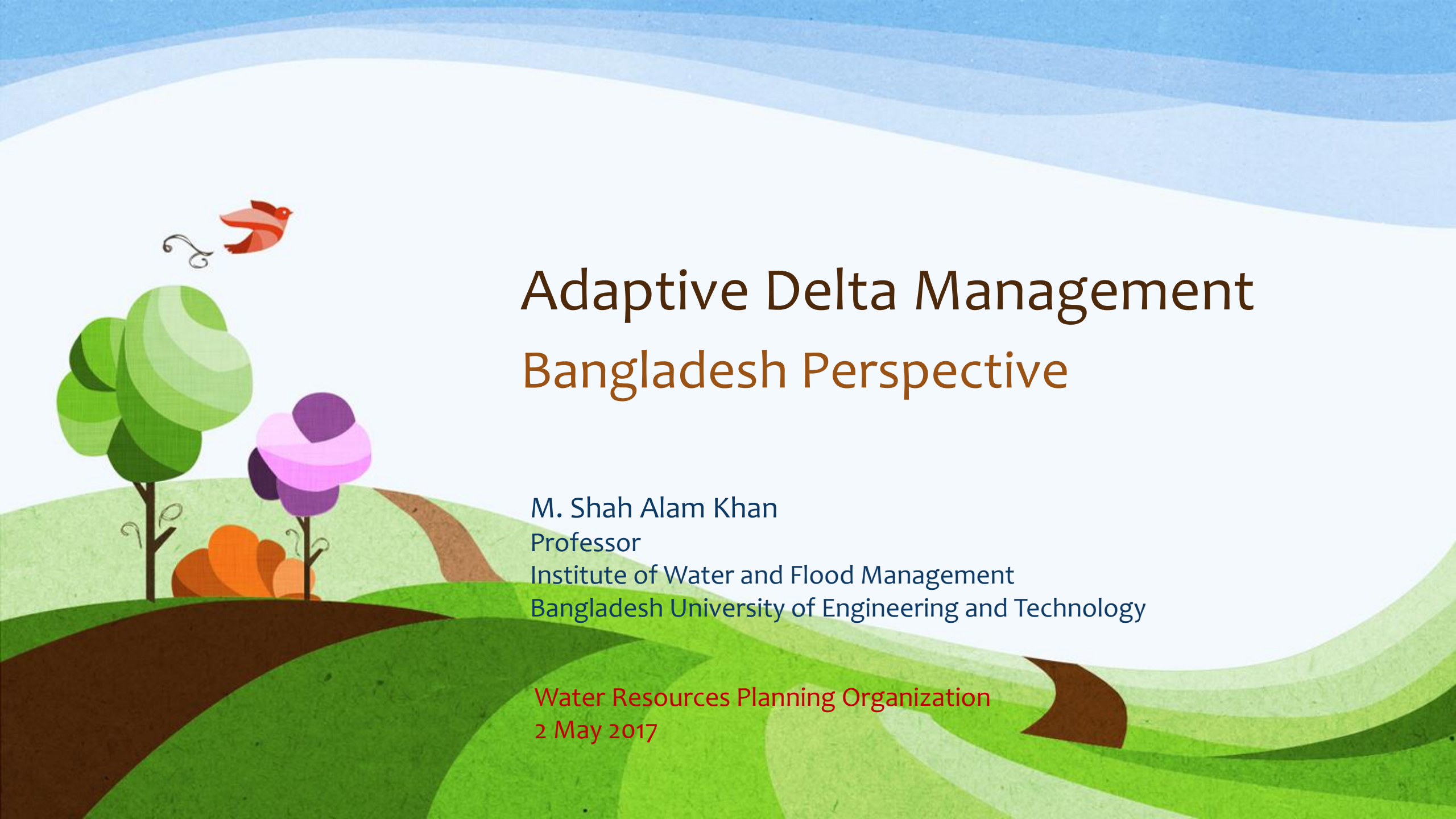

Adaptive Delta Management

Bangladesh Perspective

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Outline

- Background and evolution of ADM
- ADM concepts and principles
- Operational tools and methods
- Bangladesh context

Background of ADM

- Adaptive Management (AM)
  - in the US in the 1990s to support **natural resource management** policy
  - based on **learning** from the outcomes of management actions, **accommodating** change, and thereby **improving** management.

- AM ensures that
  - (i) **uncertainty** is acknowledged and 'information gaps' are identified,
  - (ii) there are good **prospects for learning** and experimenting in order to **narrow down information gaps** over time, and
  - (iii) the socio-economic and physical changes warrant to **adjust management directions** (interventions) as a consequence of lessons learnt.

- Growing interest in AM in river restoration/flood management programs:
  - Mississippi River Basin, Colorado River and Colombia River Basin.
  - **Thames Estuary project (TE2100)** and the **Dutch Delta Program**.

Background of ADM

- Challenges of AM implementation:
  - **institutional constraints** and lack of **leadership** in implementation
  - lack of stable (long-term) **funding and resources**
  - reluctance to admit and **embrace uncertainties** (beyond 'traditional' practices) in making policy choices

- To overcome these challenges, **three enabling elements** are necessary:
  - (i) a system approach,
  - (ii) participatory decision making, and
  - (iii) learning and experimentation (flexibility and adaptability).

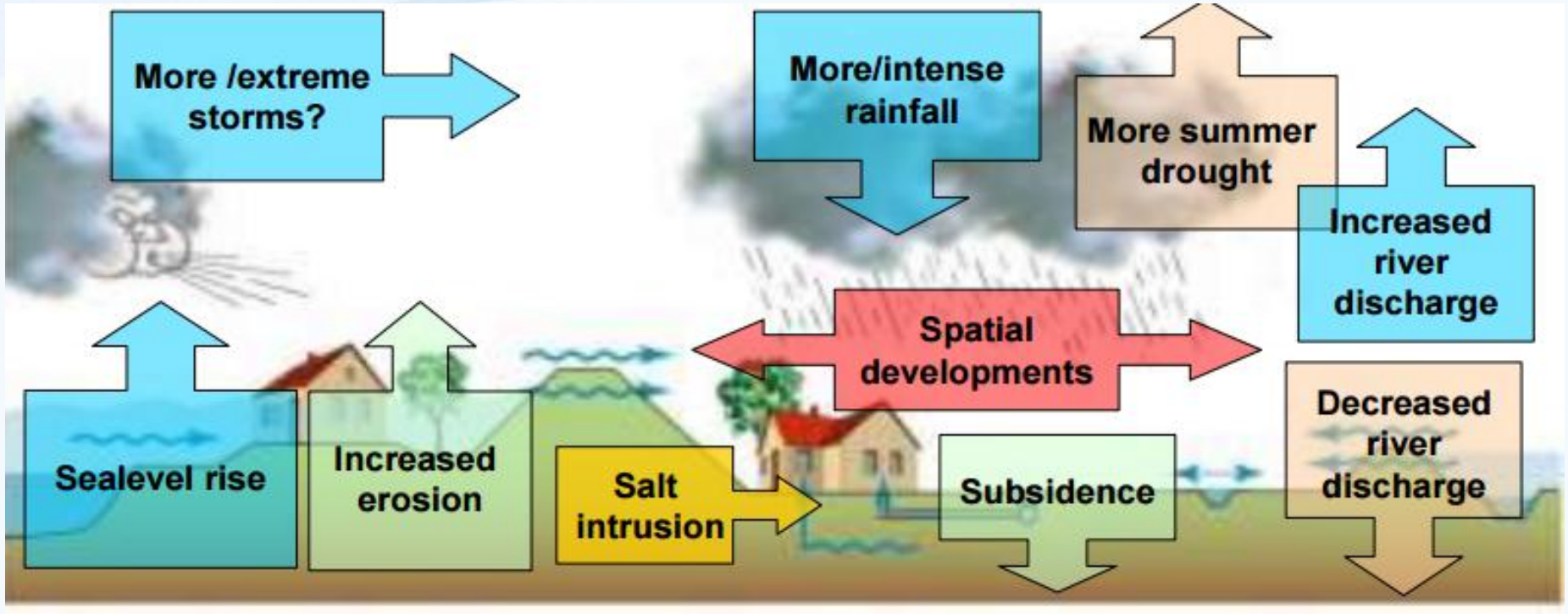
- In addition, **continuity in implementation** has to be provided by **institutional arrangements** on leadership, funding and legal aspects.

Background of ADM

- **TE2100:**
  - started in 2003, one of the first to propose an **adaptive approach** to manage flood risk based on the principles of AM
  - aims to **protect London and Thames Estuary** from tidal flooding and proposes a series of possible interventions until 2100
  - has been instrumental for decision makers to understand the **options and 'decision pathways'**

- **Dutch Delta Program:**
  - inspired by TE2100 adaptive approach, adopted **Adaptive Delta Management** (ADM) to deal with the difficulties of anticipating **climate change and socio-economic developments**
  - in the initial years (2010-2014) delivered **five** major '**delta decisions**' and **six regional adaptive strategies**
  - in the **coming decades** the emphasis will shift towards further **elaboration** of the **adaptive strategies** and **implementation** of the measures

Background of ADM : Delta Challenges



- Globally, Delta Countries face common **problems** and **challenges**
- Need a **holistic** and **adaptive 'no regret'** plan to **deal with the challenges** for achieving **sustainable development**

Adaptive Delta Management

… a structured, **iterative process** of **robust decision making** in the face of **uncertainty**, with an aim to reduce uncertainty over time via system **monitoring**.

Adaptive Delta Management

- Accepts that the **future is deeply uncertain**

  e.g., Climate change, Socio-economic development, Urbanization, Vulnerability, Social norms and acceptance

- Instead of making a '**best**' prediction and **developing a plan** for that future,

  ADM asks:

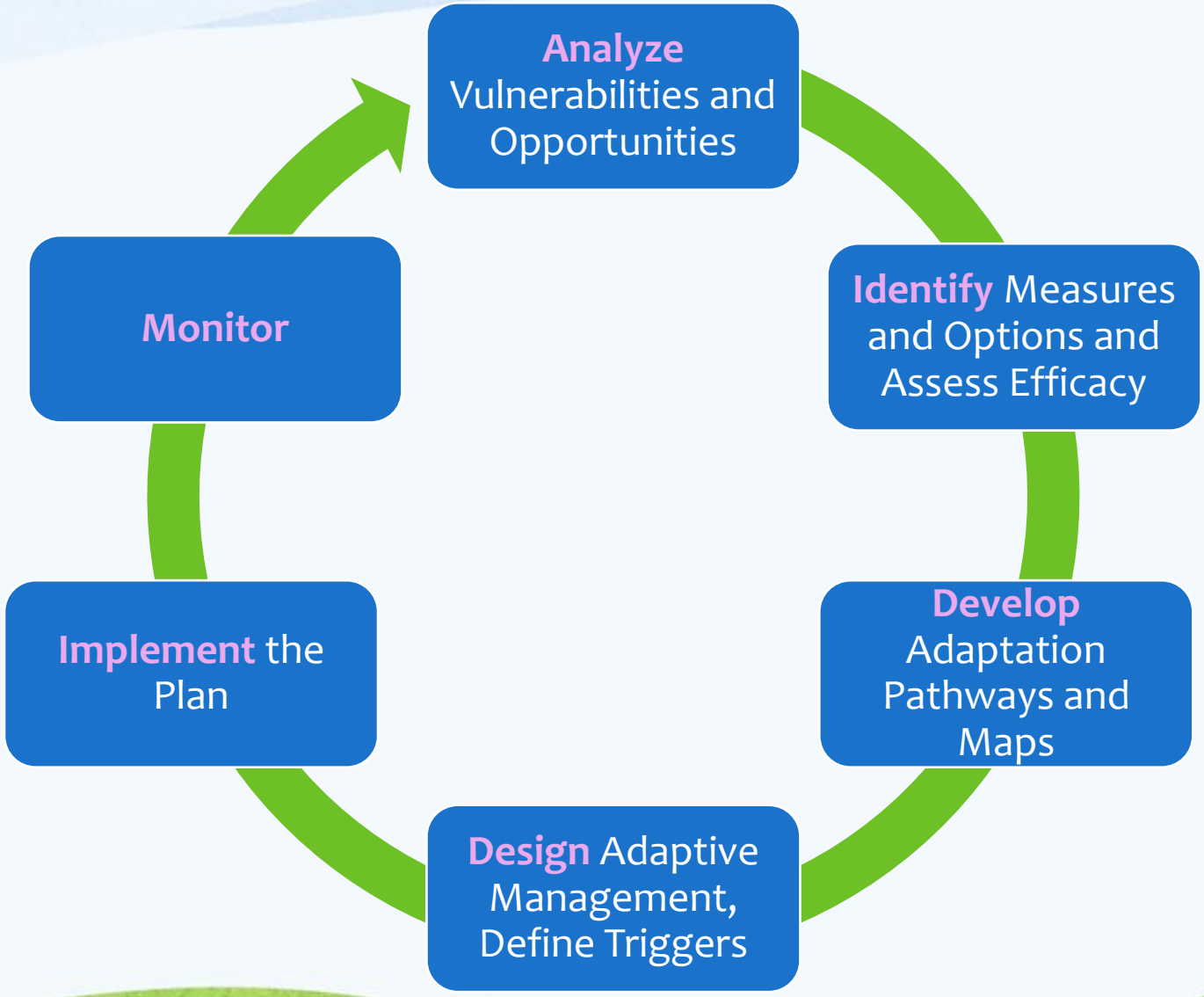
  What *could* happen in the ***future***, and what can we do ***now*** to achieve our goals, regardless of how the future unfolds?

Dealing with uncertainties is the key issue:
✓ 'what to do and when to do it?'
✓ 'not too much, not too little'
✓ 'not too early, not too late'

Adaptive Delta Management

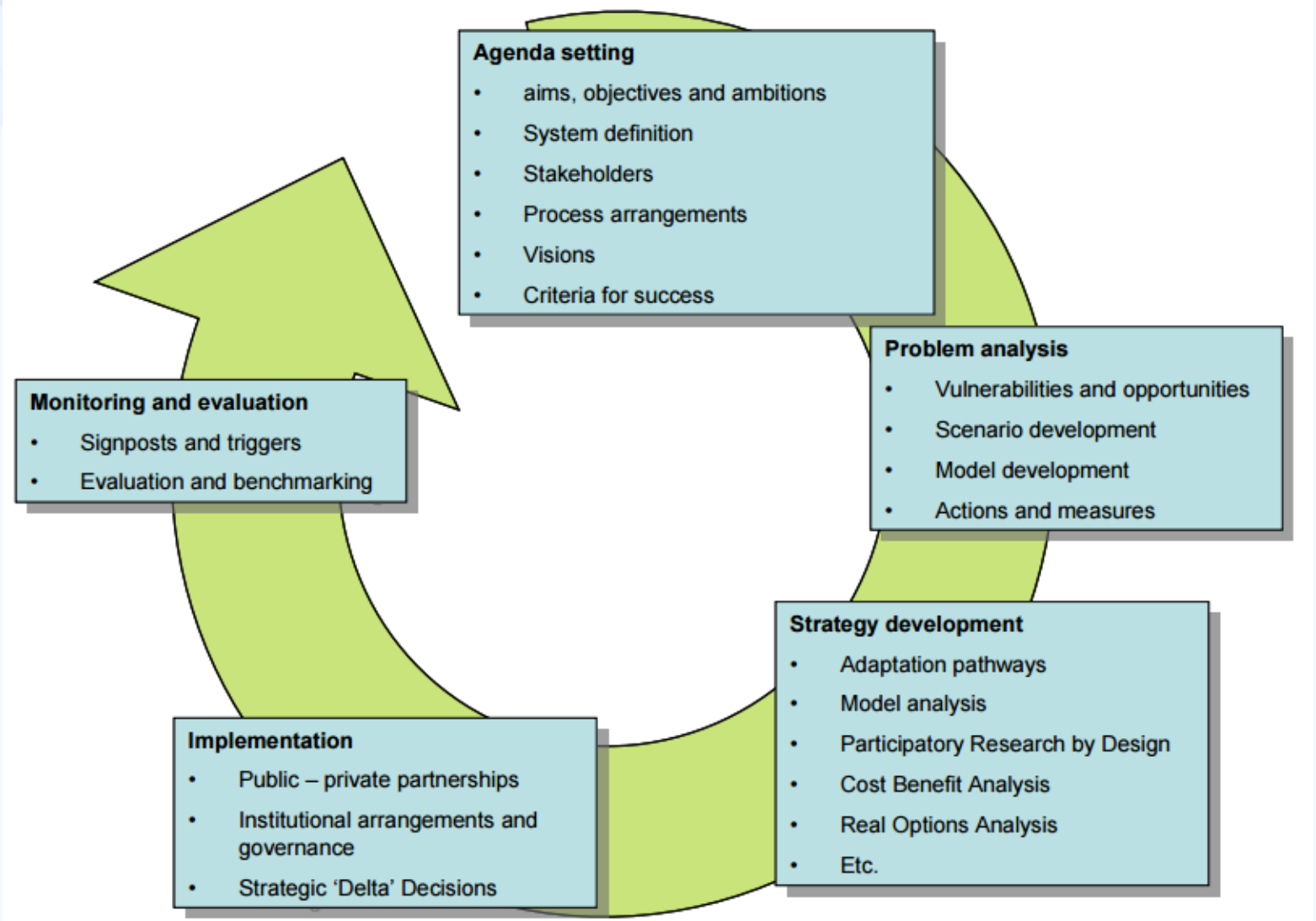
- **Deals with uncertainties** in a transparent and sensible way **to support decision making** with regard to water policy, planning and infrastructural investments
- Connects **short-term targets** and **long-term objectives**
- Combines **water management** with plans for **regional development**
- Builds further upon **IWRM experience** in developing and developed countries
- Looks for policies/strategies that will perform well under a wide variety of futures (‘**robust policies**’)

Adaptive Delta Management Cycle



(adapted from Haasnoot et al., 2013)

Adaptive Delta Management Cycle



ADM can be seen as a cyclic process; each step contains new elements, such as long term scenario building, adaptation pathway development, signposts, triggers, etc.

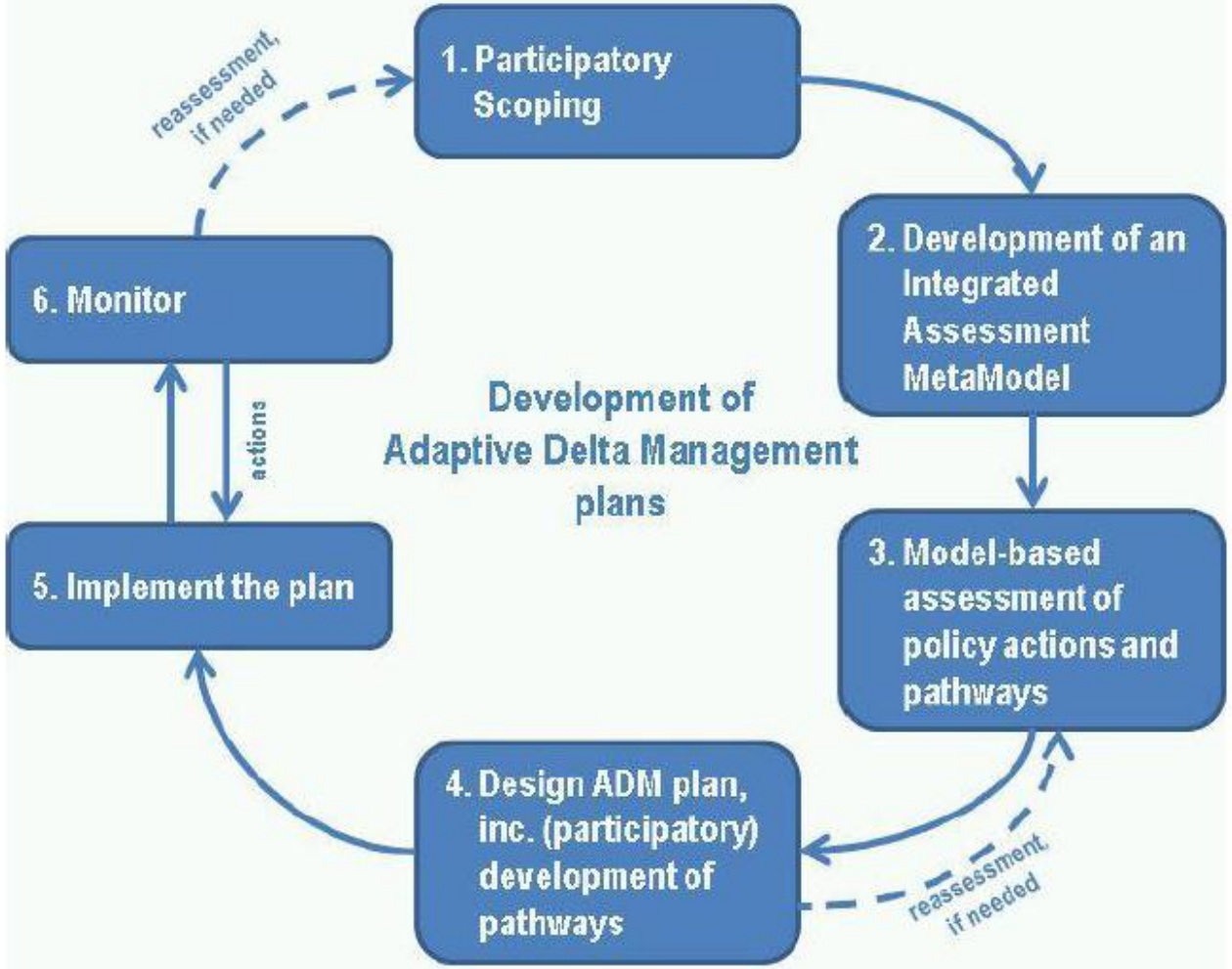
An approach for Adaptive Delta Management

Dynamic Adaptive Policy Pathways (DAPP)

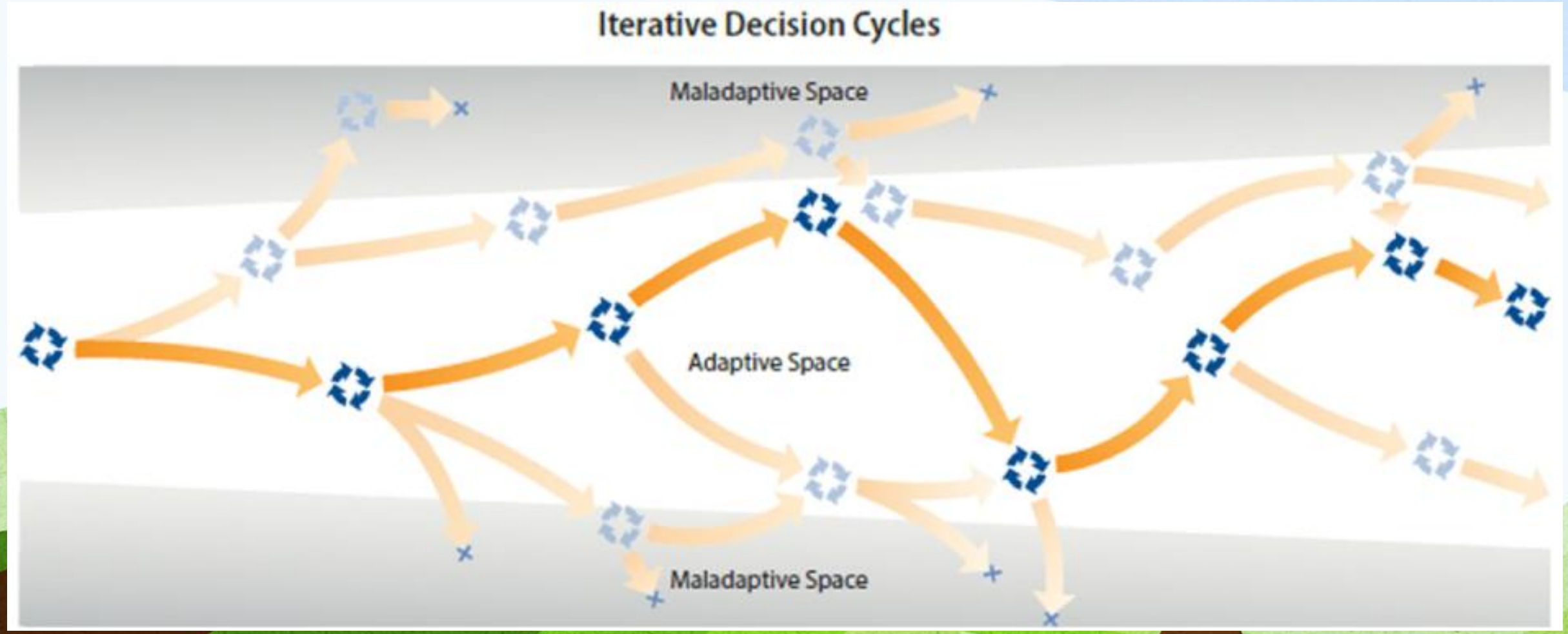
Adaptation is a path - The **end point** is not only determined by what is known or **anticipated** at present, but also by what will be experienced and learned when the **future unfolds**, and by the **policy responses** to events.

Different paths leading to the **same destination**

Dynamic Adaptive Policy Pathways



The Dynamic Adaptive Policy Pathways approach (simplified from Haasnoot et al., 2013)

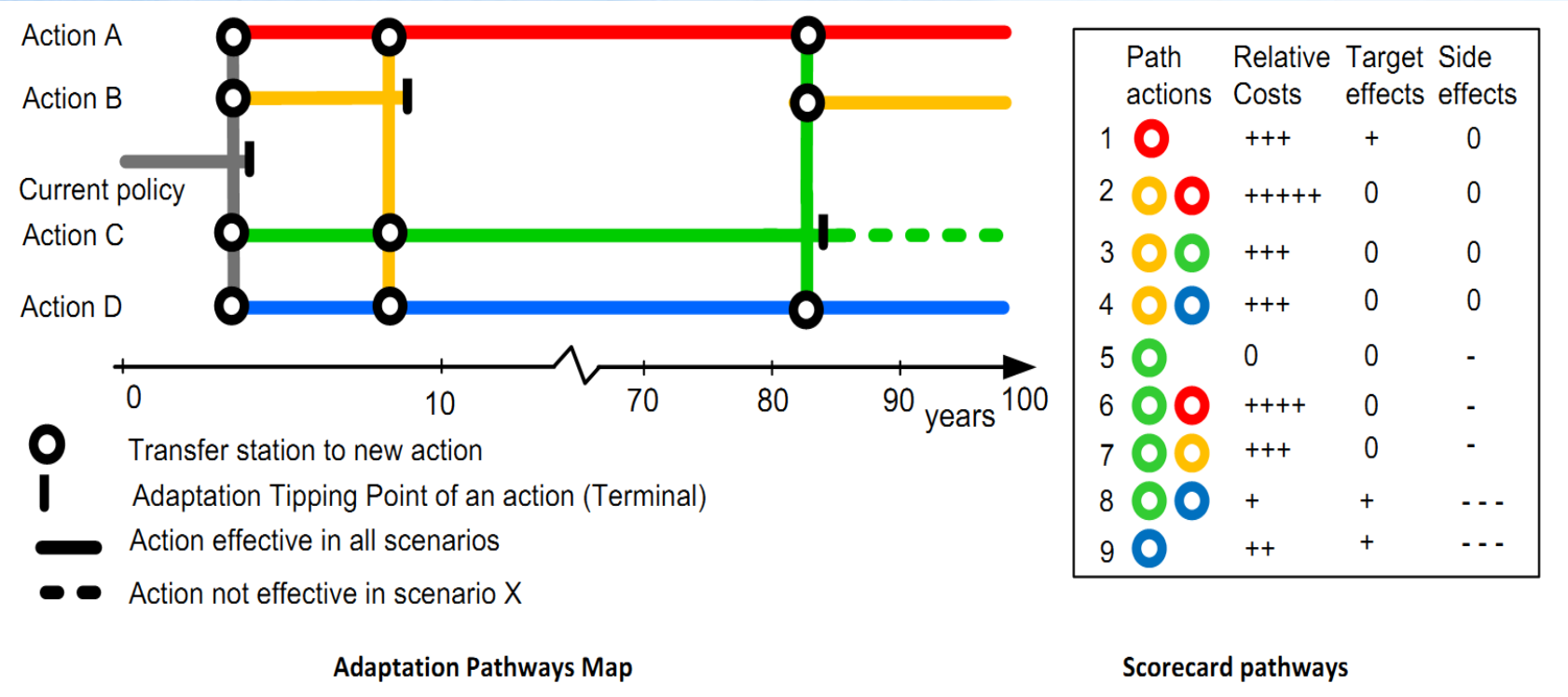


Wise et al. (2014) Glob. Env. Change. 10.1016/j.gloenvcha.2013.12.002

Adaptation pathways describe a **sequence of policy actions or investments** in institutions and infrastructure over time to achieve a set of pre-specified **objectives** under uncertain changing conditions,

and are part of a **policy** and planning **framework** (e.g. DAPP*) that ensures **evaluation** of costs and benefits and **monitoring** to track both implementation and changing conditions.

*Haasnoot et al. (2013) Glob. Env. Change. 10.1016/j.gloenvcha.2012.12.006



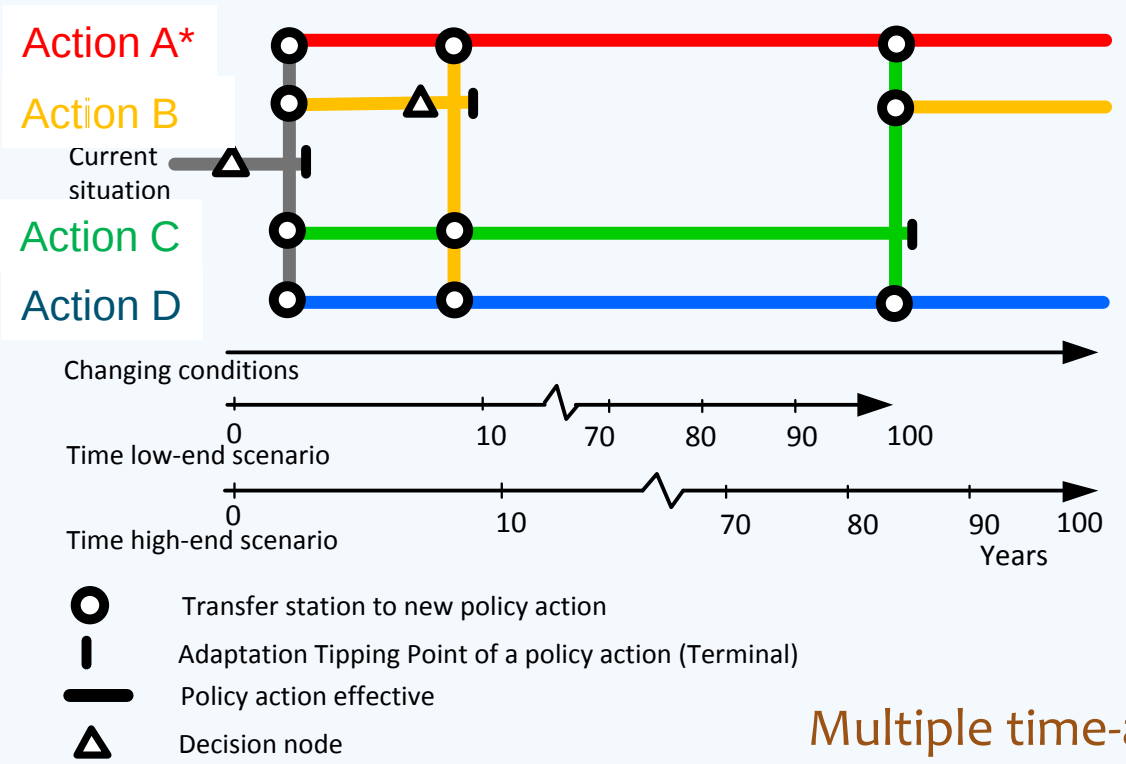
Adaptation **Tipping Points**: conditions at which a policy begins to perform unacceptably

Adaptation **Pathways**: a sequence of policy actions

Haasnoot et al. (2013). 10.1016/j.gloenvcha.2012.12.006

An adaptation pathways map shows **different possible sequences of investment decisions.** A scorecard helps to evaluate the pathways and potential decisions.

Adaptation Pathways Map



Costs and benefits of pathways

Time horizon 20 years

Time horizon 50 years

Time horizon 100 years

Pathway	Costs	Benefits	Co-benefits
1	+++	+	0
2	+++++	0	0
3	+++	0	0
4	+++	0	0
5	0	0	-
6	++++	0	-
7	+++	0	-
8	+	+	- - -
9	++	+	- - -

Pathways that are not necessary in low-end scenario

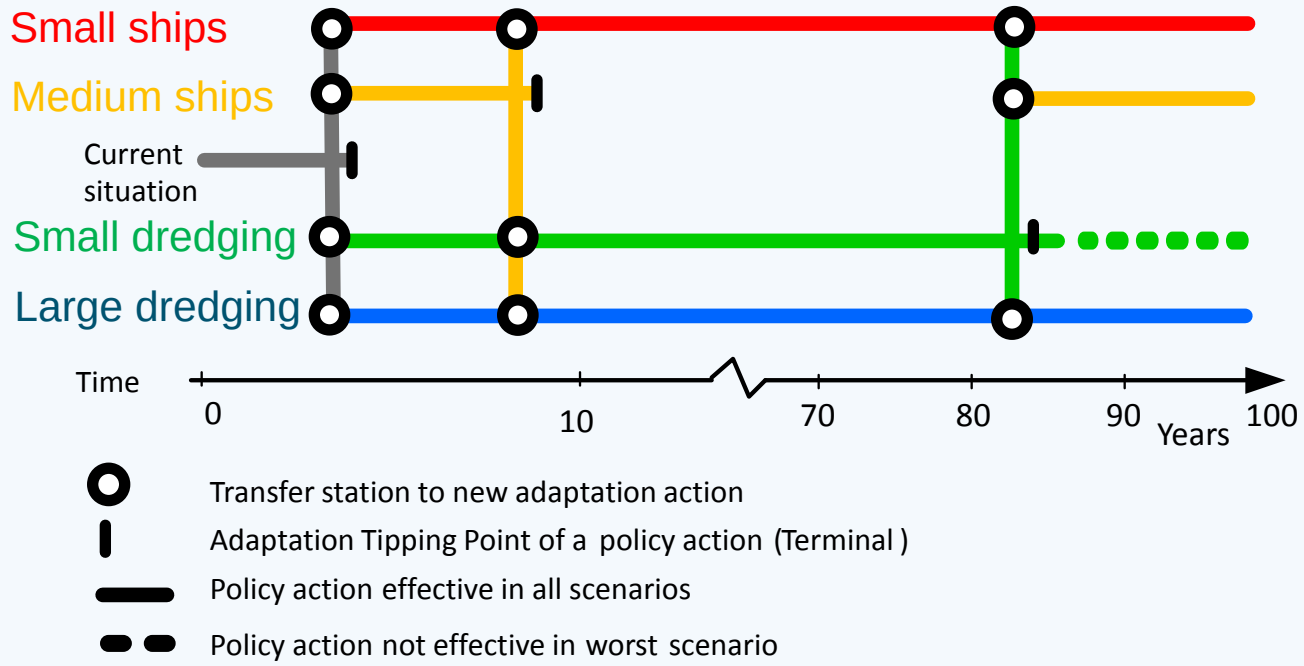
Multiple time-axes show uncertainty in moment of ATP

* single action or portfolio of actions

Haasnoot et al. (2012). Clim. Change.; Haasnoot et al. (2013) Glob. Env. Change. 10.1016/j.gloenvcha.2012.12.006

Example: Adaptation Pathways

How to keep a river navigable in a changing environment that may result in lower water levels in the river?



Scorecard for Pathways

	Path actions	Costs	Target effects	Side effects
1		+++	+	0
2		+++++	0	0
3		+++	0	0
4		+++	0	0
5		0	0	-
6		++++	0	-
7		+++	0	-
8		+	+	- - -
9		++	+	- - -

Haasnoot et al. (2012). Clim. Change.; Haasnoot et al. (2013) Glob. Env. Change. 10.1016/j.gloenvcha.2012.12.006

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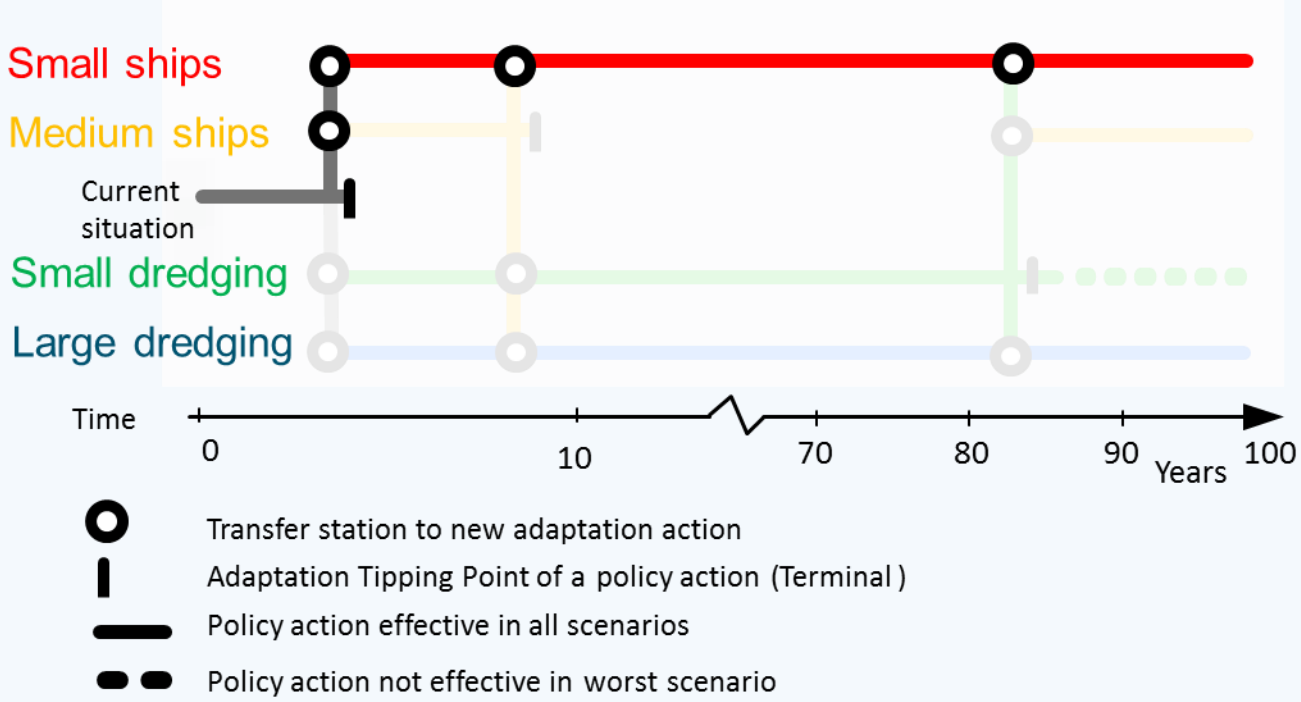

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6		++++	0	-
7		+++	0	-
8		+	+	- - -
9		++	+	- - -

Haasnoot et al. (2012). Clim. Change.; Haasnoot et al. (2013) Glob. Env. Change. 10.1016/j.gloenvcha.2012.12.006

Example: Adaptation Pathways

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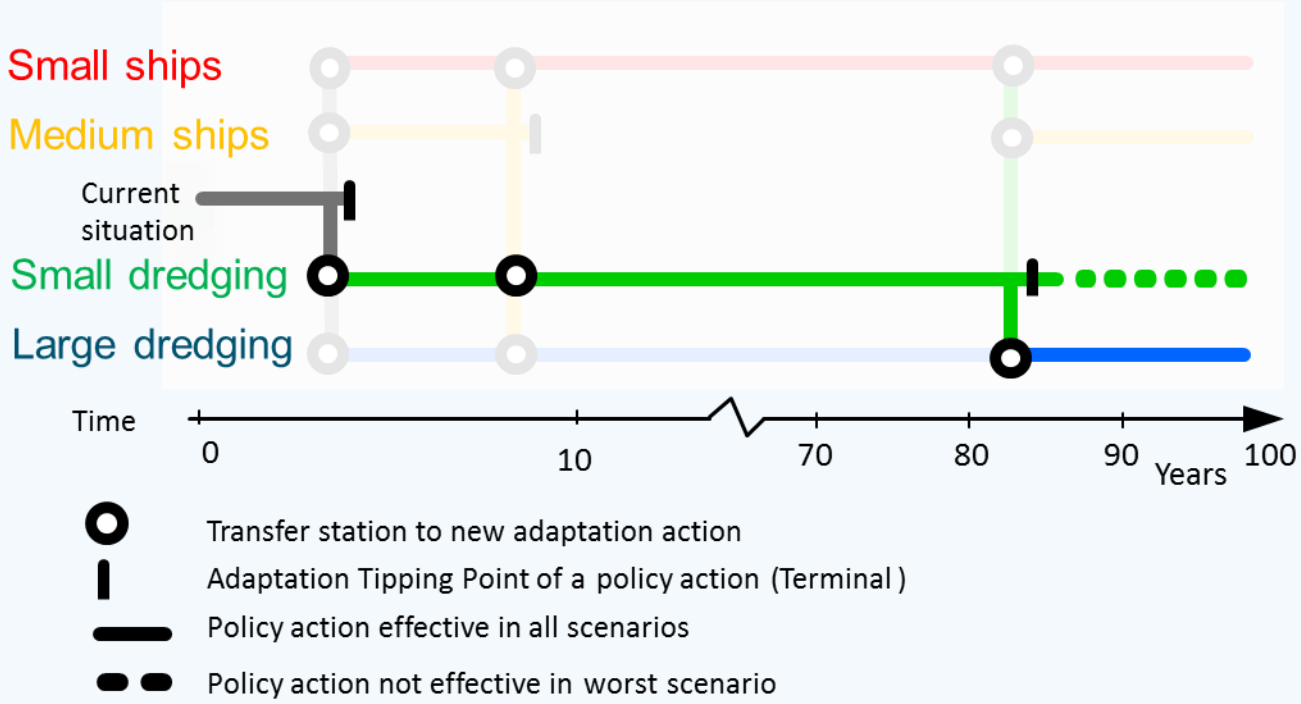

Scorecard for Pathways

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5		0	0	-
6		++++	0	-
7		+++	0	-
8		+	+	- - -
9		++	+	- - -

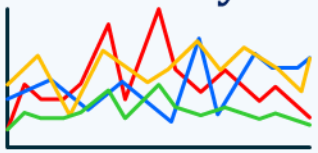
Adaptive Plan: small scale dredging, then switch to large scale dredging.
Implement corrective actions to mitigate negative side effects.
Monitor river discharges and transport developments.

Haasnoot et al. (2012). Clim. Change.; Haasnoot et al. (2013) Glob. Env. Change. 10.1016/j.gloenvcha.2012.12.006

adaptive plan = short term actions + long term options + monitoring

Models can support the development of an adaptive plan

Ensemble (transient) scenarios or sensitivity analysis



Set of actions and pathways

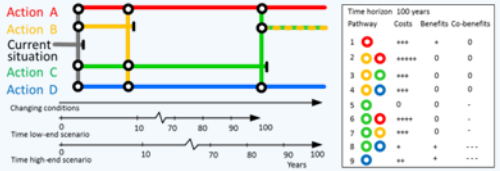
Action A Action C

Action B Action D

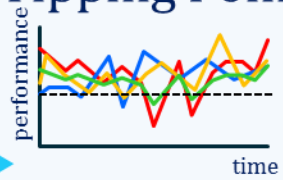
Collaborative model-based development

Participatory/qualitative Workshop & storylines

Adaptation pathways



Adaptation Tipping Points



Three model requirements for decision support of delta planning and management under uncertainty

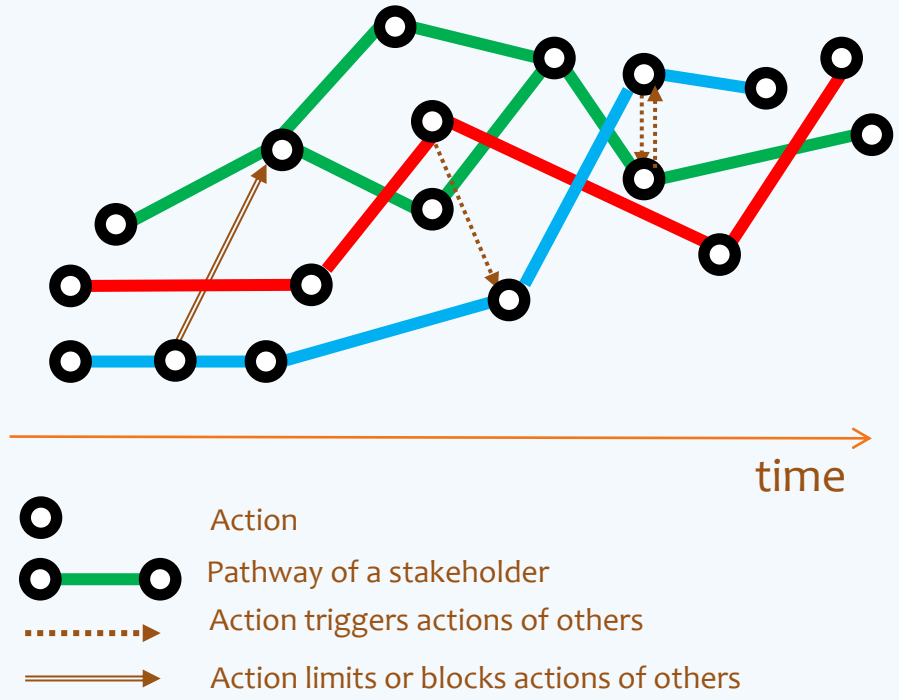
1. **Fast:** explore uncertainties and many actions over time

2. **Integrated:** multiple functions and stakeholders that interact

Haasnoot et al. (2014) Env Mod & Soft. 10.1016/j.envsoft.2014.05.020

Three model requirements for decision support of delta planning and management under uncertainty

3. **Dynamic**: interactions are not static - over time the environment and stakeholders interact. There is coevolution.



A **Fast**, **Integrated** and **Dynamic** model could be a **theory-driven metamodel** as developed for the Netherlands (Haasnoot et al. 2014, Fit for purpose. EMS)

However, in the Netherlands a lot of **data and models** are available and the **delta** is much **less dynamic** than in Bangladesh.

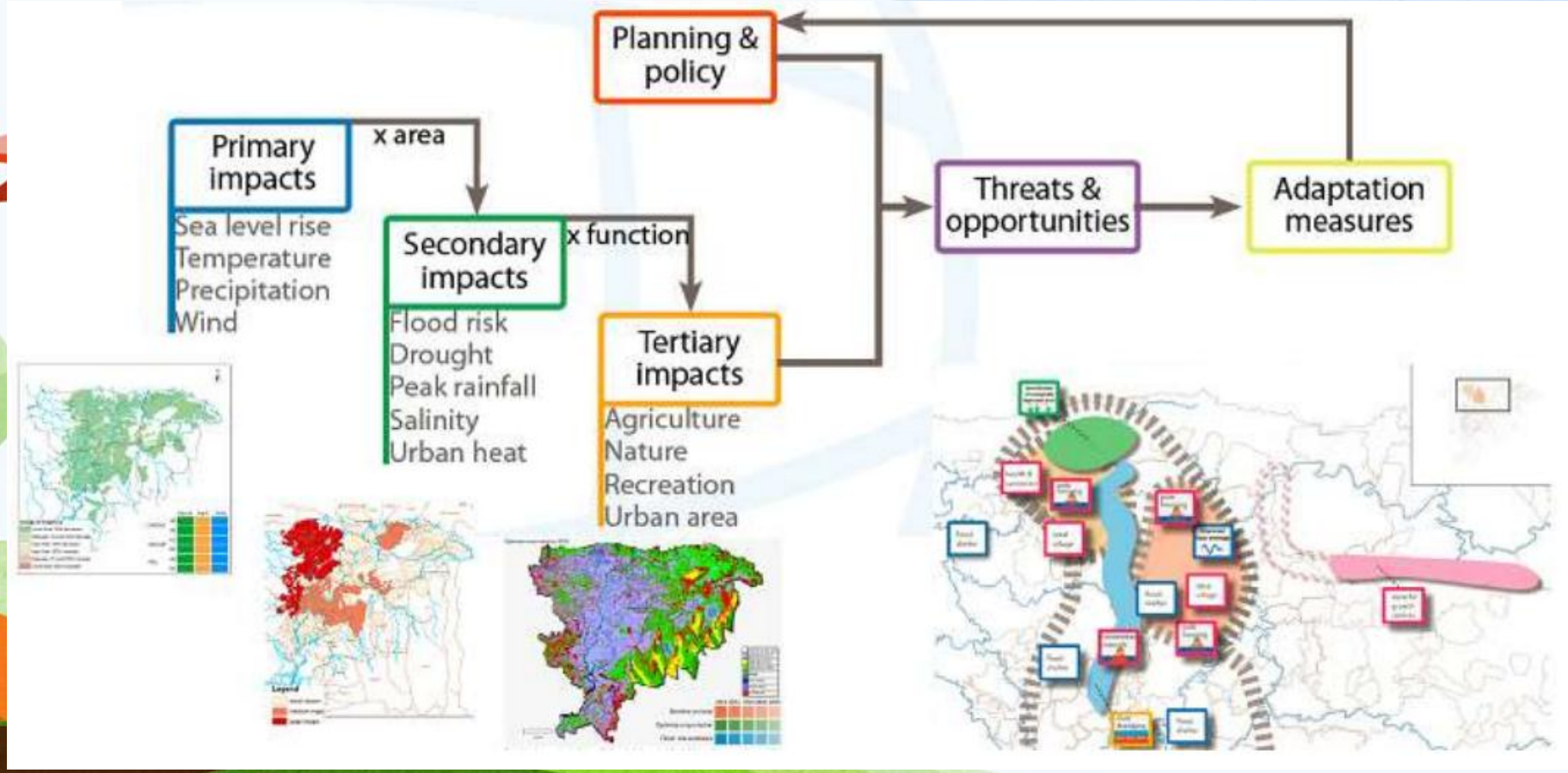
The practical challenges for ADM in Bangladesh are:

- Data/model scarcity
- Complex dynamics of the delta

Tools for Evaluation

- **Cost- benefit analysis** – societal costs and benefits.
- **Robustness analysis** – performance under different scenarios and extreme events.
- **Multi criteria analysis** – including non-tangible effects, by local and expert panels.
- **Implementation analysis** – institutional and socio-cultural barriers for implementation.

Tools for ADM - Climate Adaptation Atlas



CAA provides an **integrated perspective** on climate change by putting together dispersed information on **different climate change impacts** such as: flood risk, salinity, urban heat island effect and the sensitivity of agricultural crops to droughts

BDP2100

- Being devised to achieve **long term sustainable socio-economic development** and **provide safety** in the face of disasters in Bangladesh
- The '**Delta Vision**': *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***
- With **six *delta plan goals*** linked with the '*Sustainable Development Goals*', the plan foresees a paradigm shift in **implementation of the plan through ADM**.
- Following the ADM principles, **analytical frameworks, delta scenarios, strategy framework** and **adaptive pathways** are being developed
- Six predominant '**hotspots**' or **representative planning units**.
- Includes an **investment plan** and an **implementation framework** which envisions establishment of a 'Delta Commission' and a 'Delta Fund'.

Key Considerations for ADM in Bangladesh

Drivers

- Globalization and Macro-economic development
- Population pressure
- Pressure on land use
- Climate change and Hazards
- Dynamic morphology of delta
- Poverty and Socio-political stress
- Livelihood insecurity
- Water, Food and Energy insecurity

Integrated, Iterative and Interactive Long Term Delta Plan

Goals

- Secured Water, Food and Energy
- Sustainable Socio-Economy
- Safety from Climate Change and Disasters
- Population as Human Resources

ADM Challenges

- **Normative** concept – difficult to operationalize
- **Analytical** concepts and methods
- Need for **appropriate models and tools** (broad and flexible but can represent deep uncertainty)
- Cultural and political embedding (**paradigm shift** in traditional planning and management practices)
- Operational linkages with **investment plans**

Credits

Dr. Marjolijn Haasnoot, Deltares
Mr. Malik Fida Abdullah Khan, CEGIS
Prof. Chris Zevenbergen, IHE Delft
Prof. Wil Thissen, TU Delft
Prof. Shamsul Alam, GED, Planning Commission
Mr. Bhuiya Md. Tamim Al Hossain, IWFM, BUET

Thanks for listening!