adaptation and resilience, intertwining/integrating them with efforts to accelerate development, and reduce poverty. The guide is supposed to assist governments with making decisive actions that significantly lower climate risks on lives and livelihoods of people

As stated in the introduction of the report: *In countries around the world, climate change poses a significant risk threatening the lives and livelihoods of people. These risks cannot be reduced to zero, which means governments must take decisive action to help firms and people manage them. Doing so requires planning ahead and putting in place proactive measures that not only reduce climate risk but also accelerate development and cut poverty.*

The guideline includes six universal “Principles of Adaptation and Resilience” supported by twenty-six concrete actions that governments can use to develop effective strategies and no less than twelve toolboxes with methodologies and data sources to facilitate and ensure evidence-based strategy development. The 6 principles are:

- *Build resilient foundations with rapid and inclusive development*
- *Help people and firms do their part.*
- *Revise land use plans and protect critical infrastructure.*
- *Help people and firms recover faster and better.*
- *Manage impacts at the macro level.*
- *Prioritize according to needs, implement across sectors, and monitor progress.*

Support structures include, for example, economic analysis methodologies that can help to select potential intervention or budget tagging methods to ensure spending is consistent with expectations. Monitoring of actions, progress, delays, and priorities towards greater resilience is further supported by an indicator. The approach was able to describe how the COVID-19 pandemic, and subsequent economic crisis, affected the design of adaptation and resilience strategies, and the changes within the development landscape in all countries.

¹⁴ <https://valuingwaterinitiative.org>

¹⁵

https://sustainabledevelopment.un.org/content/documents/15591Bellagio_principles_on_valuing_water_final_version_in_word.pdf

¹⁶ <https://www.worldbank.org/en/news/feature/2020/11/17/the-adaptation-principles-6-ways-to-build-resilience-to-climate-change>

3.2.4 UNDRR: DRR & CCA in the UN Sustainable Development Cooperation Framework

The UNDRR report ¹⁷ from 2020 is a guidance note to integrated climate change and DRR to help build resilient societies. According to UNDRR, to help build resilience to climate and disaster risks, countries must be supported to identify and leverage relevant technical, financial, and organizational capacities in all sectors of society. The UN Sustainable Development Cooperation Framework is a guidance note intended to boost coordination of UN organizations to achieve the 2030 Agenda. This Cooperation Framework is an agreement between the UN and the host government and determines and reflects the UN development system's contributions in the country and shapes the configuration of UN assets required inside and outside the country. Water climate adaptation could be mainstreamed in this cooperation framework, if not yet already done.

3.2.5 AGWA Business Function Mapping framework and water resilience assessment framework

A recent AGWA report ¹⁸ (March 2022), mentions two, inter-related iterative approaches to assist private actors to manage climate-related risks: 1) identifying an organization's climate-related risks and opportunities, and then 2) determining the organization's resilience. It has been constated that

- *Traditional organizational decision-making tends to focus on the short-term, but climate change decision-making demands decisions and planning for both short- and long-term. The unique aspects of decision-making to address climate change are the longer-term time horizons, uncertainties, multisystem impacts, and high complexities associated with climate-related risks. These elements of decision-making can be challenging to integrate into near-term decision-making processes.*
- *traditional decision-making for climate change requires robust scientific understanding of potential future impacts of climate change and access to best available data and information, such as climate models, scenarios, and meteorological data.*

The proposed frameworks help organizations facilitate discussions on climate impacts and develop strategies to begin mainstreaming climate change into organizational decision-making with the goal of enhancing their resilience to known and unknown climate-related shocks and stresses. It is also suggested that "although both frameworks were designed with and for water utilities, the approaches have broader applicability. For this reason, these frameworks could be used by any organization that wishes to enable inclusive collaboration, resulting in an improved understating of the ways climate change may exacerbate their existing underlying conditions and stressors and potential solutions to address these impacts."

3.2.6 Guideline principles for Drought Risk Management under a changing climate

The recent report¹⁹ on 'Drought Risk Management under a Changing Climate' presented by the UN Convention to combat desertification (COP-15 Cote d'Ivoire) aims at raising awareness and mainstreaming best practices for climate-resilient integrated drought management worldwide. The report addresses the following issues:

- how climate change is modifying drought and impacting ecosystems, societies, and economic sectors.
- how climate change is affecting drought preparedness and response measures by imposing the need to adapt to increasing uncertainty.

¹⁷ <https://unsdg.un.org/resources/integrating-disaster-risk-reduction-and-climate-change-adaptation-un-sustainable>

¹⁸ <https://www.alliance4water.org/resources/water-in-a-changing-climate-reducing-risks-leveraging-opportunities-and-enhancing-resilience>

¹⁹ <https://www.alliance4water.org/resources/help-guiding-principles-for-drought-risk-management-under-a-changing-climate>

- guiding principles for preparing drought risk management plans considering the current and future climate change impacts and promoting sustainable and equitable sharing of water resources.

The report provides “an overall picture of how policy makers can enable climate-resilient drought management and directs the reader to some useful capacity building tools and programmes. It does so through various illustrative case studies of climate-resilient drought management and reference to the current state-of-the-art in drought risk management knowledge and understanding”.

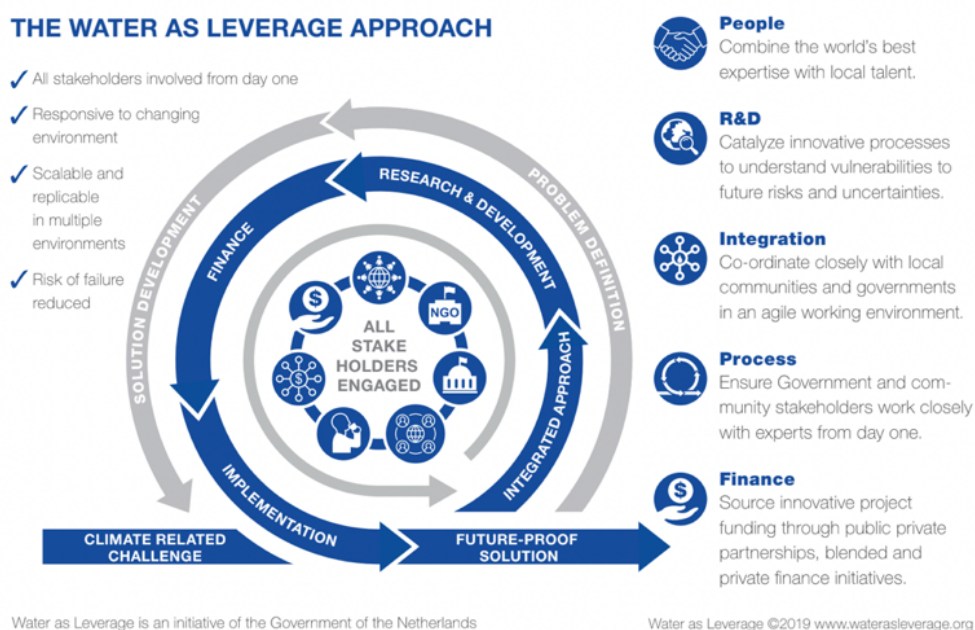
This focus on droughts is welcome as, “due to climate change, drought may no longer be a temporary aberration but increasingly become part of everyday experience.” Increased climate induced drought phenomena are reported in several regions, for example Brazil. More important even is the awareness climate change requires preparation for the uncertain future, even when not effects are yet experienced as such.

The traditional emergency responds reactions after droughts are no longer sufficient in many cases and are certainly not sustainable in the long-term. In addition, improving water use efficiency alone is also equally insufficient and may need to be accompanied by stricter water regulation and allocation agreements, just to prevent an increase of water use (Jevons’ paradox).

The report argues to deal with droughts under climate change countries require a fundamental shift in how to prepare for, manage, and respond to drought. The report highlights the need involvement at the highest policy level as well as at the implementation- or project level. The report accentuates the need for guiding principles for policy responses, governance, finance, and social inclusiveness, working in parallel and in agreement with DRR, Sustainable Development Goals (SDG’s), etc.

3.2.7 Water as Leverage approach (WaL)

The water as Leverage approach specifically explores a new way of thinking to address urban climate resilience. Water as Leverage²⁰ is an explicitly inclusive and multidisciplinary Dutch-founded public-private partnership (PPP) program. It stands out is the direct involvement of financial institutions right from the start of the development of any concrete adaptation project. WaL focusses on identifying or creating bankable, scalable spatial solutions, and has been adapted to urban areas across the world, including for example, the city of Khulna (Bangladesh).



²⁰ <https://www.worldwateratlas.org/curated/water-as-leverage/>

3.3 Climate adaptation knowledge portal and (on-line) tools

To list, describe and categorize all internationally accessible knowledge portals or online knowledge hubs, centers or toolboxes related to water- and climate adaptation is far beyond the scope of the present study. But a few initiatives are worth mentioning, here after in this report.

3.3.1 GCA STAKE portal

The '*State and Trends in Adaptation – Knowledge Exchange*' (STAKE) ²¹ disseminates data, analysis, and information on adaptation from a variety of different sources across the globe.

The GCA Knowledge Exchange aims to make knowledge on adaptation accessible and actionable in a comprehensive online portal, connecting adaptation science, policy, and practice.

3.3.2 AGWA knowledge platform

The AGWA Knowledge Platform²² is designed to promote and showcase an emerging set of approaches to water resources management that address climate change and other uncertainties — increasing the use of "bottom-up approaches" through building capacity towards implementation, informing relevant parties, engaging in discussion, and creating new networks. The Knowledge Platform features a new generation of methodologies to assess and address climate risk and other uncertainties in water resources management. These "bottom-up approaches" (BUA) work with complex stakeholder needs, build confidence for policymakers, and integrate into existing decision-making processes to achieve quantitative solutions that are both robust and flexible.

3.3.3 The EU climate adapt portal

This portal²³ facilitates sharing of information to promote and realize a climate robust Europe. It consists of 1) the European Climate Data Explorer, which is a web-based application that provides interactive access to many climate indices from the Copernicus Climate Change Services, in support of climate change adaptation. And 2) the European Climate and Health Observatory which provides access to a wide range of relevant publications, tools, websites, and other resources related to climate change and health.

3.3.3 Dutch Knowledge portal

The Dutch Knowledge Portal ²⁴ is a pre-eminent source of information for everyone engaged in climate adaptation in the Netherlands. It features practical information, useful tools, inspiring examples, and the latest news. The intention is to climate-proof The Netherlands, with all stakeholders.

3.3.4 New-Zeeland Climate adaptation platform

This platform²⁵ aims to be a portal for recent, relevant, and robust information on climate change. It showcases New Zealand practices and strives to disseminate world best practices via published research papers, lectures, books, reports, seminars, and conferences.

²¹ <https://www.adaptationexchange.org>

²² <https://agwaguide.org>

²³ <https://climate-adapt.eea.europa.eu>

²⁴ <https://klimaadaptatienederland.nl/en>

²⁵ <https://climateadaptationplatform.com>

3.3.5 Akvopedia: platform to present local solutions

Akvopedia²⁶ is a free, open-sourced resource platform that anyone can edit. The name Akvopedia is a combination of the words akvo (meaning *water* in the language Esperanto) and encyclopedia. Akvopedia article pages seek to provide a solid introduction to water and sanitation technologies, financing, and processes needed for project implementation and maintenance. It presents smart and affordable technologies and approaches in rural and urban settings. Akvopedia presents several portals related to water and offer a platform to document and show-case climate adaptation solutions by/for/with local communities. Nature based solutions are described.

3.3.6 Australian on-line tools: Water sensitive cities

These on-line software-based tools²⁷ assist in creating and evaluating concept design-, technology-, or policy-solutions that promote water sensitive objectives and outcomes across the urban development sector. These tools are said to be user-friendly and are based on outputs from the Cooperative Research Centre for Water Sensitive Cities.

3.3.7 Strategic Environmental Assessments (SEA) (tool)

Environmental impact assessment (EIA) and strategic environmental assessment (SEA) play a role to support climate change adaptation in policy making, planning and the eventual implementation of climate actions. These tools aim to integrate environmental and climate change considerations into policies, plans and programmes and evaluate their interlinkages with economic and social considerations. SEA allows:

- To structure the public and government debate in the preparation of policies, plans and programmes.
- To feed this debate through a robust assessment of the environmental and, where required, other consequences.
- To ensure that the results of the assessment and the debate are considered during decision making and implementation.

Public participation, transparency and high-quality information included in a SEA make it a tool to enhance good governance. It allows to explore

- Expected climate changes for the medium and long term
- Risks to the society (population and economy)
- Vulnerability of the different areas and land use types
- Objectives such as safety levels that need to be achieved
- Identification of adaptation options.

By using SEA as a strategic decision support tool, negative impacts in relation to building and exploiting water infrastructure can be mitigated. Starting early in the process at a strategic level, environmental and social considerations - using (academic) information, data, and stakeholder participation – can be integrated in development plans and programs. It should be noted that a UNEP draft resolution²⁸ has recently been adopted. This resolution related to sustainable and resilient infrastructure encourages member states to conduct SEA so that environmental and social considerations are integrated in decision making, at the appropriate levels and advance integrated, system level approaches to sustainable and resilient infrastructure planning and delivery.

The SEA tool was used during the preparation of the Dutch Delta Plan, The Bangladesh Delta Plan, and the Grand-Nokoué Delta Plan to ensure that decision making in the planification process is participative and inclusive.

²⁶ https://akvopedia.org/wiki/Main_Page

²⁷ <https://watersensitivecities.org.au/tools/>

²⁸ <https://www.eia.nl/documenten/00000539.pdf>

3.3.8 Water Tracker (tool)

The water tracker ²⁹ for national climate planning is a tool and diagnosis guide to help countries self-assess and enhance water resilience in their national climate planning. This initiative is being implemented as part of the water sector workstream of the adaptation Action Coalition (AAC).

3.4 Nationally Determined Contributions and National Climate change Adaptation plans

Climate policies are recognized to be essential to mitigate climate change and to develop successful adaptation processes. As a follow-up of the Paris Climate Agreement (2015), countries have prepared Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change. Updated versions of these documents have been prepared before the COP26, held in 2021. In addition, National Water Adaptation Plans have been prepared. NDCs and NAPs/NASs are available for each of the four case-countries in this study and there is a tendency to create linkages between NAPs and NDCs. NAPs are aimed to address and further expand on the crucial links between water and climate change adaptation. NAPs are supposed to identify short- and long-term adaptation needs, and develop and implement strategies (or programs) to address those needs, such as flood and drought planning, adaptation in the agricultural sector, etc.

Nevertheless research³⁰ on the NAPs show a standardization in climate change policies, namely through the adoption of comprehensive National Adaptation Plans/Strategies (NAPs/NASs) that often includes standard mitigation measures and evaluation mechanisms. Although NAPs tend to consider different non-governmental stakeholders, they are still mainly state-centered and for this reasons, NAPs' objectives mainly reflect a generalized "global agenda" and, as such, pay less attention to national/regional vulnerabilities and contexts. In fact, despite being subject to a very broad spectrum of different socio-economic levels of development, very diverse climate-risks, dissimilar vulnerabilities and readiness status among countries, NAPs tend to focus on the same critical sectors and objectives. In the case of Benin and Bangladesh, the NAPs are more focused on natural resources and conservation. In the case of The Netherlands, NAPs are focused on economic risks and opportunities. There is no NAP available for Mozambique.

Sectoral vulnerability studies are carried out to be more country and or region specific. In the case of Benin, for example, specific studies were implemented for the following sectors: agriculture, health, and water resources. In the last case, this approach showed that the Ouémé river Basin was very vulnerable not only to inundations but also to drought.

A zero draft for the National Adaptation Plan (NAP) Bangladesh was presented in February 2022. Developed within an inclusive and participatory setting (to the best extent possible), this document proposes a climate change act, revision of the climate change trust fund act and emphasized turning the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) into an overall umbrella policy.

It should be mentioned that even when the participation of non-governmental stakeholders in the development of NAPs was assured, it was also reported that in some cases, the way it was done have constrained the effectiveness of responses. It appears that mechanisms of engagement should be better aligned with different socio-cultural characteristics.

²⁹ <https://www.alliance4water.org/water-tracker-for-national-climate-planning>

³⁰ <https://www.sciencedirect.com/science/article/abs/pii/S146290111931322X>

4 ADAPTATION ICONS IN SUMMARY

4.1 The Netherlands

Netherlands, which literally means "lower countries", refers to its low elevation and flat topography, with only about 50% of its land exceeding 1 m above sea level and nearly 26% falling below sea level. More than half of the country is flood-prone, mainly due to storm surges at sea or high-water levels in the rivers. The south-western part of the Netherlands is to this day a river delta of three transboundary rivers: the Rhine, the Meuse, and the Scheldt. Population increased to just over 17 million people in 2021. With a population density of 424 per km² it is one of the most densely populated countries in Europe.

Most of the areas below sea level, known as polders, are the result of peat extraction or land reclamation that began in the 14th century. Nearly 17% of the country's land area is reclaimed from the sea and lakes. Since the late 16th century, large polder areas are preserved through elaborate drainage systems that include dikes, canals, and pumping stations.

Until the 1950s, floods regularly caused widespread damage and fatalities. The 1953 flood disaster caused the death of 1,835 people and forced the emergency evacuation of 70,000 more. It initiated the Delta Works, a comprehensive set of civil works that included the reduction the coastline's length by closing-off sea estuaries and the upgrading of flood-protection standards and consequent dike improvement along coast and main rivers. Although completed in the 1997, constant renovation and renewal of the Delta Works system is required under new risk assessments and climate change related sea level rise.

The devastating effects of Hurricane Katrina on the city of New Orleans (US,2005) raised questions in the Netherlands senate of parliament on "*the vulnerability of long-term large-scale infrastructure and critical investments to the effects of a changing climate, sea-level rise and flood risks*"

The Netherlands water managements system is characterized by a strong water-related decentralized governance system with effective regional and national water authorities, well-equipped knowledge institutes, an innovative private sector, a strong civil society and the support of adequate funding and legislation. As a result, The Netherlands is considered well protected against floods (OECD, 2014). The Netherlands is the 29th most vulnerable and the 15th most ready country countries in the ND-GAIN index³¹(2019).

The Delta³² program approach, and related delta fund still present an excellent example of a situation where adaptation is considered a shared responsibility. Participatory approaches, continuous knowledge development dominate the process in the context of a structured policy frameworks. Covering all aspects of WCA, the NL cases demonstrates the required decision-making structures from the national level to the local level and implementation.

The tested use of stress tests, risk dialogues and implementation agendas, dedicated long term learning & capacity building programs, fund allocation (for process and implementation), data-driven methodologies and attention paid to using synergy with other existing spatial processes are key elements in the success of this approach.

Climate change introduces new challenges, including increased sea-level rise, river flooding and droughts. There is a growing awareness that the adaptative IWRM that underlays the NL water

³¹ The ND-GAIN Country Index summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience. It aims to help governments, businesses and communities better prioritize investments for a more efficient response to the immediate global challenges ahead.

³² It is a common misunderstanding that the phrase delta (as in delta management or delta program) is a methodology strictly limited to larger river estuaries. Although embraced in the Netherlands and the world largest delta Bangladesh, the phrase refers to the scale, importance, and comprehensive nature of the drastic interventions.

adaptation strategies may no longer be sufficient to address ever accelerating climate change. As such, even the Dutch model may be subject to the need for transformation. Adaptive delta management is a good practice of Decision Making under Deep Uncertainty.

Latest IPCC reports confirms the necessity to prepare for present and future climate change effects. IPCC scenario's, further specified to Netherlands conditions, confirm that climate change effects manifest themselves much earlier than previously anticipated (earlier scenarios underestimated the rate of climate change). These findings will affect the second DP calibration/adjustment (2028 – 2032) and have consequences for implementation rates and related budgets.

Consequences became painfully noticeably in 2021 when a significant drought affected the eastern part of Netherlands and created saltwater intrusion problems in the west. In July 2021, several European countries including Germany, Belgium and the Netherlands were affected by catastrophic river floods, causing deaths and widespread damage, unveiling gaps in disaster preparedness and response.

These events were “off scale”, not anticipated in any scenario, and there for a wake-up call for the adaptive management that implies gradual and to-be-foreseen climate effects. These events catalyzed huge interest in climate change effects and pressure to the national government in the Netherlands for a change of strategy. A 250 million Euro in additional funding was appointed (Coalition agreement 2021-2025) to the Delta Program to facilitate acceleration of processes and implementation.

Experiences from The Netherlands demonstrate that the Dutch Delta Program shows compliance with the OECD twelve principles of water governance, especially on (innovative) governance, stakeholder participation, inter-policy and inter-agency coordination, funding, and monitoring and evaluation. Although these OECD principles proved to be useful and relevant in many countries, they cannot account for two relevant aspects of adaptive water management that are novel to water governance:

- Designing and managing of a process of adaptive planning with a long-term perspective
- Risk-based approach to adequately manage extreme events, such as floods and droughts

It could be said that mainstreaming of water climate adaptation was successful in The Netherlands following the IWRM principles and the OECD water governance principles. The Sendai DRR framework is also put into practice. Based on their knowledge and experience, Netherlands experts contributed to the development of these various guidelines and frameworks which is one of the reasons why they are (implicitly or explicitly) well mainstreamed in the various Dutch policy documents.

The main success factors so far of water climate adaptation in The Netherlands are linked to the following elements:

- Sensitivity to natural disasters
- Strong visionary leadership (endurance, determination and will)
- Dedicated institutional frameworks with strong coordination
- Limited number of key actors and special position of Delta Commissioner in Ministry
- Coalition of willing and coalition of doing
- Knowledge of situation (data, information, models, etc.)
- Trust between actors and good information
- Scenario development (“adaptation tracks”), at various stages, multi-stakeholder process, with technical & political perspectives
- Available funds

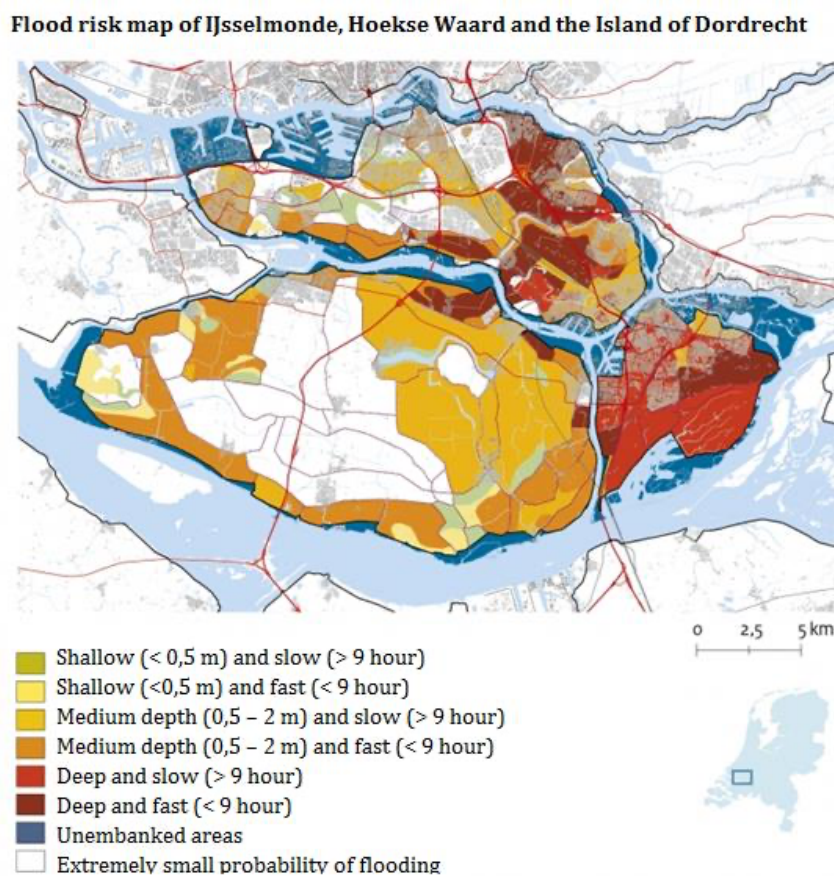
And finally, willingness to acknowledge that water climate adaptation takes more than just a plan and that checking assumptions, data, information, and models (underlying the plan) is vital and to accept that at some point radical transformative change may be needed to replace incremental change approach and change the plan.

4.2 City of Dordrecht (2 pages)

The city of Dordrecht is located in the western part of the Netherlands, in the province of South Holland. The municipality covers the entire Dordrecht Island, enclosed by the rivers Oude Maas, Beneden Merwede, Nieuwe Merwede, Hollands Diep, and Dordtsche Kil. Dordrecht has a population of about 120.000, relatively constant since 2000.

The city is situated in a transition zone between the rivers and the North Sea. It is subject to tidal ranges between 30 (eastern border) and 80 cm near the historical town of Dordrecht. The city was built on a low-lying area with a mean surface level 0 meter above mean sea level and the average high-water level of the rivers is approximately 1.0 meter above mean sea level. To prevent the city from flooding the city is protected by a dike ring. A part of the city, including a part of the historical town, is not protected by primary flood defenses and must deal with temporary flooding's due to high water levels in the river. The city is surrounded by rivers or countryside that consist of deep, low-lying polders, greatly hampering emergency evacuation options in times of flooding (Figure 1).

Figure 1: Dordrecht Flood risk map Source: PBL / taken from [E]



The city of Dordrecht is an excellent example of not only adaptation combined with urban redevelopment and alignment of municipal responsibilities and challenges but also power of innovative research-by-design processes to drive adaptation measures with very direct attention paid to the role and position of citizens and social dynamics. It is a great example on how the gap between policy frameworks and concrete implementation at scale can be achieved. Even for the Netherlands Delta Program the Dordrecht case is inspirational and provocative as it complete breaks with the institutional lock-ins and dominance of flood prevention in the Netherlands (over adaptive spatial development and disaster preparedness).

The city of Dordrecht recognized its vulnerability to flooding and introduced a multi-layer water safety model that includes adaptive spatial development and disaster prepares in an institutional environment where prevention (dikes and levees) is traditionally the dominant water safety option. Dordrecht re-develops the urban area “De Staart” as a safe, self-sufficient shelter area of about 450

hectares to use in the event of imminent flooding, in such a way that the approach acts as leverage for the initiation of truly sustainable urban development and the housing challenge the city faces, that will make room for the next economy after the energy transition, that will ensure good accessibility, and that will reconnect the city of Dordrecht with water and nature. In Dordrecht mainstreaming water and climate adaptation is used to implement a vision for improved living conditions, new economy, and a flood refuge shelter in one and the same area.

It could be said that mainstreaming of water climate adaptation is successful in Dordrecht following implicitly the IWRM principles and the OECD water governance principles. Compliance with the SDGs and the Sendai DRR framework were checked during the process but not leading for development.

The case of De Staart, Dordrecht, illustrates how mainstreaming water and climate adaptation can evolve partly as a by-product of urban regeneration and sustainable development and that mainstreaming itself can be used as one or more means to implement a vision. Dordrecht appears to be an innovation and inspiration site for the Netherlands National Delta Program, European Union (EU) research projects, Urban Design initiatives, and front runner in the development of the so-called multi-layer water security model (MLS).

The process initially started by recognition of the potential of integration various urban challenges into one focus area and was catalyzed by accepting the opportunity as a canvas for innovation and design as a case under the International Architecture Biennale of Rotterdam (IABR). Although a vision was present and existing frameworks have been instrumental, the overall process can be described as that of a “emerging strategy” or Research-by-design approach.

Climate adaptation mainstreaming is not seen as an isolated objective. Instead, water climate adaptation is considered as a driver for making an area more attractive (reconstruction). As such, it contributes to a larger overarching goal that can be shared by all key stakeholders, not just from a water climate perspective.

Long term political commitment as a driving force for innovative urban development and persistent and continuous leadership within the municipality from technical staff proved vital as it took 15 years to come from idea to first implementation phases. Eagerness for technical and social understanding of what it takes to make changes happen was underlying the process. Deliberate participation in (EU) research programs as innovative city within the urban resiliency domain proved a vital source for knowledge development (and some funding). Explicit investments in collaboration processes and network development were favored within a learning-by-doing environment.

A combination of regular exposure to water / flood annoyances and active communication towards both citizens and business create a community that is receptive to adaptive interventions. Dordrecht is implementing risk communication and hence following up the obligation of the EU Floods Directive, to inform citizens in flood prone areas about the flood risks. Every year letters are sent to the 15.000 citizens that live outside of the dikes to remind them of the flood risks. Citizens are informed on actions such as making dikes of sandbags during small floods and making facades of houses waterproof. The municipality brings flood risk management into action by placing retaining walls (stop logs) in the flood prone areas of the town. Cultural event related to water safety, education programs and public exhibitions complement the municipal intensive communications.

Despite this exceptional position within the Dutch water climate adaptation context, the city of Dordrecht is facing challenges (at the national level) to implement plans. Being a front-runner may not be an advantage when locally developed solutions based on transformative management to address specific context are not fitting in the general agreed mainstreamed framework. This is particularly true when it comes to be eligible for the national adaptation fund (when change of strategy at national level is not yet translated into application rules).

4.3 Bangladesh (2 pages)

Bangladesh, officially the People's Republic of Bangladesh, is the eight-most populous country in the world, with a population of nearly 168 million people (2022), making it one of the most densely populated one with roughly over 1,000 people per km². Bisected by the three-major river Ganges, Brahmaputra (also known as the Jamuna), and Meghna, two-thirds of Bangladesh is river flood plains, covering about 100,000 km², making Bangladesh one of the largest dynamic deltas of the world. These delta soils are fertile and productive with the opportunities for multiple cropping while water bodies provide ample scope for fisheries and livestock resources. The inland water transport offers transportation and open access to the sea is a huge advantage for blue economy and trade. Modernization and economic growth have been substantial over the last decade.

Present day Bangladesh faces a kaleidoscope of rigorous water and climate related challenges³³, such as flooding, freshwater unavailability, drought, groundwater decline, riverbank erosion and sedimentation, silted up rivers, clogged drainage, water logging, salinity intrusion, deteriorated water quality, decreased trans-boundary water flows (during the dry season linked to glacial retreat in the Himalayas), sea-level rise, increased frequency of cyclonic storms and associated surges. These are complemented by socioeconomic challenges like rapid population growth and the negative consequences of rapid modernization and economic growth like fast industrialization, unplanned urbanization, pollution, and severe environmental degradation. In the face of all adversaries, in the last decade Bangladesh gained considerable progress in development. Bangladesh reduced poverty and increased the economic growth rates to an average of 6,5% per year, with the governments ambition to become upper middle-income country by 2031.

Bangladesh, due to its unique geographic location, suffers from devastating tropical cyclones as the funnel-shaped northern portion of the Bay of Bengal amplifies the storm surge of landfalling tropical cyclones. These, combined with its delta and flood plain characteristics, make Bangladesh one of the world's most vulnerable countries for natural disasters and climate change. It is the 26th most vulnerable and the 29th least prepared country countries in the ND-GAIN index (2019) caused by the combination of poverty, weak institutional development, and frequent extreme weather events.

Although still working towards implementation (including proposed institutional reforms) the Bangladesh example clearly indicates the convincing and initiating power of holistic visions as catalyst for adaptive measures, as a fundamental step in preparing all stakeholders for a transformational state. In the Bangladesh case the close relationship between the Bangladesh Delta plan 2100 and the World Bank Group (Investment Plan) is a transformative example as such. It indicates the attention paid to extending stakeholder participation to the financial environment. Next, the overall combination of climate adaptation efforts combined with the need to 'ensure long-term water and food security, economic growth, and environmental sustainability, and effectively reducing vulnerability to natural disasters clearly indicates that a lot can be done in the awareness. Key is the integration of WRM and DRM efforts, and the overall development ambition of Bangladesh (aligned with the SDGs), via the climate adaptation pathway.

Support efforts to the Implement Bangladesh Delta Plan 2100 (BDP 2010) are annually updated, and will provide insights, allowing for better description of the overall development process, partner dynamics and potential of the BDP 2100.

Experiences from Bangladesh demonstrate that the Bangladesh Delta Program to implement the plan shows compliance with the OECD twelve principles of water governance, especially on (innovative) governance. Stakeholder participation, inter-policy and inter-agency coordination, funding, and monitoring and evaluation. Although these OECD principles proved to be useful and

³³ An excellent short history of managing the water related risks in Bangladesh is presented in the GCA paper "GCA. 2021. Living with water: climate adaptation in the world's deltas, page 26 – 34. BDP 2100: managing water resources and disaster risk in Bangladesh":

relevant, they cannot account for two relevant aspects of Adaptive water management that are novel to water governance:

- Designing and managing of a process of adaptive planning with a long-term perspective
- Risk-based approach to adequately manage extreme events, such as floods and droughts

It could be said that mainstreaming of water climate adaptation in national plans was successful in Bangladesh following the IWRM principles and the OECD water governance principles. The Sendai DRR framework is also put into practice. Based on their knowledge and experience, Bangladeshi experts contributed to the development of the Sendai DRR framework.

Although it is too early to evaluate the acceleration potential of the BDP 2100 for the actual implementation of MWCA measures in Bangladesh, it could be argued that the institutional value of the BDP 2100 for policy mainstreaming of WCA is impressive. The development of a climate adaptive national plan as a fundamental requirement for a sustainable social economic growth ambition is unprecedented.

Success factors that emerge are:

- Participative: Although there is always room for improvement, communication and participatory processes are said to be good given the innovative institutional setting of the BDP
- Local needs leading: The Dutch consortium that assisted Government with the development of the BDP2100 was specifically oriented towards serving Bangladeshi needs and requirements, using the Netherlands Delta Pan experiences as inspiration only.
- Relationships: Strong relationship between high level representatives of the Dutch consortium and the BDP staff and a strong mutual interest in delivering high quality vision for the development of Bangladesh proved vital.
- Solid (scientific) foundation: The distinct diagnostic phase via (new) baseline studies have led to much better understanding of system complexity, urgency, threats, and potential for interventions.
- Fitting in existing national planning structure: Bangladesh planning economy structure (8th 5-year plan, 20-year Perspective Plan 2021-2041) proved to be very functional in safeguarding the integration of ministerial responsibilities within the (implementation) of the BDP. As such, integration is not only facilitated in a vision but fully institutionalized (in the planning phase).
- Water Governance leading: The introduced adaptive delta management approach matched remarkably well with the OECD water governance principles framework, except for novel components (scenarios within long term vision, and risk-based approaches).
- Early-stage involvement of major International Funding Institutions (IFI's) from the very beginning proved important. A Memorandum of understanding with the World Bank (WB) allowed for swift translation from BDP concept to an investment planning program, rendering interventions and investment proposals in the BDP to match with WB selection process.

Despite challenges related to mainstreaming the water-climate adaption efforts and investment within the government structure and relations with the IFI's, one can conclude that:

- Early recognition of Bangladesh's vulnerability and necessity for action has led to Government of Bangladesh initiated change of vision, an innovative holistic perception of climate change and economic development and institutional reforms that can facilitate implementation of MWCA to a new level.
- The introduction of adaptive delta management, scenario-based planning, introduction of multi-sectoral approaches and interrelation between ministerial responsibilities, integrated long term and adaptative planning, indicates a steep institutional learning curve in Bangladesh.
- To maintain this momentum, it is hoped that streamlining IFI involvement with governmental priorities takes place, to guarantee that MWCA implementation keeps track with changing climate and increasing pressure on the delta as a whole.
- Acknowledgement of actual barriers for adaptation implementation and willingness to address them are key for success.

4.4 City of Khulna

Khulna, located in coastal Bangladesh, is the third-largest city in Bangladesh and the third-largest economic center in the country. In 2022 estimated population numbers are 950,000. Khulna is in coastal Bangladesh, at the intersection of the Rupsha and Bhairab Rivers on the alluvial soils of the Ganges Brahmaputra delta, its landscape crossed by dozens of tidally influenced rivers, canals, and creeks. Khulna is served by Port of Mongla (the second-largest seaport in the country). The city is located approximately 40 km north of the Sundarbans, the world's largest mangrove forest.

More than 50% of the city area is already developed of which 18% is built-up area. Slums are found in small portions in some parts of the city. Agricultural land covers about 14% of the area. Water bodies such as rivers, canals and ponds constitute about 16% of the area.

One of the cities of the Water as Leverage program (WAL), the city of Khulna is facing serious water resilience issues including saltwater intrusion, "dying" rivers, and coastal flooding from lack of adequate drainage and sea level rise. Interventions at multiple scales are needed to bring improve water resilience in the city. Interesting efforts are undertaken to improve historical and natural drainage systems and the concept of a Water Inclusive Enclave. River rehabilitation, sustainable polder development and water storage facilities, restoration of (natural) drainage and water storage ability define the present adaptation efforts. Linkages to urban (re)development, food production, WASH, and the city's exposure to increased tidal flooding, vulnerability to cyclones and land subsidence make Khulna representative for many coastal cities, especially in Strategic Environmental Assessment (SEA). Bridging the gap between high-over national visions and city level implementation, covering both BDP2100 and the WAL more transformative and system dynamics, make Khulna an interesting case.

Sendai DRR, IWRM and OECD Water Governance frames, at least in paper, are well established within the governmental culture of Bangladesh and Khulna, being a resiliency thinking country. Nevertheless, the international donor attention for Khulna, and good understanding of its vulnerability and climate threats are not immediately translated into actual adaptive interventions. Proposed interventions are not nested within local project identification procedures and, as a result local and national investment procedures and financing options. As such there is a big gap between these studies and actual implementation of WCA measures in Khulna.

Donor perspective

Donor financed studies are of high quality, detailed and relevant for the local conditions, incorporating latest international insights. They are, however, not always followed by (pre)feasibility studies for implementation projects. They are undertaken in close collaboration with local knowledge partner, but too often without recognizing the limited local absorption capacity for its content and disconnect with local financing and project selection procedures.

Translation of external studies to local procedures and project selection mechanisms is most often not included in donor-financed studies, seriously affecting the introduction of new approaches.

In many cases donors' identified projects are not followed up by implementation via donor financing due of lack of readiness of local government machineries and lengthy bureaucratic procedures. As a result, donors tend to draw back upon their own project selection procedures, missing out on integration with local MCW efforts.

Local perspective

Local and national financed interventions are processed via developed project plans (DPP). Bangladesh and local government KCC (Khulna City Cooperation) tend to be focused on the identification of (immediate) bankable projects (external or national funding) with short terms development impacts. The local governmental instrumentation and project machinery faces time- and capacity constraints and is unable to absorb the (international) interest, inputs, and strategies.

As a result, traditional hardware engineered approaches prevail, resulting in many floods prevention (river embankment) projects, failing to address e.g., the local drainage and water logging during rainstorms that causes most public concern and problems.

Project finance (within the governmental structure) is available for implementation (design and build) only, with financial contributions only available after project approval. No funding is available for data collection, preliminary studies, or feasibility. This results in “shallow” plan development and proposed interventions based on conventional existing local knowledge only, often missing out on new developments, latest data, and approaches.

In addition, development projects do not include operation and maintenance costs. This hampers effective WCA, as water logging in Khulna is much helped by drainage cleanup, rather than rebuild.

There is, in general, poor accountability and transparency in project selection and allocation. As everything in Bangladesh is affected by climate change too many general development projects are placed under the climate change theme, without explicitly increasing climate resilience. E.g., regular seasonal river dredging activities are now earmarked as climate adaption. As such, project selection is not at all prioritized in terms of urgency, numbers of people affected, levels of climate vulnerability, potential long terms effects, etc. but on basis of potential political or financial gains.

Although these issues are not always intentional, they reflect a situation where mainstreaming WCA is hampered by lack of capacity and inefficiencies in the functioning of the governmental system and inefficient donor - governmental collaboration, and not so much due to lack of awareness, system understanding, or lack of policy frameworks.

4.5 Mozambique

Located on the eastern coast of southern Africa, the Republic of Mozambique has the third-longest coastline on the African continent. Its 2,770 kilometers long coast hosts critical ecosystems, such as mangroves, reefs, bays, and dunes. The rest of the country is primarily dominated by savannah and secondary forests.

Mozambique is a low-income country with a largely rural population of 29.5 million. About 60 percent of the population lives in the coastal area. The population is relatively young, with around 45 percent of its population being under the age of 15. Weak economic opportunities resulting from multiple development challenges, including widespread poverty, gaps in the education system, low life expectancy, and high mortality rates hamper Mozambique from benefitting more from this economic human resource.

Mozambique mostly depends on rain-fed agriculture for subsistence and export gains. In 2019, over 70 % of the country's total workforce was employed in the agriculture sector, which together with the forestry and fishery sector, contributes to around 24.5 % (2018) of its national Gross Domestic Product.

Mozambique is one of Africa's most vulnerable countries to climate change. It is the 44th most vulnerable and the 25th least prepared country countries in the ND-GAIN index (2019) caused by the combination of poverty, weak institutional development, and frequent extreme weather events. Mozambique is the world's nr.1 most affected country by the impacts of extreme weather events (Global Climate Risk Index 2021). For the period of 2000-2019 it ranked fifth. Several cyclones recently hit the countries: Idai in 2019, Eloise in 2021, and Ana in 2022, to name a few.

The country experiences high levels of climate variability. Droughts, floods, and tropical cyclones are the most frequent disasters, which are projected to become more frequent and intense in the future. On average, the country is affected by a tropical cyclone or flood event every two years and a drought event every three years. These pose a major constraint to development since most of the country's population, especially the poor, reside in rural areas and rely on rain-fed agriculture.

Key climate stressors are rising temperatures, increase invariability and extreme rainfall, droughts, increased cyclone risk and sea level rise. Key impacts are expected in agriculture (reduced crop yields, seasonal shifts, livelihood disruption), Water resources (water stress/flooding, reduced hydropower production), coastal resources (environmental damage, fishery, tourism) and human health (vector- and water borne diseases).

As the occurrence of (more) extreme weather events adversely impact Mozambique socio-economic development trajectory, The Government of Mozambique (GoM), Non-governmental organizations (NGOs), and humanitarian agencies have been working together to reduce the impacts of extreme events through the elaboration of action plans and programs. Experience shows that more attention is given to floods than to drought. Water quality issues are hardly mentioned.

Mozambique's vulnerable climate risk profile indicates a close relationship between CCA and DRM policies and interventions. Both aim to reduce present and future risks to societies, economies, and the natural environment; both are ideally facilitated by (interrelated) strategies, resources, and actions; both are ultimately achieved at the household and community level; both are cross-sectoral and require coordination between different stakeholder groups. CCA may incorporate a longer-term perspective, but both (depending on definitions) may include the uncertainty associated with climate change complexities.

Mozambique is an excellent example of national adaptation action driven by disastrous impacts of climate-related extreme weather events. The government of Mozambique is increasingly concerned with identifying appropriate measures and strengthening capacity to tackle the adverse impacts on the country's socio-economic development trajectory. Mozambique follows a traditional NAS

trajectory, covered in the National Climate Change Adaptation and Mitigation Strategy for 2013-2025 (NCCAMS), defining both adaptation and the reduction of climate risks as national priorities, covering all regular CA working areas from water resources management to social protection. Local communities at the centre of climate change adaptation planning through its decentralised via Local Adaptation Plans at region level. The government continues to heavily rely on significant financial and technical contributions from international development partners, making its experiences relevant for other LDC's. Strategic adaptation actions worth mentioning include (e.g.): strengthen early warning systems; counter soil degradation; increase climate resilience in urban areas; adaptation of clean and climate-resilient innovations and technologies.

Several barriers for MWCA in Mozambique have been identified, including

- Insufficient coordination and governance mechanisms leading to insufficient policy coherence at national, provincial, and district levels.
- Lack of technical capacity (in number and competence) to mainstream climate change at national, provincial, and district planning and budgeting systems. It is extremely difficult to find people that are knowledgeable about water resources and able to deal with climate uncertainty, risks, and integration of complexity. Traditional education is not fitting the needs.
- capacity support through external consultancy is not a lasting solution for Mozambique. Recruitment of staff should be a priority to be able to do the job with support from technical assistance (training on the job).
- Poor data collection, data systems and data analysis capacities (in particular climate change and gender-sensitive data and information)
- Insufficient financing for climate proofing, associated with the complexity of the criteria and procedures for accessing international climate financial resources.
- Low public investment and private participation in the adaptation actions.
- Lack of funding to maintain and upgrade data collection stations (meteorological, hydrological, hydrographical, air quality, among others).
- Slow payback of the investment in climate change adaptation actions.
- Weak human capacity to determine the cost of the unpredictable climate change impacts, and of the measures to adapt to it.
- Weak capacity to design projects to access climate change financing and funds.
- Limited experience with adaptation technologies.
- Low capacity to measure, report and verify, including the effects of policies, strategies, plans and projects and of the availability and use of financial and technological resources.
- Difficulties and weak capacity to disclose knowledge about the climate change risks and actions, associated with a low capacity to manage and communicate the results of studies and projects.
- Insufficient incentives private sector and civil society participation in contributing to climate change adaptation.
- Weak coordination and charge in the implementation of the approved policies, strategies, and plans, due to a low ability to verify and enforce laws and regulations, associated with low capacity to cross-sectoral and integrated planning.

4.6 City of Beira

Beira is a low-lying port city, the second largest in Mozambique only after the nation's capital Maputo, located in the central region in the Sofala Province. Beira is Mozambique's fourth largest and fastest-growing city, with approximately 602,000 inhabitants and an annual growth rate of nearly 3%.

Much of the city of Beira—including the center—is built on the low-lying alluvium of the Pungue river and is prone to flooding due to rainfall and invasion from the sea. Some of the lowest parts of the city are regularly inundated during spring tides. Population pressure has increasingly led to urban sprawl with urban poor having no alternative than to settle in low-lying, flood-prone areas. Much of the land that people have informally settled in Beira in recent years is marshy lowland, previously used for rice agriculture. Being a breeding ground for malaria and other diseases, this type of land in its current condition is not suitable for human habitation as public health hazards are known to be especially serious for children.¹

Beira has always suffered from coastal erosion and annual flooding. In 2000, Cyclone Eline caused severe flooding in Beira, damaging buildings, roads, and livelihoods. In 2019 Cyclone Idai destroyed 90% of the city, Intense rainfall caused widespread flooding. Around 600 people died, and most residents were displaced. Fortunately, Idai coincided with a neap tide. Had Beira been hit during a spring tide, when sea levels are 2.3 meters higher, the resulting storm surge would have almost totally inundated the city.

Alongside more intense rainfall and rising sea levels, climate change is threatening Beira by shifting the trajectory of tropical cyclones southwards. Cyclone Eloise hit in 2021, confirming that the city is now in a regular 'cyclone channel'.

Climate adaptation in Mozambique is, as elsewhere, best demonstrated at the local, city level. The city of Beira provides an inspiring case for the 'building back better'-concept within the CCA or DRR frameworks of action. The Beira Recovery and Resilience Plan (post Adai) finds its traction for adaptation primarily in the possibility to combine adaptation with post disaster reconstruction and increasing housing demands, allowing for adaptation to be an integrated element of pressing social demands (rather than stand-alone). Beira demonstrates the use of an integrated approach, facilitating investment in urban drainage, coastal protection, and sanitation with affordable, flood-resilient residential housing. The Beira case shows how a strategic partnership between a municipality and a development partner can be a catalyst for change, and how strong local leadership is vital to connect local needs with international donor supply. Beira is a good example of a city where the importance of more systemic and human-centred methodologies to mainstream adaptation are fundamental. Nevertheless, the process is slow and results still expected.

Leading stakeholders and in particular consultants in charge of the preparation of plans and strategies have integrated most of the principles and frameworks that are recognized internationally. This is true for the SDGs and Sendai DRR frameworks. SDGS were integrated in the BMRPP in 2019, SDG 11 (related to sustainable cities) appears to be leading. The OECD governance principles, well known by international consultants, are implicitly used in drafting strategies and plans, even if not explicitly mentioned.

Climate adaptation as such is not the immediate driver for interventions and adaptive measures as it is economic and social pressures that drive urban development in Beira (like housing demand; industrial zone development). Options for (adaptive, climate resilience) investments needs to be explored on the ground, where demands and supply contexts strengthen each other in a co-creative process.

Beira demonstrates the use of an integrated approach, facilitating investment in urban drainage, coastal protection, and sanitation with affordable, flood-resilient residential (social) housing. The Beira case shows how a strategic partnership between a municipality and a development partner can be a catalyst for change, and how strong local leadership is vital to connect local needs with international donor supply.

Adaptation to climate resilience in Beira is a combination of early preparatory works, networking and knowledge sharing related to the city's intrinsic and increasing vulnerability to cyclones and flooding, and the catalytic momentum of cyclone Idai as trigger for coordinated multi-donor involvement under emergency relief conditions. Despite the city's social-economic development being totally depending on its ability to withstand climate and weather-related disasters, its own investment capability is totally insufficient for the required adaptation needs.

With a dedicated network and collaboration in place any serious opportunity (positive or negative) can immediately be capitalized (ref. cyclone Idai). Beira invested in a learning environment geared towards collaboration and co-creation, that facilitated a balance between new ideas and local absorption capacity. This includes building long term relationships of trust between institutions and the individuals working in these institutions. Such networks of relations of trust proved vital.

Beira is also seen as a good example of a city where a more "emerging strategy" approach rather than a planned framework approach proved to be successful. Although urban development ambition may be an excellent opportunity for mainstreaming water and climate adaptation for Beira, it should be recognized that land rights and participatory inclusiveness processes of (peri)urban farmers and dwellers are important issues.

4.7 Benin

The **Republic of Benin** is a country in West Africa. Most of its population lives on the small southern coastline of the Bight of Benin, part of the Gulf of Guinea, in the northern tropical portion of the Atlantic Ocean. The capital of Benin is Porto Novo, but the seat of the government is Cotonou the country's largest city and economic capital. Both cities are part of the Grand Nokoué conurbation (see following chapter). Benin is a tropical country, highly dependent on agriculture and is a large exporter of palm oil and cotton. Substantial employment and income arise from subsistence farming.

Benin is a low-income country with a largely rural population of 12.5 million (estimate 2021). About 50 percent of the population lives in the coastal area. The population is relatively young, with around 50 percent of its population being under the age of 18. Benin's population is currently growing at a rate of 2.73%. According to current projections, Benin's population will continue to grow throughout the rest of the century. Benin's population is projected to surpass 30 million people in 2030 and reach 47 million people by 2100, more than tripling its current population.

Benin shows little variation in elevation and can be divided into four areas from the south to the north, starting with the low-lying, sandy, coastal plain (highest elevation 10 m which is, at most, 10 km wide). It is marshy and dotted with lakes and lagoons communicating with the ocean. Behind the coast lies the Guinean forest savanna mosaic-covered plateaus of southern Benin (altitude between 20 and 200 m), which are split by valleys running north to south along the Couffo, Zou and Orem rivers.

This geography makes it very vulnerable to climate change. It is the 13th most vulnerable and the 55th least prepared country countries in the ND-GAIN index (2019). With most of the country living near the coast in low-lying areas sea level rise could have large effects on the economy and population. A large part of the country has limited groundwater reserves and in many places in the North, surface water is available only during the rainy season. This brings challenges not only for drinking water supply but also for agriculture in a region with many subsistence farmers.

Benin has a long history of demonstrating strong political will to address climate change adaptation. The government has stressed the importance of mainstreaming climate adaptation into sectoral policies (planning and implementation). The first version of the National Integrated Water Resources Management Plan (PANGIRE) was prepared in 2011. It integrated issues related to climate change stressing the importance of scientific evidence. A concrete implementation plan was developed including projects and activities, a specific budget line, institutional arrangement for implementation, and monitoring and evaluation plan. An update version is under preparation through consultations with main stakeholder and expected by end 2022.

At the international and regional level, Benin is a signatory of the Sendai Framework for Disaster Risk Reduction 2015-2030 and of the Programme of Action for the Implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 in Africa. Benin ratified the Paris Agreement and presented its second Nationally Determined Contribution (NDC) in 2021, setting the main national priorities in its fight against climate change. The NDC divided into two parts which set out mitigation and adaptation objectives respectively. It adopts a sectoral approach which focuses on the following areas: agriculture, water, the coastline, forests, and health. It also refers to current and future strategies and programs which will contribute to the implementation of adaptation goals, including those outlined in the Climate Change Strategy. The 2021 National Adaptation Plan is supposed to insure synergies in action between the DRR and the CCA. The opportunities offered by the NAP process to comprehensively reduce vulnerability and integrate adaptation into development planning at all levels are increasingly being internalized through a series of (on-going) consultations with representatives of line Ministries and government agencies, NGOs, universities, research centers, private sector, municipalities, and media. Finally, the Governmental Action Plan (2021-2026) that presents the governmental development priorities (in line with the SDGs) is said to be climate proof.

It is recognized that the approach of disaster risk reduction (DRR) and climate change adaptation (CCA) share commonalities and convergence in the problems they seek to solve. Even if DRR and CCA are managed by different departments with different mandates, institutional coherence is being

established through various coordination mechanisms. Several institutions in charge of supervision and coordination of actions in the field of adaptation to climate change exist and are operational.

At operational level, programming and planning addressing CCA concerns are mostly driven by international funding mechanisms such as the Green Climate Fund (GCF), the Adaptation Fund and the Global Environment Facility (GEF). DDR activities are mostly driven by post-disaster funding. It should be noted that the language barrier (French/English) is important in accessing these funds.

Some of the challenges that Benin faces include a lack of effective and systemic coordination that could help generate a sustained sharing of information and lead to the development of an integrated climate change information system. There is also a need to build technical expertise (e.g., climate risk management in sectors can be improved), address the lack or inaccessibility of data, and improve access to appropriate technologies. The infrastructure sector will also need to be given full consideration given its vulnerability to climate change and the volume of investment planned by the government by 2026 (PAG2).

The mainstreaming of water climate adaptation in Benin appears to be a top-down approach. Participation of various stakeholders happen through consultation and validation sessions and workshops. Strategies and Plans developed together with a Strategic Environmental Assessment shows a better implication of the stakeholders (participation and inclusion) as it is checked by the Benin Environmental Agency (ABE).

Even if shortage of water resources is recognized as a major risk in Benin, most efforts are still towards reducing floods that mainly happen in the most populated part of the coastal zone of the country. The vulnerability related to drought comes from the low adaptive capacity of the population. Strengthening the adaptive capacities of the populations through realistic adaptation options which would contribute to strengthening their resilience.

The gap in financial resources needs to be filled. The low mobilization of complementary resources for projects funded by donors was a challenge. Nevertheless, the Benin's capacity for financial innovation is recently rewarded by the magazine the Banker, a publication of the Financial Times group (May 2022). The prize called "Deal of the year" in the category "Sustainable Finance – Africa" to the Benin Eurobond show. This operation was dedicated to financing projects with a high impact on the United Nations Sustainable Development Goals (SDGs).

The distinction positions Benin's Eurobond SDG operation among the major transactions carried out during the year 2022. Indeed, in July 2021, the Republic of Benin, through the Essenam operation, became the first African country and one of the few internationally to issue international bonds dedicated to financing the SDGs, for a total amount of 500 million euros. This historic bond issue, with a maturity of 12 and a half years and with a coupon of 4.95%, received a very favorable reception from investors, with a level of oversubscription representing nearly 3 times the amount sought.

4.8 Grand Nokoué

The Grand Nokoué conurbation comprises 5 communes around the Lake Nokoué and the lagune of Porto Novo: Cotonou, Porto-Novo, Abomey-Calavi, Sèmè-Podji and Ouidah. About 3 million people are living on this area (25% of the country population).

Cotonou and municipalities around the lake Nokoué and the Porto Novo lagune do not have a dedicated water and climate change adaptation plan. Nevertheless, water and climate adaptation issues are well identified. In 2021 OECD prepared a survey report exploring the water governance of various cities in Africa making use of a detailed questionnaire, Cotonou being one of them

Recently a vision for the development of the Grand Nokoué has been prepared (Dutch funded Omi-Delta Program) and as a follow-up the implementation of the Develop2Build program (for the integrated development plan of the lake Nokoué & lagune of Porto Novo) has been started, making use of the strategic Environmental Assessment process to develop scenarios and an implementation plan. These plans are said to be climate proof. This experience to improve stakeholders' participation and inclusion should be very valuable for the mainstreaming of water climate adaptation in planning process.

Cotonou and municipalities around the lake Nokoué and the Porto Novo lagune does not have a dedicated water and climate change adaptation policy. In 2021 OECD prepared a survey report exploring the water governance of various cities in Africa³⁴ (Cotonou being one of them) making use of a detailed questionnaire based on the OECD water governance framework. Cotonou identified floods and water scarcity and droughts are key water security challenges. Water pollution and insufficient coverage of water and sanitation services are considered as important too. The megatrends considered to affect water security are climate change, urbanisation, demographic changes, and food insecurity.

As of this survey, Cotonou is said to have a dedicated water resources policy with clear goals, clear duties and presenting climate resilience aspects. Nevertheless, there is no information available about needed resources and monitoring done on a regular base. Monitoring of water resources is done by the Ministry of Mines and Water (monitoring network needs to be expended/densified and resources allocated to insure regular monitoring). There is dedicated single Water service provider (SONEB). The number of sanitation providers is not known. Solid waste management is the responsibility of the company SGDS-GN. Data related to WASH services and infrastructure are missing at the city level. The city is reporting to have data related to water risk management (water abstractions, meteorological data, historical data on water disasters, scenarios including climate change, floods drought & pollution risks, vulnerability, and risk exposure. Water supply and sanitation are funded by tariffs, subsidies from the government and financial transfer from international aid. It is reported that there are no water abstraction nor water pollution charges to fund water management in the city. Several Transparency and integrity mechanisms are in place in the city: water budget auditing, water financial information disclosure, anti-bribery management systems, whistles=blower protection policies, clear procurement processes, random audits, and prevention of conflict of interest. Nevertheless, it is reported that there are no anti-corruption plans nor integrity charters. It is not clear how the city is taking care of stakeholder engagement.

Even if there is no specific water climate adaptation plan of the conurbation Grand Nokoué, several initiatives are taking place. One of them is the recently started restoration of the city of Abomey Calavi with a package of nature-based solutions. The initiative supported by IUCN (International Union for Conservation of Nature) aims to support the city's municipal council in transforming hitherto unused land into productive green spaces to support agroecological production of vegetables and fruits and productive green and forest areas.

³⁴ <https://www.oecd.org/publications/water-governance-in-african-cities-19effb77-en.htm>

The municipality of Porto-Novo is implementing the project (funded by AfD, the French Development Agency), green city³⁵: developing and protecting the lagoon banks. It includes the development of a sustainable urban development plan to make Porto-Novo a resilient, structured city, adapted to climate change and concerned about the preservation of its environment. It integrates the development and environmental protection of lagoon banks and precarious neighbourhoods through the development of access roads to the banks and support for income-generating activities (market gardening, fish farming). It also provides for the urban renewal of neighbourhoods near the lagoon (opening and strengthening connectivity through the development of roads, drainage, arborization).

Based on a feasibility study³⁶, Cotonou and Seme Podji are part of the AfD funded PAVICC (Programme d'Adaptation des Villes aux Changements Climatiques) project. It aims to improve the living environment and the resilience of Beninese territories and populations by considering the risks associated with climate change in urban planning. The project proposes to stimulate and support this dynamic in four communities that are particularly vulnerable to anthropogenic pressures and particularly subject to flooding and erosion. The PAVICC project is structured in four components: i) Urban planning: development of strategic urban planning tools, to better take into account climatic and socio-economic risks in land use planning; ii) Resilient urban investments: developing sustainable essential urban services – drainage infrastructure, opening up neighbourhoods, securing material goods and flood-prone areas; iii) Strengthening local and national capacities: improving the control of urbanization and financing international technical assistance; iv) Implementation and monitoring of the program: operation of the program coordination unit, awareness of municipalities and populations, environmental measures in the implementation of works.

The Lake Nokoué restoration and development Plan (under preparation with funding from the Dutch Government) could be seen as a good starting point to allow mainstreaming of the water climate adaptation in the various cities, with a holistic perspective. This is supposed to happen as the Dutch Delta approach methodology, also used in Bangladesh, is supposed to be put into practice.

There is a sense of urgency (recurring floods) and a need to build infrastructure in the Grand Nokoué area to favor development. Nevertheless, climate change as such and the need for adaptation is not the driving force in the cities around the Lake Nokoué. High population growth, rapid urban development, and creation of jobs for youth are much stronger drivers. Available funds related to disaster risk reduction and climate offer the possibility to take some concrete actions to move on. The funding of the extension of the drainage system in Cotonou is such an opportunity, with co-funding from various donors. Still the Grand Nokoué conurbation faces several major challenges:

- strong need to build technical expertise at municipality level to understand water climate adaptation and address risks
- to address the lack or inaccessibility of relevant data and information
- to improve exposure and access to appropriate technologies
- effective and systemic coordination of initiatives in the area
- availability of funds of implement initiatives.

³⁵ <https://www.afd.fr/fr/carte-des-projets/porto-novo-ville-verte-amenager-et-protger-les-berges-lagunaires>

³⁶ https://pavicc-benin.bj/download/etude-de-faisabilite_pavicc_juillet-2017/

5 ANALYSIS AND CONCLUSIONS

5.1 Analysis of the use of the frameworks in a nutshell

Analysis and conclusions combine the frameworks, guidelines and principles presented in Chapter 3 with the results of the eight case studies summarized in chapter 4 (and detailed in the annexes). The table hereafter presents the main findings in relation to the various frameworks and cases. During the interviews special attention was paid to deeper understanding of the actual utilization of the respective frameworks and their used for adaptative policies and implementation.

Summary: analysis of the frameworks & analysis of the case studies

Frameworks\case studies	The Netherlands	Dordrecht	Bangladesh	Khulna	Mozambique	Beira	Benin	Grand Nokoué
IWRM	implicit	implicit	implicit	implicit	implicit	implicit	PANGIRE	implicit
SDGs	implicit	tested	leading	leading	implicit	implicit	implicit	implicit
Sendai DRR	leading	tested	leading	used	used	used	used	used
OECD water governance	used	used	used	known	?	?	?	tested
existing NDCs	oct 2021	-	oct 2021	-	oct 2021	-	oct 2021	-
existing NAP/NAS	yes	-	yes	-	yes	-	yes	-

5.2 Mainstream water climate adaptation, what did we learn?

5.2.1 Climate and adaptation policies are essential

Climate policies are essential to mitigate climate change and to develop successful adaptation processes. Many of these climate policies are already translated into National Determined Contributions (NDC's) and National Adaptation Plans/ Strategies (NAP's/NASs.) as presented in chapter 3.

As stated in the UN World Water Development report 2020 Water and climate change, *"In the NDCs, water is recognized in terms of policy statements or broad strategies, usually in term of adaptation. But few NDCs include the intention to prepare a specific water plan. And while most countries acknowledge water in their NDC's portfolio of actions, fewer have estimated the related costs of these actions, even fewer have included detailed water-related project proposals. Clear synergies between adaptation and mitigations opportunities through water are practically non-existent in the NDCs"*.

It is important to recognize that, many of the looked after climate policies and related NAPs tend to reflect a more global agenda and perspective (read: a very generalized view at the level of recognition of theme-importance) and do pay less attention (if any) to national/regional vulnerability and contexts, let alone the site specific requirements at the local level (where adaptation will have to be achieved to be effective). Despite different socio-economic level of development, diverse water climate risks and dissimilar vulnerability NAPs tend to focus on the same critical sectors and objectives. However, at global level we see that NAPs in developed countries tend to be driven by economic development ambitions, risks, and opportunities, while NAPs in other countries tend to be oriented towards safeguarding economic status plus the protection of natural resources and conservation.

The case studies described in this study show that mainstreaming water climate adaptation (MWCA) in policies indicate that national governments and municipalities have good awareness of the needs for MWCA (some more than others), reflect the issues in policy frames and international contributions and are definitive supportive for the implementation of adaptation measures. But it is in the translation to local level interventions and their implementation where actions (and results) are often insufficient (except for the Netherlands and Dordrecht).

Additionally, a predominant interest (or attention) is being paid to the risk and effects of floods, and much less to the impacts and more gradual effects of the increasing occurrence and length of droughts and/or negative effects of bad water quality. In the analyzed case studies, drought is mentioned in the documents, but implementation of adaptation action is mainly focusing on floods. Even in The Netherlands the issue of drought was really experienced in 2020 and was a wake-up call.

5.2.2 Policy coherence should be improved

Countries are faced with the growing challenge of managing increasing risks from climate change and climate variability, putting development and the achievement of the SDGs at risk, or even undo earlier achieved development results. The adoption in 2015 of the SDGs (2015-2030), the Sendai Framework for Disaster Reduction (2015-2030) and the Paris agreement on climate change should have allowed for an increased coherence in countries approaches to climate change adaptation and disaster risk reduction. Disaster Risk reduction – namely actions and plans targeting the prevention of new, and the reduction of existing disaster risk, greatly intersects with climate change adaptation. Interventions to adapt to climate change and reduce disaster risks share common objectives but too often they are developed and deployed via administrative silos. The table³⁷ here below presents the intersections between SDGs, Sendai-DRR and Paris Agreement.

	Sustainable Development Goals	Paris Agreement on climate change	Sendai Framework for Disaster Risk Reduction
Background	Global agenda for action towards sustainable development	Agreement on the global response to climate change; adaptation, mitigation and finance	Global framework to guide multi-hazard management of disaster risk
Climate change adaptation and disaster risk reduction	<p>Climate action and disaster risk reduction are cross-cutting issues, but explicitly mentioned in:</p> <ul style="list-style-type: none"> – Goal 13 to combat climate change and its impacts, – Goal 11 to make cities inclusive, safe, resilient and sustainable. <p>Climate action also contributes to the achievement of many of the other goals</p>	<p>Articles 7 and 8 explicitly focus on CCA and DRR:</p> <ul style="list-style-type: none"> – Article 7.1, on enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change – Article 8.1, on averting, minimising and addressing loss and damage associated with the adverse effects of climate change 	<p>Paragraph 13 recognises climate change as a driver of disaster risk, and points to the opportunity to reduce disaster risk in a meaningful and coherent manner</p>

As stated in the UN World Water Development report 2020 Water and climate change “*Water is the climate connector that allows for a greater collaboration and coordination across most targets for sustainable development (2030 Agenda and its SDGs), climate change (Paris Agreement) and disaster risk reduction (Sendai Framework). Streamlining water into global climate, sustainable development and disaster risk reduction processes could be a mean of connecting climate change issues with all the other SDGs. Further blending of insights, perspectives and financial mechanisms through the water perspective would be mutually beneficial, increase cost-effectiveness and help ensure their respective choices do not undermine or inadvertently heighten risks for others.*”

³⁷ <https://www.oecd.org/environment/climate-change-adaptation-and-disaster-risk-reduction-3edc8d09-en.htm>

There is a strong need to further integrate efforts to achieve the individual SDGs. Many international organizations including the UN office for Disaster Risk Reduction (UNDRR) and The Organization for Economic Cooperation and Development (OECD), promote the integration of **climate change adaptation principles**, formally delineated in the Paris agreement and the **Disaster Risk Reduction Principles** outlined by the Sendai framework for DRR. Several guidelines and studies support this analysis. The Guidance Integrating DRR and climate adaptation from UNDRR (2020)³⁸ and the OECD Strengthening climate resilience³⁹ (2021) are two examples. These guidance's aimed at fostering coherent implementation of DRR and CCA measures, taking advantage of their interlinkages underpinned by shared objectives, concepts, and activities, despite different institutional and political settings at global and national levels. UNDRR also presented a series of case study from Malawi, Niger, Uganda, and Benin⁴⁰, outlining the national policy landscape and institutional arrangements for the two practices, the Benin case being interesting within the context of the present study.

5.2.3 Understanding the mainstreaming process to better address climate change issues

Most and for all it is important to define the objective for mainstreaming WCA as a specific approach towards improving actual, factual, and effective adaptation interventions. Mainstreaming should not be defined as an objective by itself, as we simply assume that adaptation itself will benefit from integration efforts. Mainstreaming itself is not the goal. Nor should we focus only on the paraphrasing of adaptation within national and local policy frameworks. It is the effectiveness of the policy plus the capacity to implement the more holistic view on water, climate, adaptation and DRR that deserves our attention.

The mainstreaming of water climate adaptation is a process taking place in a deep uncertain environment. Management as we have done in the past works only when there is a stable situation. That is the reason why, understanding what it really takes to mainstream is so important and how much it depends on the local context. More and more countries face unstable (social, economic, and environmental) situations, as shown by all case studies. Some countries/cities were more advanced than others, but all were on the go to mainstream adaptation. The issues at stake that slow down or stop the mainstreaming were not always fully acknowledged, let say documented. Chapter 5.3 goes more in details on this.

5.2.4 Existing tools/guidelines and their potential contribution to mainstreaming

As described in chapter 3, a broad spectrum of scientific papers, tools, guidelines, and principles on and for "Mainstreaming climate change adaptation into development planning" is presently available. The UNDP-UNEP⁴¹ guide for practitioners is a good starting point for mainstreaming water climate adaptation, proposing to better focus attention on the water dimension. This guideline consists of 3 components, each with a set of activities or modules for which a range of tactics, methodologies and tools can be used. UNDP-UNEP stresses the importance of:

- Focus on an environment that has mainstreaming potential: Finding the entry points and making the case is concerned with understanding and setting the stage for mainstreaming.
- Not isolating mainstreaming and adaptation but specifically use other themes as starting point: Mainstreaming adaptation into policy processes focuses on integrating adaptation issues into an on-going policy process.

³⁸ <https://www.undrr.org/publication/integrating-disaster-risk-reduction-and-climate-change-adaptation-un-sustainable>

³⁹ <https://www.oecd.org/publications/strengthening-climate-resilience-4b08b7be-en.htm>

⁴⁰ <https://www.undrr.org/publication/benin-policy-coherence-between-disaster-risk-reduction-and-climate-change-adaptation>

⁴¹ <https://www.unep.org/resources/report/mainstreaming-climate-change-adaptation-development-planning-guide-practitioners>

- Not limiting mainstreaming to policy: Meeting the implementation challenge aims to ensure mainstreaming of climate change adaptation into budgeting and financing, implementation and monitoring and the establishment of mainstreaming as a standard proactive.

UNDP-UNEP pays particular interest to the importance of inclusive and participatory processes. It is therefore advised that stakeholder engagement occurs throughout the whole process, from inception through policy development, implementation, and monitoring. Interesting, case relevant, observations by Ishtiaque et al 2021⁴² indicate the consequences of enclosure and exclusion mechanisms that underlay lack of engagement with all relevant stakeholder groups (especially the marginalized) and a tendency to restrict participatory efforts to the elite. They study suggest this exclusion to be a direct barrier to water and climate adaptation process in Bangladesh. Enclosure and exclusion mechanisms here refer to the representations of power dynamics among actors. Enclosure indicates capturing exclusion resources and authority by an elite group; exclusion indicates the marginalization and dismissal of participation of specific groups of stakeholders in the adaptation process (Sovacool, Linnér, & Goodsite, 2015). Exclusion, or selective participative processes can be identified as adaptation barriers and explanations of the adaptation gap.

The guiding principles of the OECD water governance framework reinforces the role of water when mainstreaming climate adaptation into development planning. Experiences from The Netherlands and Bangladesh⁴³ demonstrate that both the Dutch Delta Program and the Bangladesh Delta Program show compliance with these twelve principles, especially on (innovative) governance, stakeholder participation, inter-policy and inter-agency coordination, funding, and monitoring and evaluation. Although these OECD principles proved to be useful and relevant in many countries, they do not yet account for two fundamental aspects of adaptive water – climate management, namely:

- designing and managing of a process of adaptive planning with a **long-term perspective**.
- **Risk-based approach** to adequately manage extreme events, such as floods and droughts

Adding these water-climate adaptation aspects to the exiting OECD guidelines on water governance may strongly increase their immediate relevance in stimulating adaptation mainstreaming⁵.

A series of OECD water governance studies, in Argentina (2019), in 36 African cities (2021), in Cape Town – South Africa (2021), water resilience in Brazil (2022) are comprehensive analysis of water governance challenges at local and national level, aiming not only to raise awareness of pressing and emerging issues that countries and urban area face but also to galvanize political support.

5.2.5 Mainstreaming at policy level is not the silver bullet to face adaptation challenges

Mainstreaming water and climate adaptation within the policy structure of nations appears to be a conditional necessity to improve adaptation action. Apart from the question how this could be achieved best, it would be naïve to believe that we can close the adaptation gap by addressing the issue in policy documents only. Mainstreaming by itself is not the silver bullet.

Alves et al 2020 cite “Climate policies are essential to mitigate climate change and to develop successful adaptation processes. However, there is a paucity of international studies that analyze the status of climate change policies. This paper reports on research undertaken in a sample of 13 highly diverse countries, regarding their geography, socioeconomic development, vulnerability elements, adaptation, and climate-risks. The results draw attention to the global spread and standardization of climate change policies, namely through the adoption of comprehensive National Adaptation Plans/Strategies (NAPs/NASs) that include mitigation measures and evaluation mechanisms. Although NAPs tend to consider different non-governmental stakeholders, they are still mainly state-centered (i.e., their steering and implementation are the responsibility of each

⁴² Ishtiaque A, Stock R, Vij S, Eakin H, Chhetri N. Beyond the barriers: An overview of mechanisms driving barriers to adaptation in Bangladesh. *Env Pol Gov.* 2020;1–14. <https://doi.org/10.1002/eet.1925>

⁴³ <https://www.tandfonline.com/doi/full/10.1080/02508060.2021.1911069>

country's Ministry of the Environment) in most of the 13 countries in which this study was carried out, including Mozambique and Bangladesh”.

These results show that NAPs' objectives mainly reflect a very generalized and statement-oriented global agenda, paying little attention (yet) to national/regional vulnerabilities and contexts. In fact, despite different socioeconomic levels of development, diverse climate-risks, and dissimilar vulnerability and readiness status among countries, NAPs tend to focus on an almost universal critical sectors and objectives, although a separation between developed and lesser developed countries can be observed. Based on the review of these documents in the specific case of Benin, Mozambique and Bangladesh, NAPs appear to be more focused on natural resources and conservation. In the case of The Netherlands, NAPs are more focused on economic risks and opportunities.

Existing literature⁴⁴ and the analysis of the 4 cities case studies show that⁴⁵ mainstreaming water climate adaptation at municipality level is different and even not called as such. Mainstreaming is much less of a blueprint and is mainly driven by local opportunities. The feasibility of the mainstreaming is often evaluated on a case-by-case basis as it does not suffice to make a case for the added value of using the mainstreaming opportunity. Next to that, municipalities are, at given any moment, facing a kaleidoscope of pressing and urgent challenges than require actual, spatial governmental or social interventionism, water and climate being just two of them. With (financial) resources being limiting in almost any situation, it is their interest to combine challenges as much as possible, rendering mainstreaming to be not a policy objective but a mere economic necessity. This proved to be the case in Dordrecht as in a city like Beira. Not-mainstreaming is a luxury almost no one can afford.

It implicated a more comprehensive analysis leading to sustainability by exploring practical constraints, Financing and economical elements, Institutional & organizational aspects, Environmental, Technical and Social dimensions (also called FIETS approach), A first screening can give insight into the feasibility of emerging mainstreaming opportunities associated with already planned developments.

The factors that are needed for effectively making use of mainstreaming opportunities depend on the specific context, variable in space and time. For example, an analysis of financial benefits can allow the major stakeholders to move beyond the traditional approach to managing risks to one that maximizes the potential added value benefits to the local community by using green infrastructure or nature-based solutions. Fair risk allocation amongst shareholders is paramount to develop and maintain partnerships.

5.2.6 Adaptation gaps, barriers, locks-in, and maladaptation

Adaptation gaps

Originally adaptation gaps refer to the difference between financial adaptation needs and the availability of funding, the latest UNDP Adaptation Gap reports 2020⁴⁶ and 2021⁴⁷ indicate that *“Climate adaptation is now fully part of climate policy action across the world with widespread adoption and continued development of national, subnational and sectoral adaptation planning instruments.”*⁷, with *“Indicators of adequacy and effectiveness of adaptation planning show positive trends compared to 2020.”*⁸

⁴⁴

https://www.researchgate.net/publication/327593675_Adaptation_mainstreaming_for_achieving_flood_resilience_in_cities/link/5b98cfd5a6fdcc59bf88815f/download

⁴⁵

https://www.researchgate.net/publication/327593675_Adaptation_mainstreaming_for_achieving_flood_resilience_in_cities/link/5b98cfd5a6fdcc59bf88815f/download

⁴⁶ <https://www.unep.org/resources/adaptation-gap-report-2020>

⁴⁷ <https://www.unep.org/resources/adaptation-gap-report-2021>

This may be a fair indication of the status of mainstreaming water and climate adaptation in the policy domain. However, the effectiveness and adequacy of planning, finance and implementation differ depending on national circumstances and climate risk profiles and will require greater effort.

It appears that with increasing awareness of adaptation needs, the (financial) demands grow faster than the increased availability of financial resources as “*New estimates of the costs of adaptation and the estimated financial needs for adaptation from developing countries indicate higher values than previously reported.*” Adaptation costs appear to be rising faster than adaptation finance, potentially leading to a widening of the adaptation finance gap. It is estimated that adaptation financing needs in developing countries are five to ten times greater than the currently identified international public adaptation finance flows,

In addition to finance, UNEP urges to scale up implementation levels to avoid falling to far behind with managing climate risks, particularly in developing countries. A particular concern is lack of insight in adaptation effectiveness (rather than just plain implementation of any one effort), related to limited data and analysis. Combined with the escalating impacts documented in the most recent IPCC assessment reports, this implies that current implementation rates (let alone effectiveness) may not keep pace with increasing levels of climate change.

Overall, mainstreaming water and climate adaptation as a policy-statement has established itself within the international policy domain and at national levels. There is substantial progress in national-level adaptation planning, finance, and implementation worldwide and these will generally continue to grow, maybe even partially accelerating. However, climate change impacts and adaptation needs grow even faster. To win this race further acceleration of ambition is needed⁸.

Adaptation barriers

Early signs of deeper transformation towards more climate-resilient and sustainable financial systems and investments are emerging but require stronger, long-term commitments and action⁸. It is therefore important to identify and understand barriers to adaptation beyond the development of policy frameworks, as it can be concluded that, at present, lack of framework or guideline is NOT the limiting factor or weakest link in the adaptation chain.

Adaptation barriers constrain the capacity and ability of decision-makers to act, either in the policy domain or in the planning and or implementation phase⁴⁸. Common barriers (as translated from specific coastal adaptation) include barriers experienced by individuals, governments and businesses concerned with climate and water adaptation.

Personal barriers relate to low personal understanding of climate change, its intrinsic uncertainty, and the role of scenario's, making it rather difficult to relate to planning for potential impacts, or “*even to accept that others should plan to adapt*”. The fact that climate change science is not definitive by nature may be an important source for barrier-behavior. However, as the authors state “*if people's values, emotions, reasoning or culture are challenged, then more knowledge is unlikely to make a difference.*”

Key barriers related to organizations include a lack of human resources or -capacity, inadequate funding for adaptation, and organizational cultures that limits or prevents decision-making on adaptation (and uncertainty), which may reflect, or cause the lack leadership on adaptation. Risk uncertainty, limited availability of locally relevant information, and vulnerability ignorance are additional barriers to overcome.

Regulatory and institutional frameworks are of course the basis for adaptation potential, but local government especially “*requires strong and clear support from state government in order to progress adaptation*”. The lack of interaction or translation from national level to the local (city) level is a re-occurring observation in this study. Legal uncertainties (responsivity in changing adaptation

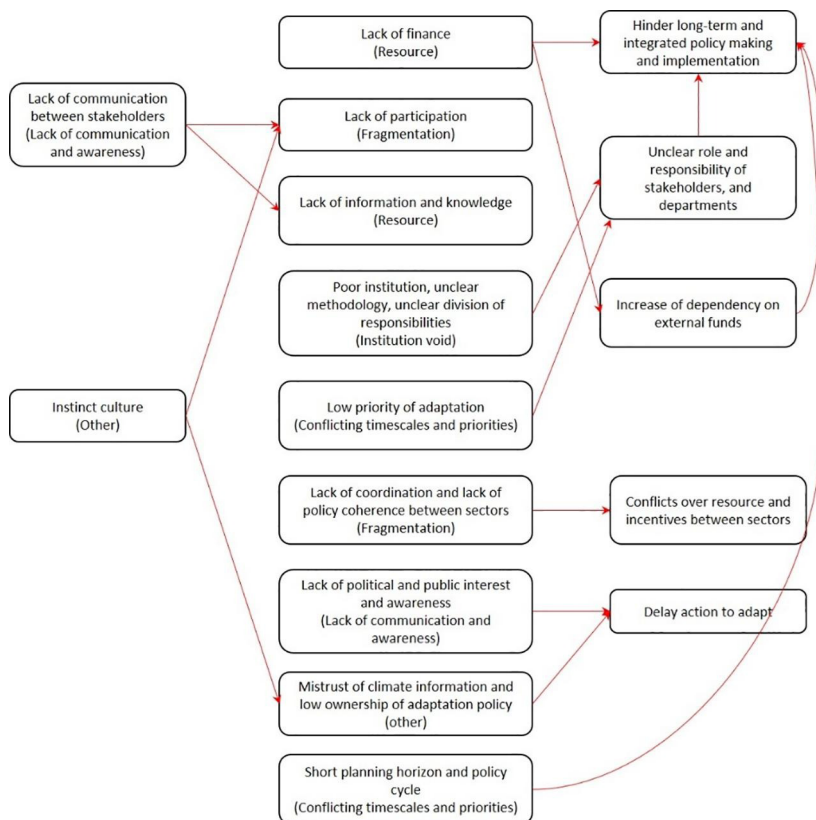
⁴⁸ <https://coastadapt.com.au/barriers-to-adapting-climate-change>

measures), insufficient (political) leadership, and cultural government – societal expectations may also represent barriers.

In their overview paper on the deeper understanding of barriers to adaptation at national levels Lee, Paavola and Dessai (2022, in Climate Risk Management) identified six main types of barriers.

1. **Resource barriers**, related to either finance or human resource, or lack of (predictable) information about climate change and its effects. Lack of funding for national adaptation policy (NAP's) is very common while international funds for adaptation policy in LDCs are unpredictable, "*with funds often not appropriate for addressing the country's root vulnerability*".
2. **Lack of awareness and communication** refers to the limited communication or knowledge dissemination between stakeholders, experts, and policymakers or among departments. Although improving, low or no awareness among the public or politicians still is a barrier for national adaptation policies, including denial and fatalism about climate change.
3. **Fragmentation** refers to the poor integration of adaptation policies across government departments and jurisdictional levels and the limitation of a selected group of stake holders rather than broad spectrum involvement. This includes the exclusion of local communities and non-state actors within national policy development, creating a void between national and local adaptation when national policies are translated to local actions.
4. **Institutional crowding and voids**, include the observed lack of institutional capacity (quantitative and qualitative); weak legislation; absence of integration approaches; the lack of clear rules and responsibilities for monitoring and evaluation, and unclear and overlapping policy responsibilities.
5. **Conflicting time scales and priorities**, representing situations were other, experienced as more pressing, policy issues are given priority in short-term policy cycles.
6. Interestingly, **uncertainty** (as intrinsically related to climate change), **lack of authority** of lead departments, **lack of national leadership**, **lack of high-level political commitment** or "*insufficient time*" were barriers that were far less frequently identified as important.

Although there is still little research available on specification of the causes of barriers, some studies identified by Lee, Paavola, and Dessai (2022) mentioned factors that may create (other) barriers or aggravate others. This research is relatively new, and the causations are not considered in detail, but first ideas on the relations between origins (or root barriers), barriers, and impacts may be very relevant to improve on MWCA towards actual and effective implementation. The figure here below is taken from Lee, Paavola and Dessai (2022):



Locks-in

As stated in the IPCC report (2022) “Despite progress, adaptation gaps exist between current levels of adaptation and levels needed to respond to impacts and reduce climate risks (high confidence). Most observed adaptation is fragmented, small in scale, incremental, sector-specific, designed to respond to current impacts or near-term risks, and focused more on planning rather than implementation (high confidence)”

As the difficulties experienced with incremental adaptation are already profound, the call for more systemic, transformative change in adaptive processes and related governance systems is growing as in many policies systems inaction continues to prevail. Recently the EU Adapt Lockin program⁴⁹ examined resistance to policy change, and the persistence of business-as-usual modalities, through a ‘lock-in perspective’ and the reinforcing mechanisms that drive stabilization and resistance in policy systems.

In many policies systems adaptation inaction continues to prevail. Using cases studies from the UK and Germany, Groen et al. 2022⁵⁰ identified a series of known and new lock-in mechanism, their role in policy stability and the self- and mutually reinforcing mechanisms (known as path dependence and policy feed- back) accompany lock-ins. Understanding these dynamics and the almost intrinsic systemic force to resist fundamental changes is vital for addressing and developing policy interventions to ‘unlock’ climate adaptation pathways.

Based on analysis of coastal adaptation dynamics in England (U.K.) and Schleswig-Holstein (Germany) Groen et al (2022) some lock-in have been identified, such as:

- **Economies of Scale** were exiting and establish adaptation technologies is simply outpricing new alternative methodologies (e.g., Nature based solutions).

⁴⁹ <https://adaptlockin.eu/>

⁵⁰ Lisanne Groen, Meghan Alexander, Julie P. King, Nicolas W. Jager & Dave Huitema (2022): Re-examining policy stability in climate adaptation through a lock-in perspective, Journal of European Public Policy - <https://doi.org/10.1080/13501763.2022.2064535>

- **Adaptive expectations:** or self-fulfilling nature of expectations, keeping people and organizations to do what they believe is expected from them.
- **Learning effects:** the effect of expecting step-by-step incremental development as a leading principle, which in fact promotes continued use of existing methodologies.
- **Collective action:** problems and potential solutions are discussed and experienced within a social network, cumulating shared views and ideas and foster collective actions.
- **Habituation,** the situation where actors have developed a preference towards certain approaches or technologies even when potentially superior alternatives exist
- **Institutional effects,** where complementary institutions develop over time which may increase efficiency and ease of communication, but also create path-dependencies and resistance to change
- **Power differentiation,** where actors impose rules and regulations on others, impose changes or actions that strengthen their power position or contribute to their agenda.

And new dynamics that were identified include, amongst others:

- **Social contraction:** were values and expectation within an experienced society-state relationship determine acceptance or rejections of newly proposed approaches.
- **Co-dependencies,** describe relationships between established actors build upon mutual gain. Co-dependencies may be the consequence of pre-determined strategies, creating lock ins-by-design.
- **Network or sector effects,** describe the situation where certain policies have created an environment which represents certain economic values, e.g., jobs and businesses that flourish because of policy decisions, and that can create incentives to maintain the status quo.

Many would recognize these dynamics that often develop semi-unconsciously and inadvertently. They simply reflect the characteristics of the system that they represent. A conceptual and systemic approach towards water climate adaptation may be confronting but the further research in this area can be of tremendous help to better understand the adaptation gap, and find the motivation, examples, and approaches to stimulate more transformative adaptation in the next 10 years. This would allow not only to focus on the “what” (description of the barriers to adaptation) but also to understand the “how” and the “why” barriers emerge and how they could be overcome.

A few examples exist documenting situation in developing countries. A recent study in Bangladesh⁵¹ analyzed the climate change adaptation governance process, focusing on the barriers that emerge through interactions among actors. Analysis reveals that there are at least five mechanisms that are involved in the emergence of barriers:

- **enclosure and exclusion mechanisms,** as representations of power dynamics among the actors.
- **boundary control,** which takes place when some actors want to keep its resources, abilities, or conflicts localized and strictly control and limit access to these.
- **organizational inertia,** the tendency of a mature organization to continue its current trajectory based on resource rigidity and routine rigidity.
- **belief formation,** the situation where numbers of individuals who perform a certain signal to others the likely value or necessity of this act and, as such, influence other individuals' choice of action.
- **frame polarization,** an interactive process through which the distance between the perspectives of two or more opposing groups increases over time due to repeated reaffirmation of the same point by the actors involved

A structural well-designed study towards barriers and lock-in the 8 case studies was beyond the scope of this study. Nevertheless, these aspects are so important for successful mainstreaming

⁵¹ Beyond the barriers: An overview of mechanisms driving barriers to adaptation in Bangladesh – Ishtiaque and all (2020)

water climate adaptation that this should be given more attention in the future, for example by joining forces with organizations and research institutes already active in this domain.

Unsuccessful adaptation and maladaptation

Some recent studies explore the effect of adaptation interventions on actual vulnerability reduction in developing countries. Some interventions inadvertently reinforce, redistribute, or create new sources of vulnerability. These maladaptive outcomes are driven by various factors:

- Shallow understanding of the vulnerability context.
- Inequitable stakeholder participation in both design and implementation.
- A retrofitting of adaptation into existing development agendas.
- A lack of critical engagement with how “adaptation success” is defined.

Several large-scale systematic literature reviews have analysed studies of climate change adaptation and recognised that there is “a glaring lack of engagement regarding the potential for adaptation measures to exacerbate and/or redistribute risk and vulnerability.” Adaptation interventions that result in increased rather than decreased vulnerability, is known as ‘maladaptation.’ A established scholarship around maladaptation exists and various definitions of ‘maladaptation’ noted, but in practice come down to intentional or unintentional actions (maladaptation) are actions that may lead to increased risk of adverse climate-related outcomes, increased vulnerability to climate change, or diminished welfare, now or in the future. Consensus on the exact definition is lacking. the IPCC Fifth Assessment Report acknowledges that ‘adaptation literature is replete with advice to avoid maladaptation, but it is less clear on what is included as ‘maladaptation’. Authors reflect on the fact that it is difficult to define unsuccessful adaptation from maladaptation.⁵²

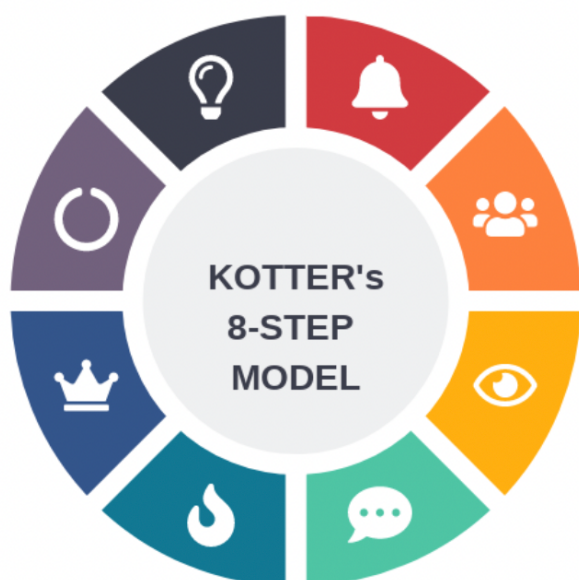
A structural well-designed study towards unsuccessful adaptation and maladaptation in the 8 case studies was beyond the scope of this study Nevertheless, these aspects are so important for successful mainstreaming water climate adaptation that this should be given more attention in the future, for example by joining forces with organizations and research institutes already active in this domain.

5.3 Conditions for actual mainstreaming of water climate adaptation.

The national development and adaptation mainstreaming in national adaptation strategies (NAP’s, NAPA’s) and national contribution (NDC’s) to mitigation and adaptation efforts is mentioned in chapter 3. However, literature and cases studies show that national policy development does not always result in local implementation and/or policy.

From the analyses of the case studies, we identified several elements that were needed for change. The analysis work has been done, making use of the Kotter’s 8 steps change model as a starting point. This model is used for many years and in different sectors and considered as the most valuable.

⁵² Source : Antje Lang, 2019 <https://www.weadapt.org/knowledge-base/vulnerability/maladaptation-an-introduction>



- 01 Create**
Establish a feeling of urgency of hurriedness towards change.
- 02 Build**
Formulate a guiding coalition
- 03 Form**
Develop a strategy to bring about change.
- 04 Enlist**
Communicate or put forth the vision or strategy for change
- 05 Enable**
Empower employees for taking action to incorporate changes
- 06 Generate**
Formulate and generate short-term goals
- 07 Sustain**
Capitalize of wins or gains in order to produce bigger results
- 08 Institute**
Incorporate new and better changes in workplace culture

From the cases studies and interviews two interesting observations emerged

The Humble responds: indicating the facts that local or national knowledge, capacity and lack of holistic approaches that acknowledge the interdependency of factor are lacking, but that there is great confidence that adaptations will be fully addressed in die time, because of a widely supported process. This is often where the need and the willingness to find a way (anyway) are recognized. Creativity & pragmatism are leading to explore solutions (“we do not know everything”) and strong willingness to cooperate. (“but we will find out together”).

The Convinced responds: indicating that international recognized frameworks and guidelines are followed, and that therefore results will come, according to approved upon schedules.

Globally the main results of the cases could be summarized in the following table.

success factors\cases	The Netherlands	Dordrecht	Bangladesh	Khulna	Mozambique	Beira	Benin	Grand Nokoué
sense of urgency	++	+++	++	+++	++	+++	++	+
leadership	+++	+++	+++	++	++	++	+	+
build coalition	++	++	++	+/-	+/-	++	+/-	+/-
existing vision/strategy	+++	+++	+++	++	++	+++	++	+
two-ways communication	++	++	++	++	++	+/-	++	+
human capacities	++	++	+/-	-	-	+/-	-	-
data & knowledge	++	++	+/-	+/-	-	+/-	-	-
own financial resources	++	+/-	-	-	-	-	-	-
understandig of barriers	++	++	++	++	++	++	+	?
change management approach	++	++	++	++	+	+	+/-	?
risk based approach	++	++	++	++	+	+/-	-	+/-
long term committment	+++	+++	+++	++	++	+/-	++	+/-

5.3.1 Drivers for change – sense of urgency

The adoption and diffusion of water climate adaptation policies by the government and or the city are driven by:

Internal drivers:

- Disasters, extreme weather events (cyclone Idai & Eloise in Mozambique/Beira), recurrent annual floods in Bangladesh/Khulna.
- Increased public awareness and concern (Hurricane Katrina and the Netherlands).
- Anticipation of the benefits of the adaptation policy and actions (Dordrecht, Beira, Khulna, Benin, Grand Nokoué).
- Role of front-runner (The Netherlands, Dordrecht, Bangladesh).

External drivers:

- Efforts by international actors / donors (Bangladesh, Beira, Benin, Grand Nokoué)
- And financial support from Foreign Funds (Benin, Beira, Khulna, Grand Nokoué)

5.3.2 Leadership

Cases in The Netherlands, Dordrecht, Bangladesh, Khulna, and the city of Beira demonstrated the importance of transformative leadership, or at least the willingness to address it. There is, however, a difference in leadership based on the ability to recognize, accept, and deal with uncertainty (this means addressing decisions under deep uncertainty – leadership) as it is emerging in The Netherlands and quite clear in Dordrecht, and leadership that recognize the power and importance of water and climate adaptation as engine for economic development as is very profound in Bangladesh.

The team “hands to do the job” that supports the leader(s) emerges as the number one barrier in this study. Water climate adaptation requires people. Human capacity was either developed over time (Dordrecht), carefully strengthened with external capacity (Bangladesh, Beira), or outsourced (Mozambique). Especially the establishment and translation of national policies with- and towards local actors is a critical barrier as is demonstrated in Khulna (no local capacity) and Mozambique (no national, no local capacity). Even when international interest is substantial, (Mozambique, Khulna) and knowledge not limiting, lack of local absorptive capacity (in planning) will keep adaptation in a mere design-stage (Khulna). Adapting university curricula to these needs and requirements is a number one priority (Mozambique, Benin). Latest information from the Government of Bangladesh indicates a plan to make interdisciplinary methodologies and the delta-plan integrating effort to become a compulsory part of any university curriculum.

5.3.3 Coalition of the willing and coalition of the doing

Coalitions of the willing (government agencies, donors, private sector) (Beira, Bangladesh) prove to be of great value. Especially in the awareness development phase, as local leadership finds encouragement and empowerment from external support. As there is no shortage of international attention and potential coalition partners, it will be the translation from exploration, study, and dialogue to real implementation on the ground that is the true challenge. Local absorptive capacity is vital therein.

Long term strategic alliances (Beira, Bangladesh, Khulna recently, Mozambique at DRR, NAP, NDC level) are to be preferred over project-based coalitions, given the nature of climate change and uncertainty. Partnerships take almost 10 years (Bangladesh, Beira, Dordrecht, Netherlands) to develop into the appreciated expert networks that fully resonate mutual understanding and trust. These elements make it easier to review development scenarios during the adaptation process (The Netherlands, Beira).

In several case studies, stakeholders’ involvement (including local communities) has been identified as a major barrier and lock in. It is recognized that water climate adaptation mainstreaming clearly benefits from real and broad stakeholder participation rather than within an exclusive (expert, policy) environment. Explicit stakeholder processes are demonstrated in The Netherlands, Dordrecht, and Benin and cannot be by-passed by sub-optimal approaches as this backfire in the translation to local requirements or implementation (Bangladesh, Mozambique). Nevertheless, it should be noted that understanding of what stakeholder’s involvement really takes varies from one case to another. This should be analyzed in more details and SEA could be a tool to document this process.

In this perspective, using the SEA tool in The Netherlands, Bangladesh and Benin has allowed:

- Allow to clarify and name the conflicting interests
- Allow to identify the data/information gaps on which analysis are based
- Allow the local actors to be involved from planning, design to implementation

5.3.4 Vision/strategy

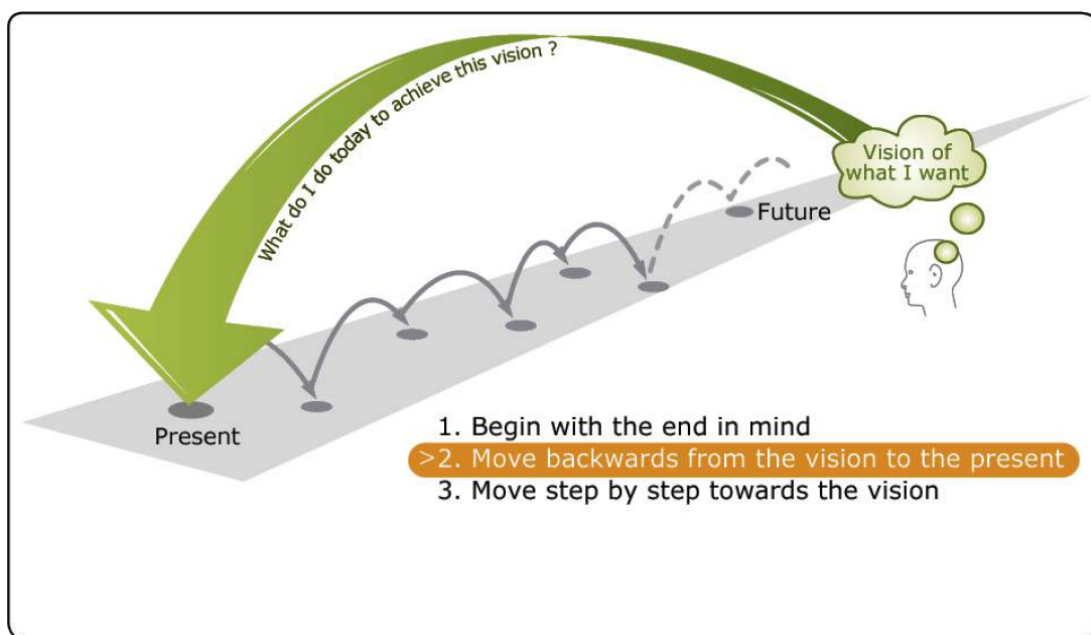
The presence of long-term perspectives, thinking in terms of scenario's, spatial (land and water) integration, and risk-based thinking have been reconfirmed as critical elements within adaptation strategies. Climate change acceleration and growing climate impacts exceed the improvements in adaptation approaches and availability of resources (as main barrier). Adaptation planning needs to be geared up. Human capacity to do that, deal with it, and implement it is the main concern.

Pre-existing vision/strategy plans allows to react faster when needed as they are already agreed upon. Even when planning efforts are not immediately implemented, they provide a base outline, network, and contacts to be operationalized when circumstances require such action.

The swift transformation from a strategic water management plan (not executed) to a “Build better back” approach after cyclone Adia (in Beira) is a fine example. Using an existing delta-approach as a catalyst for (Economic) development ambition (Bangladesh), and in return proving political support to the adaptation approach is another example of use of vision and strategies. These developments indicate the importance of local or national environments to be in a “transformative state”, ready to act upon situations that can be beneficial for MWCA.

Delta programs in the Netherlands and Bangladesh (delta is image but not a physical boundary) provides the organizational structure against which conditions for adaptation can be better facilitated than within a traditional governmental ministerial structure. Note that the “delta” specification stands for the holistic multi responsibility and dynamic viewpoint of such environment, not the limitation of its function to a river delta system. The Delta Plan for the Lake Nokoué is an image and a physical boundary.

One of the main lessons learned for these cases is that starting at an early stage with a vision is important even without having a clear final plan of how this vision will be fulfilled, bringing the environment with an adaptive/transformative state or mindset. Arrangement of a preconditional environment (Netherlands, Bangladesh, Beira, Khulna) and mindset towards adaptation are important success factor to develop possible scenarios for the future. Concrete plans will be adapted on the way. Shortly, it could be said: mindset first, outcome later. This resonates with the intrinsic uncertainty and long-term planning involved in dealing with climate change. It should be noted that at the very beginning in the case of Dordrecht, there was not even a clear vision from the start, only a mindset to adapt.



In the context of adaptation to climate change, we must realize that we deal with a permanent situation of a **“moving target due to a moving environment”**. For this reason, development scenarios are more effective than fixed plans that prove to be outrun by nature.

Implementation of water climate adaptation is more efficient and responsive to climate challenges and better meets local needs when relevant stakeholders are involved already during the planification process. Participation in an inclusive way is key for both the (policy) planning and the implementation of adaptation. Intensive ongoing dialogues with all stakeholders (Netherlands), explicit public participation, cultural integration, and communication (Dordrecht), or broad participation due to the impact of external catastrophes that effects all (Beira) play an important role in determining what needs to be done when and with whom. Responses can either be structural (Netherlands), develop gradually (Dordrecht), strategically planned (Bangladesh), driven by opportunity and attention (Beira, Khulna, Grand Nokoué). It is the united willingness to address the adaptation challenge and the capacity to actively identify ways to proceed that unites these examples.

5.3.4 Communication

Explicit communication towards the general public on risks, vulnerability and adaptive plans in Dordrecht created undisputed support at the communal and political levels. Many gaps in and needs for climate information and services (CISs) exist and should be strengthen.

Transparency, trust, and accountability are the basis for successful mainstreaming. Huge societal debates related to adaptation cannot be avoided and should be promoted. Beira is also an example where communication was put at work by the municipality to get actions in the field. *To keep the end users in mind throughout the assessment and integration process, tailoring risk information*

Moving from “command and control” approach to a more “collaborate and communicate” perspective (through e.g., collaborative design) proved to be effective in Dordrecht and seems to have potential in Khulna, Beira and Grand Nokoué.

5.3.6 Capacities and capabilities of actors

Recommending capacity building of actor is just not enough. Building of capabilities is foremost, as is the plain availability of people to work with. The adaptation results and impact worldwide depend on our ability to have, grow, or find support for (local) human capacities for mainstreaming water climate adaptation and the skill set required to do so. Holistic, long-term planning, spatial and economic planning, interdisciplinary capabilities, risk and uncertainty orientation and ability create and maintain inclusive dialogue are just the prime requirements. Equip people and societies with the means to make the needed adjustments on the short term to address the long-term perspective, even when it turns that incremental adaptation should be replace by radical adaptation.

For all the case studies it could be said that thinking adaptation and resilience is to think differently. In some cases (The Netherlands and Dordrecht) this is already the case for many actors. In the other cases, a great awareness was shown that technical capacities were not enough and that other capabilities where needed to do the job. It was also reported that there was a huge problem related to capacities. Insufficient number of staff associated with inadequate capacities and capabilities is a strong roadblock to water climate adaptation. It was said that the education of staff was often not effective to address the adaptation issues. People recognizes that they need multi-expertise’s teams and that they are just not available.

5.3.7 Understanding of and knowledge of the local situation

Data and information

Through sectoral programs countries may adopt specific and directed policies towards their vulnerability and needs. Bangladesh, Mozambique, and Benin have clearly identified critical sectors in their NAPs and developed specific sectoral plans to address them. There is a huge need to clarify, collect and analyze data and statistics used in planning as a mean to develop relevant adaptation policies and plans and assess progress on adaptation.

Data based evidence and information to understand the issues at stake, is paramount for adaptation. It should be noted that uncertainty (changing future/context) is part of the equation to understand the processes. Facts are essential to build relevant policies and plans. But assumptions and interpretation of data and information is even more crucial as they will contribute to successful adaptation or on the contrary to great impact or even maladaptation. Strong science-policy interface to contribute to better water climate adaptation and could bridge the divide between scientific findings and water governance practices

The Netherlands is a good example showing that questioning the assumptions is essential during the adaptation process. Assumptions were made that turns not to be true, effects and swiftness of climate change effects proved severely underestimated. Dry summers were anticipated but not so extreme, and on such a short term. Extremely dry summers in 2018 and 2019 resulted in economic losses and degradation of ecosystems also led to the creation of a policy table on drought⁵³ by the Ministry of Infrastructure and Water to discuss the problem with various stakeholders, and present recommendations. The following year, 2020, then beat the precipitation deficit records of 1976. The 2020 Delta Programme⁵⁴ urgently requested additional sweet water supplies in the eastern and southern parts of the Netherlands to be realized. Putting in place programmes to improve soil quality is another relevant policy measure the Dutch government is considering.

Bangladesh is also a good example that many studies exist, but they are not well enough used (no pooling of resources).

Knowledge: Dealing with risks and uncertainties

Dealing with risks and uncertainties is accepting that “we do not know everything, and that it is all right, in not always very well accepted. We learned from COVID19 that adaption to a covid19 situation means that we are learning on the way together. Water Climate Adaptation is a journey, not a result, and so is mainstreaming. For this reason, encouraging experimentation and pilot-testing on water governance, drawing lessons from success and failures, and scaling up replicable practices.

Knowledge: learning by doing

The case studies have shown that there is a need for exposure to solutions in local context considering the broader national/international context. Promoting social learning to facilitate dialogue and consensus-building, for example through networking platforms, social media, Information and Communication Technologies (ICTs) and user-friendly interface (e.g., digital maps, big data, smart data, and open data) and other means is developing rapidly (see chapter 3). Promoting innovative ways to co-operate is important to pool resources and capacity, to build synergies across sectors and search for efficiency gains. This is already experienced in the various municipal case studies.

⁵³ <https://www.rijksoverheid.nl/documenten/rapporten/2019/12/18/eindrapportage-beleidstafel-droogte>

⁵⁴ <https://www.deltaprogramma.nl>

Knowledge: learning from social sciences

Through the literature survey and the various case studies, it appears that mainstreaming water climate adaptation was not always successful, due to the dynamics of human behavior and resistance to change. Exploring these topics was not part of the scoping study but very important to catalyze mainstreaming water climate adaptation.

5.3.8 Finances

The issue of financing water climate adaptation is a recurrent point in all case studies, even in the Netherlands. There is an obvious need for continued financial resources (long term perspective). Nevertheless, even when funds are available, it is not always easy to mobilize them. There are many reported barriers, biases, and potential lock-ins (societal, governmental, institutional). Acting upon them is very important to unlock situation and will require high level lobbying towards governments and institutional funding institution to ask them to explore how the existing procedures may lack the flexibility needed to act quickly.

At present, it is visible through the case studies that many fundings are often opportunity driven. Mainstreaming water climate adaptation often means to make a case for it to fit the requirements of the funds' provider. There is nothing wrong to develop, for example, to get funding for a knowledge project to address water climate adaptation. It will increase the knowledge of the adaptation communities, increase the capacities and capabilities of the team, get interventions implemented. It will also develop the ability to have, find, and absorb financial resources and use them effectively.

5.3.9 Understanding of possible barriers, locks-in

There is an obvious tension between top-down policy development and bottom-up implementation. And often people are not able or willing to bridge these constrains, through a constructive dialogue. The complexity and multi-level nature of climate change require governance systems and people able to manage and resolve conflicts of interests across multiple scales and among diverse policy actors. A structural well-designed study towards barriers and locking in the 8 case studies was beyond the scope of this study. Nevertheless, these aspects are so important for successful mainstreaming water climate adaptation that this should be given more attention in the future.

5.4 NEXT STEPS FOR IN-DEPTH CASE STUDIES

As said several times, climate change is increasing the magnitude, frequency, duration, and severity of climate-related hazards, leading to complex and cascading risks that make people and systems, more vulnerable today, in in years to come. It has become a major driver of disaster losses and development achievement setbacks.⁵⁵

With six in ten people expected to be living in urban environments by the 2030, the role of cities is becoming more and more important and are de facto a major stakeholder for sustainable urbanization and development. The New Urban Agenda presents a shared global vision for how to build, manage, and live in cities through urbanization that is well-planned and well managed.

Based on the analysis and conclusions presented above, the following next steps could be considered when developing more in-depth case studies:

- develop case studies not only related to floods but also to drought and water quality (diagnosis).
- focus on municipal cases to explore how the process of mainstreaming water climate adaptation is taking place in practice: what is working and not working – diagnosis.

⁵⁵ UNDRR (2022) Technical guidance on comprehensive Risk Assessment and Planning in the context of climate change, United Nations Office for Disaster Risk Reduction.

- For more in-depth municipal case studies build on the on-going GCA and OCDE studies.
- Include studies on human behavior and decision-making processes, making use of social science expertise to:
 - better understand adaptation barriers, lock-ins, and maladaptation.
 - focus on awareness of lock-in processes, not on dismantling them.
- Based on strong diagnosis of the local context
 - Focus on addressing the human resources and capacities, including university curriculums.
 - Explore ways to arrange for pre-conditional environments that can stimulate and facilitate mainstreaming water climate adaptation. Assist to get into a transformative or adaptive state and mindset.
 - Build on existing communities of practitioners (GCA, AGWA, etc.) and let them work together on specific case studies.
 - Explore how the (local) private sector can be involved (is there a business case to make for water climate adaptation?).
 - Constitute water climate adaptation assessment coaching teams to support the process.

These next steps are based on the literature and interviews.

There is still a lack of sense of urgency. In the Netherlands, where adaptation is well established and facilitated, the general impression with adaptation (up until 2021) included two major assumptions:

- Climate change is a slow and progressive process till 2050, with anticipation of acceleration after 2050 and thus, that it was enough time to prepare well.
- The processes of water and spatial systems are well known and thus fully predictable.

However, as already said despite recent IPCC publications and world-wide observations of extreme weather events the Netherlands were faced with unprecedented drought in the summer of 2020 and severe river floods in the summer 2021 when Netherlands Belgium and Germany were hit with rainfall patterns and intensities that were off scale and not accounted for in weather scenarios. This led to the realization that previous assumptions were no longer valid.

- Climate change appears to happen faster than expected and not as a progressive process as expected.
- The processes of water and spatial systems are not so well known and probabilistic approaches based on statistics and past observations are falling short in the context of climate change

Because of the Dutch droughts and floods (and the related losses), politics are playing a bigger role, with the potential risk that the Dutch approach will evolve from the prevention and preparedness perspective to a more and more response and recovery, from long term vision to short term actions.

In all case studies, constraints exist, making the mainstreaming water climate adaptation too slow to face the urgency. Saying that we should speed-up is not enough and mainstreaming of policy, even if it is helping, it is not the silver bullet to change the thinking and the way we take decision to adapt.

6 RECOMMENDATIONS

Based on the analysis and conclusions of this scoping study a few recommendations could be made related to the three main topics:

- The policy framework and related documents
- Some gaps on the content
- The enabling environment

6.1 At international level strengthen existing guidelines and frameworks towards actual water climate adaptation planning & implementation

This scoping study gave a good overview of the guidelines and frameworks already existing towards adaptation planning & implementation. A few are internationally recognized and agreed upon by countries, worldwide. Since 2020, many documents have been published to evaluate and review these frameworks and guidelines. It appears that even when mainstreaming water climate adaptation in strategies and plans is happening, water climate adaptation is not going fast enough and/or not producing the expected results. Strategies and plans are not translated into practice, after they are to be applied in a controlled environment far from the present harsh characteristics of the social and environmental reality.

The scoping study recognized the value of all these guidelines and framework, all of them having a specific perspective/entry point. The OECD water governance principles offer a holistic perspective that covers most of the topics relevant to allow mainstreaming of climate water adaptation from a governance perspective. The OECD governance principles have been translated in a methodology to assess water governance; the proposed diagnosis being completed by an action plan. This form of mainstreaming makes the principles more actionable in the local context.

Nevertheless, based on experiences of policy makers and practitioners it should be very useful to address a few topics that may not be stressed enough. The original OECD water governance principles and the related methodology to assess water governance could be further evolved to specifically address a) uncertainty, b) the risk-based- and c) long-term orientation of water governance in times of climate change.

Another recommendation would be to increase strategic cooperation between international organizations toward implementation, to avoid that the existence of many frameworks and guidelines for policy makers at national level leads to confusion for many practitioners in the field.

Finally, the scoping study tends to support the idea that with so many frameworks and guideline in place, the awareness- and policy development phases have almost reached an optimum. Most of these frameworks and guidelines do not mention potential barriers and/or lock-in that have a negative impact on the mainstreaming of water implementation. This emerging policy theme needs strong attention in the coming years to allow better water climate adaptation (see other recommendations).

6.2 Emphasize the need for improve policy coherence between national and municipal levels

As said in the IPCC report, *“Despite progress, adaptation gaps exist between current levels of adaptation and levels needed to respond to impacts and reduce climate risks (high confidence). Most observed adaptation is fragmented, small in scale, incremental, sector-specific, designed to respond to current impacts or near-term risks, and focused more on planning rather than implementation (high confidence)”*.

The results of the scoping study indicate that there is a limited connection between water climate adaptation in policy and implementation, not only at national level (see point above) but also limited vertical connection between governmental levels. Mainstreaming could help but is not the silver bullet to allow swift water climate adaptation.

Even the OECD water governance principles framework, with its assessment, diagnostic and action plan components, is not making a strong connection between various levels of government (national and municipalities). This does not mean that translation from national to municipal level should be done without strong analysis of the context.

As shown by the scoping study, when mainstreaming is done, it may be that innovation at the municipality level could create a learning moment for the national level. Additionally, when the mainstreaming at national level is insufficient, water climate adaptation at municipal levels is still urgently needed and happening on an ad-hoc basis. This mainstreaming at lower governmental level could be effective but it depends on the local team that produces the results. Coherence is depending on the knowledge of the various stakeholders and when insufficient, support and assistance are recommended (see other recommendations).

For this reason, to accelerate adaptation, development of municipal case studies would be advisable, as a place where people can learn on the job. 'No regret' water climate adaptation actions, implemented by municipalities, will allow to address the short term needs of local populations even when the mainstreaming of water climate adaptation at national level is not yet done. However, these local actions should be put in perspective and respect the connected social and natural context. There again the OECD water governance principles, tested in various municipalities world-wide offer a good framework to work with.

It will have the great advantage to allow identification, acknowledgment and better understanding of barriers that obstruct national-local interactions (in policy phase and in implementation). Dissemination will tremendously contribute to mainstreaming.

6.3 Pay much more attention for drought and water quality

The scoping study concluded that, at present, most of the (national) attention, scientific literature, more advanced case studies and efforts related to reconstruction are to be found in the flood/water safety domain. Nevertheless, many countries already face drought and water quality issues. Their effects on the population are often not directly visible on the short term and the causality is much more difficult to demonstrate. For this reason, unfortunately, they get less attention, even if on the long term the impact may be much higher. For example, casualties in one single flood event may be high but a drought period may make much more victims as this will happen on a much longer period, usually several months after crops failed. Similar problems exist related to bad water quality having great impact on human health but not being scientifically proven, often by lack of data.

As many organisations are already focussing on floods risks and related infrastructures to be built, it is advised to address drought and water quality issues more seriously, as it has high consequences on food security and safety, human health, environment, and biodiversity. Water climate adaptation related to drought and water quality could be addressed through a series of studies and pilots that are answering local people needs. Cape Town in South Africa was a good example for drought (at some time insufficient) management.

6.4 Prioritize the need (and availability) for data, information, and knowledge exchange

As stated by the UN, “Data is the lifeblood of decision-making and the raw material for accountability. Quality and timely data are vital for enabling governments, international organisations, civil society, private sector, and the general public to make informed decisions and to ensure the accountability of representative bodies”.⁵⁶

Data and related data analytics make it possible to understand complex water systems in a holistic perspective. An increasing number of institutions face a **widening gap** between **emerging realities** (like growing populations, climate change and rapid digitalization) and their **existing practices**. Still many organisations are struggling with data. Understanding water systems that get more and more complex in a rapidly changing environment is a huge challenge that countries and cities must face. Mainstreaming water climate adaptation allows to be better prepared for the unexpected (such as extreme situations created by climate variability) and quality data is again the basic building block in the decision-making process, as existing knowledge and experience are not enough anymore. Good quality data is needed for planning, learning, and monitoring but data analytics and valid interpretation of data is even more important.

Additionally, scientific information⁵⁷ needs to make its way into national adaptation policies. At present, national adaptation policies are only to a limited extent informed by scientific information, due to insufficient availability of information, limited human and technical capacity to analyze data and lack of finance (see also other recommendations related to these elements).

For this reason, it is recommended to further stimulate and promote gathering, dissemination and sharing of open water climate relevant data. This could be done by local actors/businesses. As adaptation is a process people should know the situation before implementing actions to be able to measure outputs, outcomes and ultimately impact. This is of particular importance in a context where many maladaptation's and/or unsuccessful adaptations are reported. Recently, ECOSOC⁵⁸ provided a global set of climate change statistics and indicators, many of them water related. Additionally, the Adaptation Action Coalition is implementing the water tracker, initiative aiming at helping to ensure that water resilience is integrated into national climate plans, could be a useful tool. At local level gathering, documenting and sharing adaptation solutions are very needed for practitioners.

It is also recommended to intensify collaboration with relevant (open) data and information partnerships and initiatives, strengthening their message and actions for support. Attention should be given to indicators relevant to track successful adaptation (processes), maladaptation and unsuccessful adaptation.

Finally, it may be very useful to monitor and detect relevant changes and critical transitions to ensure successful and timely implementation and reassessment of plans. This would allow to anticipate change to support adaptive planning.

6.5 Continue disseminating / to emphasize the position of uncertainty, risks, and long-term perspectives as fundamental aspects of adaptation

As shown by this scoping study, comprehensive understanding of risks is a priority. Risk Assessment and management in the context of climate change requires a comprehensive, systemic perspective on risks and its underlying drivers due to the complex and partly systemic nature of water climate-related risks. There are non-linear interactions among systems components. Risks need to be integrated across sector and multiple levels. This includes integrating risks into a wide range of national policies, sectoral and subnational strategies, plans, programmes, projects, and other planning instruments. Dissemination of information and knowledge will help decision-makers,

⁵⁶ <https://www.un.org/en/sections/issues-depth/big-data-sustainable-development/index.html>

⁵⁷ <https://www.tandfonline.com/doi/full/10.1080/17565529.2021.2018985#metrics-content>

⁵⁸ <https://unstats.un.org/unsd/statcom/53rd-session/documents/2022-17-ClimateChangeStats-E.pdf>

practitioners, and stakeholders to unpack the complex risk landscape and develop more responsive plans and policies and actions tailored to national and local needs. This could be done in different self-reinforcing initiatives (training, case studies, etc.).

6.6 Continue to explore adaptation approaches and interventions, but investigate their actual effect on vulnerabilities

Some adaptation interventions on vulnerability reduction in developing countries inadvertently reinforce, redistribute, or create new sources of vulnerability. These maladaptive outcomes are driven by various factors such as i) Shallow understanding of the vulnerability context, ii) inequitable stakeholder participation in both design and implementation, iii) a retrofitting of adaptation into existing development agendas, and iv) a lack of critical engagement with how “adaptation success” is defined.

Successful mainstreaming is to understand not only what is working (or not) but much more why it is working, or why it failed. Improve understanding of potentially effective adaptation approaches and underlying processes is recommended. Learning from failed processes and wrong / unsuccessful interventions will be very valuable to address people’s needs.

This could be done via active research on maladaptation and non-functional adaptation, or failed adaptation attempts in countries and/or municipalities. As many no-regret adaptation actions are already developed and implemented at communities’ level (in municipalities), these examples could stimulate dialogue and knowledge development within practitioners and policy makers networks. It would be an excellent opportunity to prepare stakeholders to transformational adaptation.

6.7 Explore innovations and new domains: make use of / embrace spatial, design-oriented approaches

The results of the scoping study have shown that innovative approaches are needed to address water climate adaptation. Problems created by water (floods or drought) have not always a typically water solution. In many cases the solution is to be found in ‘horizontal collaborations’, e.g., collaboration with other sectors (for example agriculture when drought creates food insecurity) and domains such as spatial planning when areas should be used to temporarily store water. Such integration request human capacity to deal with complex systems and the kaleidoscope of social, economic, environmental, technical, institutional, financial challenges, to name a few. Frameworks alone will be insufficient to cover this complexity, or the need for creative and visionary concepts that may be required to cope with the risks of climate change.

For this reason, it is recommended to explore, promote, and stimulate the use of design, or research-by-design approaches as integrating instruments to help catalyze the mainstreaming of water climate adaptation. Some initiatives already exist such as Water as Leverage, Rebuild by design, re-designing Deltas.

It is also advised to stimulate creative involvement of (spatial) design-oriented actors, next to policy framework development and study design-based cases should be developed within the context of barriers and lock-ins (“*How can creativity bypass adaptation barriers?*”). For the last, social science experts should join force with water and climate experts, planners, etc. These case studies can be developed at national and/or municipalities levels.

6.8 Position barrier- and lock-in dynamics into the international water climate adaptation dialogue

Barriers to adaptation constrain the capacity and ability of decision-makers to act, either in the policy domain or in the planning and or implementation phase. Additionally, often hidden mechanisms and

feedbacks can create self-reinforcing lock-in dynamics that preserve current systems and make them highly resistant to change. Several driving forces exist being political, institutional, behavioral, and infrastructural. For example, *climate change adaptation governance involves multiple actors, operating from local to national level, and during their interactions, several challenges may surface and act as barriers to adaptation. While lists of barriers exist presenting “what” is occurring, there is still limited understanding of “how” or “why” barriers emerge in the governance process.* Some of these barriers have been observed in the case studies (and some limited literature). Fundamental obstructions cannot be overcome via frameworks or guidelines alone.

To foster water climate adaptation, it is recommended to explore barriers and lock-dynamics together with knowledge institutes that have started developing experience on these issues. Acknowledging barriers and lock-ins, negative feedback mechanisms and intrinsic system resistance towards change is fundamental to get the adaptation process going and support it.

It is further recommended to develop knowledge of social behavior and decision-making processes through cooperation with social science experts. They should be brought together with the existing water climate adaptation community. Finally, GCA may be willing to actively include these topics within the GCA high level dialogues, leading the way in this emerging policy theme.

6.9 Attribute to capacity and capabilities

Without no surprise, nothing is more pressing than the need for national and local capacities and capabilities to mainstream water climate adaptation, from planning to implementation. It is recommended to explore actual (and future) human resources needs of existing strategies, next to (existing) financial investment needs.

Discussions should be started or continued to explore ways how to adapt university curriculum to accelerating water climate change and need for adaptation capacity. As adaptation is often community driven, capacity building should also be fostered. And it is also recommended to stimulate national – local capacity interaction to avoid exclusive dynamics in policy – and implementation planning. Lifelong learning approaches are paramount as the environment in which water climate adaptation professionals evolve is changing.

Finally, it should be said that new capabilities should be developed to address the pressing needs. There are needs for various professionals but most of them should be developing capabilities linked to decision making under deep uncertainty, long term perspectives, horizontal and vertical interaction between themes and governmental levels, truly inclusive and participative approaches, etc.

It is recommended to support:

- Assessment of international, national, and local capacities for water climate adaptation (IFIs, governments, NGOs, private sector, etc.)
- Training in adaptive planning and decision making under deep, and long-term uncertainties.
- Improving understanding and ability to gather and work with data in decision making processes.
- Introduction of research-by-design or design processes to prepare for integration of challenges.
- Develop capabilities related to specific topic e.g., strategic environmental assessment (SEA) for improved participation and inclusion, gender inclusive education interventions

6.10 Facilitate strategic learning alliances for water climate adaptation processes

Based on the experiences of case studies and the literature, it is recommended to reinforce strategic learning alliances to improve processes and procedures, bridging cultural divides between scientific climate, adaptation, planning, governance, finance, and policy environments. Such alliances however should not be concentrated at the global dialogue level but at the national and particularly local/community level.

These alliances would allow to:

- Understand IFI's/donors versus national financing procedures and allocations and bring these differences into the debate
- Include potential donors in the development / concept phase
- Build upon what is already happening in countries/cities
- Streamline donor procedures with local requirements towards implementation
- Select and/or develop true water climate adaptation projects within a strategic framework or adaptation plan / approach
- Secure local/national capacity to fully absorb, use and guide (multi)donor interests

6.11 Initiate and facilitate Water Climate Adaptation Coaching Teams

Recommendations 1 to 10 point into the direction to strengthen national and local capacity to implement the available policy concepts and adaptation ambitions. External experts, called in to produce the necessary reports will not do the job as the capacity-chain stops right there. Doing the work “for them” will never generate lasting effects and impacts. Most of the cases in this scoping study at national or local level demonstrate that strategic long term collaborative partnerships may be a way forward. Patience is required (up to ten years) but collaboration in a setting based on mutual respect and shared ambition to solve the adaptation puzzle proved an important “soft” boundary condition for progress in mainstreaming adaptation.

It is there were adaptation can be truly boosted, in the ability to recognize the opportunities already available. Based on the experience of the case studies and because of the lack of capacities and capabilities at all levels and all sectors to mainstream water climate adaptation, it is recommended to use a coaching on the job approach. **Water Climate Adaption Assessment teams**, with change management knowledge and expertise should be made available in countries and cities requesting support when their organisations lack this experience. Mainstreaming water climate adaptation will be possible when people in organisations will be able to recognize, use and utilize together the opportunities, funds, projects, or available resources to implement adaptation measures in such a way that they address local needs and do not exacerbate and/or redistribute risk and vulnerability.