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Modelling costs for water and sanitation infrastructure:

Comparing sanitation options for Can Tho, Vietnam

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WEDC conference 2011
Loughborough University, UK
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Selecting Sanitation Options for South Can Tho, Viet Nam

- AusAID Australian Research Development Awards
- Institute for Sustainable Futures, University of Technology in Sydney
- Partners - Can Tho University, Can Tho Water Supply & Sanitation Company

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ĐẠI HỌC CẦN THƠ

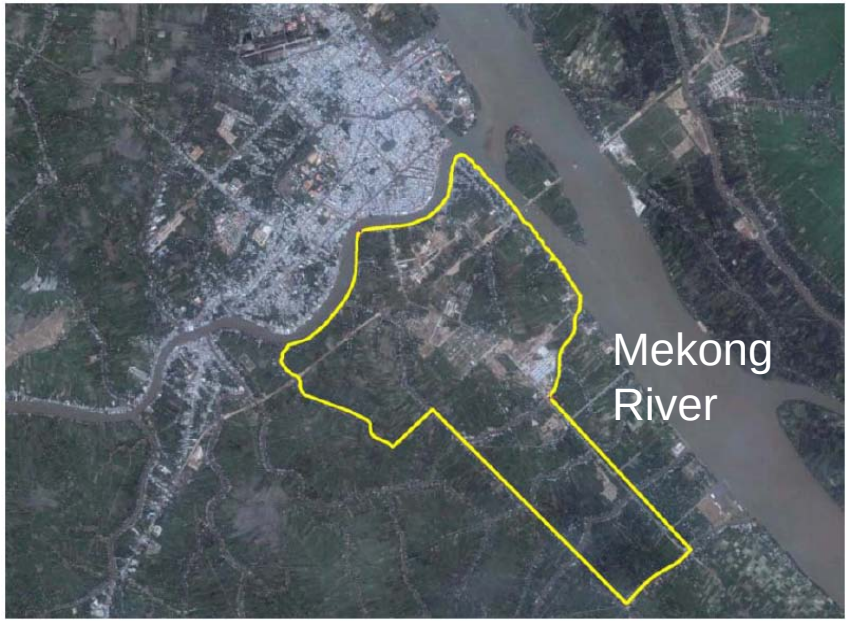
Australian Government
AusAID

Outline

- Background to the study area
- Study objectives
- Overview of cost-effectiveness analysis
- Steps in modelling cost-effectiveness
- Sanitation options
- Our results
- Important aspects of the modelling

The site - South Can Tho

- Largest city in the Mekong Delta
- Built on waterways and canals
- Currently use septic tank systems



- New centralised wastewater system under construction for northern area of city
- Southern zone set for rapid growth

Study objectives

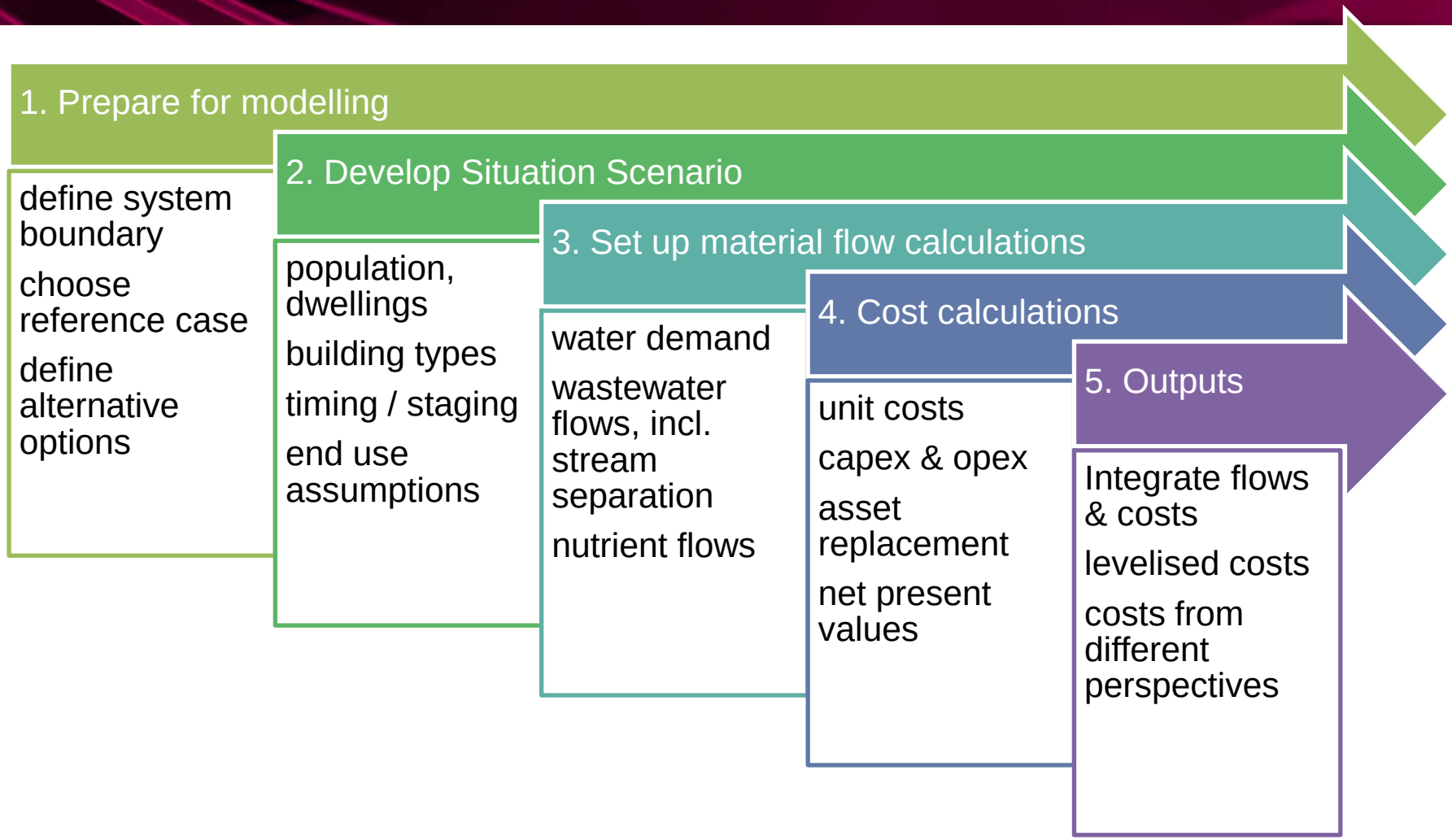
- Undertake a collaborative & analytical decision making process to select a sanitation option for South Can Tho that is the most
  - Context appropriate
  - Fit for purpose
  - Cost-effective
  - Sustainable

Cost Effectiveness Analysis (CEA)

- Compare relative costs of options against a ‘base’ or ‘reference’ case
- Costs are levelised in terms of service received e.g.
  - cost per kilolitre of water supplied ($/kL),
  - cost per household for sanitation ($/household)

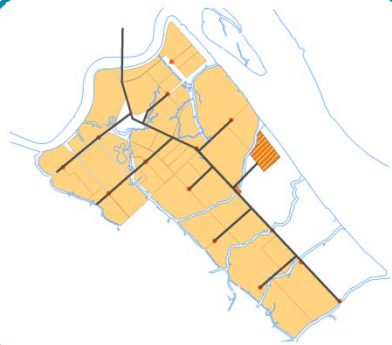
CEA seeks the ‘least cost’ alternative

Modelling cost-effectiveness



Sanitation options

Option 1
Centralised – connect to wastewater treatment plant



Option 2
Decentralised systems

Option 3
Combination of centralised and decentralised systems

Option 4
Combination of centr. & decentr. systems with urine diversion & reuse

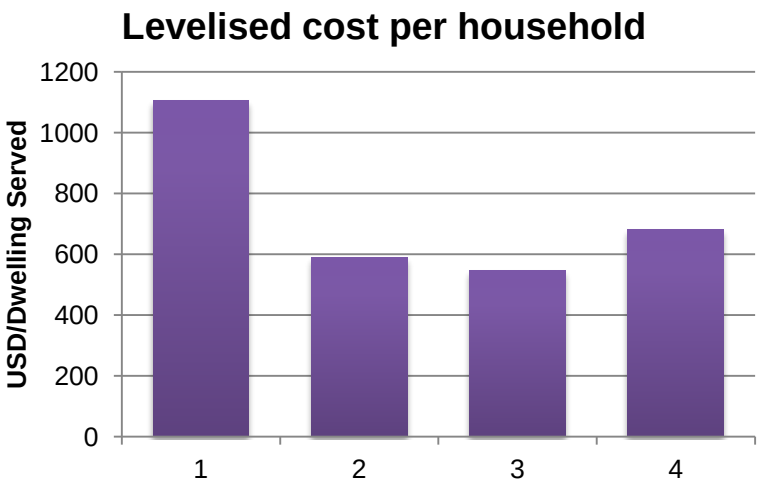
Costing - Option 2

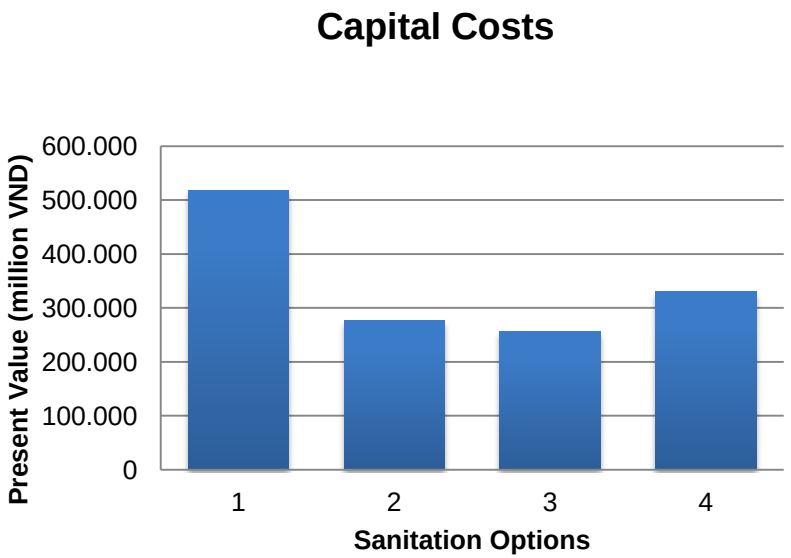
Discount rate (%)		8									
Option 1											
			2011	2012	2013	2014	2015	2016	2017	2018	2019
Capital		NPV (mil VND)									
Pipes, trenches & pumps		VND 65,759	65758	0	0	0	0	80698	0	0	0
Distributed treatment plants		VND 194,510	194506	0	0	0	0	240848	0	0	0
Discharge pumps		VND 601	601	0	0	0	0	744	0	0	0
Discharge pipes		VND 3,779	3779	0	0	0	0	4680	0	0	0
	Sum Capex without di	VND 264,649	264644	0	0	0	0	326969	0	0	0
Disinfection		VND 12,014	12013	0	0	0	0	14876	0	0	0
	Sum Capex with disinf	VND 276,663	276657	0	0	0	0	341845	0	0	0
Operation & Maintenance		NPV (mil VND)									
Electricity costs per kWh	base cost (VND)		1020	1040.4	1061.208	1082.4322	1104.0808	1126.1624	1148.68567	1171.6594	1195.0926
Labour costs per day	base cost (VND)		105000	110250	115762.5	121550.63	127628.16	134009.56	140710.042	147745.54	155132.82
No. Small network pumps			6907	6907	6907	6907	6907	15459	15459	15459	15459
No. Decentralised treatment plants/discharge pumps			39	39	39	39	39	87	87	87	87
Network											
Energy - Local pumps		VND 427	0	3410	3478	3547	3618	8261	8426	8594	8766
Energy - Discharge pumps		VND 32	0	258	264	269	274	626	639	652	665
Labour - local pumps		VND 41	0	327	344	361	379	891	935	982	1031
Replacement - Local pumps	annualised costs	VND 881	0	7049	7049	7049	7049	15777	15777	15777	15777
Replacement - Discharge pumps	annualised costs	VND 5	0	40	40	40	40	90	90	90	90
Decentralised treatment plant											
Energy		VND 0	0	0	0	0	0	0	0	0	0
Labour		VND 17	0	136	143	150	158	371	390	409	430
Equipment		VND 0	0	0	0	0	0	0	0	0	0
	Sum Opex	VND 1,404	0	11221	11317	11416	11518	26015	26256	26504	26758
Disinfection O&M		VND 565	0	4522	4522	4522	4522	10122	10122	10122	10122
	Sum Opex with disinfe	VND 1,970	0	15743	15839	15938	16040	36137	36378	36625	36880
Total		NPV (mil VND)									
Total without disinfection		VND 266,054	264644	11221	11317	11416	11518	352984	26256	26504	26758
Total with disinfection		VND 278,633	276657	15743	15839	15938	16040	377982	36378	36625	36880
Metrics of service		NPV									
Wastewater volumes treated	NPV (m3/year)	7940981	7058502	7058502	7058502	7058502	7058502	15798720	15798720	15798720	15798720
Dwellings serviced	NPV (dwellings/year)	24870	22106	22106	22106	22106	22106	43038	43038	43038	43038

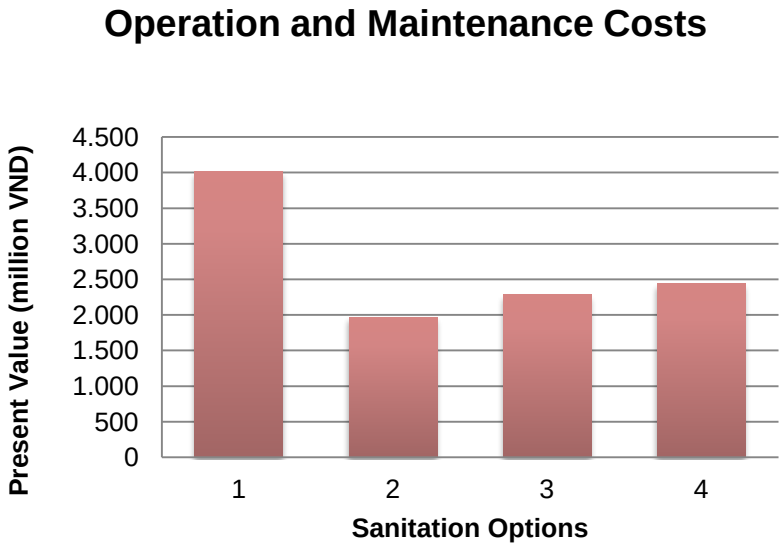
Estimating and collecting costs (the most challenging part)

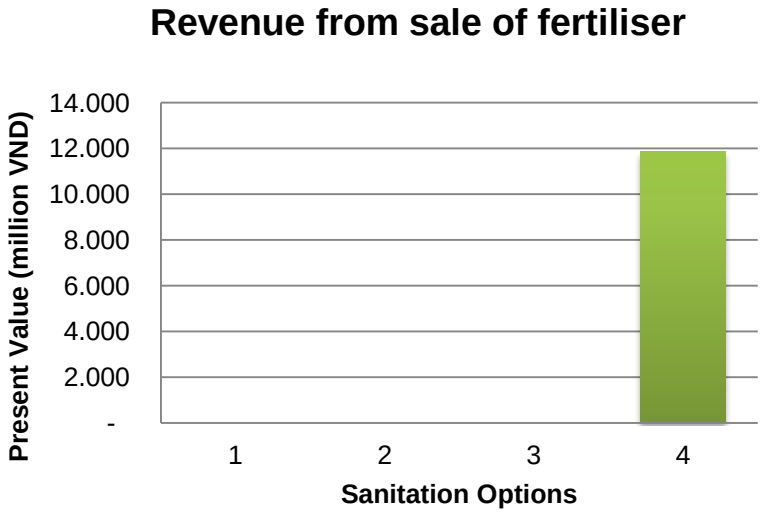
- High level conceptual design, without designing in detail
- Local unit costs for materials & labour
- Collected costs for different size and types of treatment plants, scaled according to flow rate
- Used local costs or costs from nearby countries

Results


Levelised cost per household
USD/Dwelling Served
1200
1000
800
600
400
200
0
1
2
3
4


Capital Costs
Present Value (million VND)
600.000
500.000
400.000
300.000
200.000
100.000
0
1
2
3
4
Sanitation Options


Operation and Maintenance Costs
Present Value (million VND)
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
500
0
1
2
3
4
Sanitation Options


Revenue from sale of fertiliser
Present Value (million VND)
14.000
12.000
10.000
8.000
6.000
4.000
2.000
-
1
2
3
4
Sanitation Options

Important aspects of the modelling

- Understanding staging of development / population growth over time was important
  - Estimated flows linked to costing
- Nutrient flows were essential to assess benefit of nutrient capture and reuse
- Levelised costs – reference to service provided (cost-effectiveness) useful for further comparison

Important aspects of the modelling

- Included life cycle costs: capital, operating & maintenance, asset replacement, benefits
- Tried to make costing as inclusive as possible (incorporating different financial perspectives)
- Consistent costing boundary across options
- Consistent & transparent assumptions

Summary

- Useful method for comparing diverse options
- Some aspects (i.e. data collection) were time intensive, however, the detail allowed a fair comparison between options
- Worked well in conjunction with sustainability assessment & stakeholder engagement

Acknowledgements:

Juliet Willetts, Cynthia Mitchell, Naomi Carrard

Link to report:

http://www.isf.uts.edu.au/publications/Willettsetal2010canthocasestudy.pdf

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