THE BANGLADESH DELTA PLAN

An example of adaptive delta management

20-03-2021

WILLIAM OLIEMANS - SIBDP (DELTARES)



BANGLADESH DELTA PLAN 2100

General Economics Division Bangladesh Planning Commission, Ministry of Planning Government of the People's Republic of Bangladesh

August, 2018

'THE BEST GIFT FOR THE FUTURE GENERATIONS BY THE PRESENT GENERATION' বাংলাদেশ ডেল&টা প্ল্যান ২১০০

My contribution today

- Recap key ADM definitions that I will refer to
- Approaches from ADM that support moving from Plannning -> Implementation:
 - Scenarios
 - Adaptation pathways
 - Integrated assessment, MCA and the metamodel





Key defitinitions (from the BDP2100)

- *Holistic planning:* Addressing problems of a system in a comprehensive way, viewing the system in relation with its interdependent elements. Multiple policy domains may be involved
- Integrated approach: Combination of relevant elements to understand the total system
- Adaptation Pathway: A sequence of measures to achieve a set of goals under changing external conditions, like climate or socio-economic factors; and Adaptation Tipping Point: Threshold conditions under which an action or strategy no longer meets goals or standards
- Scenario: A plausible narrative of potential future conditions, to serve as a basis for action (Van Notten, 2005). In ADM, scenarios describe the 'external context' that are outside one's influence, and mostly policy-free
- *Strategy*: A from Delta Vision point of view coherent combination of measures that contributes to reaching the Delta Goals





SCENARIOS: MAKING SENSE OF AN UNCERTAIN FUTURE





Support to Implementation of Bangladesh Delta Plan 2100 (SIBDP)

The times are a changing: climate



The times are a changing: socio-economic











Support to Implementation of Bangladesh Delta Plan 2100 (SIBDP)

An example: flood damage





An example: flood damage

- At 8% annual GDP growth, asset value doubles after 12 years, triples after 25 years and quadruples after 35 years
- In the damage assessment (Bangladesh Metamodel) for the Productive Scenario, the damage increases approximately 9-fold (899%) in 2050. 70% of that increase is due to increased Exposure and Vulnerability and 30% due to climate change



Support to Implementation of Bangladesh Delta Plan 2100



Productive



Diversified economy

(high per capita growth)

High global growth, moderate climate change, strong regional collaboration, growing population (185, 200 and 165 mln in 2030, 2050 and 2100). High GDP growth, diversified economy, modernized agriculture, decentralization, increased connectivity, high urbanization (49, 70 and 85% in 2030, 2050 and 2100)



Resilient

High global growth, high climate change, large upstream developments, stabilizing population (175, 170 and 125 mln in 2030, 2050 and 2100) - high outmigration, High GDP growth, agro-technology development, decentralization, high connectivity, moderate urbanization (45, 60 and 75% in 2030, 2050 and 2100)

Extreme water conditions

Low global growth, high climate change, large upstream developments, fast growing population (197, 230 and 260 mln in 2030, 2050 and 2100), decreasing GDP growth, highly centralized urban growth, poor housing (39, 48 and 60% urbanization in 2030, 2050 and 2100) high rural poverty, urban-rural isolation

- Taking measures in time but not too soon
- Investing in productive development & prosperity, with environmental sustainability: trade offs
- Assessing impacts
 beforehand and
 developing alternative
 routes or pathways; be
 prepared





Moderate water conditions



Low global growth, moderate climate change, limited upstream developments, fast growing population (188, 210 and 190 mln in 2030, 2050 an d 2100), low GDP growth, traditional economy dependent on low value industry, increased inequality, centralized urbanization (40, 52 and 70% in 2030, 2050 and 2100), poor connectivity



Traditional economy (low per capita growth)





very high GDP per capita growth

℃÷ moderate climate change





moderate sea level rise



b1

regional collaboration, driven by economic interests



1111

connected second tier cities

low value, low-skilled products

environmental degradation by

population pressure

top-down centralization

70% urban population

high value industrial products







moderate climate change











environmental degradation by **b**1 industrial production

₩ N high private sector involvement



0000

high sea level rise



170m population

high GDP per capita growth

regional collaboration

high climate change

İİİİ 230m population

b very low GDP per capita growth

~~

high climate change

high sea level rise



regional competition and upstream extraction



industrial production

high value agro-industrial products

血血 decentralization



67% urban population



🐈 🍸 low value, low-skilled products

environmental degradation by population pressure



45% urban population

Ei







DAPP: a short introduction



Haasnoot M., H. Middelkoop, A. Offermans, E. van Beek, W.P.A. van Deursen (accepted). Exploring pathways for sustainable water management in River



deltas in a changing environment. Climatic Change

Adaptive Pathway: Groundwater & productivity in the Barind

- Key Issue (BDP2100 Freshwater Strategy, Barind Hot Spot Strategy)
- Highly productive agriculture system, major contribution to Boro production
- OBJECTIVE: Maintain or enhance agricutural productivity whilst sustaining groundwater use







Strategies and measures

Provide Surface Water From the Brahmaputra

Provide Surface Water from the Ganges

Provide Surface Water from the Mahanada

Rainwater Retention and Storage

Managed Aquifer Recharge

DECREASE DEMAND

Stimulate water Saving through crop change, irrigation efficiency and soil practices

Levy a Groundwater tax for agriculture

Designate groundwater protection zones, limiting land use

Designate groundwater protection zones, limiting Rabi crops

Designate groundwater protection zones, limiting abstraction



INCREASE SUPPLY



Support to Implementation of Bangladesh Delta Plan 2100 (SIBDP)









2030





2030





2030



Provide Surface Water From the Brahmaputra

Provide Surface Water from the Ganges

Provide Surface Water from the Mahanada

Rainwater Retention and Storage

Managed Aquifer Recharge

Stimulate water Saving through crop change, irrigation efficiency and soil practices

Levy a Groundwater tax for agriculture

Designate groundwater protection zones, limiting land use

Designate groundwater protection zones, limiting Rabi crops

Designate groundwater protection zones, limiting abstraction



2030

20

Scenario: Productive

Support to Implementation of Bangladesh Delta Plan 2100 (SIBDP)

Provide Surface Water From the Brahmaputra

Provide Surface Water from the Ganges

Provide Surface Water from the Mahanada

Rainwater Retention and Storage

Managed Aquifer Recharge

Stimulate water Saving through crop change, irrigation efficiency and soil practices

Levy a Groundwater tax for agriculture

Designate groundwater protection zones, limiting land use

Designate groundwater protection zones, limiting Rabi crops

Designate groundwater protection zones, limiting abstraction





Provide Surface Water From the Brahmaputra

Provide Surface Water from the Ganges

Provide Surface Water from the Mahanada

Rainwater Retention and Storage

Managed Aquifer Recharge

Stimulate water Saving through crop change, irrigation efficiency and soil practices

Levy a Groundwater tax for agriculture

Designate groundwater protection zones, limiting land use

Designate groundwater protection zones, limiting Rabi crops

Designate groundwater protection zones, limiting abstraction







INCREASE SUPPLY

DECREASE DEMAND







WITH NA



Added value adaptation pathway?

- Does it enhance **integration**? If yes, why, if no, why not
- Does the parthway support adaptive planning? If yes, why, if no, why not
- Does it stimulate a **holistic** approach? If yes, why, if no, why not
- Adaptation pathways are meant to clarify and structure complex problems and solutions in which uncertainty plays a role:
 - For which topics or objectives would an adaptation pathway support your 'adaptive planning'?
 - Could it help to analyze and understand uncertainties and clarify alternative options?



HANK YOU FOR YOUR ATTENTION

QUESTIONS?

GOPALGANJ, TRAINING ON THE BDP2100, GED

MCA and integrated assessment - BDP2100



MCA and integrated assessment - BDP2100



MCA and integrated assessment - BDP2100

		NW	/ Environi	ment an	d Ecosys	tems Pro	ogramme	e Objectiv	ve 2: Res	toring Cł	nalan Bee	el			
					D. J. J.	i a la Davalada d		Criteria					1		Legend
		Go	al 1		Relat	Goal 2	n Delta Plan 2100 G	208IS	Go	al 4	Goal 5	Poverty Reduction	Implementati	on feasibility	-3 Major Negative Impact -2 Moderate Negative Impact
Project Code	Project Name	Flood damage	Flood affected population	Food security	Rice production	Fish production	Sustainable groundwater	Access to safe drinking water	Water quality	Ecosystems services	Capacity development	Poverty Reduction	Implementation readiness	Potential financing	-1 Minor Negative Impact O No Impact
NEW	Application of environmental flow method for the Atrai, Dharla, Dhudkumar rivers	0	0	0	0	0	0	0	1	1	2	0	2	2	1 Minor Positive Impact 2 Moderate Positive Impact
C 1.43	Revitalization of Khals all over the country	1	1	1	o	1	o	0	1	1	o	1	o	1	3 Major Positive Impact Support to Implementation of Bangladesh Delta Plan 2100 compe
OP 1.3	Revitalization & restoration of Hurasagar & Atrai rivers	2	1	0	1	1	o	0	1	1	0	¢	1	1	
OP 1.2	Revitalization and restoration of Beel Halti	1	1		1	1	0	0		1	0		1	1	Kingdom of the Netherlands
XIST	Fisheries Resource Management and Socio-economic development in Chalan Beel	0	0	1	0	2	0	0	0	1	1	1	2	1	
XIST	Chalan Beel Infrastructure and Livelihood Improvement Project	-1	-1	1	0	0	0	0	-1	-1	1	1	2	1	
NEW	Integrated Development and Restoration of Chalan Beel	3	3	2	1	2	0	0			2	1	1	2	

* NEW = Newly Developed

* EXIST = Existing Concenpt Note, not included in the BDP2100 Investment Plan



Project scorecard

DP New1 = Rainwater harvesting for domestic water supply and irrigation in the North-West

DP 1.1 = Rasjahi irrigation project

DP 1.4 = Kurigram irrigation project South Unit

DP 1.5 = Kurigram irrigation project North Unit (2nd Phase)

	Goal & Indicators	DP_New1	DP1.1	DP1.4	DP1.5
Ξ	Goal 1				
	I-1: Reduction in damage due to river and rainfall floods	0,00	1,00	1,00	0,00
	I-2: Reduction in population affected by river and rainfall floods	0,00	1,00	1,00	0,00
⊡	Goal 2				
	I-3: Food security	1,00	1,00	1,00	1,00
	I-4: Rice production	1,00	1,00	1,00	1,00
	I-5: Fish production	1,00	0,00	0,00	0,00
	I-6: Sustainable groundwater use	1,00	2,00	1,00	2,00
	I-7: Rural population with safe drinking water access	1,00	1,00	0,00	1,00
Ξ	Goal 4				
	I-8: Water quality in water bodies and rivers	0,00	-1,00	-1,00	-1,00
	I-9: Restoration of goods and services of wetland ecosystems	1,00	-1,00	-1,00	-1,00
Ξ	Goal 5				
	I-10: Capacity and knowledge development	0,00	0,00	0,00	0,00
Ξ	Goal overarching				
_	I-11: Reduction of extreme poverty	1.00	0.00	2 00	2 00
	וסדממו	7,00	5,00	5,00	5,00
Ξ	Implementation				
	I-12: Implementation readiness	1	0	2	2
	I-13: Potential financing available		Support to		tation of
	I-14: Implementation costs (Million BDT)		Banglades (SIBDP)	h Delta Pla	n 2100

Weights – Sensitivity analysis

Weights according to four different world views:

- Environmental world view
- People world view
- Economic world view
- Balanced world view

SCORES

- -3 Major negative impact
- -2 Moderate negative impact
- -1 Minor negative impact
- 0 No impact
- 1 Minor positive impact
- 2 Moderate positive impact
- 3 Major positive impact



Environmental worldview

$\hat{\mathbf{x}}$			14: Outenie Anglusie DDD0400 North West					
$\boldsymbol{\ominus}$		IMU	IITI-Criteria Analysis BDP2100 - North-West					
STEP 1: How important are the following goals for the	STEP 2: How important are the following		STEP 3: Select projects to compare Ctrl+left click to select multiple projects					
North-West?	indicators?		Meerdere selecties					
Divide weight: 0			Apply weights			Re	emove weights	
Goal 1: Ensure safety from floods			Goal & Indicators	DP_New1	DP1.1	DP1.4	DP1.5	
and climate change related	Divide weight: 0		Goal 1					
JISASTERS	I-1 50		I-1: Reduction in damage due to river and rainfall floods	0,00	0,08	0,08	0,00	
15	I-2 50		I-2: Reduction in population affected by river and rainfall floods	0,00	0,08	0,08	0,00	
			Goal 2					
Goal 2: Ensure water security and efficiency of water usages	Divide weight: 0		I-3: Food security	0,02	0,02	0,02	0,02	
25	I-3 <mark>8</mark>		I-4: Rice production	0,02	0,02	0,02	0,02	
20	I-4 7		I-5: Fish production	0,08	0,00	0,00	0,00	
			I-6: Sustainable groundwater use	0,08	0,15	0,08	0,15	
	^{I-5} 30		I-7: Rural population with safe drinking water access	0,06	0,06	0,00	0,06	
	I-6 30		🖂 Goal 4					
	I-7 25		I-8: Water quality in water bodies and rivers	0,00	-0,16	-0,16	-0,16	
Coal 4: Consorius and preserve	20		I-9: Restoration of goods and services of wetland ecosystems	0,24	-0,24	-0,24	-0,24	
vetlands and ecosystems	Divide weight:)	🖂 Goal 5					
40	I-8 40		I-10: Capacity and knowledge development	0,00	0,00	0,00	0,00	
	I-9 60		Goal overarching					
		_	I-11: Reduction of extreme poverty	0.10	0.00	0.20	0.20	
Goal 5: Develop equitable governance				0,59	0,00	0,06	0,05	
10	I-10							
			I-12: Implementation readiness	6		S	upport to Imp	
Overarching goal: Poverty reduction	I-11		I-13: Potential financing available			B	angladesh De (IBDP)	
10			I-14: Implementation costs (Million BDT)	1(

· · · ·	•
Fconomic worl	dview

Θ			Mu	Iti-Criteria Analysis BDP2100 - North-West				
STEP 1: How important are	STEP 2: How in	nportant		STEP 3: Select projects to compare				
the following goals for the	are the follo	owing re?		Ctri+left click to select multiple projects				
North-West:	mulcato	131		Meerdere selecties				
Divide weight: 0				Apply weights			R	emove weights
Goal 1: Ensure safety from floods	Divide weight:	0		Goal & Indicators	DP_New1	DP1.1	DP1.4	DP1.5
and climate change related				😑 Goal 1				
1303(013	I-1	60		I-1: Reduction in damage due to river and rainfall floods	0,00	0,24	0,24	0,00
40	I-2	40		I-2: Reduction in population affected by river and rainfall floods	0,00	0,16	0,16	0,00
			i	⊡ Goal 2				
Goal 2: Ensure water security and efficiency of water usages	Divide weight:	0		I-3: Food security	0,07	0,07	0,07	0,07
45	I-3	15		I-4: Rice production	0,14	0,14	0,14	0,14
45	 I_4	30		I-5: Fish production	0,16	0,00	0,00	0,00
		50		I-6: Sustainable groundwater use	0,02	0,05	0,02	0,05
	I-5	35		I-7: Rural population with safe drinking water access	0,07	0,07	0,00	0,07
	I-6	5		⊟ Goal 4				
	l-7	15		I-8: Water quality in water bodies and rivers	0,00	-0,03	-0,03	-0,03
		13		I-9: Restoration of goods and services of wetland ecosystems	0,03	-0,03	-0,03	-0,03
wetlands and ecosystems	Divide weight:	0		□ Goal 5				
5	I-8	50		I-10: Capacity and knowledge development	0,00	0,00	0,00	0,00
•	10	50		Goal overarching				
		50		I-11: Reduction of extreme poverty	0.05	0.00	0.10	0.10
Goal 5: Develop equitable governance				lotaal	0,53	0,67	0,68	0,37
-	I-10			Implementation				
5				I-12: Implementation readiness				upport to Impl
Overarching goal: Poverty reduction			-	I-13: Potential financing available			B	angladesh Del
5	I-11			I-14: Implementation costs (Million BDT)	1		milli (S	IBDP)

Kalai	ncad	WOR	GV	
Dalai				

\ominus			Mu	Ilti-Criteria Analysis BDP2100 - North-West						
STEP 1: How important are the following goals for the	STEP 2: How i are the foll	mportant owing		STEP 3: Select projects to compare Ctrl+left click to select multiple projects						
North-West?	indicato	rs?		Meerdere selecties						
Divide weight: 0				Apply weights	Apply weights Remove weights					
Goal 1: Ensure safety from floods		0		Goal & Indicators	DP_New1	DP1.1	DP1.4	DP1.5		
and climate change related	Divide weight:			🖂 Goal 1						
lisasters	I-1	50		I-1: Reduction in damage due to river and rainfall floods	0,00	0,13	0,13	0,00		
25	I-2	50		I-2: Reduction in population affected by river and rainfall floods	0,00	0,13	0,13	0,00		
		_		🖂 Goal 2						
Goal 2: Ensure water security and efficiency of water usages	Divide weight:	0		I-3: Food security	0,05	0,05	0,05	0,05		
05	I-3	20		I-4: Rice production	0,05	0,05	0,05	0,05		
25	I_4	20		I-5: Fish production	0,05	0,00	0,00	0,00		
		20		I-6: Sustainable groundwater use	0,05	0,10	0,05	0,10		
	I-5	20		I-7: Rural population with safe drinking water access	0,05	0,05	0,00	0,05		
	I-6	20		🖂 Goal 4						
	l-7	20		I-8: Water quality in water bodies and rivers	0,00	-0,10	-0,10	-0,10		
		20		I-9: Restoration of goods and services of wetland ecosystems	0,10	-0,10	-0,10	-0,10		
vetlands and ecosystems	Divide weight:	0		🖂 Goal 5						
20	I-8	50		I-10: Capacity and knowledge development	0,00	0,00	0,00	0,00		
	I_9	50		Goal overarching						
	1-0	50		I-11: Reduction of extreme poverty	0.15	0.00	0.30	0.30		
Goal 5: Develop equitable governance				Iotaai	0,50	0,30	0,50	0,35		
45	I-10			Implementation						
15			_	I-12: Implementation readiness				pport to Imple		
Overarching goal: Poverty reduction				I-13: Potential financing available			Ba	ngladesh Delta		
15	I-11			I-14: Implementation costs (Million BDT)			(SI	BDP)		

Overview MCA scores and costs

	DP_New1	DP1.1	DP1.4	DP1.5
Worldview	Rainwater harvesting	Rasjahi irrigation	Kurigram irrigation south	Kurigram irrigation north
Environmental	0.59	0	0.06	0.05
People	0.69	0.61	0.78	0.68
Economic	0.53	0.67	0.68	0.37
Balanced	0.5	0.3	0.5	0.35
Costs (mBDT)	100	19910	19954	6968



Added value MCA?

- Does it enhance **integration**? If yes, why, if no, why not
- Does using MCA support adaptive planning? If yes, why, if no, why not
- Does it stimulate a **holistic** approach? If yes, why, if no, why not
- MCA is meant to support decision making for complex multidisciplinary problems and solutions that involve both quantitative and qualitative decision-making criteria:
 - For which topics or objectives would an MCA support your decision making?
 - Could it help to reach a consensus and analyze critical decision-making points further, through e.g. modelling, or other further detailed analysis



HANK YOU FOR YOUR ATTENTION

QUESTIONS?

GOPALGANJ, TRAINING ON THE BDP2100, GED