



Delft University of Technology

Strategies for climate change adaptation lessons learnt from long-term planning in the Netherlands and Bangladesh

van Alphen, Jos; de Heer, Jaap; Minkman, Ellen

DOI

[10.1080/02508060.2021.1911069](https://doi.org/10.1080/02508060.2021.1911069)

Publication date

2021

Document Version

Accepted author manuscript

Published in

Water International

Citation (APA)

van Alphen, J., de Heer, J., & Minkman, E. (2021). Strategies for climate change adaptation: lessons learnt from long-term planning in the Netherlands and Bangladesh. *Water International*, 46(4), 477-504. <https://doi.org/10.1080/02508060.2021.1911069>

Important note

To cite this publication, please use the final published version (if applicable).
Please check the document version above.

Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Takedown policy

Please contact us and provide details if you believe this document breaches copyrights.
We will remove access to the work immediately and investigate your claim.

Strategies for Climate Change Adaptation: Lessons learnt from Long-term Planning in The Netherlands and Bangladesh

Jos van Alphen, staff member Dutch Delta Commissioner;
Jos.van.Alphen@deltacommissaris.nl
(corresponding author)

Jaap de Heer, Team Leader Bangladesh Delta Plan 2100 Formulation Project and Partner
Twynstra Gudde Strategy Counsellors; jhr@tg.nl

Ellen Minkman, Faculty of Technology, Policy and Management, Technical University
Delft; e.minkman@tudelft.nl

Strategies for Climate Change Adaptation: Lessons learnt from Long-term Delta Planning in The Netherlands and Bangladesh

Abstract

This paper evaluates long-term climate change adaptation strategies in The Netherlands and Bangladesh using the OECD Principles of Good Water Governance. Deltas face complex challenges and adequate long-term planning is essential for these regions. However, experience with these long-term planning efforts and linkages with theoretical frameworks on long-term water-related policy and strategy development remain limited. Both countries politically approved significant investment portfolios for a long-term adaptive strategy. This paper highlights similarities and differences in the resulting strategies. Using the learning assessment methodology, we propose to add risk-based approaches and long-term strategic perspectives as additional OECD principles in the conclusion.

Keywords: Climate Adaptation, Water Governance, Long Term Planning, The Netherlands, Bangladesh

Introduction

Deltas are geo-morphological areas, situated in the transitional zone between the marine and riverine environment, largely defined by their flat low-lying surface form. Low-lying delta areas derive their special and dynamic character by the ongoing interaction between the supply of fresh water, sediment and nutrients by the rivers and tidal dynamics and salt intrusion from the sea. Delta's have always been attractive places to live, resulting in a concentration of people and business centres in delta cities. Nowadays, deltas face multiple and complex challenges, including rapid population growth, loss of ecosystems, land subsidence and salt intrusion, which are aggravated by climate change. When insufficiently addressed, the risks of property damage, economic loss and human casualties increases (Ahmed and Suphachalasai, 2014). Existing

planning practices are focussed on the short to medium term, while addressing present and future challenges of urban deltas requires a perspective of multiple decades to accommodate for climate change and tailor future developments to changing circumstances. However, these long timescales also entail uncertainty about future circumstances, design of interventions and development pathways, posing challenges to policy makers and planners. Moreover, adequate planning also requires solid institutional arrangements, continued funding and stakeholder commitment. Long-term planning in urban deltas thereby entails dealing with the uncertainty following climate change induced threats.

A promising approach for such long-term planning is Adaptive Delta Management (ADM). To date, ADM has been applied in a limited set of cases (Bloemen et al., 2018, 2019) and existing studies were mainly ex ante assessments of its potential value (e.g. Dewulf and Termeer, 2015; Zevenbergen et al. 2018), descriptions of ADM policies (Van Alphen, 2016); or ex post evaluations of a particular project implemented under ADM flag, such as the (hydrological) suitability of de-poldering in the Netherlands (Van Staveren et al., 2014). However, no blueprint exists and as such

ADM is not an approach that can be transferred easily from one country to another as it demands a fundamental change in institutional capacity at multiple levels including new knowledge and skills, relationships and policy frameworks, and, hence, depends on the local socio-economic characteristics, culture and governance (Zevenbergen et al., 2018, p. 299).

ADM needs to be tailored to fit existing institutions (e.g. Minkman & Van Buuren, 2019), but the question remains how to introduce and develop principles of ADM into an existing planning practice with its institutional arrangements and governance modes. This paper therefore aims to explore how a long term adaptive planning approach, indicated as ADM,

can be institutionalized, by examining two well-documented examples of ADM in The Netherlands and Bangladesh. In addition, we investigate whether the present international frameworks in the field of water management (notably the OECD Principles on Water Governance) can adequately account for the future challenges of deltas and, if not, how they can be improved.

In this paper we will first present a more detailed account of ADM and the OECD principles for water governance as analytical framework in section 2. In section 3 we highlight how we used participant observations to reflect on the process of introducing and integrating ADM in planning practices. In section 4 and 5 we explore how the ADM approach is adopted in both cases and reflect on that process from the theoretical frameworks on OECD principles. The paper concludes with drawn lessons for introducing ADM and suggests to extend the OECD principles with risk-based approaches and long-term perspectives.

Theoretical Framework: a holistic Approach to Water Management

For the existence of delta countries, adequate planning and water management are vital. At the start of the century, international organisations and national governments embraced Integrated Water Resource Management (IWRM). This novel approach ‘promotes the coordinated development and management of water, land, environmental and related resources, in order to maximize the economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems’ (GWP 2000, as cited in Allouche 2016, p. 412). IWRM-based policies and measures thus focus primarily on management of water resources, meaning that IWRM cannot fully account for climate change adaptation. Climate change is likely to increase the frequency, intensity, extend and impact of extreme event disasters. Although its precise impact on societies is still highly uncertain,

climate change already now affects water management in terms of floods, droughts and sea level rise. This uncertainty challenges deciding on strategic investments in water related infrastructure, spatial planning and land use as well as making these, often large, investments future-proof. This thus requires a much broader, more holistic and by consequence, multi-sectoral and multi-stakeholder scope. Adaptive Delta Management is such a holistic, long-term approach.

Adaptive Delta Management

Strategies (and their related measures) have a design lifetime and might be no longer suitable when conditions change and additional or different measures may be needed to achieve the desired objectives. Adaptive Delta Management (ADM) broadens the scope of IWRM practices with methodology and tools to manage future uncertainty regarding the planning and design of future delta related strategies and investments. Scenarios describe several narratives of possible futures regarding external, and thus hard to influence, conditions, such as climate or socio-economic development. As such, scenario's act as a framework for the development of a range of strategy pathways. Specific threshold conditions or emerging trigger points determine when to change from one strategy to another (Kwadijk et al., 2010). Adaptive strategies try to avoid 'lock in' and 'pathway dependency' by maintaining the option to take future measures when necessary (Delta Commissioner, 2010, 2012; Van Rhee, 2012; Marchand & Ludwig, 2014).

ADM proposes a holistic approach, which requires the alignment of policy and investments in different sectors (e.g. water, land use and disaster management). Authorities at different government levels jointly explore different pathways, use scenarios to evaluate these pathways and design an adaptive plan. Such plans will consist of short-term actions with direct impact, long term strategic options and a related research agenda. The decision to take the next step of a pathway or plan adjustment is based on monitoring of signals of tipping

points (Haasnoot et al., 2013). For example, while a traditional response to sea-level rise would involve heavy investments in structural measures, an adaptive strategy may consist of beach nourishments, which are intensified or re-considered only when sea-level rise exceeds a certain threshold (e.g. 10 mm/year). Hence, ADM requires continuity in institutions that are responsible for planning, implementation, maintenance, monitoring and evaluation tasks. Principles of ADM are summarized in Table 1.

OECD Principles for Water Governance as analytical Tool

Due to large diversity between and even within countries there is no one-size-fits-all solution to water and climate challenges (OECD, 2014, 2015). The interdisciplinary nature of climate change adaptation requires the involvement of multiple authorities and stakeholders. Coping with current and future challenges requires robust public policy and strategy making, which includes identification of measurable objectives in pre-determined time-schedules at the appropriate scale, a clear task division among responsible authorities and regular monitoring and evaluation (OECD, 2015). In short, governance should adhere to a set of basic principles, and be customized to site specific water challenges and socio-economic conditions, .

The OECD Principles on Water Governance (see Box 2) contribute to these tangible and outcome-oriented public policies. Although several frameworks have been developed by policy makers, advisors and scientists, the OECD principles have been embraced by both scientists and practitioners (Neto et al. 2018), based on three mutually reinforcing and complementary dimensions of water governance (see also Table 2): effectiveness, efficiency, and trust and engagement. Effectiveness refers to ‘the contribution of governance to define clear sustainable water policy goals and targets at all levels of government, to implement

those policy goals, and to meet expected targets’, while efficiency denotes ‘the contribution of governance to maximize the benefits of sustainable water management and welfare at the least cost to society’. Finally, trust and engagement means ‘the contribution of governance to building public confidence and ensuring inclusiveness of stakeholders through democratic legitimacy and fairness for society at large.’ (OECD 2015, p.3). The OECD Principles on Water Governance (see OECD, 2015) facilitate the development of ‘good water governance’, thereby acknowledging there is a wide range of options to anticipate water and climate related challenges. These principles further allow for reflexive learning, whereby learning and real-life action are combined to break through existing paths to strengthen governance approaches (Seijger et al. 2018). Overall, the OECD principles can be used to design water governance structures as well as evaluate existing frameworks. In this paper, we will do the latter by evaluating the application of ADM in Bangladesh and the Netherlands with reference to these OECD principles.

Table 2

Methodology

This paper presents the experiences with the implementation of ADM principles in The Netherlands and Bangladesh. These cases were selected because these are, to our knowledge, the only two examples where ADM principles transformed nation-wide delta management and penetrated to the core governance system. We analyse, on an equal level, how different organizations in both countries managed to develop adaptive strategies, built institutional frameworks that are necessary for successful implementation and fitted these in their respective settings.

This analysis was performed using the OECD principles, following the learning assessment methodology to analyse water programs as developed by Seijger et al. (2018). This method consists of four steps, starting with a problem definition for the assessment, including objectives and focus. Here, the scope of the analysis concerns the governance of the Dutch Delta Program (DDP) and Bangladesh Delta Plan (BDP 2100) , as described in detail in section 4.

The second step is to assess the governance of these programs according to the OECD principles. Detailed, inside knowledge of the process is needed to analyse the application of ADM in these two cases. Reconstructing this process in retrospect by external researchers is therefore challenging. To overcome these challenges, a specific type of action research was applied, whereby the first two authors introspectively scrutinized the process in which they had participated from their role as practitioners. These authors participated in the process of preparing the ADM-based plans in the Netherlands and Bangladesh from the early start until approval and start-up of implementation. In the Netherlands this occurred between 2010 and 2014, in Bangladesh between 2014 and 2018. Presently (2020) they are involved in the implementation (The Netherlands) or the start of implementation (Bangladesh) of these plans. Besides their practical involvement, both authors regularly exchanged experiences and

critically reflected on their mutual challenges during this process. This was done in one-on-one sessions and in meetings with other experts from the Netherlands or Bangladesh.

Following the approach of Neto et al. (2018, p.63), we assessed alignment with the OECD principles in the objectives, implementation, on the ground results and policy impact and scored them with a Likert-scale ranging from 1 to 5 (see Appendix 2). Neto et al. (2018) studied the OECD Principles on Water Governance and assessed several applications. In this contribution we add the assessment for the Netherlands and Bangladesh. Two challenges were encountered in applying this framework. First, both delta plans have a time horizon until 2100. Implementation and on-ground results but especially policy impact, cannot be fully evaluated yet. Second, the Dutch Delta Program was established some 5 years before the Bangladesh Delta Plan, preventing one-on-one comparison. We have addressed both issues by placing emphasis on alignment and implementation in our analysis. In addition, we have stretched the interpretation of implementation by also including preparations to and intentions for implementation.

The third step is external validation. For this purpose, we involved a third author who specialized in policy transfer of ADM from The Netherlands to Asian countries. She was involved to reflect on these experiences from an external point of view. The results of step 3 are described in section 5. The fourth and final step is to systematically reflect on the lessons learnt (see section 6).

Results

Delta Challenges in the Netherlands

The Netherlands is situated in the deltas of the transboundary rivers Rhine, Meuse and Scheldt. More than half the territory is flood-prone, mainly due to storm surges at sea or high water levels in the rivers. The western part of the country consists of polder systems, located several meters below main sea level. Until the 1950s, floods regularly caused widespread damage and fatalities. Dams were then constructed to reduce the coastline by closing-off estuaries and high flood protection standards (up to 1/10.000 per year) were established (Van Alphen, 2016). In addition a strong water related decentralized governance system developed, with effective regional and national water authorities, well equipped knowledge institutes and innovative private parties, supported by adequate funding and legislation. As a result, the Dutch delta is well protected against floods, (OECD, 2014). Climate change now introduces new challenges, including sea-level rise, increased river flooding and droughts.

Formulating the Dutch Delta Program

Previous transformative plans, like the Delta Works, needed a disastrous event as primary driver (Verduijn, Meijerink & Leroy, 2012). In 2007, the Dutch government commissioned the Second Delta Committee to advice on the future of the Dutch delta while anticipating on climate change. The Committee's advice was presented in 2008 and consists of a long-term holistic vision on the Dutch delta and presents recommendations on long-term, adaptive strategies, measures and governance to achieve this vision (Delta Committee, 2008). In order to implement such an adaptive strategy, they proposed to establish a new investment program, called the Delta Program. The advice received broad political support, and the Delta Program was started in 2010.

The Delta Program has the objective to to create and maintain a safe and attractive Netherlands, now and in the future, by providing adequate flood risk management and fresh

water supply (Van Alphen, 2016). Developing and implementing such a program has three main prerequisites: multi-governmental approach, dealing with future uncertainty, guarantee long term continuity. As such, a special commissioner was installed to coordinate the development and implementation of the Delta Program. This Delta Commissioner is a high-level senior government official, responsible for the preparation of the Delta Program and advising the Cabinet on necessary actions. He is an a-political figure in order to ensure continuity regardless of every-day politics. An annual budget of 1.2 billion euro (the Delta Fund) is available for implementing the Delta Program at national and regional level. In the Netherlands, 3 ministries, 12 provinces, 21 regional water authorities, 355 municipalities and 25 safety regions are responsible for water, land use and disaster management. The proposed strategy thus required intensive collaboration between different government levels. The required changes in the governance system were formalized in the Delta Act, which was adopted unanimously by the Dutch Parliament in 2011.

The Delta Commissioner extended the long-term holistic vision and advice of the Second Delta Committee into a full-fledged policy and investment program. The three water related challenges that are dealt with are flood risk management, fresh water supply and water and climate proofing of the urban environment. Baseline studies and problem analyses were jointly produced by a diverse set of stakeholders. This participatory process means that representatives from authorities, stakeholder organizations, private companies and knowledge institutes were invited in regional design workshops to co-decide upon available knowledge, the uncertainties involved, and research and measurements needed for decision-making. Annual progress reports of the Delta Commissioner to Cabinet and Parliament created an urgency to proceed.

The preparation phase resulted in proposals for policy frameworks ('Delta Decisions'), regional strategies and related investment and research programs dealing with flood risk

management, fresh water supply and water-robust and climate proof urban development. These proposals were adopted by all involved authorities and approved by Cabinet and Parliament in 2014. Eventually, the national frameworks and regional strategies became official policy in the National Water Plan (Rijksoverheid, 2015) and related regional and local policy documents and are translated in Investment Agendas on Flood Risk Management, Fresh Water Supply and Spatial Adaptation.

Implementing the Delta Program

After the Delta Decisions were approved, implementation of the Delta Program started in 2015 with translation of these policies and strategies into legal instruments, local and regional water management and land use plans and with the preparation and execution of concrete measures, pilots and research programs. Gradually the accent of the efforts shifted to the regional level, while the Delta Commissioner and his staff remained focused on coherence between the regions and progress. Regarding the latter, a monitoring and evaluation system has been developed, to establish whether the implementation of measures is still on track or whether the external trends in climate change make acceleration or transition to other measures necessary (Haasnoot et.al, 2018). In 2020 the first 6 year recalibration was presented, concluding that climate is changing more rapidly than assumed and additional efforts may be necessary from 2050 on (Delta Commissioner, 2020).

ADM is explicitly mentioned as basis for the Delta Program and took shape through scenario development. The Delta Program has a time horizon of 2050, with a view-through towards 2100 (Zevenbergen et al., 2013; Petersen and Bloemen, 2014; Van Buuren et al., 2016). This introduces a large uncertainty regarding climate, but also socio-economic conditions. External scenarios, combining climate change and socio-economic trends, made this uncertainty manageable, by specifying the potential range in long-term water challenges. Adaptive strategies are able to speed up or slow down when actual developments require so. The delta

dynamics cause a continuous need for new water related investments and maintenance, aggravated by climate change and subsidence. In the Dutch Delta Program this continuity is achieved by leadership (Delta Commissioner), sound institutional arrangements between cooperating parties, stability in funding all legally based in the Delta Act, and a complimentary monitoring and evaluation program.

Complicating Factors

The time horizon of the Delta Program and related scenario's is 2100. Although the effects of climate change on e.g. sea level rise and river discharge are apparent on this time scale, their effects on present strategies are not enough to surpass tipping points on the short or medium term and do not demand switches in strategies on the short term. Present flood protection and beach nourishment strategies can be continued, at least until 2100. This made it difficult to advocate for a critical review of foreseen investments in land use and infrastructure. In addition, we found out that a strict moment of tipping cannot be defined. Instead, the 'sell-by-date' of a measure or strategy can be stretched by technical developments, increased available funding and changing societal preferences, thus enlarging the interval before tipping.

The Delta Program is focussed on the main water challenges, which is also the policy domain of the Ministry of Infrastructure and Water Management. In addition, the Delta Commissioner submits his annual progress report and proposal to the Minister, who on budget day introduces it, on behalf of the Cabinet, to Parliament as part of the budget proposal of the department as a whole. During the start of the Delta Program these complementing responsibilities on the same policy field induced some competition between the Delta Program and ministerial organisations. Good chemistry between Delta Commissioner and Minister prevented escalation. Gradually the Delta Commissioner focussed more on the long term water perspective (up to 2050 and beyond) on short term measures, and the need for stability in funding, assisting the Minister to put these issues on the political agenda.

Long term water challenges can be aggravated by land use developments that neglect climate change regarding e.g. flood risk and fresh water availability. An integrated approach can contribute to preventing an increase of future water challenges and related damage or expenditures. However, the Delta Act and Fund focus on investments in flood protection and fresh water supply measures. On the project level, water related projects sometimes trigger cooperating parties to combine their local investment agenda's, develop a multi-use design and agree upon mutual funding by using ad-hoc financial constructions. To achieve this integrated approach on the regional and national level still remains a large challenge.

In 2014 the national policy frameworks and regional adaptive policies were presented to Parliament and adopted, and implementation could start. This transition was accompanied by a large change in staff in the cooperating organisations, from policy-related staff to staff working in executive sectors. The latter were less familiar with the purpose of the Delta Program, the ADM concept and related knowledge about long term water challenges, the governance structure, budget allocation. Fortunately the Delta Commissioner and his staff remained and provided continuity. Nevertheless, it took almost 2 years to get the implementation phase on track and on speed.

Bangladesh Delta Challenges

The Bangladesh delta is situated in the tropical monsoon climate zone of the Indian Ocean. It consists of the deltas of the transboundary rivers Ganges, Brahmaputra and Meghna. More than two-third of the country is less than 1 m above sea level, and prone to monsoon floods, cyclonic storm surges and water logging. Bangladesh is among the countries that are most affected by climate change and risks from natural hazards (Kreft et al., 2017). Agriculture is a major economic sector in Bangladesh and vulnerable for climate change induced temperature

rise and saline intrusion following sea-level rise (Brammer, 2014). Hence, climate change is a real threat for Bangladesh.

Formulating the Bangladesh Delta Plan 2100

In 2012 the Government of Bangladesh (GoB) decided to formulate a long-term adaptive plan. The BDP 2100 formulation project started in 2014, covering the whole country including the Chittagong Hill Tracts (CHT). BDP 2100 integrates short to medium term economic development objectives with long-term sustainable resources management. Bangladesh aims to achieve upper middle-income status and eliminate poverty by 2030. This goal is intertwined with the longer-term challenge of water resources management integrated with agriculture, fisheries, transportation, and environmental protection (De Heer & Aartsen, 2019). Because of this, the BDP 2100 has a broad multisectoral scope and combines a long-term vision on the delta at the end of the century with short and medium-term goals as steps to realise that vision. These goals (see Table 3) and associated strategies, institutions and investments are adaptive in nature (Ministry of Planning, 2018).

The BDP 2100 formulation process is aimed at adequate strategies and institutional framework for achieving these vision and goals. The BDP 2100 was formulated by a Dutch-Bangladeshi consortium of experts, the project was hosted by the General Economic Division (GED) of Bangladesh' Planning Commission. Strategy-process, content, governance and stakeholder participation form basic elements of the formulation process (see Figure 1).

Figure 1

Content is about the diagnostic description of issues and challenges in the dynamic delta (Ministry of Planning, 2018). Governance refers to the required institutional adjustment of involved ministries and agencies as well as embedding BDP 2100 in the institutional and

planning context. Stakeholders are in this holistic planning approach of crucial importance for sharing knowledge, reaching common understanding, support and ownership to realize the required coordination and decision making (De Heer and Jenkins, 2012). Overall, seven ministries and about 2,600 people gave input and feedback in stakeholder workshops and consultations at regional and local levels.

The BDP 2100 formulation covered three phases (see Figure 2) of which the first consists of mobilizing the project, designing the process and preparing 26 Baseline Studies. Second, interactive planning took place.

Figure 2.

Experts from government agencies, private sector and other stakeholders elaborated on the external drivers, issues and challenges, resulting in possible adaptive strategies. They are closely involved in articulating demands of agriculture, fisheries, livestock, transportation, industry, water supply, sanitation and environment sectors. The potential and preferred strategies were selected based on the developed vision, four scenarios and related selection criteria and standards. This phase also included formulating an Investment Plan and a governance framework. This framework arranges institutional and funding aspects, capacities and readiness of implementing agencies. The third and final phase focuses on institutional arrangements and decision making, with broad consultation and the approval process of the Delta Plan. Eventually, the BDP 2100 was approved by the government in 2018.

In Bangladesh, the whole process of developing baseline studies, articulating a long-term vision and goals, scenarios, strategies, measures, a data & knowledge portal and investment plan was combined in a single, four-year project at the national level. The final BDP 2100 acts as a long-term reference framework for future and existing planning activities and will

feed into the Bangladesh' Five Year Plans cycle and Annual Plan and Budget. The BDP 2100 is incorporated in the core governance of Bangladesh, where climate change, scenarios and strategies will be monitored and adaptation will be considered..

Implementing the Bangladesh Delta Plan 2100

Although Bangladesh has water policies and plans for considerable time, the effectiveness of implementation of integrated water management is weak, due to political, financial and institutional constraints as limited capacity and budgets, insufficient coordination and collaboration.. These issues will be addressed in the implementation phase through the establishment of new institutions (a Delta Governance Council to coordinate investment decision making, a Project/Program Selection Committee, a Delta Wing in the Planning Commission and a dedicated Delta Fund) and simultaneous capacity development at implementing agencies. These institutions will operate result-driven, facilitated by a data and information portal and monitoring system to evaluate progress. Presently 0.8% of GDP is annually spend on BDP 2100-related activities (investments, operation and maintenance). The implementation of the BDP 2100 involves a by GoB agreed 2.5% of GDP per annum, which is around US\$ 7 bln per year, reserved for initiating new and maintaining existing delta interventions, of which 0.5% of GDP should originate from private sector investments. The remainder should come from tax financing, application of cost recovery based on beneficiary pays principle and mobilizing foreign funding including tapping into the global Green Climate Fund initiative.

Complications during the Formulation Process

During the start-up of the project early 2014 it became clear that GoB aimed at synchronization of the project with ongoing planning procedures. This meant, that serious input was expected early 2015 for the new Five Year Plan, so already one year after the start

of the project, in fact in the Baseline Study phase. This was an urgent and serious claim, which as such was positive but also put enormous pressure on the fresh team, leading to modification of the Work Plan and allocation of staff. However, it was seen and utilized as a great opportunity to align BDP 2100 in such an early stage with the national planning process in the core governance of Bangladesh.

In the usual rational, linear planning approach, long term orientation and related uncertainty wasn't an issue in the administrative culture, while it became a major factor in the process under BDP 2100. This resulted in confusion and tension because it was thought to be impossible to make a long term plan under unclear conditions. A way out was focusing on the meaning of adaptation over time and to define a break down in phases (2030, 2050, 2100) which make it possible to signal changes by research and monitoring and adapt to them. The long term vision and goals on the delta provided convincing inspiration and ambition that served as strategic direction.

The government's aspirations proved to be very high in terms of climate proof Bangladesh and in terms of socio-economic development including poverty reduction and achieving middle income status. It intended to take up the long term challenges of climate change, natural disasters and sustainable water resources management in conjunction with economic development, food security, environment and land resources. In defining the scope of the BDP 2100, the government also insisted that population growth and urbanization needed to be addressed and that the hilly areas (not really at delta level) of the CHT would be included. During the Baseline Study phase, initially 19 themes would be studied, however, besides the CHT, new research items were added by GoB, resulting in 26 Baseline Studies. The focus of BDP 2100 became much broader than foreseen with many challenges to manage this. This also refers to another complication. The long term planning as well as the multi sectoral scope legitimized the positioning of the BDP 2100 formulation process under the Ministry of

Planning instead of the Ministry of Water Resources which claimed the BDP 2100 project initially. The risk was to be trapped in too many studies and having too little time and budget for the strategy making and preparing the delta plan. Solution was additional staff and budget and conducting the studies partly parallel to the strategy process.

Working with external scenarios to explore possible developments and gain more insight in uncertainties caused new conceptual and acceptance problems. The first is about the concept of scenarios and the way they are used here, because GoB normally works with and chooses from several policy, content loaded, scenarios. External scenarios as narratives of futures which may or may not happen, which one cannot choose from, were new and felt uneasy. Secondly, the naming of the scenarios is sensitive, only positive labelling was acceptable e.g. congestion and stagnation as label was not allowed because government policy was aiming at growth and development. The scenarios were discussed many times, further refined, also with calculations and finally accepted for checking the BDP-strategies on robustness against a set of uncertainties. An additional method used to address uncertainties is accepting that there is no one best way to achieve vision and goals and instead design alternative adaptation pathways. Focus is then on monitoring the developments, looking for tipping points and acting upon it by adaptation, if needed following a different pathway, avoiding strong structural interventions as long as possible also to avoid lock in situations.

During the strategy process, GoB indicated to not only formulate the delta plan but also to elaborate it in an Investment Plan up to 2030 in order to take up investments as soon as possible after approval of the BDP 2100. Investment planning has been done in cooperation with the World Bank. The WB team was fielded when the BDP 2100 strategy and formulation process was almost ready and it experienced a large information gap concerning Background Studies, ADM, use of scenario's and assessment of the strategies and measures which were prepared in a participative way with contributions from all over the country. Concentration on

transfer of knowledge and of content with many already by the BDP-team prepared project proposals was the way to overcome this hurdle to prepare an Investment Plan that was acceptable to GoB.

Analysing the Delta Program and BDP 2100 using the OECD Principles

As described in Section 3, Neto et al. (2018) was followed for our analysis of the Dutch Delta Program (DDP) and Bangladesh Delta Plan 2100 (BDP 2100). Appendix 2 contains results of this analysis for each case in the table provided by Neto et al. (2018).

The Dutch and Bangladesh deltas differ widely in water challenges, socio-economic conditions and governance frameworks, and so do the respective delta plans that have been prepared in recent years (Appendix 1). Despite these differences it can be noted that both plans show strong consistency with the OECD-principles (Appendix 2). In both cases scores for policy impact and on-the-ground-results are generally lower. This is due to the fact that both plans are still under implementation. Interestingly, scores for principle 7 (regulatory frameworks) are lowest in both plans. This is because the development of regulatory frameworks often starts after the policy development is finished. Moreover, this activity is time-consuming in its preparation and approval.

The main differences between the DDP and BDP 2100 concentrate around two aspects. BDP 2100 scores on implementation, ground results and policy impact are generally a fraction lower than DDP scores because of the stage of implementation: the DDP entered this stage 2014, while BDP 2100 entered implementation stage in 2018, although the scores reflect strong intentions to follow the principles in the realization of BDP 2100. On the other hand BDP 2100 scores higher on principle 3 (policy coherence/ alignment) than DDP. This is

explained by the wider scope and more extensive multi-sectoral involvement in Bangladesh compared to the Netherlands.

Do the OECD Principles on Water Governance contribute to Adaptive Delta Management?

The analysis of the Dutch Delta Program and Bangladesh Delta Plan 2100 regarding the OECD principles shows that these plans have been developed in consistency with these principles. Both plans also introduced a new approach to deal with long term uncertainty that is inevitably connected to long-term water related investment planning: adaptive delta management (ADM). From our experiences we present lessons that illustrate whether and how both approaches (ADM and the OECD principles) can reinforce each other.

Long-term Vision, managing Uncertainty

The first lesson relates to the need for well-organized water management infrastructure and dedicated governance in low-lying countries, especially as climate change challenges maintaining and improving physical and governance infrastructures. Both applications of ADM give a central role to this long-term perspective, albeit in a different way. Bangladesh aims to become a middle-income country by 2021 and avoid economic and social setbacks as much as possible, which requires implementing huge investment programs in water management and related sectors. On the contrast, the Netherlands wished to maintain its high living standards in the future. The Netherlands thus applied ADM while focussing on the question: ‘How can we protect our country from adverse impacts resulting from uncertain changing conditions and align this with other policy agenda’s?’, while Bangladesh focussed on development goals: ‘How can we enable socio-economic development and food security together with water safety and security under uncertain changing conditions regarding climate

change and trans-boundary water issues?’. As a result, Bangladesh was inspired by the Dutch pioneering example but used water investments as leverage to achieve water and food security and development goals, thereby adding specific features to the approach (e.g. combination of national, hotspot and thematic strategies; investment plan; decision support model). Hence, in both countries a long-term ambition induced changes, with climate change as main driver.

Application of this vision is a balancing act in practice. Investments in water related infrastructure and land use development involve measures with a life span up to 50-100 years, which will strongly determine future water management and land use while climate change, population growth and economic development cause major uncertainties. These uncertainties result in a bandwidth of possible futures. In both cases, scenarios were developed that represent plausible water challenge futures, e.g. in 2050 and 2100. These scenarios highlight when present strategies will fail and act as inspiration for the development of additional or new strategies. Combined in adaptation pathways these strategies and flexible measures are aimed to find a balance between ‘too much, too early’ and ‘too little, too late’. In this way future uncertainty is made manageable in a cost-effective manner. An example of a flexible measure is the ‘building with nature’ principle, i.e. using natural processes to stimulate sediment transport or deposition, or reduce wave action through mangrove forest or oyster reefs. However, tension emerged in both Bangladesh and the Netherlands between deciding on large structural measures on the short term (especially when funding is available), or keeping options open for the future. Especially Bangladesh, with a less developed water system than the Netherlands, needed infrastructural measures to realize basic water security. As such, applying adaptive planning requires a long-term vision and balance between short-term ‘no-regret’ measures and long-term adaptive strategies. This basic ‘dealing with future uncertainty’ element of ADM is new compared to IWRM and still absent in the OECD principles.

Perform a holistic Delta Analyses of Issues, Challenges and Knowledge Gaps, explore Opportunities for Linkage with other Agendas and integrated Measures

To facilitate the preparation of a delta plan along the lines of the abovementioned lessons, data and knowledge is needed on the physical, biotic and socio-economic status of the delta, the expected trends and developments, interlinkages between subsystems and the governance and institutional set-up. In both cases a process of Joint Fact Finding was adopted to create consensus among involved authorities, experts, and stakeholders on what information is known, lacking or unknown and uncertain, which conclusions can be drawn, and how knowledge gaps will be filled. The available data and knowledge as well as the gaps and necessary actions were documented, e.g. in 26 Baseline reports (Bangladesh) or the annual progress report to the Parliament (the Netherlands). In both countries, study reports, draft policy frameworks and preferred strategies are externally reviewed by independent reviewers and discussed in Panels of Experts, with special attention for uncertainties, unknowns and possible scenarios. In any case, both approaches to build scientific consensus on collected data and proposed strategies support OECD principle 1 (clear roles and responsibilities) as well as principles 5 (on data and information) and 10 (stakeholder engagement).

ADM also extends the emphasis in IWRM on integrated approaches. On the ground, water related infrastructure interferes with other activities that already exist or may be planned. Combining separate plans and investments in an integrated program may be more efficient (in terms of required funding, work and material), increase added value and public acceptance. Such integration requires involved stakeholders to be transparent in their investment agendas, to tune their agendas (and related budgets) and to agree on responsibilities in contracting and maintenance. Searching for integrated solutions worked in the Netherlands in the 'Room for

the River' program and resulted in combining coastal defence reinforcements with urban development plans. In Bangladesh, the BDP 2100 investment program linked several sectoral agendas. Like a holistic vision, this underlines OECD principle 3 (policy coherence). Relevant here are also principle 2 (manage water at the appropriate scale(s)); principle 4 (capacity of responsible authorities); principle 5 (sharing data and information and principle 6 (mobilizing (shared) financial resources).

Arrange Ownership, stimulate Coherence, by combining 'bottom up' and 'top down' Approaches

A third lesson concerns the need to create ownership for tailored measures and stimulate coherence between regions. Certain areas in the delta are 'hotspots', meaning they have specific challenges and demand a regional approach. For example, coastal areas face salinization, hilly areas face flash floods and rivers face bank erosion, siltation and floods. Similarly, where upstream areas struggle with droughts, urban areas need to improve water supply and sanitation. On the other hand, important linkages exist between these regions in the transfer of water, sediment and nutrients, which asks for system or catchment-based coherence and thus coordination on a supra-regional, delta level. In Bangladesh and the Netherlands, where the delta largely covers the national territory and rivers are transboundary, this implies national coordination and international cooperation. Regional strategies ('bottom up') and (inter)national coordination ('top down') requires a multi-governance structure that enables gradual integration of national and regional strategies and institutional arrangements for adequate ownership. For this purpose, parties involved should agree upon a common timetable and governance structure from the start to ensure political commitment. In the Dutch situation, with decentralized water and land use governance, the independent Delta

Commissioner leads this process. In Bangladesh, with a more centralized governance, leadership was provided by the Member (Senior Secretary) of the General Economics Division (GED) of the Ministry of Planning. This GED is also responsible for the preparation of the national Five Year Plans and longer term (20 years) Perspective Plans. Where international agreements were already in place for the Dutch rivers, the BDP 2100 indicates the importance of settlement of transboundary issues in the near future and provides an approach based on water diplomacy to achieve this. This alignment of regional strategies through (inter)national coordination emphasizes OECD principle 2 (manage at the appropriate scale), principle 3 (foster coordination), principle 8 (promote innovative governance approaches), principle 9 (mainstream integrity and transparency for greater accountability), principle 10 (informed outcome-oriented contributions) and principle 11 (encourage water governance frameworks for managing trade-offs across water users).

Governance to guarantee Progress and Continuity

The fourth lesson is that delta management requires continuous efforts on water management and flood protection, given its dynamic nature (e.g. natural hazards, continuous processes like subsidence and climate change). The preparation of a holistic long-term vision and strategies with investment agenda are first steps, which need follow-up and implementation. This requires governmental (institutionalized) ownership and broad political commitment, since reservation of large budgets is imperative for a long period. This ownership and commitment crystalized in Bangladesh and the Netherlands in installing specific high-ranking official or commission to supervise, report and advice. This refers to OECD principle 8 (promote an innovative governance approach). Furthermore, annual progress reports to Parliament or to a national steering committee may help to maintain urgency in the development phase and

continuity during implementation. In Bangladesh the delta plan was connected with the regular 5-year plans and in the Netherlands, the Delta Commissioner annually reports progress and proposes rolling-on investment plans to the Dutch Cabinet.

In addition, long-term financial stability has to be guaranteed, e.g. by a fund or specific part of the government budget that is relatively free from frequent political prioritization. The Dutch Delta Fund is supplied by budget from the national government and receives a 15% contribution of regional authorities, whereas in Bangladesh a block provision (as 2.5% of the GDP) is foreseen for delta plan related investments. Additional investments from private parties and international institutions are also envisaged. The Dutch fund has already proven to aid continuity, as the funding stream remained relatively undisturbed during the economic crisis of 2010-2014. These arrangements meet with OECD principle 6 on mobilizing water finance and allocate financial resources in an efficient, transparent and timely manner.

Finally, the implementation phase needs a well-developed monitoring and evaluation system in order to establish on a regular base whether the implementation is still on schedule and on the right track. In the Netherlands a Delta Program monitoring and evaluation system has been developed (Haasnoot et al., 2018) and first results were presented in 2020 (Delta Commissioner, 2020). In Bangladesh such a monitoring system is under construction. This fits well with OECD principle 12 on monitoring and evaluation.

Risk-based Planning

Living in deltas has many benefits, but can be dangerous during extreme events like flooding or droughts. These two cases teach us that delta management also entails risk management. Delta strategies should be designed in such a way that they optimize the use of water during normal conditions and prevent damage and fatalities during extreme events. The level of

protection or water supply (and hence the budget for involved investments and maintenance efforts as well as the accepted residual risk) forms a political choice and decision, often at the national level. On a local or regional level, the elaboration of the measures to comply with these risk-based standards is a matter of tailor-made approach, in which stakeholders and relevant authorities have to be involved. In Bangladesh flood protection standards vary between high risk urban areas and locations with vital infrastructure and lower risk rural areas. In the Netherlands this risk-based approach has resulted in a new system of regionally differentiated flood protection standards, based on the potential damage, number of fatalities and societal disruption due to a flood (Van Alphen, 2016). This system was developed in close consultation with local authorities and approved in Parliament.

Conclusion

This paper evaluated the application of Adaptive Delta Management (ADM) in the Netherlands and Bangladesh. The Dutch and Bangladesh deltas differ widely in water challenges, socio-economic conditions and governance systems, and so do the respective Delta Plans that have been prepared in recent years. Comparing both cases provides lessons for other applications of ADM in practice and indicates points of attention for further research. The paper focused attention to climate change adaptation, by showing through the cases that adaptive planning and implementation to protect vulnerable areas and populations requires action now, rather than in the future.

The applications of ADM in the Netherlands and Bangladesh were assessed using the OECD Principles on Water Governance (OECD 2015). Based on these results, we conclude that both the Dutch Delta Program and the Bangladesh Delta Plan show compliance with these principles, especially on (innovative) governance, stakeholder participation and inter-policy

and inter-agency coordination, funding and monitoring and evaluation. Although these OECD principles proved useful and relevant in many countries, they cannot account for two relevant aspects of ADM that are novel to water governance. These two aspects are the long-term nature and the risk-based approach underlying ADM. We therefore propose to add a 13th and 14th principle. The 13th principle concerns the designing and managing a process of adaptive planning with a long-term perspective. This entails preparing narratives of different possible futures (scenarios) and combining these scenarios with adopting a long-term holistic vision. Combined, they form a framework for adaptive strategies that are able to deal with future uncertainties in water related challenges, notably climate change, and may give direction to short term investment agenda's. We further point to the importance of increasing government capacity in the process of applying ADM principles. In both discussed cases there was ample attention to government capacity during the formulation processes. Given that ADM is inherently surrounded with uncertainty (Kwadijk et al., 2010) governments need to be able to manage these uncertainties and monitor signals for tipping points (Haasnoot et al., 2013). The cases showed that governments do so by investing in capacity related to managing uncertainties, such as strategic planning skills, learning, governance and participatory processes as well as knowledge management for dealing with climate change adaptation.

The 14th principle concerns the risk-based approach. As living in a delta has many benefits and involves high levels of economic activities and investments, a risk-based approach could be adopted, to adequately manage extreme events, like floods and droughts. These extreme events are expected to increase in frequency and intensity due to climate change and thus are likely to become more relevant in future water governance.

In addition to these conclusions, a reflection on the methods used is appropriate here. We have used a specific type of action research, whereby we reflected on the policy development processes from within. As such, our starting point was that ADM is a valuable extension of

Integrated Water Resource Management. To prevent bias from our side, we combined two recent methods to use the OECD principles of respectively Seijger et al. (2018) and Neto et al. (2018). These methods enabled us to be transparent in our analysis and complemented each other. Still, ‘policy impact’ and ‘on ground results’ (see Neto et al., 2018) of ADM cannot be fully assessed yet, even after ten years, due to the time horizon of up to a century of such strategies and the relatively short implementation experience. We nevertheless therefore encourage other researchers to apply this combined method to analyse other cases of ADM in practice to build a global knowledge base.

Living in a delta requires flexibility and adaptive strategy making to deal with long-term uncertainties and dynamics of nature, society and climate change accompanied by large and continuous investment programs and ongoing long-term implementation. Overall, this comparative case study showed that Bangladesh and the Netherlands managed to develop such a strategy, while complying to the OECD Principles of Good Water Governance and provided lessons from these experiences that could aid other applications of ADM in practice. Furthermore, this paper calls for ‘future proofing’ these OECD principles so they can account for long-term and risk-based water governance frameworks that are required to deal with climate change and other uncertain issues with long duration.

References

- Ahmed, M. & Suphachalasai, S. (2014) *Assessing the Costs of Climate Change and Adaptation in South Asia*. Available at: <http://www.adb.org/sites/default/files/pub/2014/assessing-costs-climate-change-and-adaptation-south-asia.pdf>.
- Allouche, J. (2016). The Birth and Spread of IWRM: A Case Study of Global Policy Diffusion. *Water Alternatives*, 9(3), 412–433.
- Bloemen, P., Reeder, T., Zevenbergen, C., Rijke, J., & Kingsborough, A. (2018). Lessons learned from applying adaptation pathways in flood risk management and challenges for the further development of this approach. *Mitigation and Adaptation Strategies for Global Change*, 23, 1083–1108. <https://doi.org/10.1007/s11027-017-9773-9>
- Bloemen, P. J. T. M., Hammer, F., Vlist, M. J. Van Der, Grinwis, P., & Alphen, J. Van. (2019). DMDU into Practice: Adaptive Delta Management in The Netherlands. In V. A. W. K. Marchau, W. E. Walker, P. J. T. M. Bloemen, & S. W. Popper (Eds.), *Decision Making under Deep Uncertainty: from theory to practice* (pp. 321–351). Springer International Publishing. <https://doi.org/10.1007/978-3-030-05252-2>
- Brammer, H. (2014). *Climate change, sea-level rise and development in Bangladesh*. University Press Ltd, Dhaka.
- De Heer, J. M., & A. Jenkins. (2012). Practices of cross cultural collaboration in sustainable water management in Bangladesh. *International Journal of Business Anthropology*, 3(1), 15–38.
- De Heer, J.M., & M. Aartsen. (2019). Bangladesh prepares itself for a climate resilient future. *Water Governance*, 03/2019, 87-97.
- Delta Commissioner. (2010). *Delta Programme 2011: Working on the delta. Investing in a safe and attractive Netherlands, now and in the future*. Ministry of Transport, Public Works and Water Management, The Hague, The Netherlands.
- Delta Commissioner. (2012). *Delta Programme 2013: Working in the Delta. The road towards the Delta Decisions*. Ministry of Infrastructure and the Environment, The Hague, The Netherlands.
- Delta Commissioner. (2020). *Delta Programme 2021: Staying on track in climate proofing The Netherlands*. Ministry of Infrastructure and Water Management, The Hague, The Netherlands.
- Delta Committee. (2008). *Working together with water, a living land builds for its future*. Delta Committee. http://www.deltacommissie.com/doc/deltareport_full.pdf
- Dewulf, A., & Termeer, C. (2015). Governing the future? The potential of adaptive delta management to contribute to governance capabilities for dealing with the wicked problem of climate change adaptation. *Journal of Water and Climate Change*, 6(4), 759-771. <https://doi.org/10.2166/wcc.2015.117>
- Haasnoot, M., Kwakkel, J. H., Walker, W. E., & ter Maat, J. (2013). Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world. *Global Environmental Change*, 23(2), 485–498. <https://doi.org/10.1016/j.gloenvcha.2012.12.006>

- Haasnoot, M., Van 't Klooster, S., & Van Alphen, J. (2018). Designing a monitoring system to detect signals to adapt to uncertain climate change. *Global Environmental Change*, 52, 273–285. <https://doi.org/10.1016/j.gloenvcha.2018.08.003>
- Kreft, S., Eckstein, D. & Melchior, I. (2017). *Global Climate Risk Index 2017; Who suffers most from extreme weather events? Weather-related loss events in 2015 and 1996 to 2015*. German Watch, Berlin.
- Kwadijk, J. C. J., Haasnoot, M., Mulder, J. P. M., Hoogvliet, M. C., Jeuken, A. B. M., Van der Krogt, R. A. A., Van Oostrom, N.G.C., Schelfhout, H.A., Van Velzen, E., Van Waveren, H., De Wit, M. J. M. (2010). Using adaptation tipping points to prepare for climate change and sea level rise: a case study in The Netherlands. *WIREs Climate Change*, 1(r), 729–740. <https://doi.org/10.1002/wcc.64>
- Marchand, M., & Ludwig, F. (2014). *Towards a Comprehensive Framework for Adaptive Delta Management*. <http://www.delta-alliance.org/media/default.aspx/emma/org/10848051/Towards+a+Comprehensive+Framework+for+Adaptive+Delta+Management.pdf>
- Ministry of Planning. (2018). *Bangladesh Delta Plan 2100 (Strategy Document; Investment Plan; 26 Background Studies in 6 Volumes)*.
- Minkman, E., & Buuren, A. Van. (2019). Branding in policy translation: how the Dutch Delta Approach became an international brand. *Environmental Science and Policy*, 96 (June), 114–122. <https://doi.org/10.1016/j.envsci.2019.03.005>
- Neto, S., Camkin, J., Fenemor, A., Tan, P., Melo Baptista, J., Ribeiro, M., Schulze, R., Stuart-Hill, S., Spray, C. & Elfithri, R. (2018). OECD Principles on Water Governance in practice: an assessment of existing frameworks in Europe, Asia-Pacific, Africa and South America. *Water International*, 43(1), 60–89. <https://doi.org/10.1080/02508060.2018.1402650>
- OECD. (2014). *Water Governance in the Netherlands, Fit for the future?* OECD. <https://doi.org/10.1787/9789264102637-en>
- OECD. (2015). *OECD Principles on Water Governance*. OECD. <http://www.oecd.org/governance/oecd-principles-on-water-governance.htm>
- Petersen, A., & Bloemen, P. (2014). Planned Adaptation in design and testing of critical infrastructure : The case of flood safety in The Netherlands. *International Symposium for Next Generation Infrastructure*, 221–225. Retrieved from <https://discovery.ucl.ac.uk/id/eprint/1469402/2/221-225.pdf>
- Rijksoverheid. (2015). *Nationaal Water Plan 2016-2021*. <https://www.government.nl/documents/policy-notes/2015/12/14/national-water-plan-2016-2021>
- Seijger, C., Brouwer, S., Van Buuren, A., Gilissen, H. K., Van Rijswijk, M., & Hendriks, M. (2018). Functions of OECD Water Governance Principles in assessing water governance practices : assessing the Dutch Flood Protection Programme Functions. *Water International*, 43(1), 90–108. <https://doi.org/10.1080/02508060.2018.1402607>
- Van Alphen, J. (2016). The Delta Programme and updated flood risk management policies in The Netherlands. *Journal of Flood Risk Management* 9 (4), 310–319. <https://doi.org/10.1111/jfr3.12183>

- Van Buuren, A., Ellen, G. J., & Warner, J. F. (2016). Path-dependency and policy learning in the dutch delta: Toward more resilient flood risk management in The Netherlands? *Ecology and Society*, 21(4), 43. <https://doi.org/10.5751/ES-08765-210443>
- Van Rhee, G. (2012). *Handreiking Adaptief Deltamanagement*. Stratelligence Decision Support.
- Van Staveren, M. F., Warner, J.F., Van Tatenhove, J. P. M. & Wester, P. (2014). Let's bring in the floods: de-poldering in The Netherlands as a strategy for long-term delta survival? *Water International*, 39(5), 686-700. <https://doi.org/10.1080/02508060.2014.957510>
- Verduijn, S. H., Meijerink, S. V., & Leroy, P. (2012). How the second delta committee set the agenda for climate adaptation policy: A dutch case study on framing strategies for policy change. *Water Alternatives*, 5(2), 469–484.
- Zevenbergen, C., Van Herk, S., Rijke, J., Kabat, P., Bloemen, P., Ashley, R., Speers, A., Gersonius, B., Veerbeek, W. (2013). Taming global flood disasters. Lessons learned from Dutch experience. *Natural Hazards*, 65(3), 1217–1225. <https://doi.org/10.1007/s11069-012-0439-3>
- Zevenbergen, C., Khan, S.A., Van Alphen, J., Terwisscha Van Scheltinga, C., & Veerbeek, W. (2018). Adaptive delta management: a comparison between The Netherlands and Bangladesh Delta Program. *International Journal of River Basin Management*, 16(3), 299-305. <https://doi.org/10.1080/15715124.2018.1433185>

Appendix 1. The Dutch Delta Program and Bangladesh Delta Plan, a comparison

Characteristic	The Netherlands	Bangladesh
Country characteristics		
<i>Territory (km²)</i>	41.543	147.570
<i>Inhabitants (mln)</i>	17	160
<i>GDP (bln US\$)</i>	828	288
<i>Climate</i>	Temperate maritime North East Atlantic	Tropical monsoon Indian Ocean
<i>Main climate change related threats</i>	Sea-level rise, increased precipitation, droughts	Sea-level rise, temperature rise
<i>Area threatened hosts</i>	<ul style="list-style-type: none"> • 60% of population • 60% of GDP • 60% of territory 	<ul style="list-style-type: none"> • 80% of population • 90% of GDP • 70% of territory
<i>Institutional setting</i>	parliamentary democracy decentralized government	parliamentary democracy centralized government
<i>Growth rate (%/yr last decade)</i>	-2 to +3	7
Characteristics of the delta plan		
<i>Development time frame</i>	2010 – 2014	2014-2018
<i>Implementation time frame</i>	2015 – present	2019 – present
<i>Scale</i>	National, regional, local	National, multi-sectoral (7 ministries) regional, local
<i>Vision for the delta in 2100</i>	To maintain a safe, prosperous and attractive delta for present and future generations, anticipating climate change	Ensure long term water and food security, economic growth and environmental sustainability while effectively coping with natural disasters, climate change and other delta issues through robust, adaptive and integrated strategies, and equitable water governance.
<i>Output Characteristics</i>	National policy frameworks on flood risk management, fresh water supply and climate proof urban areas, and regional adaptive strategies and related investment agenda's for national government.	National, Hotspot and Thematic Strategies on flood risk management, fresh water supply, and regional adaptive strategies (also on water supply & sanitation and river bank erosion), agriculture, transportation, urban development & spatial planning, Blue Economy and related investment agenda's
<i>Similar elements of the governance structure</i>	<ul style="list-style-type: none"> • Long term approach (2050-2100), • scenario's 	<ul style="list-style-type: none"> • Long term approach (2050-2100), • scenario's
<i>Dissimilar elements of the governance structure</i>	<ul style="list-style-type: none"> • Multi governance, linking 'bottom up' (regions) and 'top down' • Joint fact finding (JFF) • Coordination by Delta Commissioner • Annual progress report to Cabinet (→ Parliament) 	<ul style="list-style-type: none"> • Multi-governance, 26 Baseline Studies, focus on 6 'Hotspots' Top down with extensive local consultation • JFF • Coordination by National Planning Commission • Input to national 5 year plans and Annual Development Plans
<i>Institutional arrangements</i>	<ul style="list-style-type: none"> • Delta Commissioner • Annual progress report to Parliament • Delta Fund (1.2 bln Euro/yr), (0.15% of GDP) • Delta Act 	<ul style="list-style-type: none"> • Delta Governance Council, chaired by Prime Minister • Input to national 5 yr plans • Delta Fund (7 bln \$/yr) (2.5% GDP) • Special BDP rules and institutions

Appendix 2: Comparison of DDP and BDP regarding the OECD principles on water Governance, following the approach of Neto et al (2018).

Alignment of program with OECD principle

- (1) No alignment
- (2) Poor = some common objectives
- (3) Moderate = common objectives and measures of policy proposed
- (4) Good/strong = previous experience and well-aligned policy ongoing
- (5) Full alignment = policy framework matching all the objectives of the OECD principle

Implementation takes OECD principle into account

- (1) No implementation
- (2) Poor = minimally addressed
- (3) Moderate = consistently included, with some measures proposed
- (4) Good/strong = under implementation through measures in place
- (5) Full alignment = implemented with evaluated results/good practice

On-ground results

- (1) No evidence of change
- (2) Poor = involving major agent of change (institutional or other)
- (3) Moderate = involving different agencies and stakeholders
- (4) Good/strong = involving multilevel platforms of participation and decision making
- (5) Major changes evident = implemented with evaluated results/good practice

Policy impact

- (1) No impact
- (2) Poor = considered and being implemented in the ongoing water policy
- (3) Moderate = considered for implementation in other policies (transversal impact)
- (4) Good/Strong = impacting different institutional levels of governance (vertical impact, bottomup and top-down)
- (5) Very strong impact = producing political change after evaluation (e.g., new legislation, regulatory measures, institutional restructuring or innovative institutional arrangements).

Principle	Criteria	Dutch Delta Programme		Bangladesh Delta Plan 2100	
		Score (1-5)	explanation	Score (1-5)	explanation
Principle 1: Clear roles and responsibilities	Alignment	5	The DP recognizes the existing roles and responsibilities of all national, regional and local authorities involved in water management and spatial planning	5	Decision making at Cabinet level endorsed the BDP institutional framework in which roles and responsibilities are clearly defined. Roles and responsibilities between national and local level will be redefined.
	Implementation	5	The DP adopts a related multi-governance structure for coordination and decision making regarding policy development and implementation.	4/3	A specific 'Delta Wing' was already established and other preparations concerning the BDP institutional framework are ongoing. A special Delta Fund is under construction as block-provision in the national budget
	On-ground results	5	See 'alignment'	4	Ongoing alignment process with sectoral ministries, Five Year Planning cycle and budget allocation
	Policy impact	5	See 'alignment'	5	Major changes in sectoral ministries, because of coordination mechanism Delta Governance Council (DGC) and adaptive planning and programming

Appendix 2 cont.

Principle 2: Appropriate scales within basin systems	Alignment	5	The DP recognizes that water related challenges should be dealt with on the appropriate spatial scale (surface or ground water system), but also that on a supra system scale interlinkages exist that should be safeguarded	5	BDP strategies and measures are currently localized, following a river basin management approach. BDP divides coastal protection in 3 characteristic systems. Transboundary issues require international basin approach which is a challenge.
	Implementation	4	The DP organized policy development by responsible authorities on the appropriate system scale in 6 regional programmes, complemented by 3 national policy frameworks and 2 supra regional policy decisions.	3	The Basins are identified and data collection on basin characteristics is ongoing. Implementation Program for the North-Western basin is discussed with many stakeholders. Preparations ongoing, see alignment.
	On-ground results	4	6 regional adaptive strategies and 3 national implementation programmes (flood protection, fresh water supply and climate proof spatial adaptation).	2	Stakeholder workshops in relevant basins. Preparations ongoing, see 'alignment'.
	Policy impact	5	Implemented legislation on regionally differentiated flood protection standards. Development of regionally differentiated fresh water supply agreements is underway.	4	The BDP holistic / multisectoral approach is being translated to basin and coastal systems. Preparations ongoing
Principle 3: Policy coherence	Alignment	4	Coordination between water management, land use planning, agriculture, nature and disaster management is accounted for, as well as in policy development, planning and design of measures ('creating added value for society by linking agenda's').	5	BDP shows a holistic approach of the Bangladesh delta addressing water safety and security, water supply and sanitation, food security and facilitating economic growth. Linkage with policies on poverty reduction, disaster management, shipping and Blue Economy
	Implementation	4	Policy coherence is achieved by participation of all relevant authorities in regional and national steering committees and approval by the Cabinet	3	BDP Investment Plan contains proposals from the mentioned sectors. Coordination takes place by the DGC based on the 8 th Five Year Plan with a linkage to budget allocation.
	On-ground results	4	Regional pilots to adapt agriculture to drought and salinization and hence reduce fresh water demand, pilots for flood proof urban developments. A midterm evaluation showed that integration between flood protection, fresh water supply and climate proof spatial adaptation could be further improved.	4	Coordinated input from BDP to the 8 th Five Year Plan with contributions of 7 ministries.
	Policy impact			3	Clearly a better focus on joined action instead of usual silos.
Principle 4: Capacity	Alignment	4	Knowledge and skills of water managers and land use planners are generally well, but are further developed regarding adaptive planning and design	5	Gets a lot of attention in terms of 'Readiness' for the large investment volumes. Capacity building is key as is knowledge and data management capacity e.g. for feasibility studies and creating bankable projects
	Implementation	4	Dedicated training programmes are in place	3	Capacity building in various forms and other preparations ongoing
	On-ground results	4	See 'implementation'	3	High expectations / anticipation on investment volume of BDP
	Policy impact	4	Adaptive planning is internalized on almost any authority, adaptive design has to be further developed	3	BDP related capacity draws attention given new way of budget allocation

Appendix 2 cont.

Principle 5: Produce and share data and information	Alignment	5	The DP adopts a Joint fact Finding approach, in which data, model and research results are shared (e.g. on common web-portals), and discussed in regional and national steering committees	5	BDP embraces the principle that it will always be science and knowledge driven. BDP established an Information Portal and Data Bank which are updated frequently. An explicit Knowledge Management Strategy and Knowledge Agenda indicate knowledge gaps and shape the research questions.
	Implementation	5	The development and results of the Delta Model were supervised and evaluated by an independent external advisory committee	5	Elaboration of a data and knowledge based decision support system takes place. A new research program was launched with support of development partners. The information Portal and data bank are updated, get continuous attention.
	On-ground results	5	The substantiation of regional strategies and national policy frameworks was accounted for in so-called 'synthesis report', that were reviewed (and qualified as 'up to standard') by independent experts.	4	Preparations ongoing, see 'alignment' and 'implementation'
	Policy impact			4	Preparations ongoing, see 'alignment' and 'implementation'.
Principle 6: Financing	Alignment	5	The measures of the DP are financed from the Delta Fund, which has a volume of about 1.2 billion euro's/year with a rolling on planning horizon of 12 years	5	BDP finances the investments based on a block provision of 2.5% of the GDP annually (\$ 5-6 bln) divided into 2% investments, 0,5% for operations and maintenance. Of this 2.5%, private sector investments are expected to be 1.5%. Funding takes place by a specific Delta Fund with contributions of GoB, IFIs, Development Partners, private sector and Green Climate Fund.
	Implementation	4	The Delta Commissioner presents every year a budget proposal to the Cabinet and may advise to make more budget available when necessary	3	Preparations ongoing, see 'alignment'
	On-ground results	5	Since the start of the DP 3 different Cabinets and the economic crisis occurred, which had only limited effect on the volume of the Delta Fund	4	Preparations ongoing, see alignment. Sectoral ministries anticipate BDP related allocation
	Policy impact	5	The Delta Fund clearly created continuity and stability in water related investments, maintenance and knowledge development.	4	Preparations ongoing, see alignment, . Sectoral ministries anticipate BDP related allocation
Principle 7: Regulatory frameworks	Alignment	3	New flood protection standards have been developed, adopted and are implemented, they are underway for fresh water supply, and need to be concretized for climate proof spatial planning	4/2	Flood protection standards have been introduced and will be further risk based elaborated. Licensing and regulations for water use in the various sectors are under construction, also for waste water discharge and treatment as well as for groundwater use and irrigation.
	Implementation	3	See 'alignment'	3	Preparations ongoing, see 'alignment'
	On-ground results	3	See 'alignment'	3	Preparations ongoing, see 'alignment'
	Policy impact	3	See 'alignment'	2	Preparations ongoing, see 'alignment'

Appendix 2 cont.

Principle 8: Adopt and implement innovative governance	Alignment	5	The DP has adopted a multi-governance approach in which relevant authorities are involved in decision making on the appropriate regional and national level. This process is coordinated by the independent Delta Commissioner, who presents his annual proposal to the Cabinet. On behalf of the Cabinet the Minister of Infrastructure and Water Managements (who is politically responsible) presents the DC's proposal to the Parliament. This annual progress report and budget proposal creates a kind of urgency to proceed with the implementation	5	BDP provides a new institutional framework. The long term BDP planning is embedded in the Five Year Planning cycle and yearly budget allocation processes. Besides, a new coordinating mechanism Delta Governance Council and related institutions has been established. The BDP follows an innovative strategy approach of ADM where issues and challenges are seen in a future perspective following several scenarios of possible futures. The new holistic approach of the delta leads to many interrelated strategies and actions, following adaptive pathways and adaptive design. A new institutional arrangement is under construction for engagement of water users at a regional level.
	Implementation	5	In a midterm review this multi-governance structure is evaluated as effective	4	Preparations ongoing, see 'alignment'
	On-ground results	5	See 'implementation'	4	Preparations ongoing, see 'alignment'
	Policy impact	5	See 'implementation'	3	Preparations ongoing, see 'alignment'
Principle 9: Integrity and transparency	Alignment	4	Practices regarding Integrity, accountability and trust in decision making are already established in present organizations. legislation and governance, DDP only adds common procedures on decision making, taking account of democratic procedures of the involved organizations.	4	BDP follows important principles of accountability as indicated in GOB programs on integrity and transparency e.g. to reduce corruption.
	Implementation	4	Implementation of these practices is responsibility of participating organizations	3	Preparations ongoing, see 'alignment'
	On-ground results	4	See 'implementation'	2	Preparations ongoing, see 'alignment'
	Policy impact	3	See 'implementation'	2	Preparations ongoing, see 'alignment'
Principle 10: Stakeholder engagement	Alignment	5	In the multi-governance approach relevant authorities are involved. In addition regular involvement of NGO's is organized by OFL (Cooperation Platform Physical Environment) and in regular meetings and design workshops for local communities	5	Stakeholder engagement is one of the pillars of BDP. It has various forms such as broad national consultation and participation in analysis of issues and solutions; multi-level governance involves district and local levels in preparing basin wise implementation programs.
	Implementation	5	See 'alignment'	54	Many stakeholder sessions have been organized, called Delta Ateliers, covering the whole country. Further preparations concerning project executions are ongoing, see 'alignment'
	On-ground results	5	See 'alignment'	4	Stakeholder involvement in basin implementation programs Preparations ongoing, see 'alignment'
	Policy impact	5	See 'alignment'	4	Preparations ongoing, see 'alignment'

Appendix 2 cont.

Principle 11: Managing trade-offs	Alignment	5	The DP approach is aimed to create solidarity between generations (do now what is necessary and avoid that they have to pay for present neglect) and regions (a major flood or drought will affect the entire Dutch society) . Regional strategies create coherence between rural and urban water management issues (e.g. drainage/storage of excess rainstorm waters)	5	The holistic, multi sectoral character of BDP is based on the Delta Vision and goals, which address water safety and security, food security and economic growth. The 7 involved ministries bring in there project proposals and measures which need to be prioritized and selected. The huge investment program claims a large part of GoB budget which cannot be used for other purposes. Besides, the international basins of the large rivers show transboundary problems and tradeoffs.
	Implementation	4	See 'alignment'	4	See alignment; this is preparations ongoing with respect to selection and prioritization of projects and financing.
	On-ground results	4	See 'alignment'	3	See 'alignment' , preparations ongoing
	Policy impact	4	See 'alignment'	4	Far more integrated focus; see 'alignment'
Principle 12: Monitoring and Evaluation	Alignment	5	The DP adopts an adaptive approach, which includes a 6 year evaluation interval to establish whether the implementation is still on track or whether external developments justify adaptation of the strategies (or policy goals). An independent Signal Group informs the Delta Commissioner on relevant external developments (like recently on a potential acceleration of sea level rise)	5	BDP follows Adaptive Delta Management (ADM) with 5 yearly updates in relation to the Five Year Planning cycle. Long term developments as well as program wise progress or troubles will be monitored and evaluated with a Result Based M&E system.
	Implementation	4	The first 6 year evaluation will be completed in 2020, results will be reported to Parliament in DP2021 September 2020, and, when approved, will be translated in the National Water plan.	4	The input to the recent 8 th Five Year Plan contains a Result Based Monitoring and Evaluation systems including elaborated targets and indicators. Preparations ongoing
	On-ground results	4	The first 6 year evaluation is performed by the regional and national steering committees, their conclusions are substantiated in so-called synthesis documents, which are reviewed (and qualified as 'up to standard') by independent external experts	4	Preparations ongoing
	Policy impact	5	When approved by the Parliament, the results of the first 6yr evaluation will become official policy in the National Water plan.	4	Involved ministries need to evaluate based on ADM and Result Based M&E

Principles of Adaptive Delta Management

1. Adopt a long-term approach, including a vision, scenario's and adaptive strategies to manage future uncertainties and to connect short term decisions with long term objectives;
2. Perform a holistic delta analyses of issues, challenges, knowledge gaps, with awareness of the need for multi sectoral planning and stakeholder involvement, explore opportunities for linkage between (public and private) investment agenda's on different sectors, levels and stakeholders;
3. Arrange institutionalized ownership and stimulate coherence;
4. Guarantee progress and financial and institutional continuity of implementation and updating

Table 1. Principles of Adaptive Delta Management (based on Bloemen et al., 2019; De Heer & Aartsen, 2019).

- | |
|---|
| <ol style="list-style-type: none"> 1. Allocate and distinguish roles and responsibilities for water management and foster co-ordination across these responsible authorities; 2. Manage water at the appropriate scale(s) (..) to reflect local conditions, and foster co-ordination between the different scales; 3. Encourage policy coherence through effective cross-sectoral co-ordination, especially between policies for water and the environment, (...) agriculture, spatial planning and land use; 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; 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; 6. Ensure that governance arrangements help mobilize water finance and allocate financial resources in an efficient, transparent and timely manner; 7. Ensure that sound water management regulatory frameworks are effectively implemented and enforced in pursuit of the public interest; 8. Promote the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders; 9. Mainstream integrity and transparency practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making; 10. Promote stakeholder engagement for informed and outcome-oriented contributions to water policy design and implementation; 11. Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations 12. Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public and make adjustments when needed. |
|---|

Table 2. OECD Principles on Water Governance (OECD, 2015)

The BDP 2100 delta vision is ‘Ensure long term water and food security, economic growth and environmental sustainability while effectively coping with natural disasters, climate change and other delta issues through robust, adaptive and integrated strategies, and equitable water governance.’

This long-term vision is translated into specific goals as basis for strategy formulation. The BDP 2100 proposes 2 higher level national goals set by the National Plans and 6 water, ecology and land use specific goals that contribute to these higher level goals.

Higher level goals:

- 1) Eliminate extreme poverty by FY2030;
- 2) Achieve upper middle income status by 2030;
- 3) Being a prosperous country beyond 2041.

BDP 2100 specific goals are:

- 1) Ensure safety from floods and climate change related disasters;
- 2) Enhance water security and efficiency of water usages;
- 3) Ensure sustainable and integrated river systems and estuaries management;
- 4) Conserve and preserve wetlands and ecosystems and promote their wise use;
- 5) Develop effective institutions and equitable governance for in-country and trans-boundary water resources management;
- 6) Achieve optimal and integrated use of land and water resources.

Table 3. BDP 2100 Vision and Goals. (Ministry of Planning, 2018)

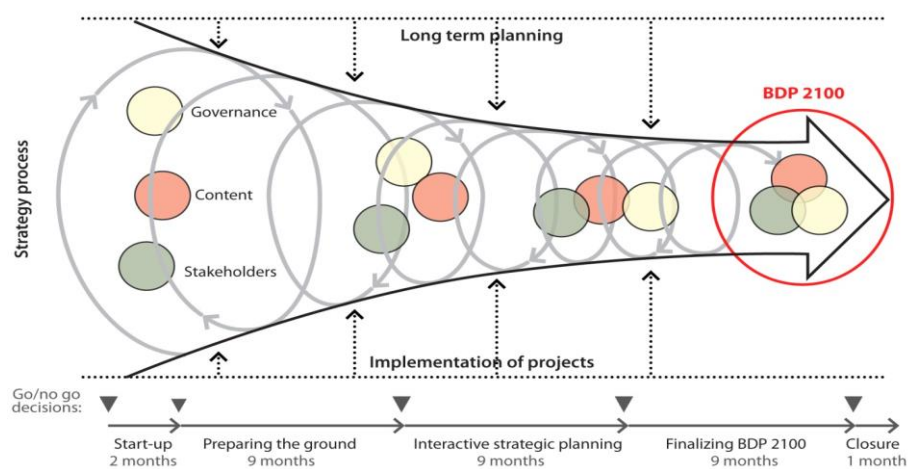


Figure 1.

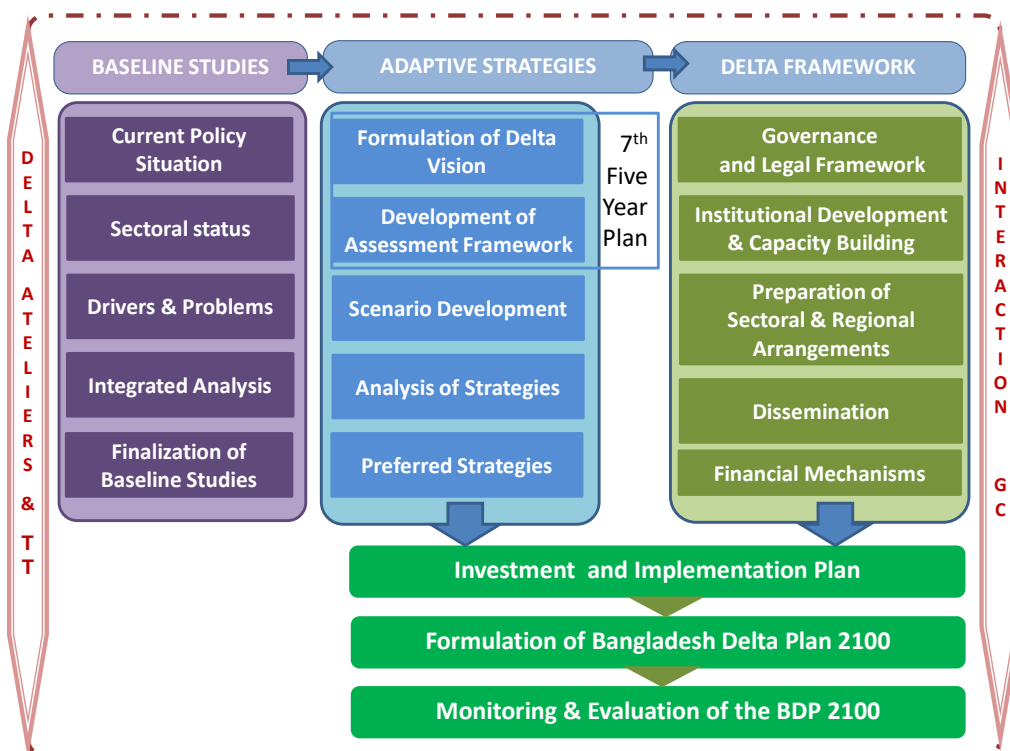


Figure 2.

Captions figures

Figure 1. Managing the interactive planning and learning process. (Ministry of Planning, 2018)

Figure 2. BDP 2100 process. (TT means Touch Tables; GC means Guiding Committees).