

IN THIS EDITION

Situated in a flood-prone delta, the Netherlands has a long history of successful water management underpinning its resilience and survival through the centuries. Given the need to adapt to the escalating threat of climate change, the country initiated a new Delta Programme. CLC spoke with the Delta Programme's Commissioner, Peter Glas, to learn how it integrates flood prevention, freshwater supply and spatial planning for climate adaptation and glean key lessons to achieve long-term resilience.



Figure 1: Windmill in the Dutch city of Leiden. Windmills were traditionally used to pump water out of polders into the rivers. Source: W. Bulach

The Delta Programme: The Dutch integrated approach to climate resilience

THE BEGINNINGS OF THE DELTA PROGRAMME

The Netherlands ('Lowlands' in Dutch) is situated in the low-lying coastal Rhine-Meuse-Scheldt delta region where major rivers discharge into the North Sea. Two-thirds of the country lies below mean sea level, and for centuries it was plagued by floods and inundation from rivers and seas. Despite these difficulties, the Dutch did not retreat from the delta, and fought against the odds to create modern-day Netherlands (Figure 2). This feat was largely possible through poldering—a process that involves progressively reclaiming land, building dykes to hold back seawater, or draining wetlands through windmills or other

technological means—to keep low-lying lands inhabitable and usable for agriculture.

Two large-scale flood disasters from the sea occurred in 1916 and 1953, inflicting heavy casualties and economic losses. The 1953 flood was especially devastating, leaving more than 2,000 casualties and flooding 9% of all farmlands. In response, the Dutch initiated what has been dubbed the First Delta Programme and implemented a series of groundbreaking coastal hydraulic engineering projects (Delta Works) to protect the delta region, which includes the Oosterscheldekering (East Scheldt storm surge barrier), the world's largest storm surge barrier.

The country's existential water challenges have persisted despite these measures. With rising global temperatures and carbon emissions in the 20th century, the Dutch have experienced higher water levels, heavier precipitation and increased flooding from riverine systems. Other challenges, such as increasing erosion of the sand dunes that serve as a natural coastal protection; rising sea levels (1 metre every 100 years); greater demand for spatial development; land subsidence (0.5 to 1.0 cm each year); frequent summer droughts; and salt intrusion, have also strained freshwater supply.

Given the increasing complexity of the challenges and conflicting needs of strengthening both flood prevention

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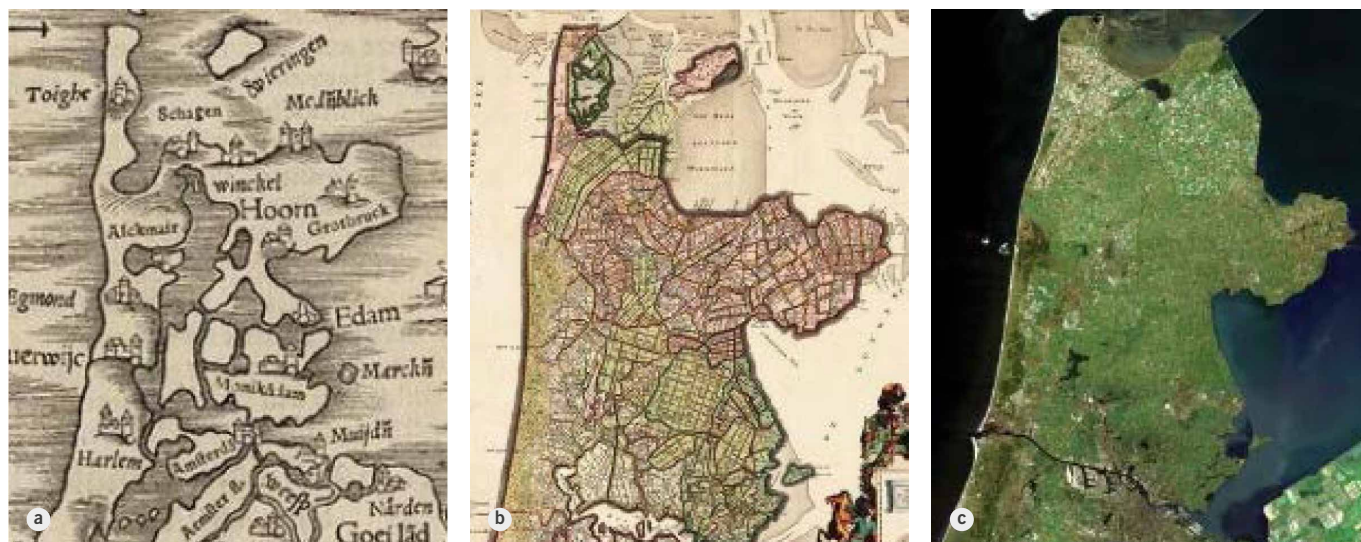


Figure 2: From left to right, (a) North Holland Region in 1580; (b) in 1700; and (c) in 2000. The Netherlands has grown in size through centuries of poldering and reclamation, with various land parcels becoming connected. Source: Delta Commission

and freshwater supply, the Second Delta Programme was inaugurated in 2007. The new Delta Programme re-invented the goal to integrate flood protection, freshwater supply and spatial planning to achieve long-term resilience against climate change. In 2012, the Dutch Parliament passed the Delta Act, which provided clear political backing, defined leadership roles and allocated funding (Delta Fund) to the new Delta Programme.

PLANNING FOR UNCERTAINTY AND TIPPING POINTS — THE DELTA PROGRAMME’S STRATEGY

Robust and flexible adaptive management

The Delta Programme recognises the uncertainty surrounding long-term climate change projections, which can render current interventions outdated and ineffective decades later. It relies on a strategy of adaptive management to ensure continued relevance of the

long-term plans by linking short-term decisions to long-term climate change, and keeping strategies flexible and ready to switch if the future scenario changes beyond defined “tipping-points”. This depends not only on climate change but also socio-economic parameters such as investment, population growth, land-use change and water demand (Figure 3).

According to Delta Programme Commissioner Peter Glas, these “tipping points” are thresholds, or acceptable risk levels, beyond which policy and management needs to improve or change, which can be determined by stakeholders or formalised by law. “We incorporate uncertainty into the planning programme, but we start now, we don’t wait for the future to happen,” Glas said via teleconference on 3 June. “What you do has to be both robust and flexible. It sounds contradictory, but we think it can be done”.

A key to adaptive management is the iterative process of monitoring, research,

and re-calibration of existing strategies (Figure 4). A “Monitoring, Analysing, Acting” method is used, where the Programme determines whether plans are still on schedule and achieving the desired goals; if past decisions should be adjusted based on new developments; if challenges are being tackled in an integrated manner; and if a wide range of stakeholders are participating. The decisions and preferential strategies that are used to direct implementation are systematically reviewed every six years and updated if necessary.

Also intrinsic to this process is the strong emphasis on science-based decision making. The act of re-calibrating strategies, decisions and plans is predicated on new and better information being made available through research. The Programme taps on a wide knowledge base, involving research institutes like Deltares and universities. It also constantly invests in knowledge and investigates new aspects

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of water management. For example, in 2019, the Sea Level Rise Knowledge Programme was set up to focus on the impact of rising sea levels on flood risk management and freshwater supply. This study considers a wide range of potential systems affected by these impacts, including the economy, agriculture, land use, nature and ecology. It even explores potential actions to be taken for a period beyond 2100.

Long-term, integrated, and multi-layer planning

Planning for the long-term is integral to the Programme since the impacts of climate change will occur over decadal timescales. The Programme, therefore, has a 2100 planning horizon, while aiming to ensure that the country will be climate-proof and water-resilient by 2050, with standards and guidelines to be progressively implemented under its supervision.

The Programme focuses on integrated master planning that combines flood risk management, freshwater supply and spatial planning. Where feasible, the integrated approach links flood protection to spatial development along the coastal region, with the objective of maintaining a safe, attractive and economically strong coastline. These efforts require an effective governance framework that coordinates across different levels of government, businesses, researchers and the community. To foster this multi-stakeholder collaboration, all stakeholders involved embrace three core values—Solidarity, Flexibility and Sustainability—as mutually-binding beyond dispute to guide the organisational and collaborative processes.

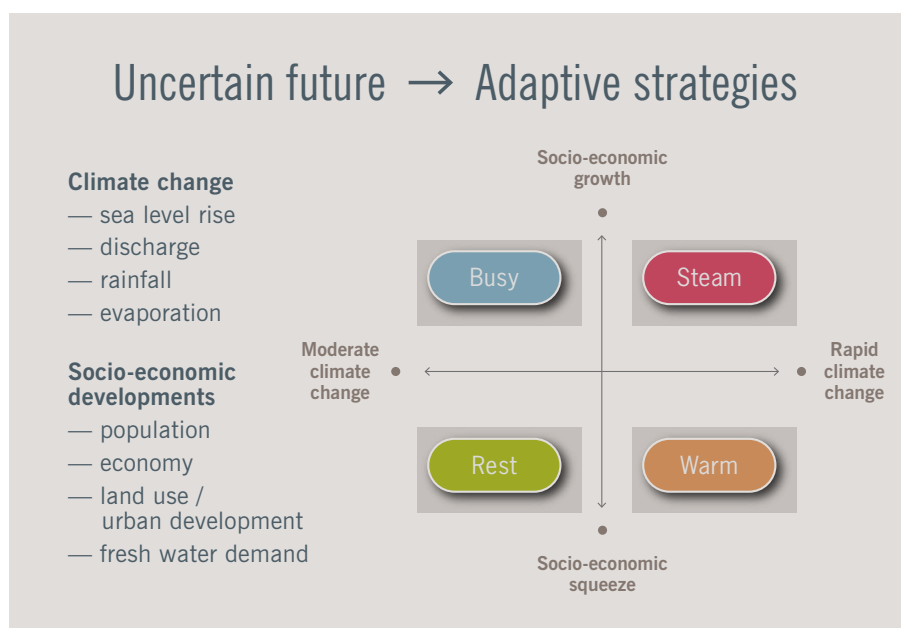


Figure 3: General adaptive strategies based on climate change and socio-economic parameters.
Source: Delta Commission

Strategies used in the Planning Process

- 1/ **Starting now**
 - Monitoring changes
 - Increasing knowledge
- 2/ **Scenarios show us 'tipping points'**
- 3/ **Check robustness and flexibility of strategies**
- 4/ **Adaptive delta management**



Figure 4: Strategies used by the Delta Programme to incorporate uncertainty into the planning process.
Source: Delta Commission

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Instead of a traditional engineering definition of “coastline protection” that merely focuses on defending physical land area and infrastructure, the Dutch take a human and community safety approach to floods, focusing on prevention, flood-resilient spatial planning and crisis management (Figure 5). A risk-based approach is applied when designing flood defences such as dykes, dunes and storm surge barriers, by considering both the likelihood and severity of any failure and reducing the chance of an individual dying from a flood in any given year to less than 0.001%. Flood-resilient spatial planning is used to reduce the damage of flooding to critical assets, while crisis management and emergency response plans are prepared to reduce the loss of lives in the event of a disaster.

Where possible, the Delta Programme pushes for the preferred strategy of “Building with Nature”, where natural systems, processes and materials are used to meet society’s need for multipurpose infrastructure, thus combining flexibility and sustainability. The Sand Motor on the Delfland coast to combat coastal erosion is one such example.

In 2011, 21.5 million m³ of sand was deposited to form a 128-hectare peninsula. This single deposit would gradually spread along the coast by wind and hydrodynamics to nourish the beaches and seabed, eliminating the need for multiple replenishments. This was enabled by detailed simulation modelling to predict the movement of the sand, which is expected to last 20 years.

The “Room for the River” design plan to address flood protection is another example. Instead of building higher and higher inflexible dykes, the programme looks to improve the ability of landscapes around rivers to act as natural sponges

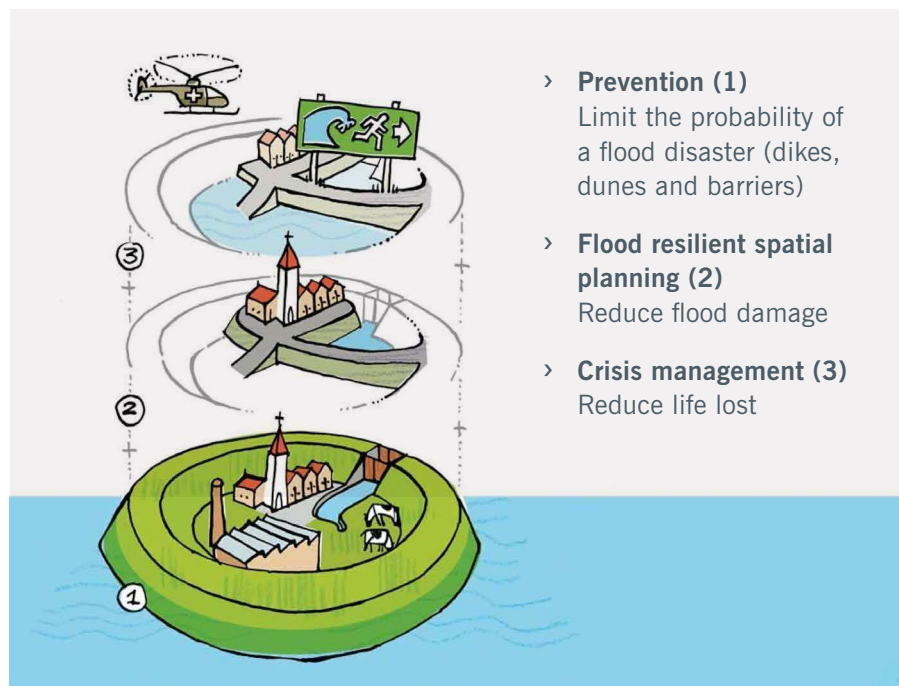


Figure 5: A multi-layered approach to flood management. Source: Delta Commission

in the event of a flood, to reduce risk. According to Commissioner Glas, “Room for the River is a new phase of not constraining the rivers, but actually widening the former floodplains, giving that back to the river”.

FOSTERING AN ECOSYSTEM OF GOVERNANCE

Dealing with hard truths, convening with soft power — The role of the Delta Commission

The Delta Programme Commission enjoys a unique position. Unlike ministries and statutory boards, it holds no executive power. Yet, it wields a great deal of ‘soft power’ and is empowered by national legislation (the Delta Act of 2012) to work with multiple levels of stakeholders, including the ministries, provincial and municipal governments as well as the regional water boards that manage barriers and waterways.

The Commission sits on a solid financial foundation, administering the dedicated ring-fenced Delta Fund. Its average annual budget of 1.3 billion euros (S\$2 billion), allocated through 2032, ensures sufficient funds to implement measures to meet the national goals of water and climate resilience over time.

The Delta Programme’s governance model—working collaboratively with administrative bodies and engaging society—is instrumental in ensuring an impartial process of strategy formulation, agency coordination, and garnering public trust and support.

“It’s not a blueprint, it’s not an engineering solution—it’s an ecosystem,” Glas said. “Values and concepts are important, and you have to go through the phase of agreeing what the values are”.

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Regional and multi-stakeholder approach

Multi-stakeholder collaboration is crucial for the Delta Programme's success (Figure 6).

“We are all servants to the inhabitants of our countries,” Glas said. “So, stakeholders are the businesses, NGOs, the inhabitants. They have to live, they have to work [in the Netherlands]...So you need to cooperate across levels and across stakeholders”.

To foster multi-layer communication and sharing, the Delta Programme holds an annual Delta Conference of stakeholders, researchers and community members. Plenary sessions assemble representatives of government, industrial associations and civil society to discuss broad issues covered by the Delta Programme. Breakout sessions cover topics such as science, technology and management solutions in more detail, eliciting participation from a wide range of stakeholder interest groups.

By inviting businesses to play an active role in water management, the Delta Programme further strengthens the Netherlands' reputation as a global hub of expertise in the field. Technical expertise and effective organisational frameworks have become export products in themselves, attracting worldwide interest. This has also translated into the growth of knowledge enterprises and ongoing innovation, including integrated software and IT solutions for spatial planning, risk assessment and modelling, and water management.

COLLABORATIVE AND INCLUSIVE DECISION-MAKING

A collective endeavour for joint fact-finding

The Delta Programme owes its success in part to the Dutch culture and mentality

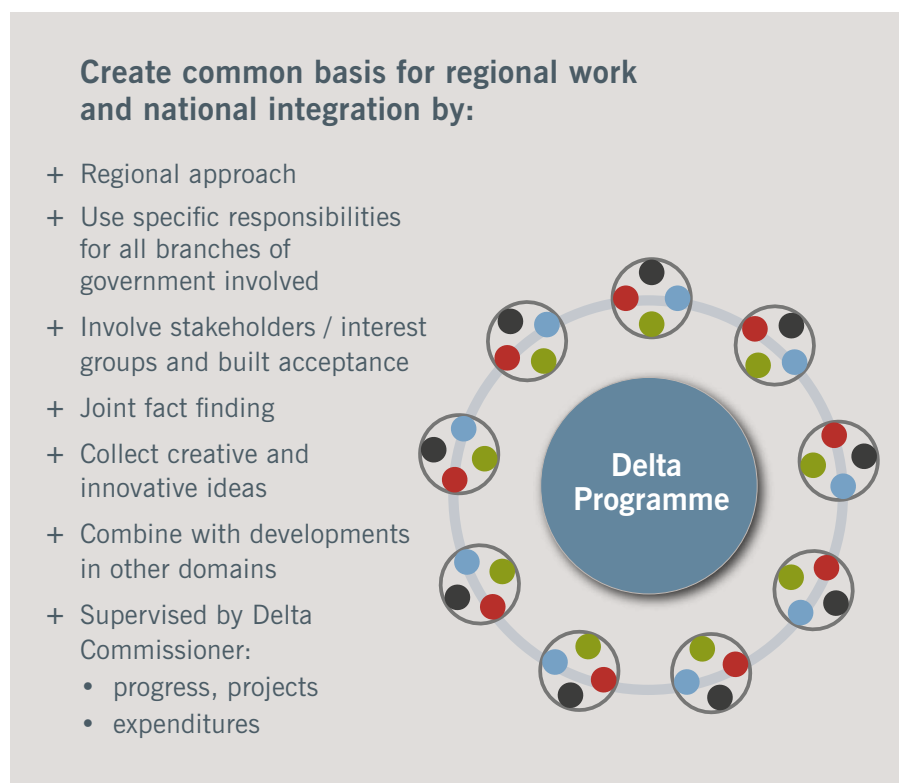


Figure 6: Multi-layer co-operative governance that is key to the Delta Programme's success. The small colored dots represent ministries, provinces, municipalities and regional water boards. Source: Delta Commission

developed through centuries of living with flooding.

In the Netherlands, water management—not just flood protection, but also water provision—is by and large a public affair and a collective endeavour. Infrastructure development is controlled by the government with a fixed portion of national revenue set aside for it each year. Obtaining public buy-in is generally not a challenge if the decision-making process is inclusive and transparent.

“There is a general awareness that being a delta comes with existential hazards and risks,” said Glas. “Working on dykes and flood defences is a no-brainer...it needs to continue, and money needs to be spent” on it.

The typical Dutch decision-making process involves a joint fact-finding phase, or a dialogue process involving problem analysis, review and open discussion of all possible strategies. Through this multi-level framework, the Delta Programme has developed a holistic, collaborative approach where people from different organisations and different levels are represented to contribute their local, sector-specific knowledge, to arrive at a joint vision and well-informed strategy.

“If you skip [joint fact-finding], in the end, it will become political and things will start to deviate rather than maintaining focus...[and] collect creative and innovative ideas,” Glas said. “Science doesn't have all the

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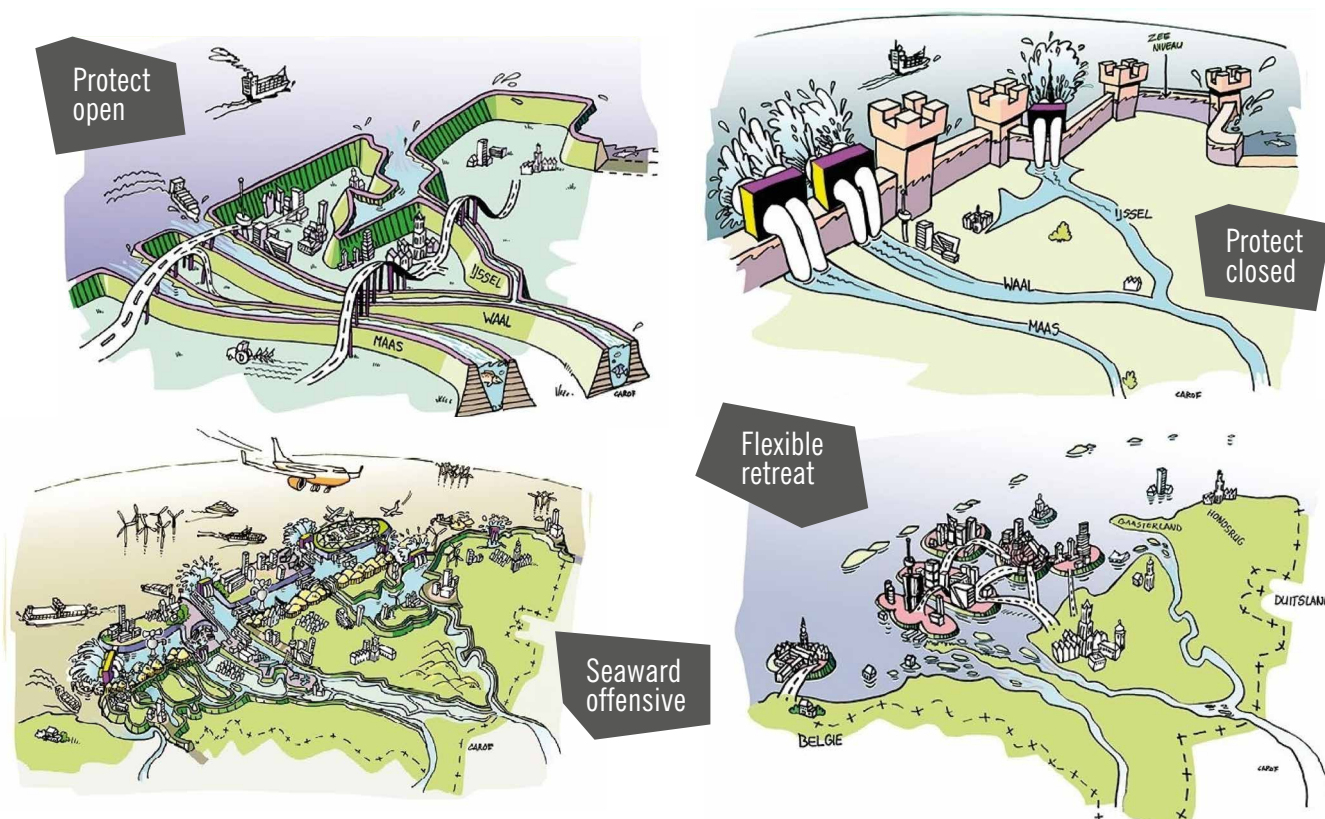


Figure 7: Cartoons depicting general nation-wide adaptation concepts against sea level rise. Source: Delta Commission

ideas. Sometimes the farmer knows his land better than any scientist. It [also] broadens the basis of acceptance by the people if things have to change in their local community and environment, if they are involved from the onset.”

Poldering: Building consensus begins with values

The Delta Commission’s collaborative decision-making process starts with an agreement among stakeholders on values, followed by science, modelling and analysis, before arriving at the strategy and solution.

This inclusive process resonates with the Dutch concept of “poldering”, where people sit around a table and talk openly until they reach full agreement. Additionally, implementing bodies—be they national, provincial or municipal governments—can only receive Delta Fund subsidies when there is complete agreement among all stakeholders. This incentivises them to come to an agreement. As Commissioner Glas put it: “If you speak with one voice, you get the money.”

This “broad consensus” model of decision-making requires creating

an ecosystem that includes all the stakeholders working collaboratively, based on the core values of Solidarity, Flexibility and Sustainability. Stakeholders from different sectors, representing a wide variation in education, capacity and training are incorporated in the process as local knowledge is valued alongside expertise. There is wide appreciation throughout the world that this coordinated and consensus-based approach of the Delta Programme leads to holistic strategies and decision-making, which helps the Netherlands to arrive at a coherent, long-term masterplan.

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TRANSLATING DUTCH PRINCIPLES INTO A GLOBAL GOVERNANCE MODEL FOR RESILIENCE

The Delta Programme exemplifies both a successful governance model and a collaborative process. Faced with the complex challenge of climate change, the programme forged resilience through integrated planning as well as whole-of-society decision-making. While the approach is largely attributed to the unique 'poldering' culture of the Dutch, its key principles can be applied worldwide to develop consensus-based policies. They include developing broad agreement around a vision, forging an integrated planning approach with multi-stakeholder collaboration, and in particular, engaging communities in inclusive dialogues about values right from the start.

These principles have been successfully adopted in other countries, most notably the United States. After its northeast region was devastated by Hurricane Sandy in 2012, the Department of Housing and Urban Development launched Rebuild by Design (RBD) to build forward-looking resilience beyond conventional disaster relief. This new public-private framework was inspired by the Dutch, and brought together multiple business, finance, knowledge and civil institutions. Expertise across different industry sectors was convened in a multi-stage design competition with well-structured collaborative research and community engagement processes



Figure 8: The essence of Dutch poldering – Hearing the voices of all stakeholders, and getting them to work collaboratively to forge climate resilience Source: Amsterdam Rainproof Programme

similar to the Delta Programme's 'joint fact-finding'. The result: solutions that went beyond conventional engineering measures. The consultants came up with integrated blue-green infrastructure plans on climate adaptation, such as Hoboken's "Resist, Delay, Store, Discharge" and nature-based engineering solutions including Staten Island's "Living Breakwaters". These alternative designs promised multiple benefits beyond protecting against the next storm, while preserving the unique heritage and identities of the places.

More recently, the same approach was adopted in the San Francisco's Bay Area challenge, "Resilience by Design". This was triggered by the city's vision to develop broader resilience against sea level rise and other long-term challenges.

It brought about projects such as the South Bay Sponge, a regional 'sponge city' concept masterplan that proposes varied land use typology and density for the highly urbanised Silicon Valley districts. The design consortium further identified opportunities for a new framework of cooperation and coordination across cities and jurisdictions, as well as public-private partnerships to invest collectively in the implementation of future projects.

Such innovative programmes showcase how the Dutch experience can be translated to other contexts around the world, be it in low-lying coastal deltas, cities on the water or island-states with critical infrastructure and vulnerable communities.

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