

Modelling impacts of waste treatment options

Meera Mehta
Dinesh Mehta
Upasana Yadav

Sanitation and Health

Facts

2.4bn



Approximately 2.4 billion people live without improved sanitation, of which almost 1 billion people continue to defecate in the open.

Source: WHO, 2015 (under JMP report)

0.85 m



Every year 0.85 million children die from diarrhoea. 88% are caused by poor sanitation and unimproved water.

Source: Unilever; London School of Hygiene and Tropical Medicine

443 m



443 million school days are lost because of WASH related diseases

Source: UN, 2010

Research on sanitation impact and health

32% ↓



Many studies suggest that improved sanitation can reduce rates of diarrhoeal diseases by 32%–37%.

Source: Esrey et al (1991), WHO (2014), Plos Med

> 65%



High level of sanitation usage (over 65 per cent) and widespread handwashing practice are necessary to achieve significant health impact

Source: Odhisa sanitation health impact, 2014

No direct Evidence

Many studies concluded that Direct cause and effect of sanitation on health outcome is not as readily apparent as the health impact of water

Sanitation Service Outcomes and Risks

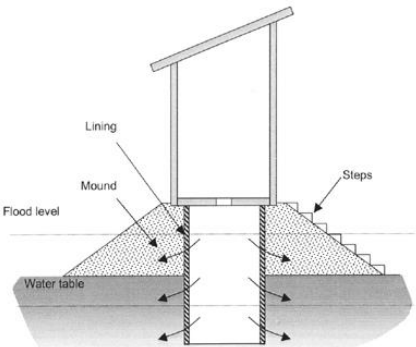
Key variables for public health and environmental impacts



Service Level Outcomes



Water borne diseases

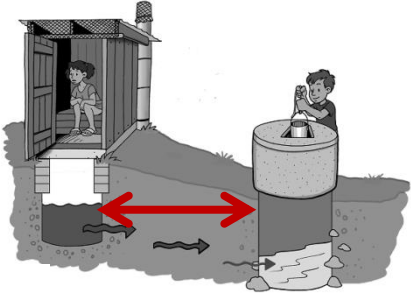


Depth of groundwater and coverage of single pit toilets



Solid Waste disposal

Risk Assessment



Lateral distance between drinking water source and sanitation



Exposure of public to raw sewage flowing in open drains



Disposal of untreated wastewater and septage



Sanitation facility in schools and colleges

SaniPlan model

Decision support tool for planning citywide sanitation

Key Features:

- Multi-year planning framework
- Menu of improvement actions
- Integrate Project and Municipal Financial Planning
 - Capex and Opex
- Inbuilt scenario comparison
- Public health impact

Audience:



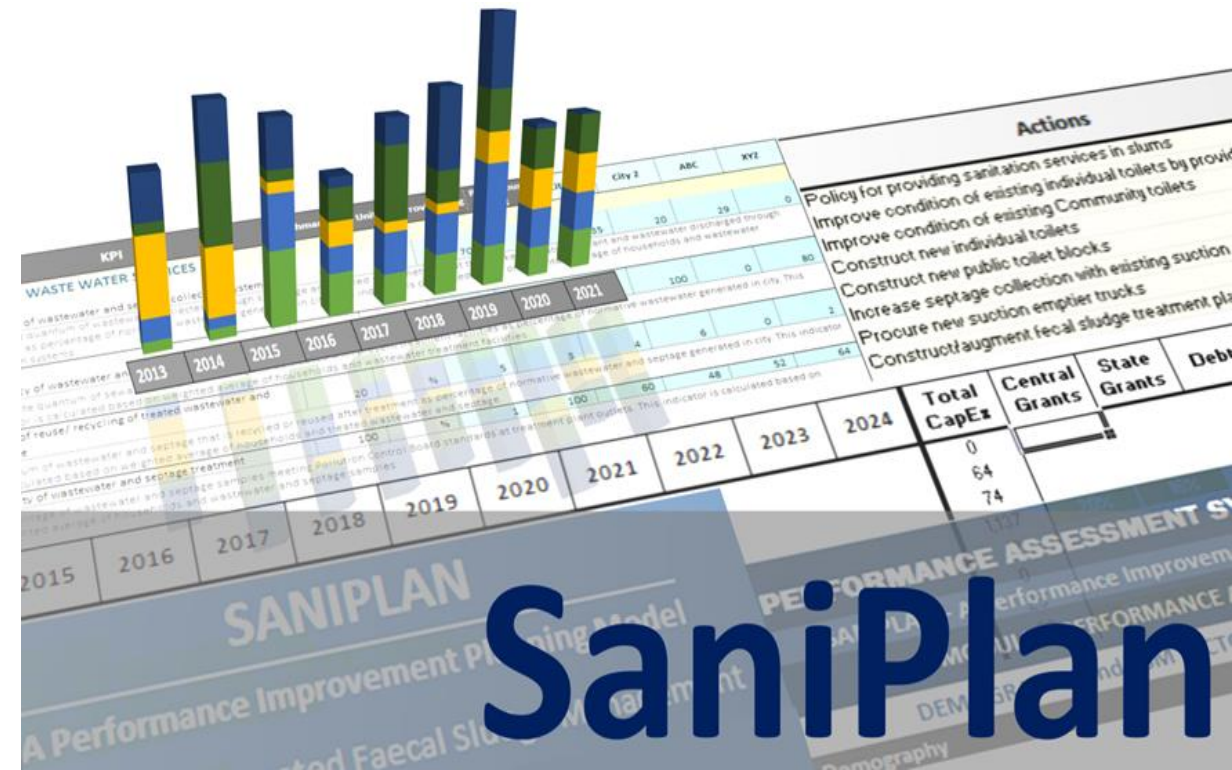
Consultants



City Planners

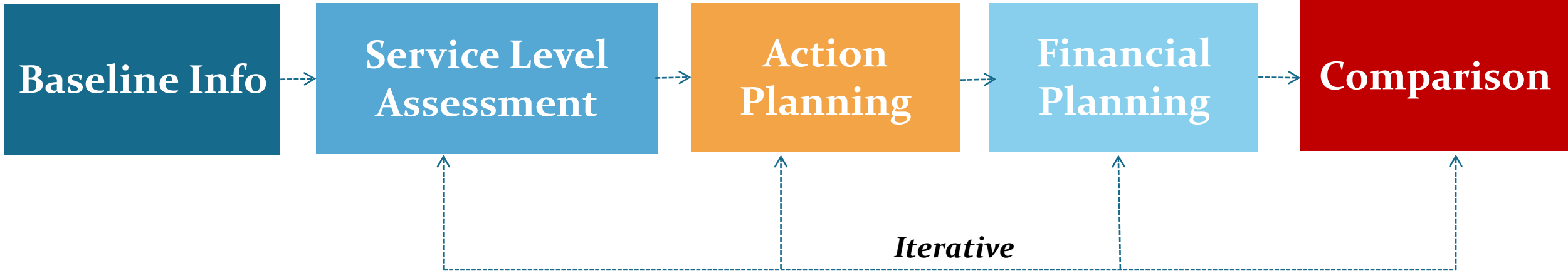


Donors

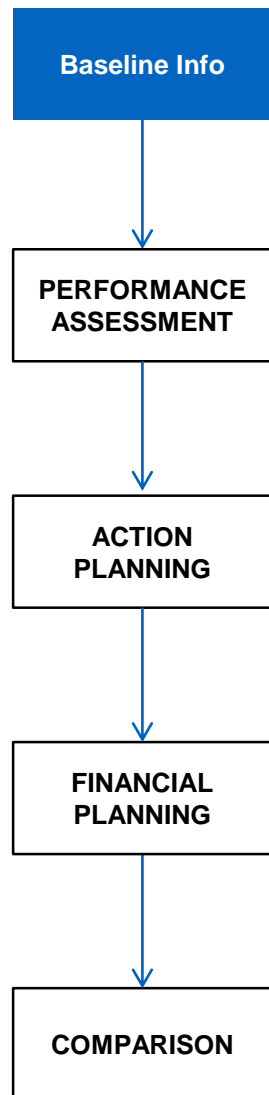


SaniPlan

SaniPlan framework



Baseline Information –small town in India



7580 HHs	5145 Toilets	4425 Septic tanks	4 MLD??
----------	--------------	-------------------	----------------

3/4th HHs -own toilets
1/4thCommunity toilets or OD

85% toilets connected to **septic tanks**

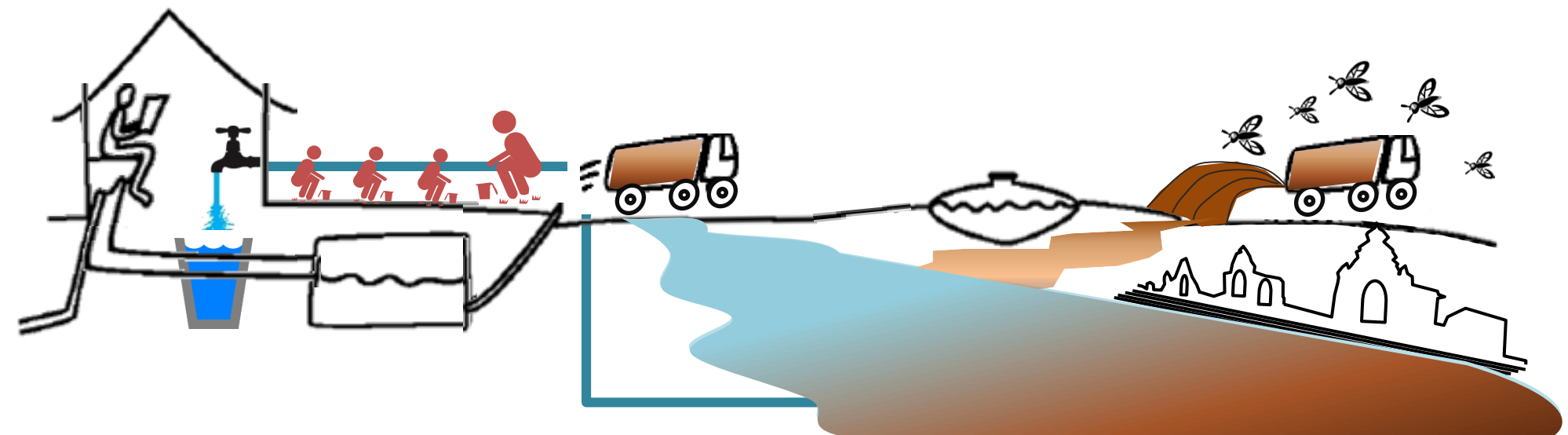
Effluent discharged directly in **open drains to water bodies....**

Environmental and Health hazards

Increased health risk

Only **2%** of septic tanks are empty

No treatment Facility- Dumped in SWM dumping site



Service Level Assessment

Key Performance Indicators - comparison against peer groups



Coverage of toilets
58%

Coverage of HHs with adequate sanitation system
5%

Efficiency of collection system
5%

Adequacy of treatment capacity
0%

Extent of reuse
0%

Quality of treatment
0%

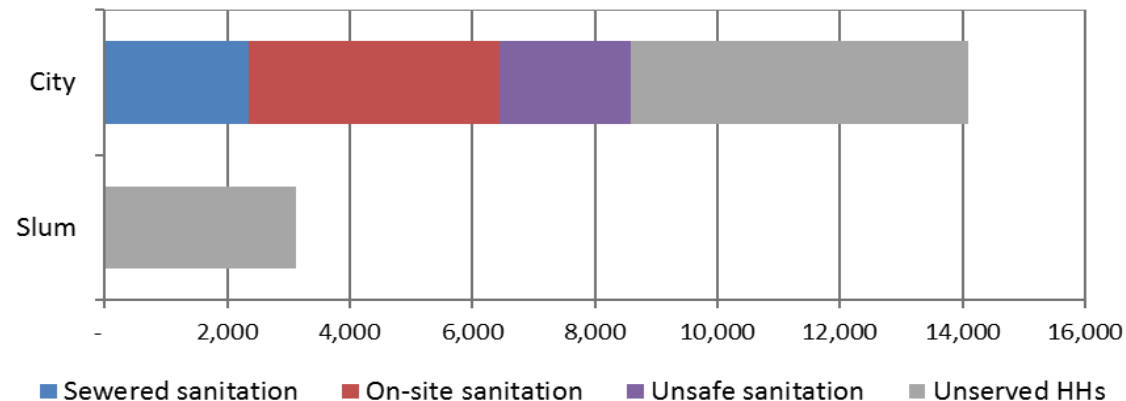
Efficiency in redressal of customer complaints
70%

Collection of taxes and charges
0%

Cost recovery
0%

Local Action Indicators - indicated through graphs

Households with adequate sanitation system



Baseline Info

PERFORMANCE ASSESSMENT

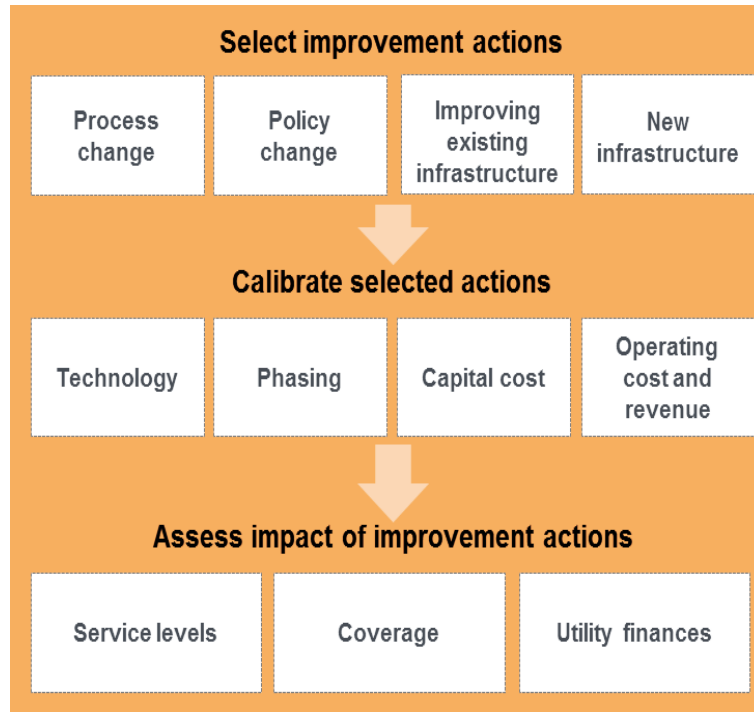
ACTION PLANNING

FINANCIAL PLANNING

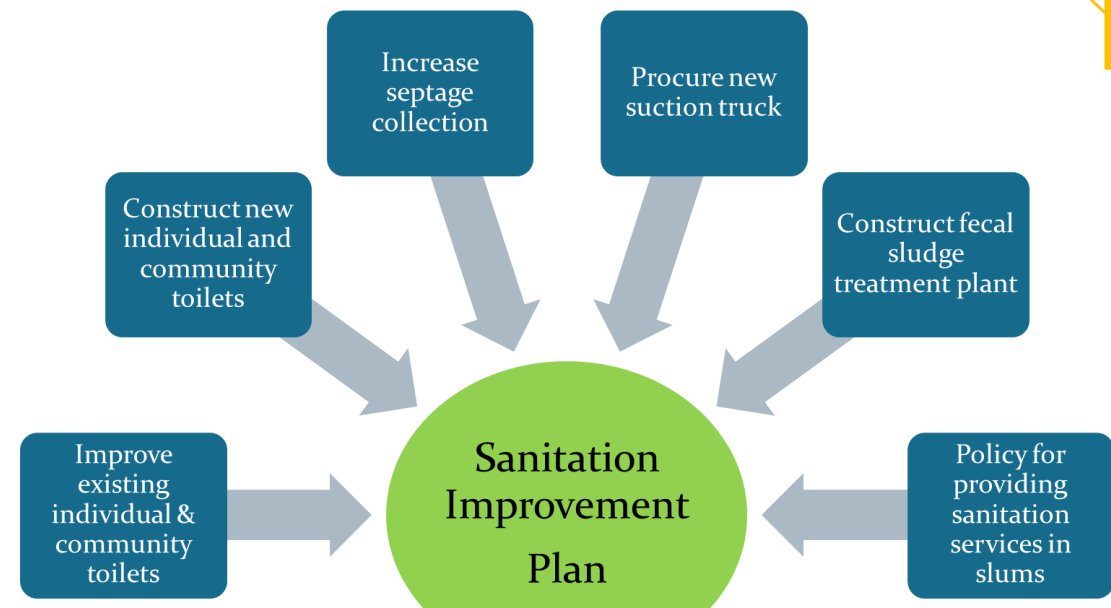
COMPARISON

Action Planning: Preparing Service improvement plans

Model provides 110+ list of improvement actions



PROVIDE WASTEWATER COLLECTION & CONVEYANCE SYSTEM TO HOUSEHOLDS			
Learn more	Activate	2015	2016
Baseline	- Suction emptier trucks with LG at present	Numbers	1
	- Suction emptier trucks with private operators at present	Numbers	-
Improvement	<u>Suction emptier trucks of LG</u>		
	- Additional trucks to be procured by LG	Numbers	2
	- Aggregate capacity of all new suction emptier trucks	kilo liters	7.0
	- Number of trips by a suction emptier truck	Trips/ truck/day	3.0
	<u>Suction emptier trucks of Private operators</u>		
- Additional number of trucks expected to be procured by private operators to function within city limits	Numbers		
- Aggregate capacity of all new suction emptier trucks	kilo liters		
- Number of trips by a suction emptier truck within city limits	Trips/ truck/day		
Finance	- Block cost for a suction emptier truck to be procured by LG	Cost/truck	1,200,000
	- O&M expenses for new trucks procured by LG	% of CapEx/annum	50%



Activate/ Deactivate actions

Phasing of actions

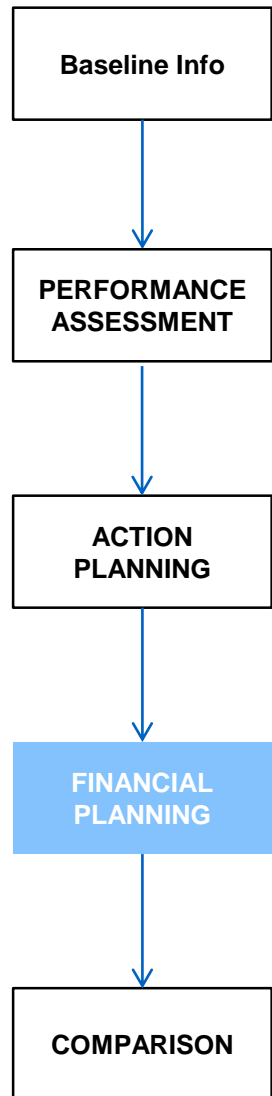
Baseline information

Improvement information

Cost and Finance information

Integrated Sanitation and Financial Planning

Matching financial requirements with available funds in an iterative manner



Assess aggregate funding demand from all improvement actions

Financial implications of each Improvement action

Capital expenditure

Revenue generation

Operating and maintenance expenditure

Effect of inflation based on phasing

Aligning both these financial streams to evolve sustainable 'Financing Plan'

External sources of funds
Exploring funding pattern possible for each improvement action

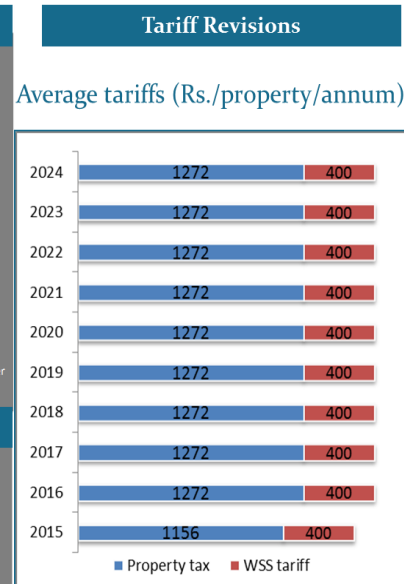
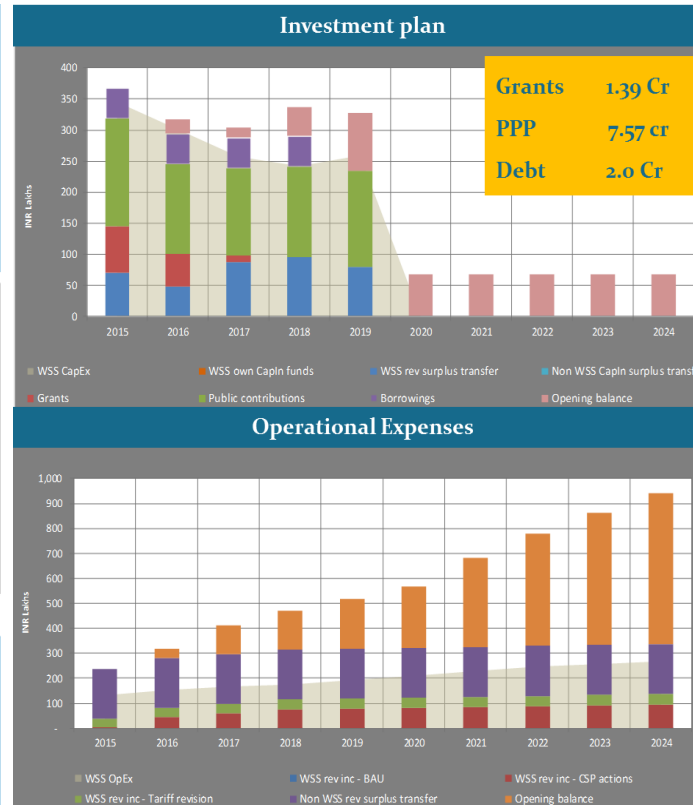
Internal sources of funds
Exploring options to increase revenue from own income sources

Assess financial health and extent of revenue surplus available

Municipal finances of urban local bodies

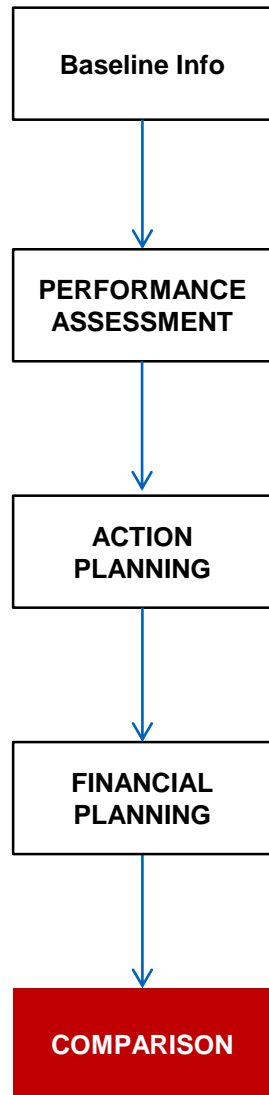
Past trends of municipal finances

Forecasting for finances for Business as Usual scenario



Immediate increase in tariffs by 35%;
No increments required later

Dashboard for Decision-Making



Sanitation options for comparison

Create your options by selecting appropriate mode to improve coverage of toilets, wastewater management and financing mechanism

Select Toilet option: Individual toilets
 Select Conveyance regime: Regulated- 3 yrs
 Select Treatment technology: SDB
 Select financing mechanism: Innovative finance

Option 1
 Individual toilets
 Regulated- 3 yrs
 SDB
 CapEx: 2161.59
 O&M: 19.91

Option 2
 Individual toilets
 Regulated- 3 yrs
 Sintex Package treatment Plant
 CapEx: 2177.36
 O&M: 29.15

All figures are in Rs. Lakhs

Impact on service levels

Financial implications

Capital financing plan (Rs. lakhs)

Option	Grants	Pvt Cost	ULB Share	Borrowings
Option 1	~100	~1000	~1000	0
Option 2	~100	~1000	~1000	0

Tariff level required (Rs/Household/annum)

Option 1	2,527
Option 2	3,000

Summary of Action plan

Select mode: CAPITAL EXPENDITURE

	2014	2015	2016	2017	2018
Option 1					
Improve existing individual toilets	-	168.5	180.3	-	-
New individual toilets	-	292.8	313.2	335.2	358.6
Increase septage collection with	-	0.7	0.7	0.8	-
New suction emptier trucks	-	10.0	10.7	11.4	-
Fecal sludge treatment plant	-	95.0	-	-	-
Option 2					
Improve existing individual toilets	-	170.3	182.2	-	-
New individual toilets	-	292.8	313.2	335.2	358.6
Increase septage collection with	-	0.7	0.7	0.8	-
New suction emptier trucks	-	10.0	10.7	11.4	-
Fecal sludge treatment plant	-	107.0	-	-	-

Scenarios:

- Toilet options,
- conveyance regime,
- Treatment technology and
- Financing mechanism

Comparisons:

- Cost,
- Impact on service levels,
- Financial implications

Sanitation Outcomes & Risk Assessment

Key variables for public health and environmental impacts

1 Current Service levels assessment

	2014
Coverage of toilets	87
% Open Defecation	13
Coverage of unsafe and pit toilets	3
Coverage of household with adequate sanitation system	5
Adequacy of wastewater and septage treatment capacity	0
Efficiency of collection of solid waste	100
Adequacy of solid waste processing facilities	0

2 % of water borne diseases to total diseases reported over defined period

<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
0-10%	10%- 50%	>50%

3 Depth of groundwater level

<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
<5m	5-15m	>15m

4 % of drinking water source located <10m (Horizontal separation) from single pit sanitation system

<input type="radio"/>	<input checked="" type="radio"/>
< 25%	> 25%

5 % Availability of safe sanitation facilities in schools and colleges ?

<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
< 25%	25%-50%	> 50%

6 Location of disposal of untreated wastewater or septage?

Open ground affecting soil and groundwater quality	<input checked="" type="radio"/>
Water bodies affecting water quality & aquatic life	<input type="radio"/>
Treatment plant safe to environment	<input type="radio"/>

7 Exposure of public to raw sewage flowing in open drains or dumped in open ground?

<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Low	Medium	High

8 Disposal mechanism of solid waste prevalent in your city? (Input for all applicable modes)

Mode of disposal	
Burning of solidwaste	<input type="checkbox"/>
Disposed in waterbodies	<input checked="" type="checkbox"/>
Disposed on open ground	<input checked="" type="checkbox"/>
Disposed in compliant landfill, composting, and other safe practice	<input checked="" type="checkbox"/>

Based on composite scoring

Risk Assessment

Impact on health	Surface and ground Water quality	Environment benefits
------------------	----------------------------------	----------------------

Safe zone. Minimal actions required	Low Risk
No critical variables at risk. Some variables need to be addressed to mitigate risk.	Medium Risk
Critical variables are at risk, or their interplay is dangerous. Immediate attention and substantial improvement required.	High Risk

As per SaniPlan sector assessment

Health Impact Assessment after Sanitation Improvement

Impact on public health and environment after improvement planning



1	Service Levels	Outcomes	
		2014	2024
	Coverage of toilets	87	100
	% Open Defecation	13	0
	Coverage of unsafe and pit toilets	3	0
	Coverage of household with adequate sanitation system	5	94
	Adequacy of wastewater and septage treatment capacity	0	16
	Efficiency of collection of solid waste	100	100
	Adequacy of solid waste processing facilities	0	0

2 % of water borne diseases to total diseases reported over defined period

<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
0-10%	10%- 50%	>50%

3 % Availability of safe sanitation facilities in schools and colleges ?

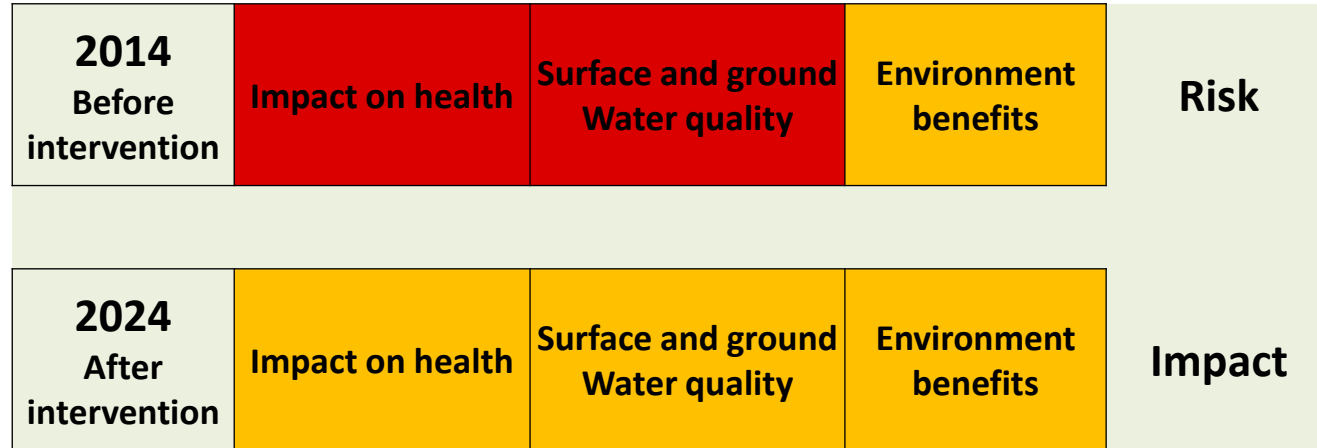
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
< 25%	25%-50%	> 50%

4 Exposure of public to raw sewage flowing in open drains or dumped in open ground?

<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low	Medium	High

5 Disposal mechanism of solid waste prevalent in your city? (Input for all applicable modes)

Mode of disposal	
Burning of solidwaste	<input type="checkbox"/>
Disposed in waterbodies	<input type="checkbox"/>
Disposed on open ground	<input type="checkbox"/>



Reduction in
diarrhea

Reduction in
Pollution in
waterbodies

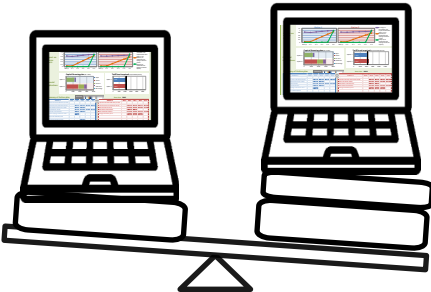
Healthy and
Clean town

Conclusion

Better planning
Evidence based decision-making process



Compare feasibility of options



Assess Service level Outcomes and impact on finances

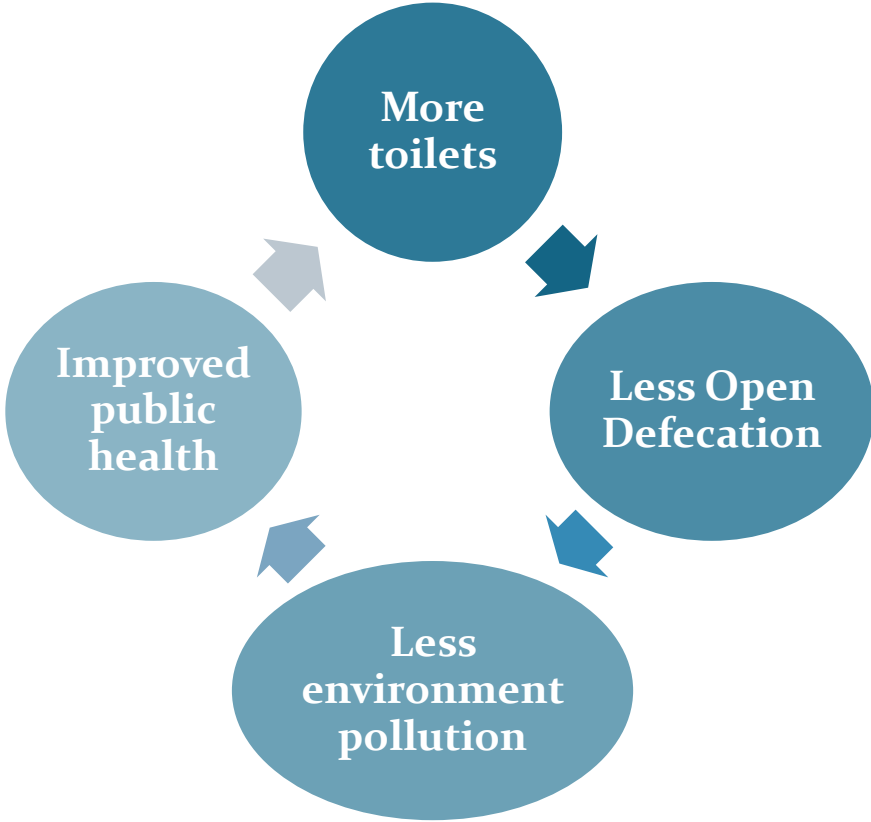
Service Outcomes



Finance



Assess impact of improved sanitation on public health and environment



Investment in improved sanitation is investment in better Public Health

Thank you . . .

meeramehta@cept.ac.in
dineshmehta@cept.ac.in
upasana.yadav@cept.ac.in

CEPT
UNIVERSITY

C-WAS Center
For Water And Sanitation

pas.org.in



pas@cept.ac.in



[pas_project](https://www.facebook.com/pas_project)



[pas.cept](https://twitter.com/pas.cept)



[pascept](https://www.linkedin.com/company/pascept)



[PASproject](https://www.youtube.com/channel/UC...)



tiny.cc/pasenews

