BANGKOK

Climate Resilience Pathways:

Water Security and WASH in Asia Pacific

Climate resilient sanitation: Navigating and financing options for adaptation and mitigation

TUESDAY 29 APRIL – 13:30-15:00

WELCOME!!!

This session is a collaborative effort brought to you by the **Climate Resilient Sanitation Coalition**

Thank you: Sanyu Lutalo (WB), Martin Gambrill (WB), Brooke Yamakoshi (UNICEF), Michele Paba (UNICEF), Rajeev Munankami (SNV), Shahidul Islam (SNV), Jeremy Kohlitz (UTS-ISF), Freya Mills (UTS-ISF), Naomi Carrard (UTS-ISF), Sam Drabble (WSUP).

What is your starting point on climate resilient sanitation?

Agenda

- WELCOME
- **Part 1: State of the evidence on mitigation and adaptation in sanitation**
  - World Bank (adaptation),
  - UTS SCARE (mitigation and adaptation)
  - SNV (adaptation)
- **Part 2: Financing climate resilient sanitation**
  - Climate financing – animation
  - Overview of GCF guidance on sanitation
- CLOSING

Part 1: State of the evidence on mitigation and adaptation in sanitation

Climate resilient sanitation session

Climate Resilient Urban Sanitation for People, Planet and Prosperity

Sanyu Lutalo

The World Bank

BANGKOK

Climate Resilience Pathways:

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Climate-Resilient Urban Sanitation for People, Planet, and Prosperity

Sanyu Lutalo

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Why climate-resilient urban sanitation matters

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Extreme climate impacts are worsening the sanitation crisis

Globally,

3.5 billion people

lack access to safely managed sanitation

About

one third

of urban populations in low- and middle-income countries face the

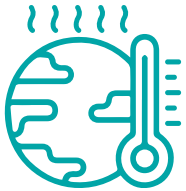
‘triple burden’

of poverty, climate hazards, and inadequate sanitation

The world must accelerate progress

five-fold

to achieve universal safely managed sanitation by 2030



Climate change is intensifying the challenge: water scarcity, flooding, rising sea levels, and extreme temperatures are straining already fragile urban sanitation systems

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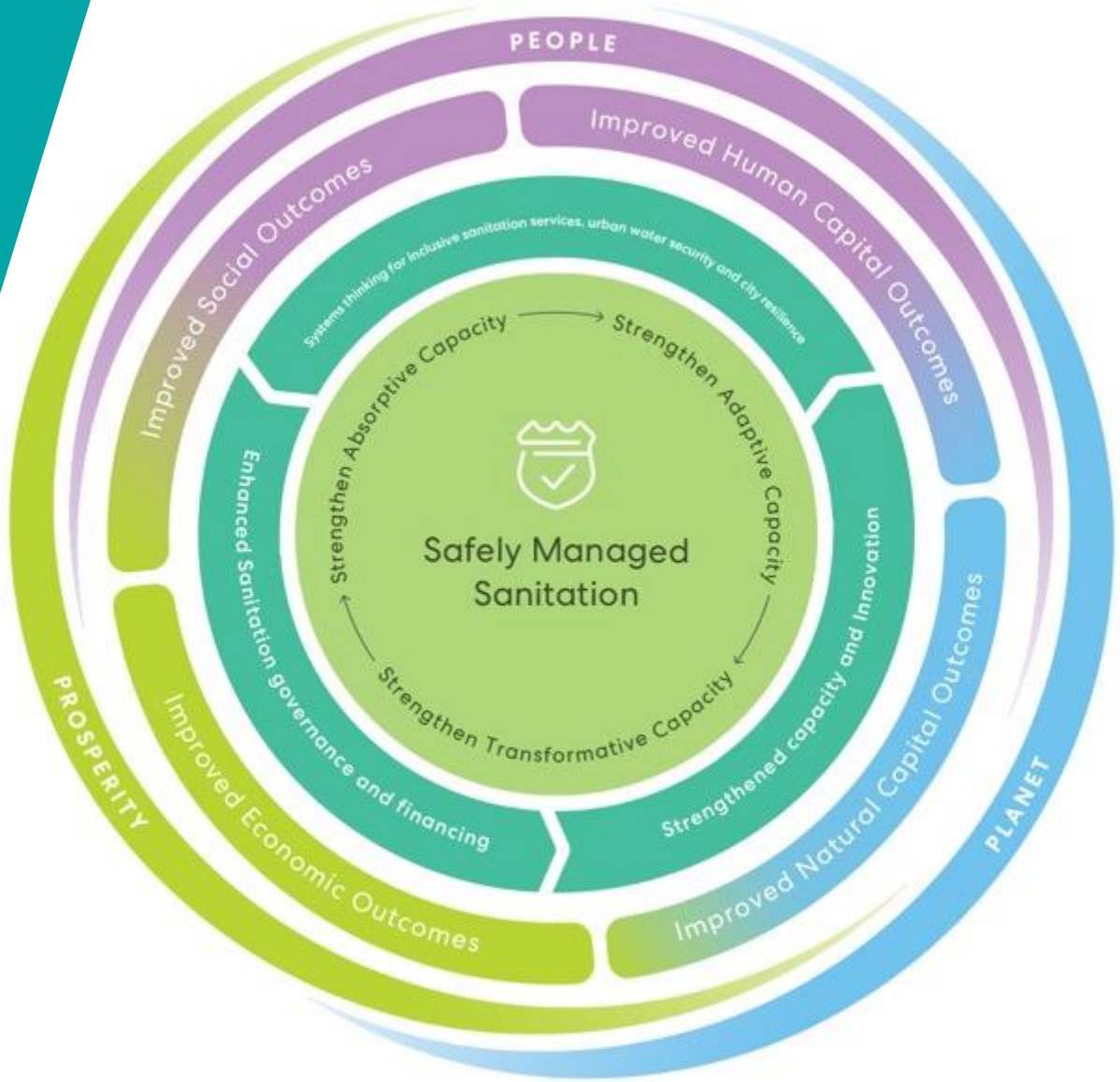
A CONCEPTUAL FRAMEWORK



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Climate-resilient sanitation and people

In crowded urban informal settlements, flooding spreads pathogens from inadequate sanitation systems, increasing public health risks.

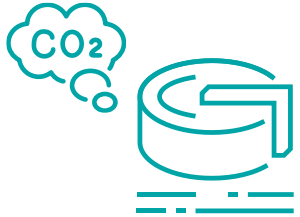
Climate hazards worsen cholera outbreaks, which are compounded by poverty and conflict. Marginalized populations – including women, girls, and people with disabilities – face the greatest health risks from climate-related sanitation challenges.

Failure of water and sanitation infrastructure caused by climate hazards can increase school absenteeism, particularly among girls managing menstruation.

Ensuring equitable access to safe and reliable sanitation services for all reduces health disparities and enhances social welfare, especially under adverse climate conditions.

Climate-resilient sanitation and the planet

Globally, large volumes of untreated or inadequately treated wastewater contaminate freshwater and marine ecosystems. This is worsened by climate change impacts, such as extreme rainfall and resulting sewer overflows.

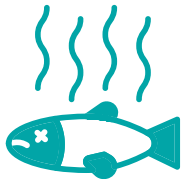


Greenhouse gas emissions from sanitation systems contribute to global warming.

High residual loads of phosphorous and nitrogen, associated with untreated or poorly treated wastewater, harm biodiversity and water ecosystems.

Sustainable sanitation practices – such as treating wastewater and fecal sludge and transforming waste into valuable resources – can prevent water pollution, reduce greenhouse gas emissions, and maintain the delicate balance of environmental systems.

Climate-resilient sanitation and shared prosperity



Downstream environmental pollution is estimated to reduce GDP growth by up to one third. Coastal ecosystems provide global services of about US$25 billion per year, protecting shorelines, storing carbon, and supporting tourism.

Droughts and floods interrupt school attendance and damage critical infrastructure, especially affecting the income of the poor and limiting their children's future earning potential

Jobs can be created directly through building, adapting, retrofitting, managing, and maintaining sanitation systems in response to climate change.

Investing in climate-resilient sanitation protects ecosystems from pollution, enhances livelihood opportunities, and creates jobs.

What is climate-resilient sanitation?

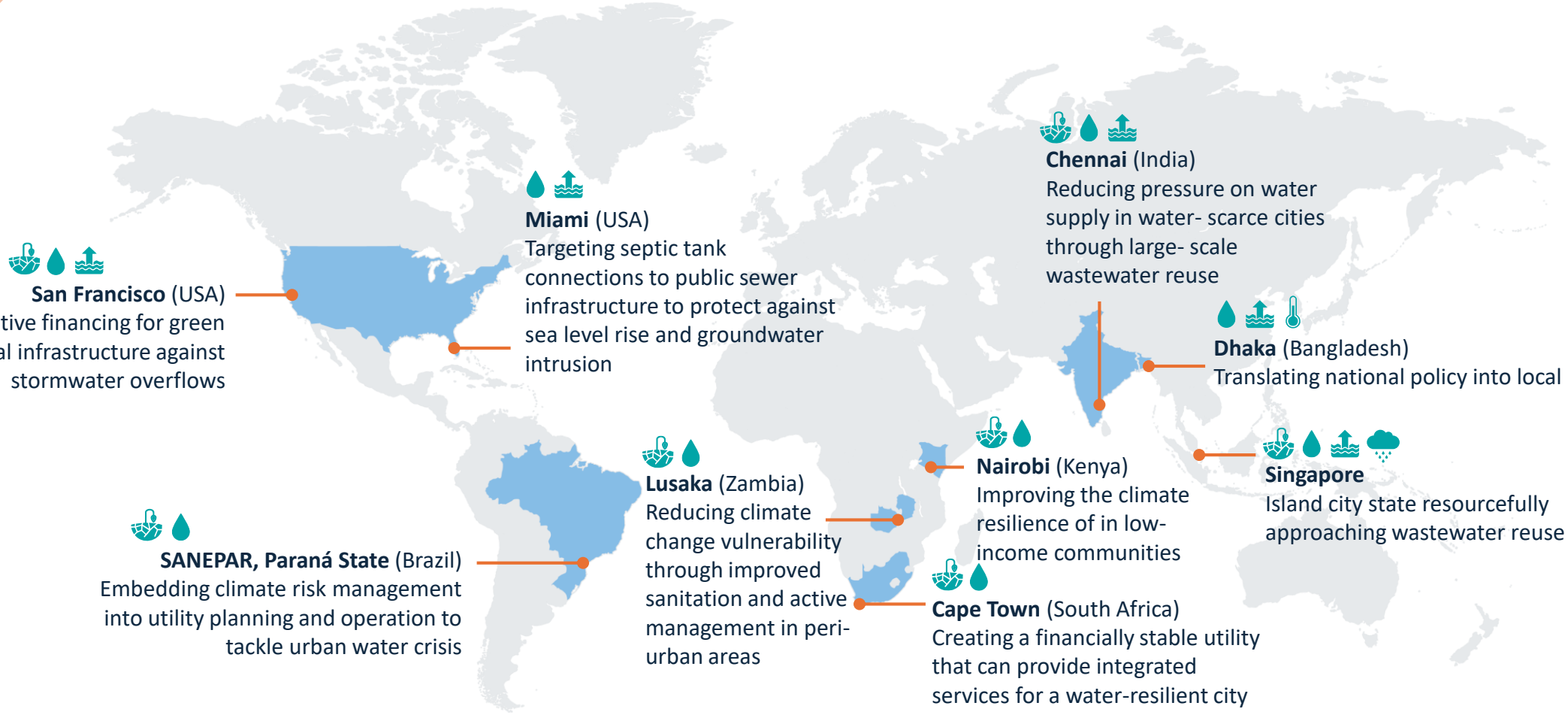
Climate-resilient sanitation services **anticipate, respond to, cope with, recover from, adapt to, or transform from** climate-related events, trends, and disturbances while striving to **achieve and maintain universal access to safely managed services**, even **in the face of an unstable climate**, paying **special attention to the most exposed vulnerable groups** and, where possible and appropriate, **minimizing emissions.**

Building urban resilience to climate change

Climate-resilient sanitation:

- Includes **sewered and non-sewered systems** designed to minimize environmental pollution, reduce greenhouse gas emissions, and improve public health.
- Supports **transformative adaptation** by **integrating sanitation into the broader urban water cycle** to concurrently address water scarcity, the impacts of climate change on wastewater and stormwater systems.
- Involves fostering **inclusive and equitable citywide sanitation services** and enhancing the capacities needed to manage them.

Water challenges are prompting many cities to rethink their sanitation systems



Climate Hazards

- Drought
- Flooding
- Sea level rise
- Increased temperatures
- Rainfall

San Francisco (USA)
Innovative financing for green capital infrastructure against stormwater overflows

Miami (USA)
Targeting septic tank connections to public sewer infrastructure to protect against sea level rise and groundwater intrusion

Chennai (India)
Reducing pressure on water supply in water- scarce cities through large- scale wastewater reuse

Dhaka (Bangladesh)
Translating national policy into local action

Singapore
Island city state resourcefully approaching wastewater reuse

Nairobi (Kenya)
Improving the climate resilience of in low-income communities

Lusaka (Zambia)
Reducing climate change vulnerability through improved sanitation and active management in peri-urban areas

Cape Town (South Africa)
Creating a financially stable utility that can provide integrated services for a water-resilient city

SANEPAR, Paraná State (Brazil)
Embedding climate risk management into utility planning and operation to tackle urban water crisis

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Rethinking urban sanitation in the face of climate change

- Cities are struggling **with too much, too little, and too polluted water** as a result of climate-induced hazards.
- An **integrated, systems-wide** approach to sanitation planning and programming is necessary. A **citywide inclusive sanitation approach** involves tackling structural inequities in service provision and striving to provide universal, equitable, and sustainable services.
- **Circular economy** approaches can enhance the climate resilience of urban sanitation, protect the environment, and yield financial benefits.
- A **robust enabling environment, strong governance, and effective financing mechanisms** are vital for implementing resilient sanitation systems.

The transformative potential of circular climate-resilient sanitation systems

By incorporating circular economy principles into climate-resilient sanitation systems, cities can:

Maximize water-use efficiency

Enhance water security

Recycle nutrients and soil conditioners

Diversify urban water sources

Restore ecosystems

Generate energy and reduce emissions

Reduce costs and create income potential

For example, biogas produced from wastewater or biochar from fecal sludge can reduce reliance on fossil fuels.

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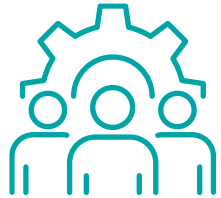
A robust enabling environment and effective governance are crucial

Achieving climate-resilient urban sanitation requires concerted stakeholder engagement across sectors and different levels of governance.

Effective partnerships are key for ensuring coordinated action. Successful outcomes require clearly assigned responsibilities, strong accountability mechanisms, and alignment of incentives, funding, monitoring systems, and regulations.



Strong political leadership is vital for integrating climate change considerations into sanitation policies and sanitation into climate action, as well as for translating policies into action.

The costs of climate-resilient sanitation

Substantial investments are needed to incorporate climate resilience into sanitation systems, but **the costs of inaction will be far higher**.

Many **national budgets overlook the financial impact of climate hazards on sanitation**.

Achieving universal access to climate-resilient sanitation requires **focusing on both immediate financing needs and long-term funding sustainability**.

Financing solutions include:

- Integrating service provision to capitalize on economies of scope and of scale
- Implementing well-designed cross-subsidies
- Accessing climate finance
- Creating opportunities for private-sector investment.

What needs to be done?
Policy objectives

1

Improve sanitation governance and increase financing to support a systems approach to transformative adaptation and climate resilience.

2

Rethink urban sanitation and implement systems thinking that emphasizes inclusive sanitation services, urban water security, and climate resilience.

3

Enhance capacity building and skills development and adopt innovative technologies and practices to create adaptive, resilient, and sustainable sanitation systems.

Policy objective 1

Improve sanitation governance and increase financing to support a systems approach to transformative adaptation and climate resilience

Actions

1. Adopt flexible planning, financing, management, and regulatory frameworks to support adaptation and mitigation efforts of service providers.
2. Integrate circular economy approaches into sanitation policy, institutional, and regulatory frameworks.
3. Prepare service providers and governments for multiple revenue streams and to incentivize private-sector engagement in service delivery and resource recovery.
4. Incorporate costs of climate-resilient sanitation into project-financing mechanisms to balance financial viability with affordability.
5. Incorporate sanitation in existing climate commitments across all levels of government.

Policy objective 2

Rethink urban sanitation and implement systems thinking that emphasizes inclusive sanitation services, urban water security, and climate resilience.

Actions

1. Focus on providing effective, universal sanitation services, integrating existing principles of CWIS with climate resilience.

2. Integrate sanitation with wider urban services and development processes.

3. Prioritize activities that emphasize adaptation while seizing opportunities for mitigation.

Policy objective 3

Enhance capacity building and skills development, and adopt innovative technologies and practices, to create adaptive, resilient, and sustainable sanitation systems.

Actions

1. Develop capacity, knowledge, skills, and mechanisms for innovative and sustainable adaptation and mitigation in the sanitation and related sectors.

2. Enhance data collection and monitoring capacity to promote evidence-based climate-resilient sanitation services and financing, using innovative tools and technologies.

3. Strengthen local government and utility capacity to drive innovation for resilient sanitation systems, focused on reducing climate-induced failures and mitigating greenhouse gas emissions.

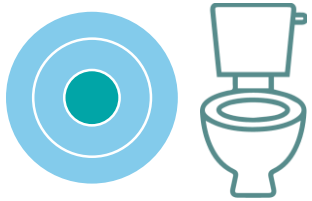
Implementation pathways for action on policy recommendations

Implementation plans and pathways in countries and cities will vary, depending on existing sanitation coverage, income levels, vulnerability to climate change, and related factors such as availability of funding, institutional capacity, and development priorities.

In all cases, the **systematic assessment and modeling of climate risks and impacts** on sanitation systems can help identify appropriate interventions and ensure they are climate smart.

Mapping poverty, climate risk, and low access to sanitation services is a useful way to prioritize areas at country, regional and city level in order to tailor investments and interventions.

Tailoring priorities to local context

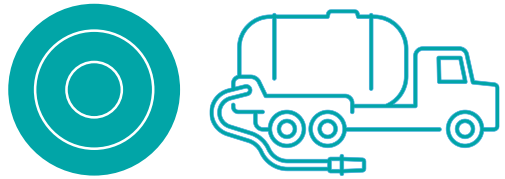


Cities with low sanitation coverage and limited resources

- Focus on safely managed sanitation for all and on reducing vulnerabilities

Cities with higher sanitation coverage

- Build resilience to withstand climate stresses and to reduce pollution and greenhouse gases



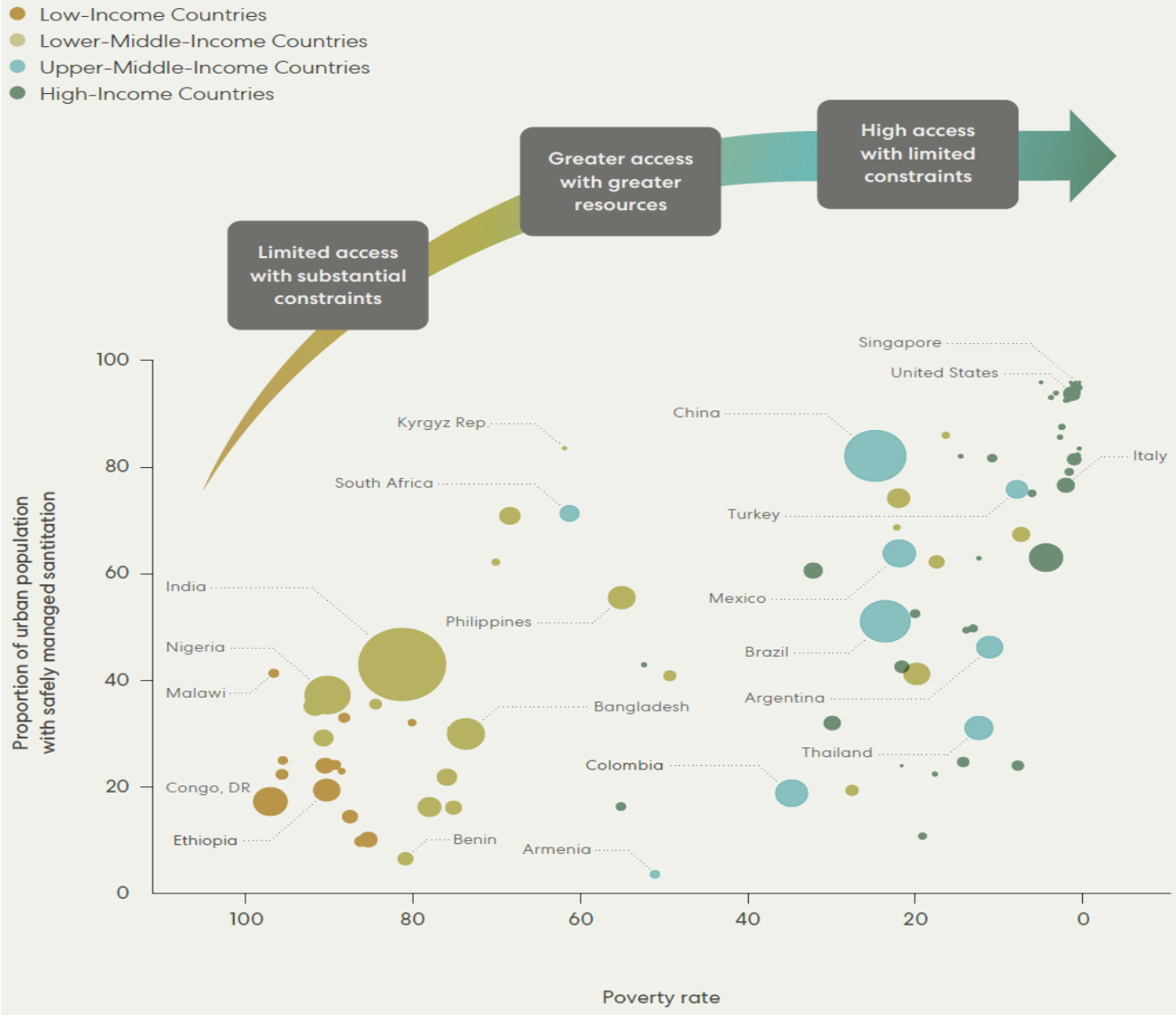
Cities with high sanitation coverage and adequate resources

- Lead innovation in climate-smart service systems

Priority action pathways reflecting the relation of poverty with deficits in safely managed urban sanitation

Countries will need to prioritize action based on context.

The graphic shows countries' level of access to safely managed sanitation in relation to poverty.



Priority action pathways reflecting the relation of GDP with deficits in safely managed urban sanitation

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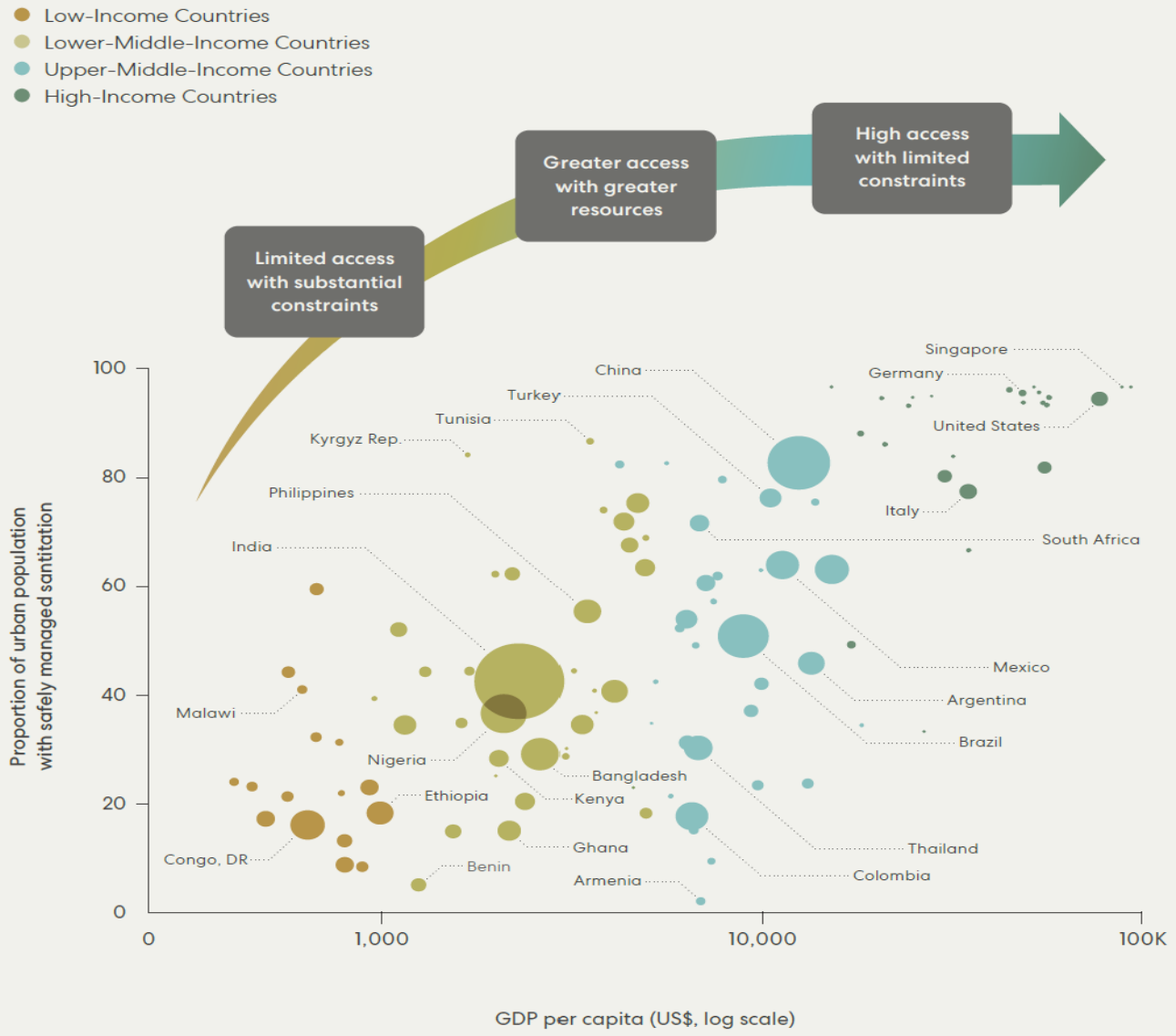

The time to act is now!

There is an urgent need to shift to climate-resilient sanitation for all

Governments and utilities must rethink urban sanitation service provision beyond infrastructure and on a citywide scale

Coordinated action is particularly critical in rapidly growing cities in low- and middle-income countries

Building climate-resilient sanitation systems will enhance urban water security, boost prosperity, and make cities more livable

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Climate resilient sanitation session

Sanitation and Climate: Assessing Resilience and Emissions (SCARE)

Dr Freya Mills

UTS-ISF

Project background

SCARE is a research project focusing on understanding greenhouse gas emissions and the climate resilience of sanitation with a focus on household facilities

i) **Field assessments of direct emissions of methane and carbon dioxide from containments** (latrines, tanks) in Nepal, Ethiopia, Uganda & Senegal to provide better empirical evidence to support more reliable estimates of sanitation contribution to GHGs

ii) **Assessing climate resilience of sanitation systems** in Nepal, Ethiopia & Uganda to improve evidence on actions needed to strengthen resilience

Consortium led by University of Bristol with University of Technology Sydney, Kathmandu University, University of Leeds, Haramaya University, Kyambogo University, Ecole deThies, Global Green Growth Institute

Two strands of field research

Emissions assessment

- Direct measurements of CH4 & CO2 from on-sanitation containments using a new design of flux chamber
- Design based on systematic review of flux chambers previously used (Poudel et al 2023)
- Faecal sludge characteristics also measured in field and lab
- Groundwater inundation model developed (Reddy et al 2023)
- Toilet typologies defined (most ‘septic’ tanks just holding tanks)

Resilience assessment

- Surveyed 1,429 households across Nepal, Ethiopia, and Uganda
- Interviewed several dozen community members, service providers, and local government staff
- Analysis of survey results to determine sanitation attributes correlated with sanitation performance during floods
- Mapping results of surveys and interviews against a newly created sanitation resilience framework

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Climate Resilience Pathways:

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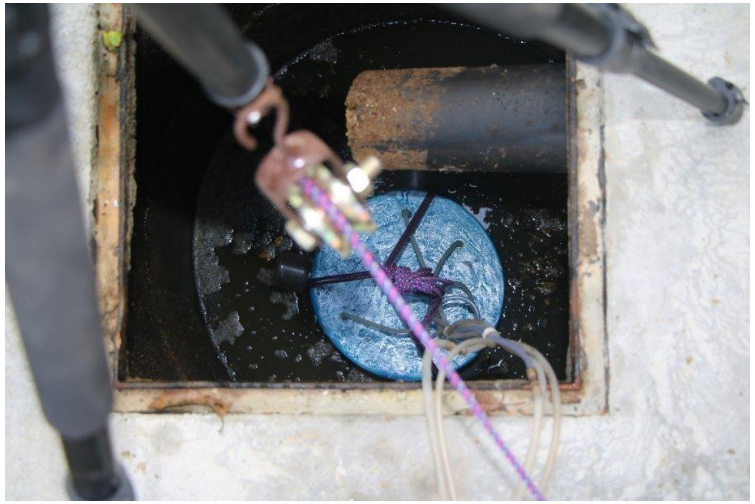
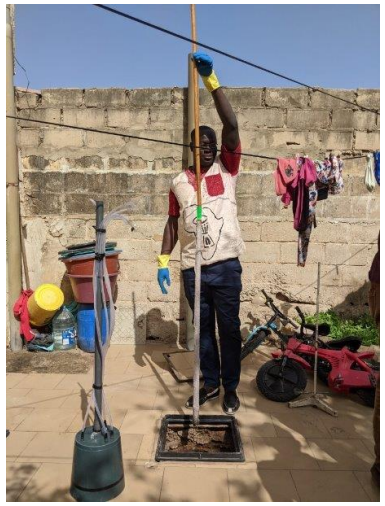
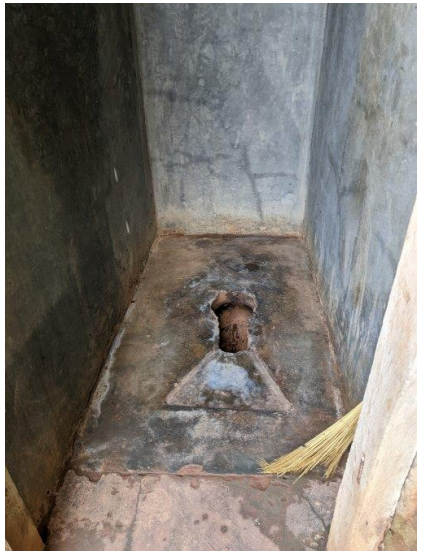
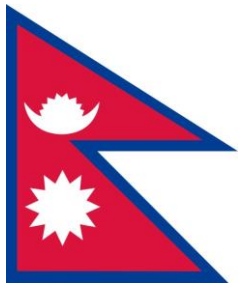






Annual CH4 Emission Ranges

Country	Ethiopia	Nepal	Senegal	Uganda
				
Median (IQR) g CH_4/cap/day	21.6 (4.4 – 68.4)	6.6 (3.4 – 12.9)	15.9 (6.8 – 37.0)	9.0 (4.1 – 19.4)

IPCC mean emission rate for onsite sanitation: 3.2 g CH_4/cap/day (Manga and Muoghalu, 2024)

Emerging emissions findings

- Ranges have been presented for each country, instead of per containment type as there is a need to consolidate a unified definition of onsite containment units

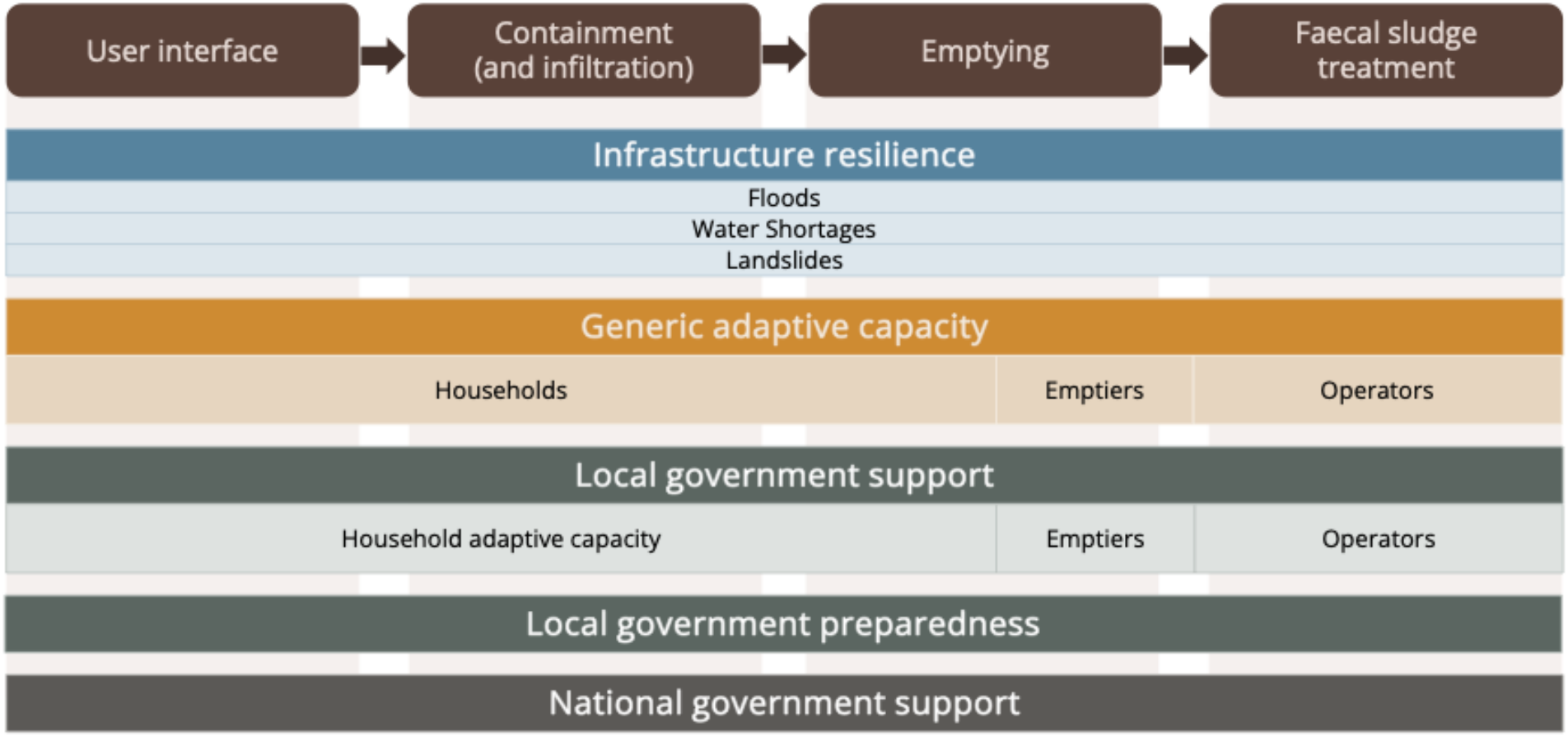
- On-site sanitation options often do not follow standardised design/construction criteria but still are commonly classified under a generic category (i.e., holding tanks are usually referred as septic tanks). This creates a challenge when using theoretical emission factors referring to specific on-site sanitation typologies.

- Portable, low-cost CH4 and CO2 analysers can report accurate data, within their own limitations, but fieldwork and calculation of empirical GHG emissions required well trained personnel to overcome the limitations from combining such equipment with flux chamber methods.

Emerging resilience findings

- Analysis focused on floods which are relevant in all three country contexts (droughts and landslides are less relevant for Uganda and Ethiopia sites where dry toilets are common)
- Flood-exposure correlated with higher rates of sanitation failures
- Poor quality sanitation (e.g. crack in slabs, impermanent superstructures) associated with higher rates of flood-related failures
- Poor quality sanitation infrastructure, living in rural areas, and discomfort using a neighbour's latrine associated with open defecation following flood damage

Climate resilience of sanitation framework



Climate resilient sanitation session

WASH SDG Project end-line survey flood and drought findings

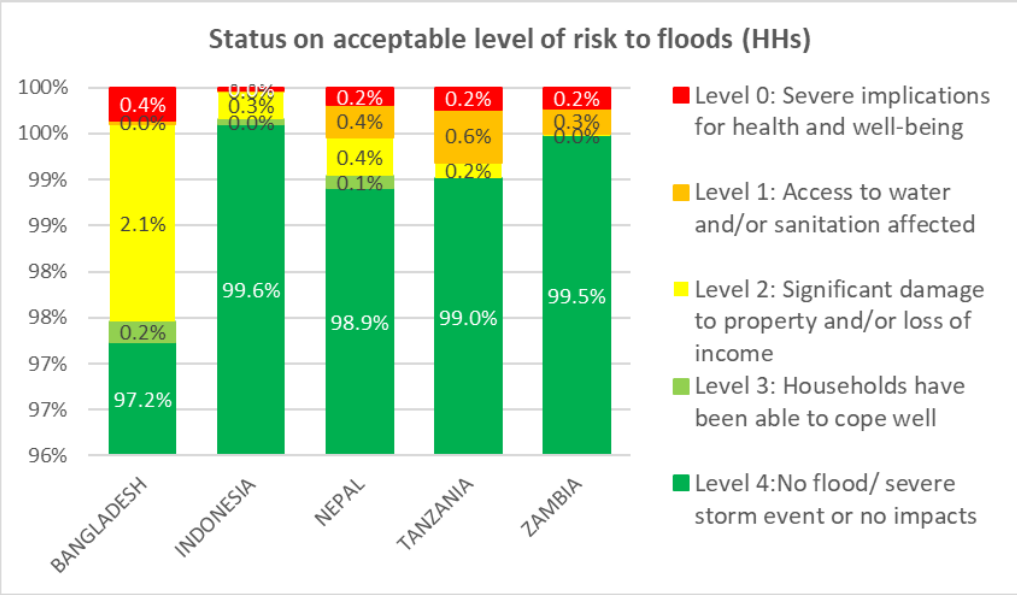
Shahidul Islam

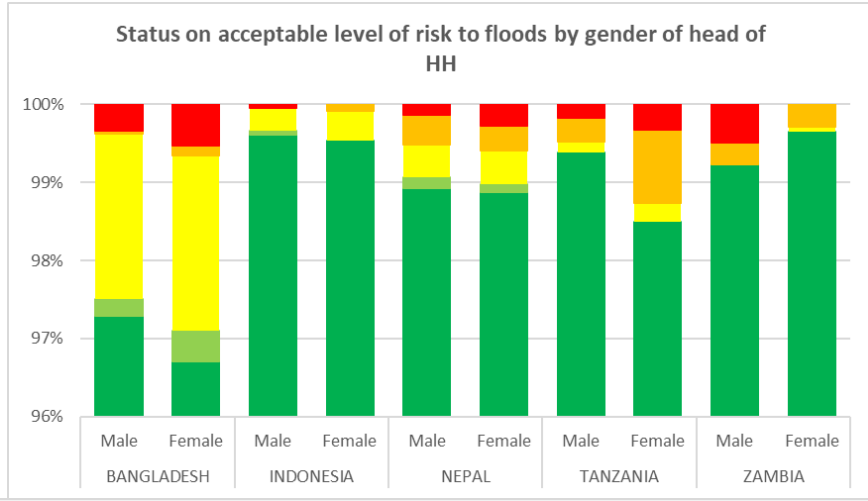
SNV

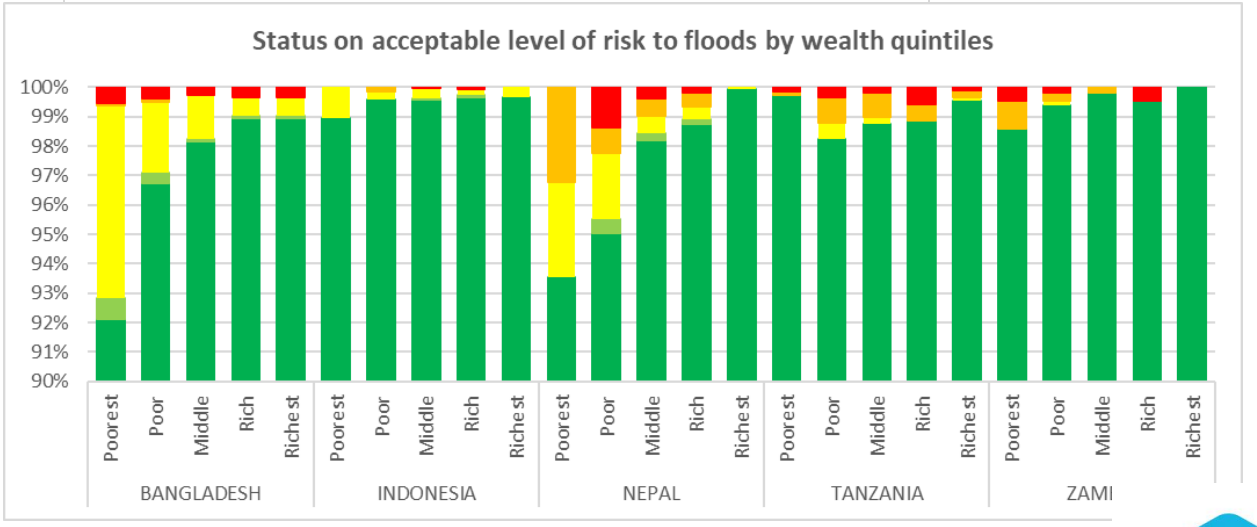
WASH-SDG project background

- The consortium project, led by the Netherlands WASH SDG Consortium: WASH Alliance, SNV and Plan.
- Dutch commitment to contribute to SDG 6, with the aim of reaching an improved WASH situation for all.
- Strategic objective: increase demand, improve quality of service provisions, and improved governance.
- Implemented in Bangladesh, Ethiopia, Indonesia, Nepal, Tanzania, Uganda and Zambia.
- SNV implemented in 18 cities of 5 countries
- Endline survey conducted in 2023, included flood and drought module

Status of flood by countries

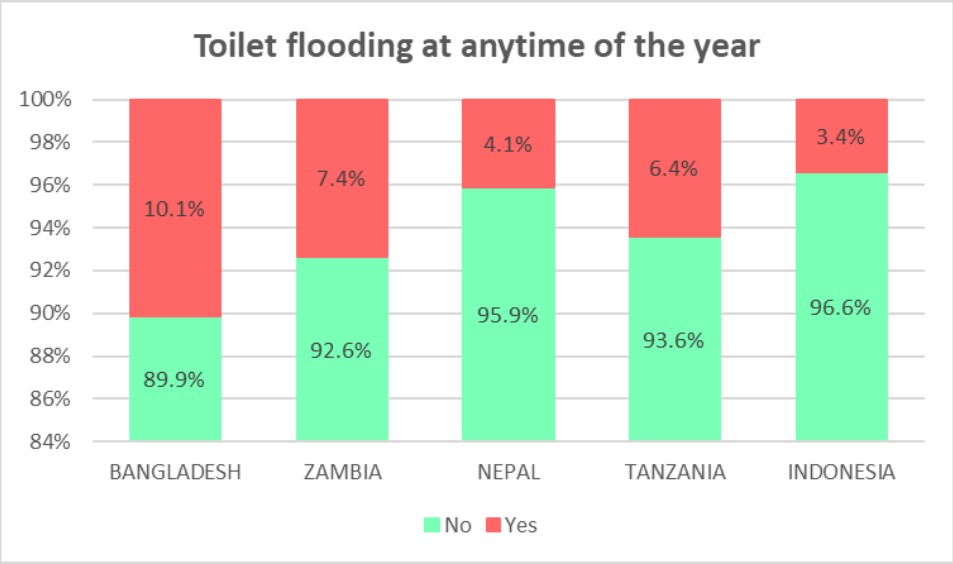


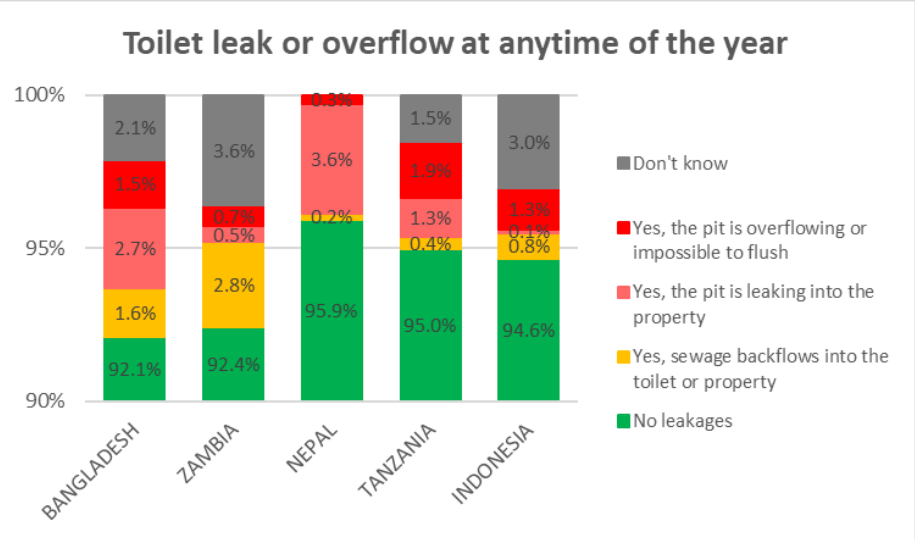




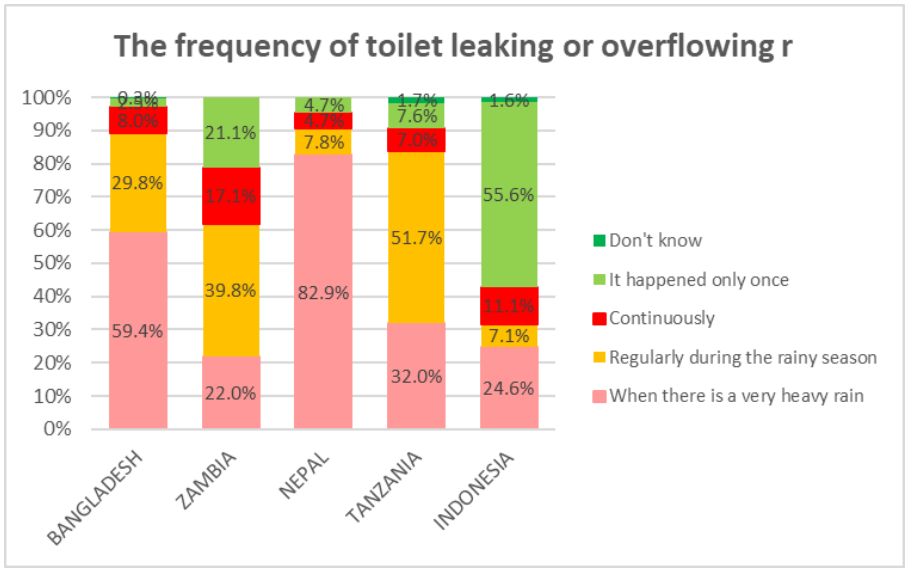
- The ratio of households in Bangladesh project sites is higher among the countries.
- Female-headed households also affect more compared to the male-headed HHs
- Households in lower wealth quintiles are the most vulnerable, and significantly higher in Bangladesh and Nepal.

Impact of flood on sanitation system

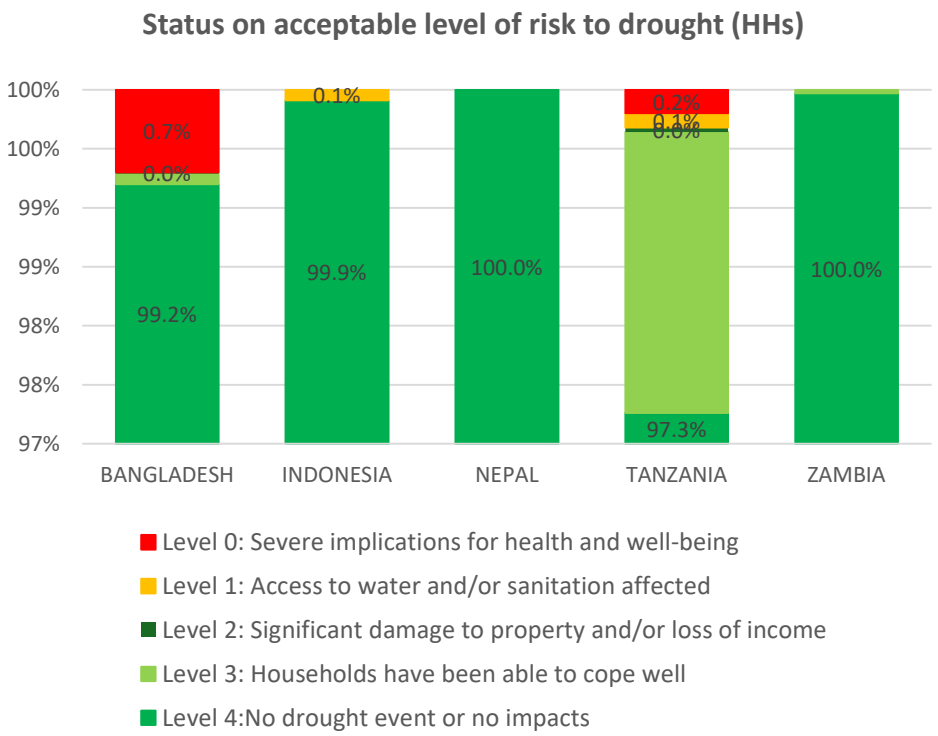


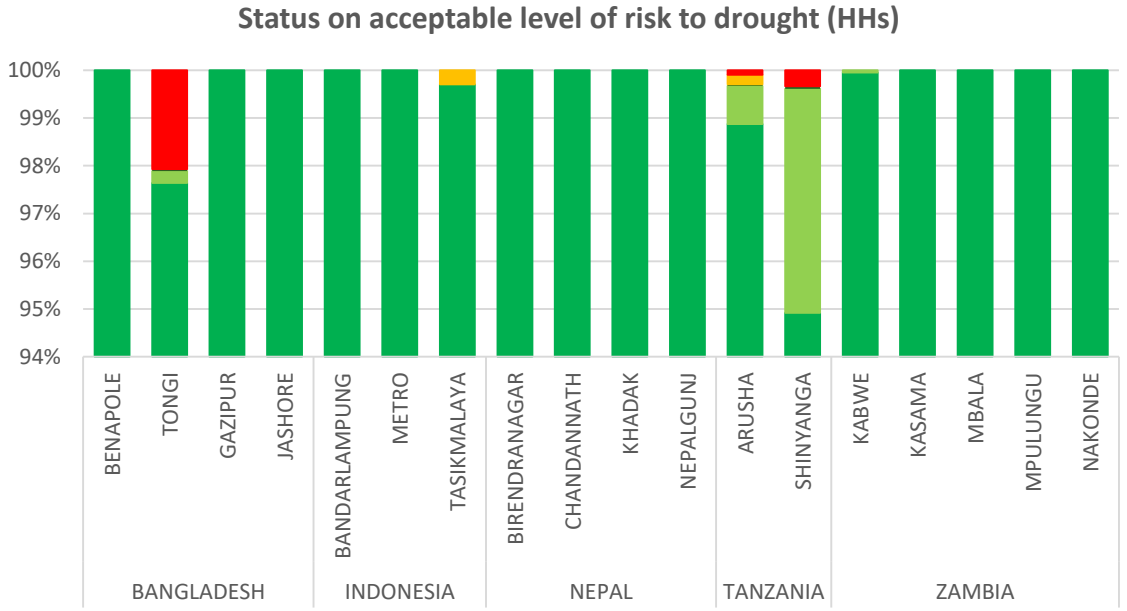


- A significant potion of the HH toilets got affected during flood. The ratio is higher in Bangladesh.
- There are evidences that a portion of the HH toilets had leak of overflow at any time of the year, and it is noticeable during rainy season.



Status of drought

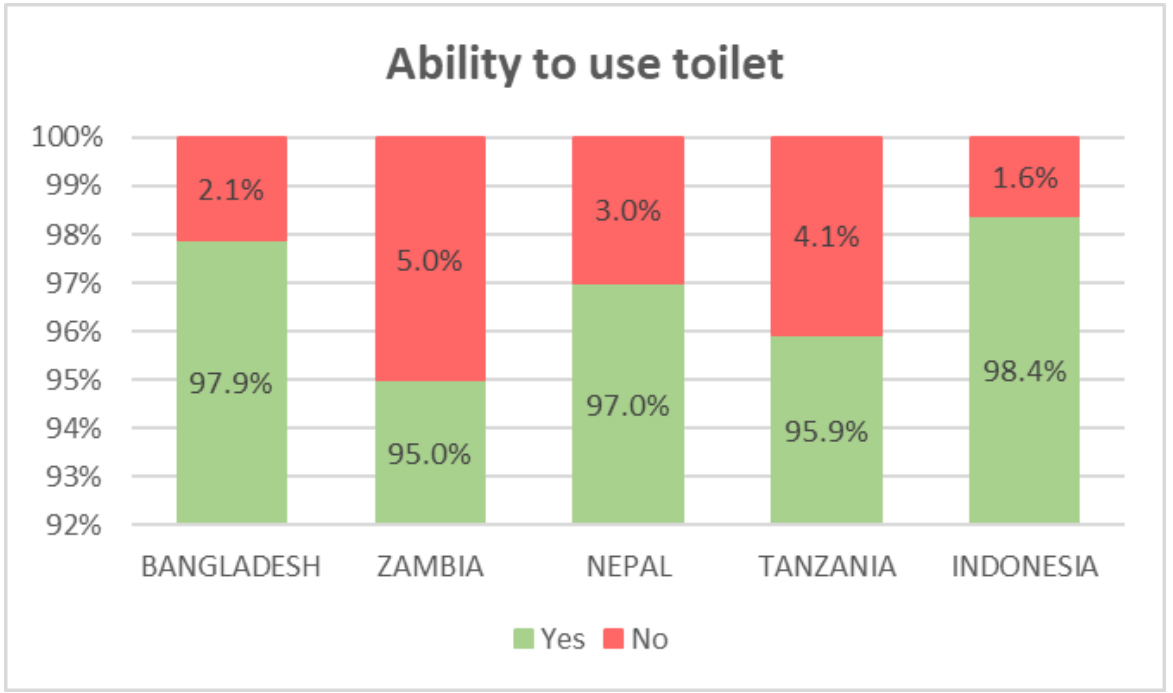




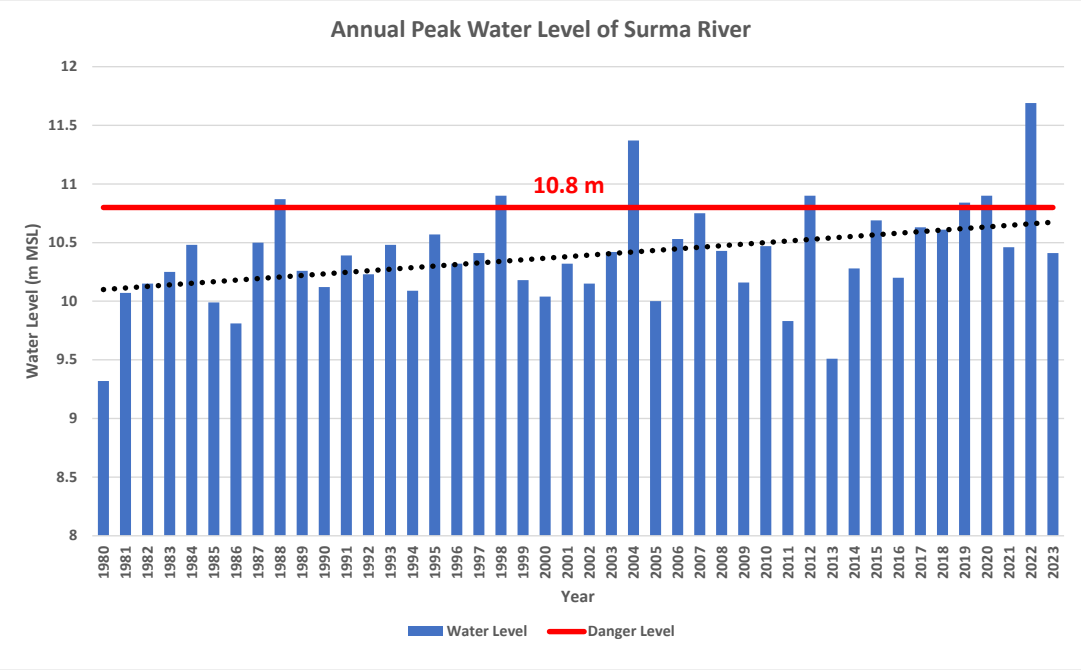
- The ratio of households in Bangladesh project sites is higher among the countries.
- Tongi in Bangladesh: industrial area, high population density, lot of poor settlement, onl dependant of ground water

Most vulnerable people are concerned

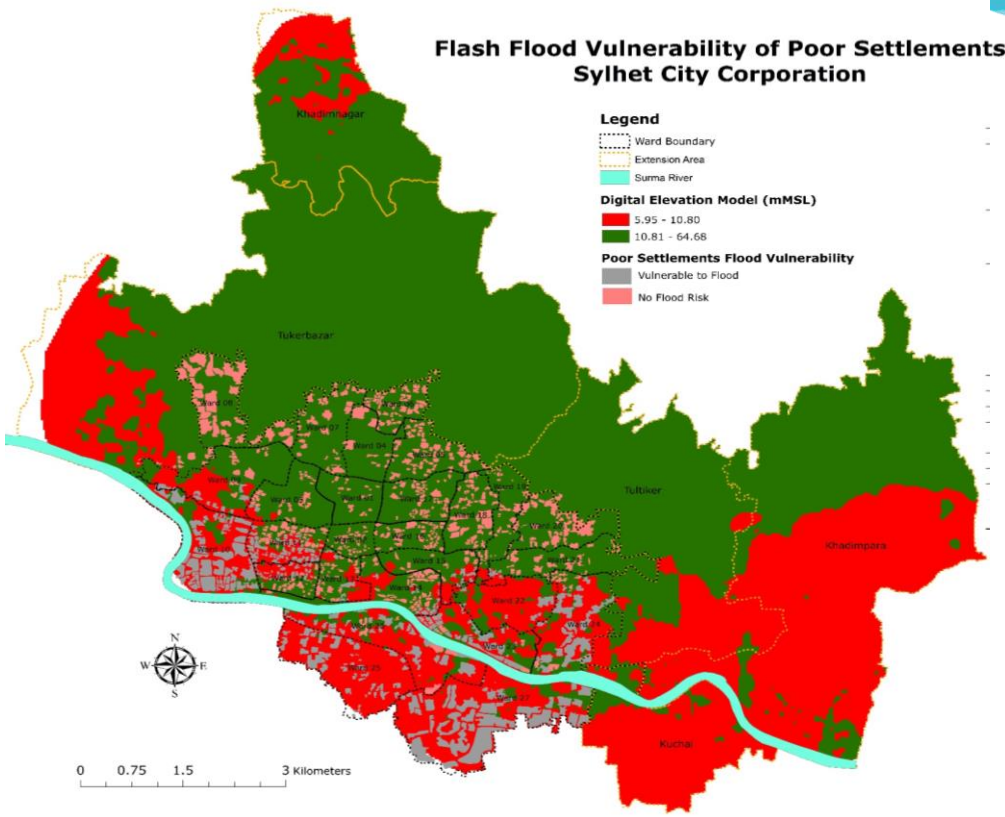
- A small portion of the household members were not able to use toilet themselves.
- They are most vulnerable during flood.



Flood Vulnerable Area in Sylhet, Bangladesh (2022)



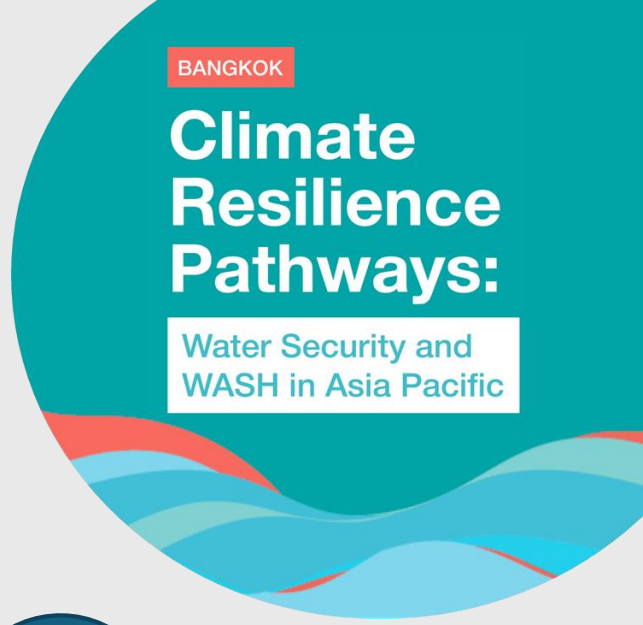
- Consistent increase in annual peak water level.
- Poor households are the most sufferer: specially to use sanitation & waste management services
- Identified bottlenecks in the drainage system, flooding the low-lying areas (low-income settlements)
- Urban flood has not been focused yet: poot early warning system, no preparedness, poor response



335 poor (one-third) settlements are identified who are vulnerable to flood (total 1,026).

Kingdom of the Netherlands

DISCUSSION



What is the relevance of this evidence to your situation and context?

What further evidence needs are most important for your organisation?

Part 2: Financing climate resilient sanitation

Climate resilient sanitation session

Cambodia- survey and financing strategy

Brooke Yamakoshi, Michele Paba

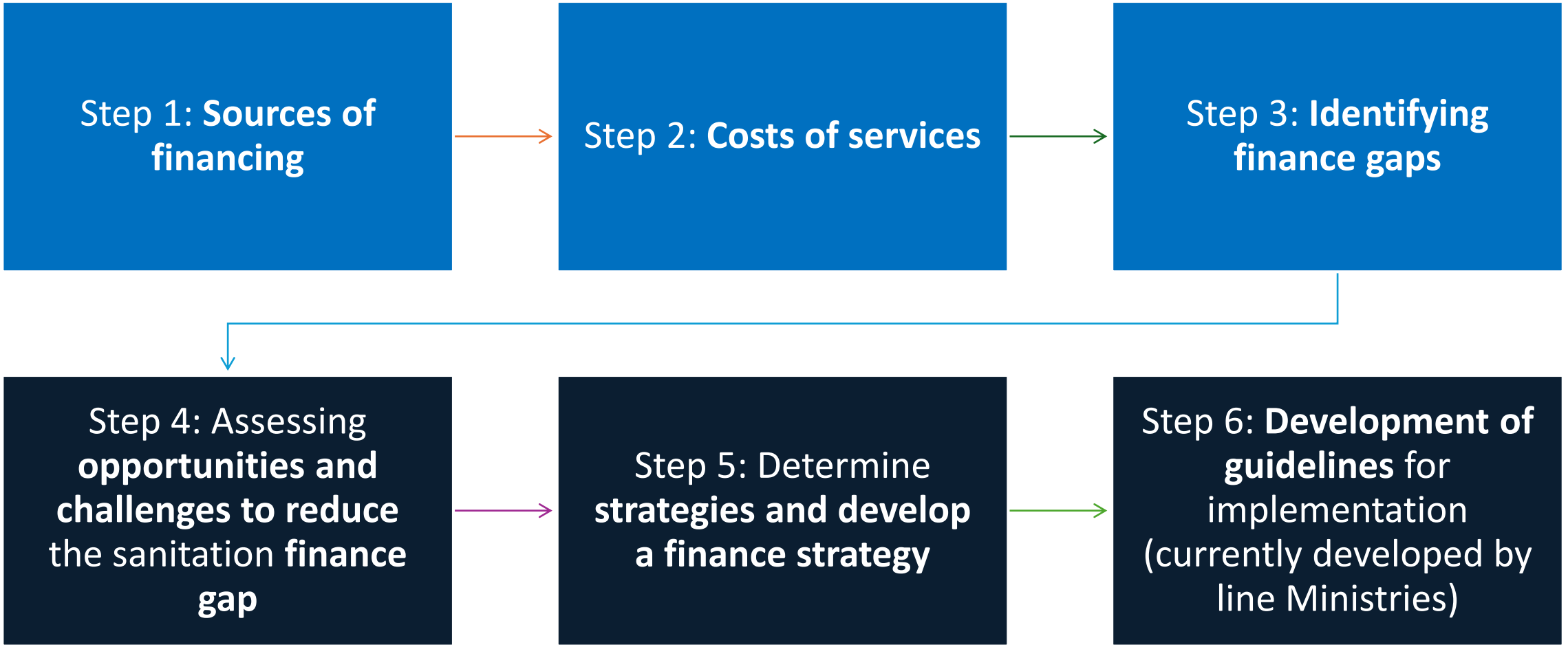
UNICEF

National Finance Strategy for Sanitation

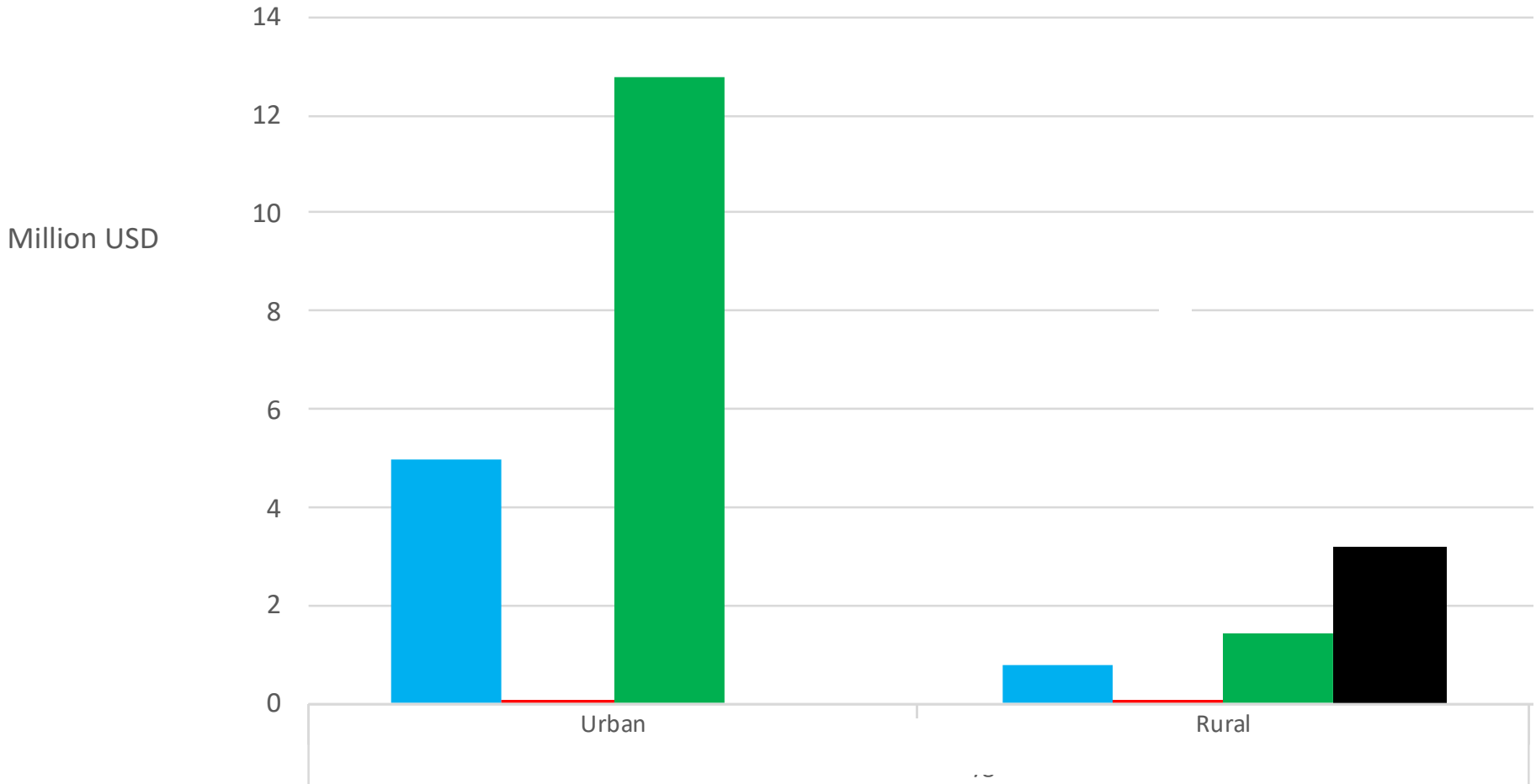
CAMBODIA

unicef

Steps for the development of the strategy



STEP 1 Source of financing: Public funding sources for sanitation, annual, in USD

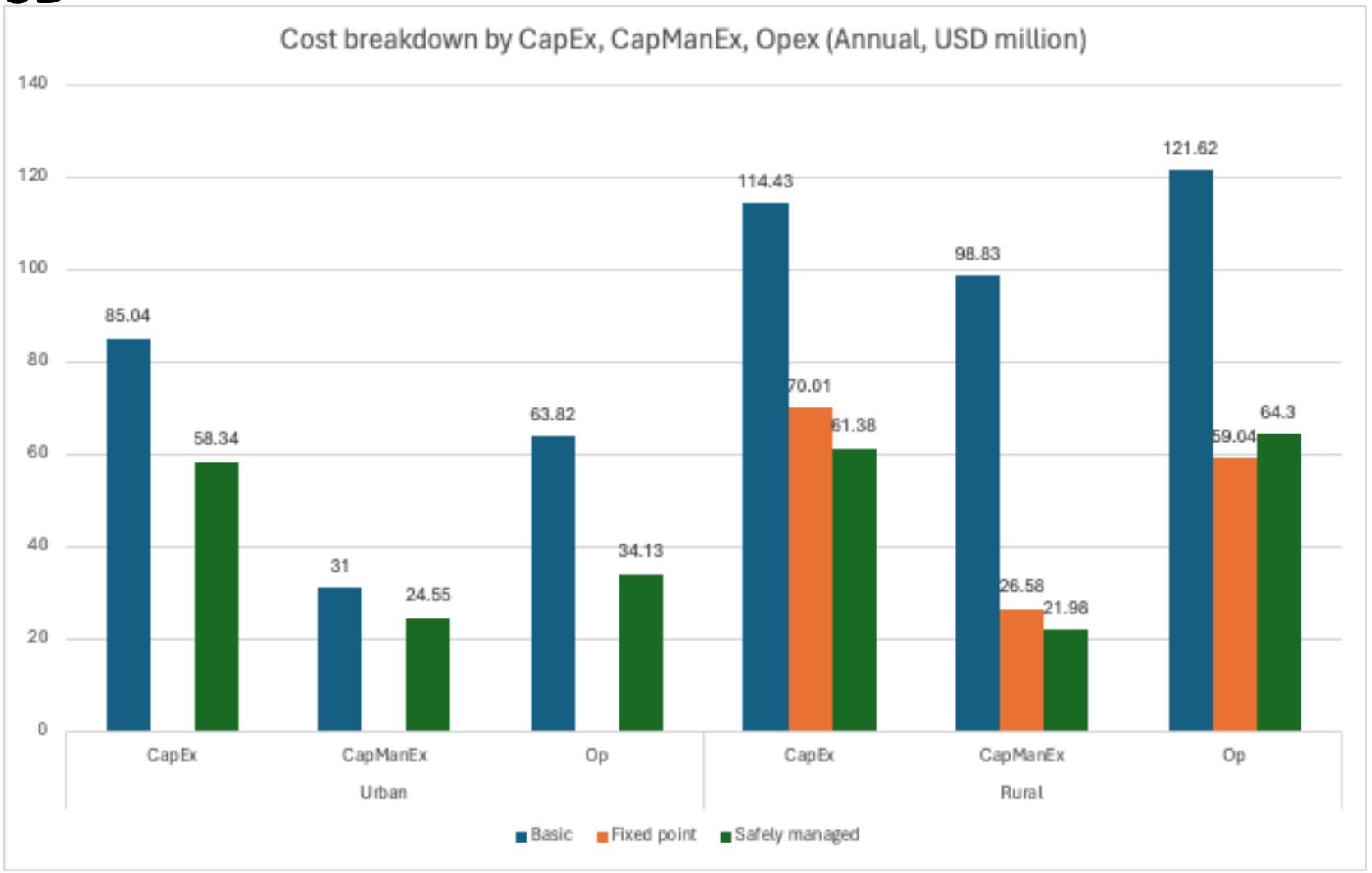


	Urban	Rural
NATIONAL BUDGETS SPENT	5,000,000	775,000
SUB-NATIONAL BUDGETS SPENT	98,500	98,500
CURRENT ODA (loans or repayable financing)	12,780,000	1,420,000
CURRENT ODA (grants and voluntary transfers)	0	3,200,000

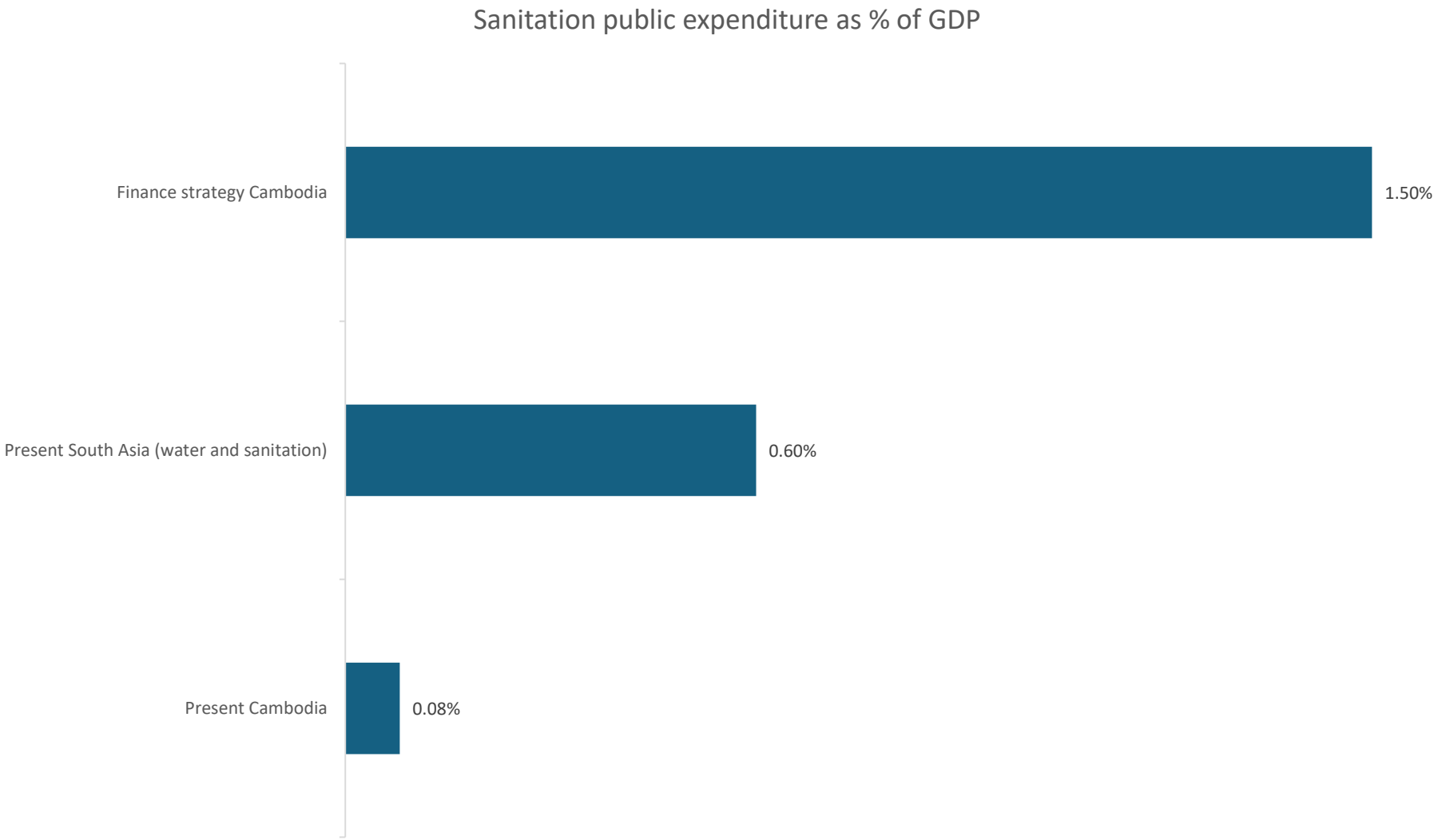
STEP 1 Source of financing: Household/consumer contributions to CapEx, CapManEx and OpEx for sanitation (estimates)

Cost	Household/consumer contribution	USD, millions
OpEx		
Rural	100%	245
Urban	100% for basic sanitation	64
	50% for safely managed sanitation	17
Total Opex		**326**
CapManEx		
Rural	100%	147
Urban	100% for basic sanitation	31
	50% for safely managed sanitation	12
Total CapMaEx		**191**
CapEx		
Rural	90%	221
Urban	90%	77
	50% for safely managed sanitation	29
Total CapManEX		**327**
Total household/consumer contribution		**843**

STEP 2 cost of services: Annual costs of reaching entire population with different service levels by 2030, by main cost component, in MUSD



STEP2: Sanitation public expenditure as % of GDP



STEP 3: Annual funding gap to reach national sanitation targets, USD millions

	Estimated annual costs CapEx, CapManEx, OpEx (USD, million)	Estimated household annual contributions (USD, million)	Present annual public funding (USD, million)	Estimated annual funding gap (USD, million)
Urban	297	230	17.9	49
Rural	638	614	5.5	19
Total	**935**	**843**	**23.4**	**68**

STEP4

Foundational elements required to attract additional finance	Urban sanitation	Rural sanitation
Government level		
1. Finance strategies and policy		
2.Tariff setting and economic regulation		
3.Regulation and accountability mechanisms		
4.Clarity of mandate and obligations of service providers		
Service provider level		
5.Service providers financial and operational management		
6.Business planning and client acquisition		
7.Autonomy and legal framework		
Suppliers of finance level		
8.Commercial/ Public Development Bank risk profile		
9.Market distortions		
10.Development funds crowding out private investments		

STEP 5: Options to reduce finance gap

Total **financing gap estimated at USD 68 m per year**

15 options identified to reduce gap

Potential to raise between USD 58 m and 123 m per year

Three areas were explored:

- Increase efficiency of existing funds
- Raise more funds
- Raise more repayable finance

STEP5: Options to reduce finance gap

Increase efficiency of avalaible funds

Options		Minimum range per year USD	Maximum range per year USD
1	Subsidy targeting	4,000,000	6,000,000
2	Ringfencing the 10% sanitation fee in Phnom Penh	4,000,000	4,000,000
3	Develop asset management plans for WWTPs	Not estimated	Not estimated
4	Support local authorities with options and costs for adequate budgeting processes and cost reduction	Not estimated	Not estimated
5	Use of decentralised sanitation solutions in cities/ towns	Not estimated	Not estimated
6	Phased approach to FSTP development	Not estimated	Not estimated
7	Create a sanitation budget code to track and monitor sanitation funding flows	Not estimated	Not estimated

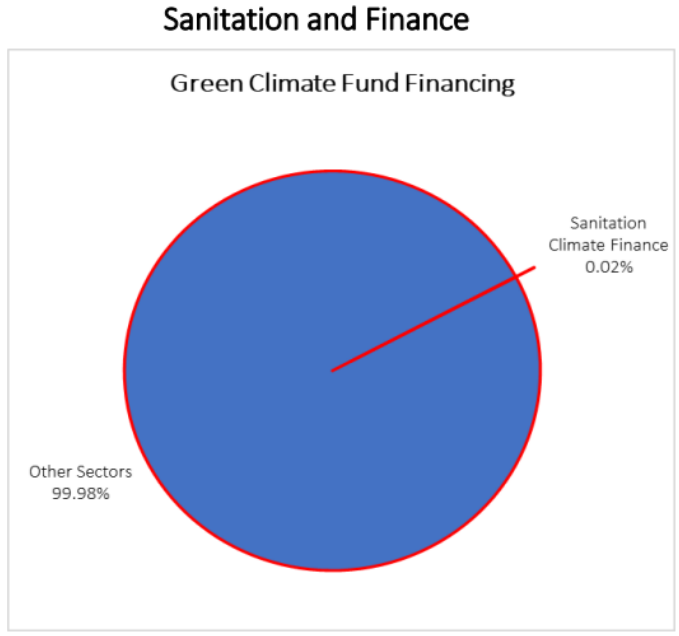
STEP 5/6: Options to reduce finance gap

Mobilise more funds and repayable finance

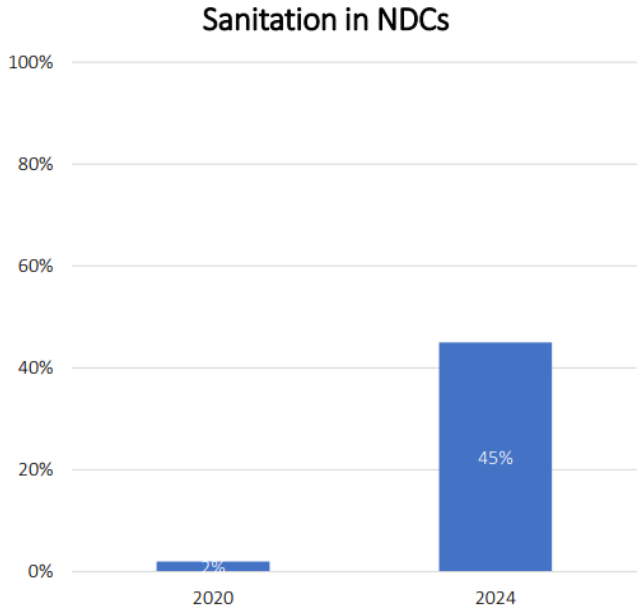
Options		Minimum range per year USD	Maximum range per year USD
Mobilise additional funds			
8	Collecting a sanitation levy in all cities through combined sanitation and piped water bills	27,000,000	55,000,000
9	Increasing the rate of the wastewater/sanitation levy		
10	Sanitation tax	20,000,000	40,000,000
11	Climate Finance	1,000,000	10,000,000
12	Increase line Ministry budget allocations to sanitation	1,000,000	6,000,000
13	Designate sanitation as an obligatory function of sub-national authorities	400,000	1,000,000
14	Enforce and increase penalties for breaching national standards on wastewater discharge	250,000	500,000
Increase repayable finance			
15	Access repayable finance from public development banks for sanitation	Not estimated	Not estimated
Total		**57,650,000**	**122,500,000**

Focus on climate financing for sanitation

Sanitation in Climate Finance and Policy



As of 2020, sanitation was just 0.02% of climate financing.



Sanitation representation in NDCs has grown from 2% to 45% in four years.

Globally sanitation is receiving only 0.020% of climate financing

Cambodia is firmly including sanitation in its NDC 3.0 measures

Great opportunity to leverage more climate resources → GCF guidelines on CR sanitation

Thank you

unicef
for every child

Climate resilient sanitation session

Green Climate Fund: Accessing climate finance for sanitation

Juliet Willetts

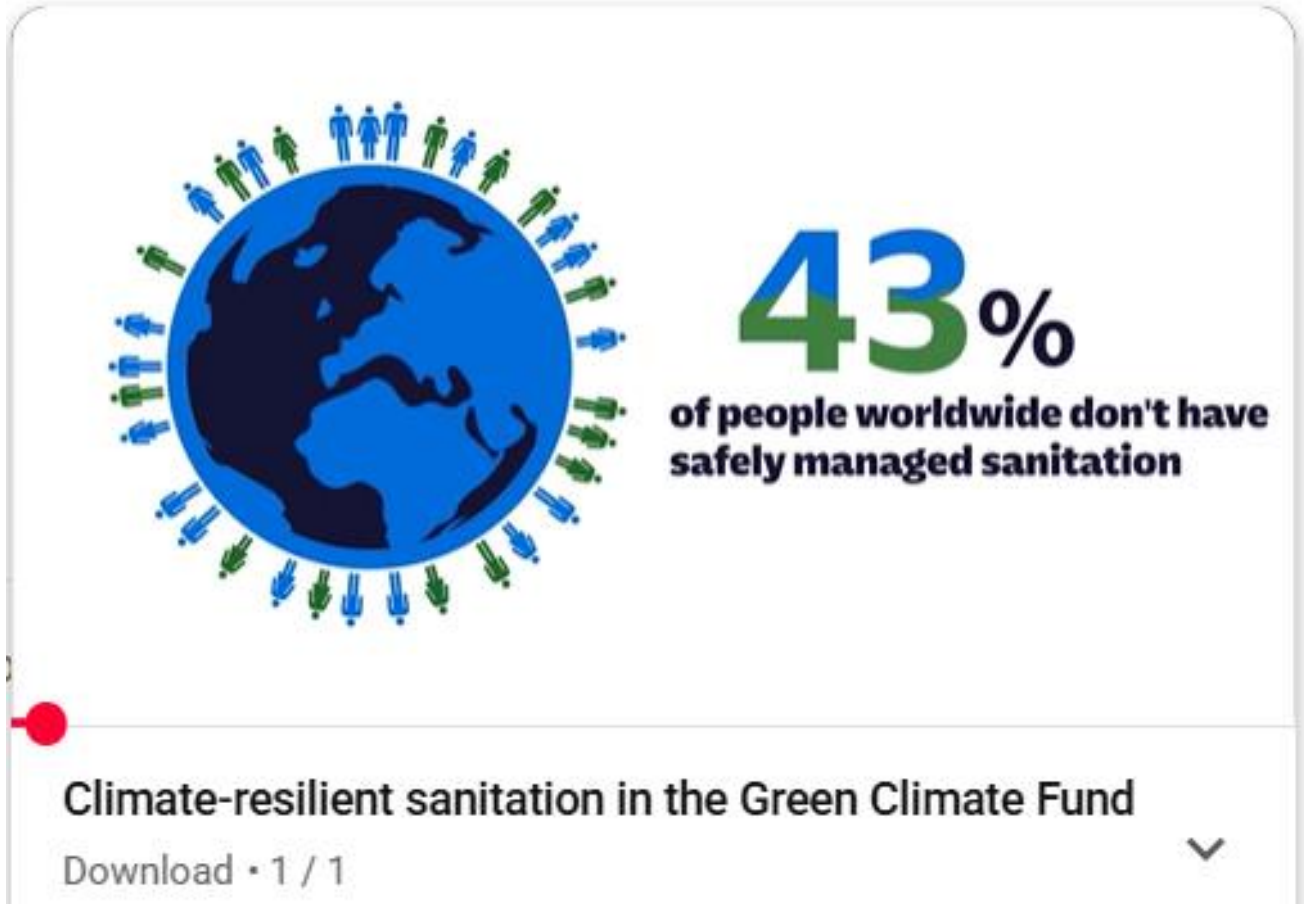
UTS

CLIMATE RESILIENT SANITATION: COALITION FOR ACTION

BANGKOK
Climate Resilience Pathways:
Water Security and WASH in Asia Pacific

Overview of the Green Climate Fund (GCF) Sanitation Annex

Prepared by: Sam Drabble, WSUP



https://www.youtube.com/watch?v=smmnqt9I4Ag

Applying the Annex: Key messages

- Sanitation is first and foremost a **public health intervention**
- CRS proposals need to **articulate the anticipated mitigation and/or adaptation impact**
- While GHG reductions from CRS interventions are likely, **do not promise specific reductions**
- CRS projects should **promote links with other sectors** (e.g., environment, health, agriculture)
- CRS infrastructure is not effective on its own – **projects should include systems strengthening**

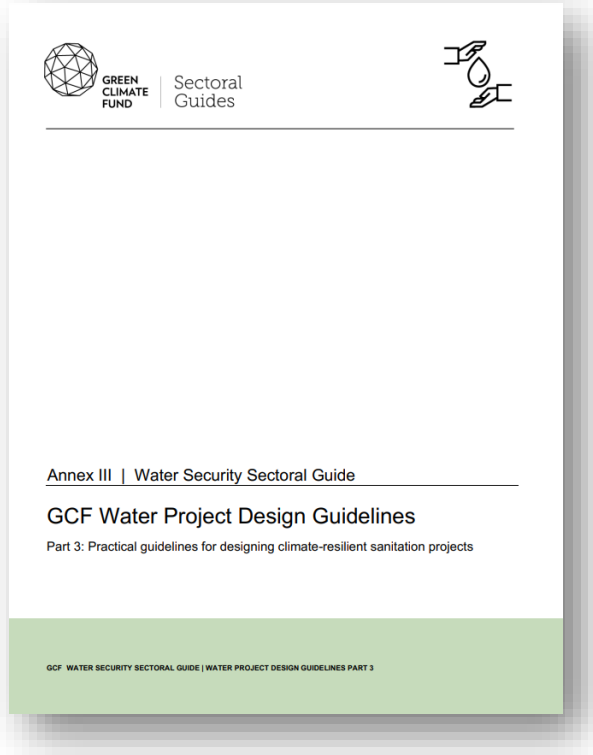
Recap: Purpose of the GCF Annex

Annex provides **practical guidelines** for developing CRS projects and programmes

Complements the **GCF Water Security Sectoral Guide** which has 3 parts:

- **Annex 1** - *Practical guidelines for designing water-climate-resilient projects*
- **Annex 2** - *Applications of the Practical guidelines for designing water-climate-resilient projects in IWRM, CR-WASH, and Drought and Flood management*
- **Annex 3** - ***Practical guidelines for designing climate-resilient sanitation projects***

Target audience includes Direct Access Entities at the national levels, International Access Entities and Accredited Entities



Structure of the Annex

1

1 Introduction

Relationship to the GCF Water Security Sectoral Guide; Status of sanitation globally; Sanitation, the climate crisis, and health; GCF approach to CRS

2

2 - Building the Climate Rationale for Sanitation Projects: Adaptation

3

3 - Building the Climate Rationale for Sanitation Projects: Mitigation

4

4 - Potential interventions to support CRS across the Sanitation Service Chain

- Adaptation; Mitigation; Strengthening systems to enable CRS

5

5 - Developing a GCF proposal

1 Introduction: GCF approach to CRS

Sanitation proposals to GCF must have a **clear climate rationale** and display a **level of ambition consistent with GCF's envisioned paradigm shift** for CRS. Successful proposals must achieve:

- Effective articulation of the **climate science basis and rationale** for the project
- Alignment with overall **GCF investment criteria**
- Alignment with GCF **key strategies for climate-resilient sanitation**

GCF investment criteria

- ✓ Impact potential
- ✓ Paradigm shift potential
- ✓ Sustainable development potential
- ✓ Needs of the recipient
- ✓ Country ownership
- ✓ Efficiency and effectiveness

GCF key strategies for CRS

- ✓ Climate-resilient infrastructure and services
- ✓ Circular economy and integrated management
- ✓ Community engagement and capacity building
- ✓ Policy, regulatory and governance support
- ✓ Monitoring and evaluation

2 Building the climate rationale: Adaptation

- **Climate risk assessments** are a critical step in **developing the climate rationale** for any GCF project

- Annex provides guidance for conducting **sanitation-focused** climate risk assessments

Assessments should follow the structure described in the GCF Water Sector Guidelines Annex 1:

Risk = Hazard X Exposure X Vulnerability

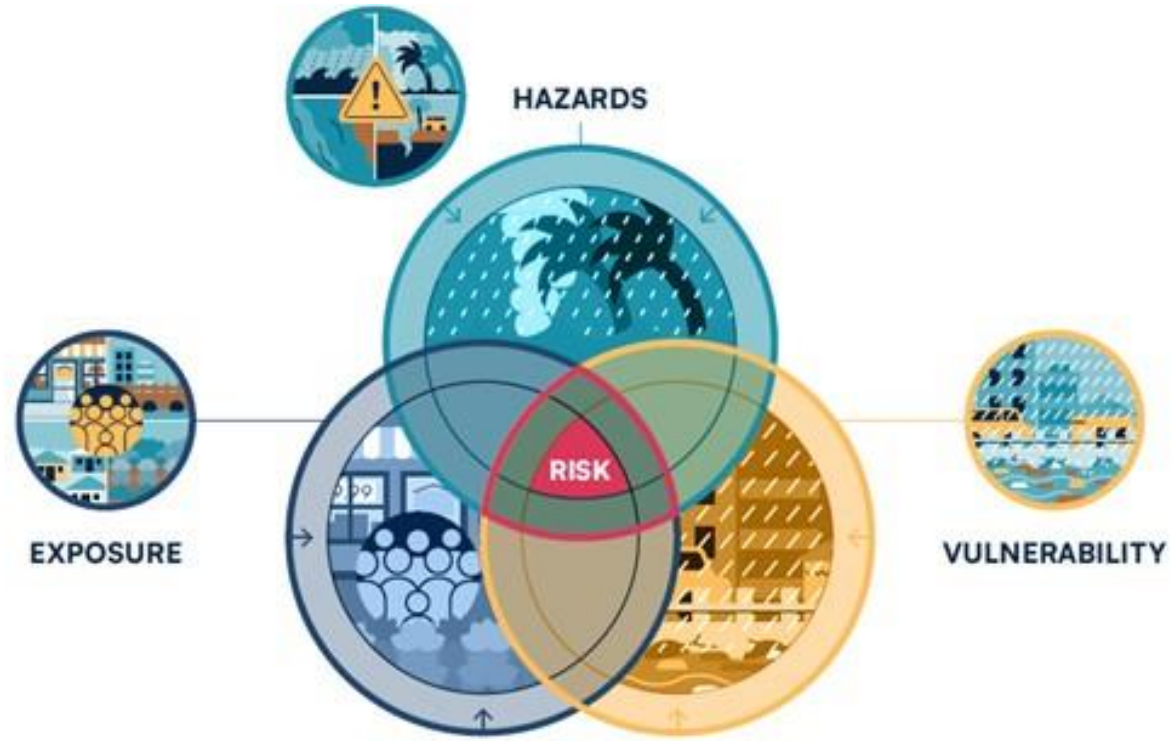


Figure 2.1, Page 26

2 Climate hazards and their impacts

CLIMATE RESILIENT SANITATION: COALITION FOR ACTION

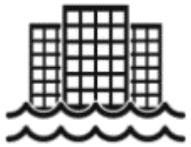
BANGKOK Climate Resilience Pathways: Water Security and WASH in Asia Pacific

- Climate risk assessments must outline **hazards to be accounted for** and their impacts on sanitation systems

Extreme storms

Sea level rise

Droughts and water scarcity



Flooding

Extreme temperatures

Evidence of Climate Change Impacts on Urban Sanitation System (relevant to flooding and storms) (Hyde-Smith et al, 2022)

Hazard	Impacts (using Peal et al, 2020 failure mode classification)				
	Fecal sludge not contained, not	**Fecal sludge and supernatant not delivered**	**Fecal sludge and supernatant not treated**	**Wastewater not delivered to treatment**	**Wastewater not treated**
High-intensity rainfall, increased flooding, erosion and landslides	Damage to pits or superstructures making latrines unusable	People 'drain' toilets into the environment using floodwater during flood	Flooding and damage to wetland flora	Increased frequency or spill volume of combined sewer overflows	Flooding and damage to wastewater treatment plant structure and equipment
	Pits overflow/collapse leading to fecal contamination	Structural damage to pavements		Increased risk of urban flooding (overflow of inspection chambers, flooding of basements)	Flooding of wastewater treatment plant leading to temporary system failure and discharge of raw sewage
	Toilets become inundated/inaccessbile (causing people to abandon toilets and revert to open defecation)	Road collapse or development of sinkholes due to destabilization of soil caused by damages sewers		Increase risk of pipe damage due to changed soil moisture and subsidence	Electricity failure leading to failure of pumps and aeration
				Changes to inflow and infiltration rates into the sewer system	Road interruptions leading to disruption of site access for wastewater treatment plant staff and supplies
	Electricity failure resulting in lack of water supply and non-functioning of toilets	Damage to roads infastructure elements other than pavements (eg bridges)		Sewer blockages after an event because of sand, debris or solid waste entering sewers and pump stations	Pollutant load exceeding biological treatment capacity of wastewater treatment plants
	Inundation of drainfields	Road capacity decreases/increases in congestions/travel time increases		Electricity failure leading to failure of pumps	Discharge of untreated/partially treated effluent due to overloading or bypassing of treatment
	Backflow/overflow of sewage from septic tanks	Roads become inaccessible		Damage to sewer pumps and mains	Increased dilution of influent
	Damage to pits, septic, tanks and absorption fields	Electricity failure leading to traffic light failure		Overload of sewer system resulting in overflow to the drainage system	Reduced nutrient removal cpacity during high-intensity rainfall events (eg due to reduced retention time and high
Contamination of and damage to surface water and groundwater supplies				Higher pollutant concentration in receiving waters due to increase in combined sewer overflow spill volumes/frequency	Contamination of receiving water bodies due to wastewater treatment plant failure
Changes to groundwater recharge and groundwater levels	Floatation and damage of septic tanks due to high groundwater levels	Structural damage to pavement (destabilisation of the substrate)			Inflow and infiltration into seprate systems causes higher inflow into wastewater treatment plants that stretch their design capacity
	Flodding and famage of septic tanks due to high groundwater levels				
	Higher groundwater pollution				
More extreme winds				Uprooting of trees and replacement of dmaged electricity poles leading to damage of sewer pipes	Damage to wastewater treatment plant infrastructure/buildings

Table 2.1, Page 29

2 Characteristics of exposure and vulnerability

Exposure = the presence of people, livelihoods, ecosystems, etc, that **could be adversely affected by climate hazards**

Exposure assessments essential to identify different **elements at risk** and calculate loss estimates

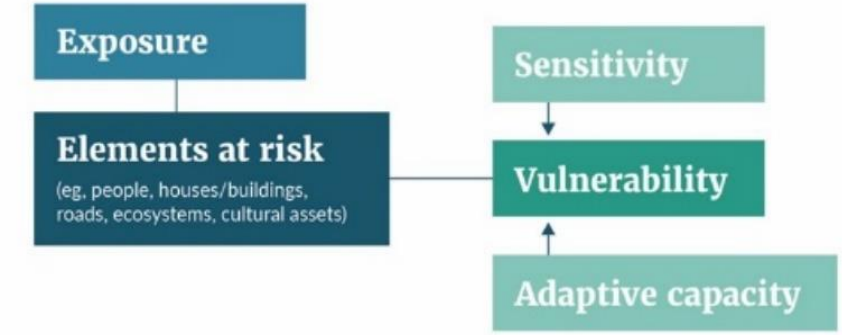


Figure 2.2, Page 36

Vulnerability = sensitivity or susceptibility to harm and capacity to cope and adapt

Vulnerability assessments essential to understand susceptibilities of systems and populations **when exposed** to climate hazards

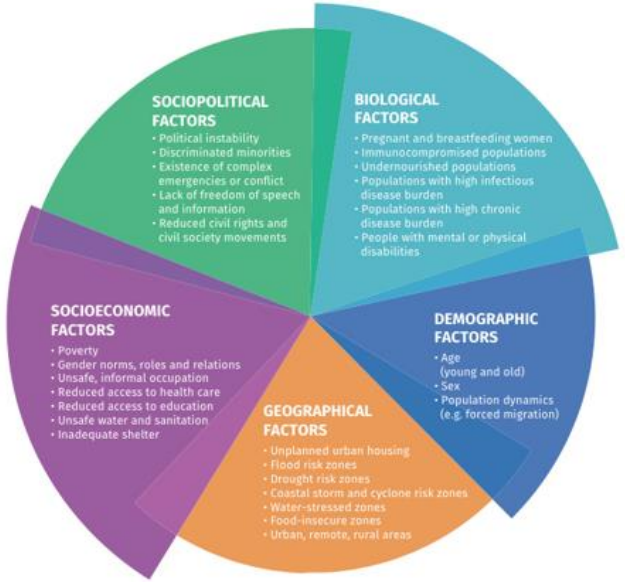


Figure 2.3, Page 38

3 Building the climate rationale: Mitigation

Annex sets out the evidence for the nature and scale of emissions arising from:

- **As-designed operation** of sanitation infrastructure and services

- Disposal of unstable faecal matter into the aquatic environment or on to land

- Use of products which **could be substituted** by well-managed use of **sanitation by-products**

	Containment	Emptying and transport	Treatment	Managed or unmanaged disposal in aquatic environments or on land	Substitution of sanitation by-products for other products
Scope 1					
Direct and fugitive emissions	CO_2, CH_4 and N_2O from pits, tanks and containers	n/a	CO_2, CH_4 and N_2O from treatment plants	CO_2, CH_4 and N_2O from land and water bodies	n/a
Transport	n/a	CO_2 from truck fuel combustion	n/a	CO_2 from truck fuel combustion removing sludge for land disposal	n/a
Scope 2					
Imported energy use	n/a	n/a	CO_2 from imported energy used in treatment processes	n/a	n/a
Scope 3					
Embedded carbon	Materials in construction of pits, tanks and containers	n/a	Materials in construction treatment plants	n/a	n/a
Other indirect emissions	n/a	n/a	n/a	n/a	Reduction in manufacturing and transportation

Table 3.1, Page 41: Principal sources of greenhouse gas emissions from whole-chain sanitation systems which store waste onsite before using road-based transport to move to treatment.

3

Current evidence base on emissions from sanitation systems

- Rate and scale of emissions from any sanitation system dependent on the technology deployed, its operation and local contextual factors

- To date, **only limited empirical data exist** with which to estimate sanitation emissions. Emerging conclusions:

  - **The primary source of emissions in most sanitation systems are direct emissions** caused by the stabilisation of faecal sludges in storage pits and tanks or at treatment plants, or by discharges of untreated faecal waste
  - These emissions are significant and are likely to have been underestimated historically
  - Limited evidence that either sewered or non-sewered sanitation 'better' than the other in terms of emissions
  - The primary issue is that **most faecal waste never reaches treatment**

Photo: Olivia Reddy, University of Bristol

4 Responses and interventions

Annex highlights the potential for sanitation to act as an **entry point for wider systems change** across sectors and to contribute to **transformative adaptation** to climate change

Guidance is provided on potential **interventions to support climate change adaptation** across the sanitation service chain

Type of Response	Containment	Emptying and Conveyance	Treatment, Reuse and Disposal
Technical modifications to new or existing infrastructure	Raised latrines/ containment **CRIS** Robust and resilient latrines/ containment **CRIS** Low or no water latrines **CRIS** Sealable and removable containment CRIS	Simplified sewers **CRIS** Vacuum sewer systems **CRIS** Treatment of sewer overflows **CRIS/IM** Sustainable Drainage Systems **CRIS/IM**	Site selection and flood prevention **CRIS** Corrosion resistant design **CRIS** Modular FSTP/WWTP design **CRIS** Decentralised/ distributed FSTP/WWTPs **CRIS**
Active management of the infrastructure or service		Scheduled or more frequent emptying for OSS **CRIS** Preventative O&M of sewer systems **CRIS**	Application of treated wastewater and faecal sludge **CRIS/IM**
Preparing sanitation systems for cascading impacts of failures in other systems	Alternative water sources for flush toilets **CRIS/IM**	Alternative emptying vehicles and equipment for OSS **CRIS**	Alternative power sources for FSTPs and WWTPs **CRIS**

Elements of GCF projects: CRIS – Climate Resistant Infrastructure and Services, IM – Integrated Management

Table 4.1, Page 53

4 Responses and interventions (2)

Potential **interventions to support climate change mitigation**

Intervention type	Effect category	Category
Infrastructure modifications	*Anaerobic digestion at treatment (with or without co-treatment of MSW)*	*CRIS/IM*
	Addition of methane/biogas capture on aerobic treatment plants	*CRIS/IM*
	Enhanced composting of faecal wastes to produce agricultural products (including black soldier-fly lava)	*CRIS/ IM*
	Water recovery from wastewater or faecal sludge treatment for use in agriculture	*CRIS/IM*
	Additional tertiary treatment and enhanced nutrient removal	*CRIS/IM*
Scale and management operations	*Regular emptying of household pits and tanks particularly prior to rainfall*	*CRIS*
	Optimisation of scale and design of sewerage	*CRIS*
	Optimisation of scale of operations for road-based sanitation	*CRIS*
Governance and regulatory modifications	*Improved regulation of emptying including incentives for planned emptying and disposal at treatment*	*CRIS*
	Results-based contracts for treatment operators	*CRIS*

Elements of GCF projects: CRIS – Climate Resistant Infrastructure and Services, IM – Integrated Management

Table 4.3, Page 66

Potential **system strengthening interventions** to enable CRS

Box 4.1: Summary of potential PIRF interventions to enable climate-resilient sanitation.

- Ensure projects align with and strengthen relevant climate policies and plans, particularly NDCs and NAPs
- Ensure policy frameworks promote circular economy approaches
- Ensure service providers are prepared for a future of multiple revenue streams and equipped with climate-specific knowledge and skills
- Mainstream climate-resilient sanitation into regulations, guidelines, standards, and codes of practice at every step of the sanitation service chain
- Leverage a menu of financing options to support the sustainability and scalability of project interventions
- Create targeted financial incentives to support private sector engagement and resource recovery
- Strengthen policy, institutional and regulatory frameworks to support the integration of sanitation with wider basic services and urban development processes
- Build flexibility into planning, financing, and regulatory frameworks to support service providers in adapting to emerging or unexpected conditions

Box 4.1, Page 75

Applying the Annex: Key messages

- Sanitation is first and foremost a **public health intervention**
- CRS proposals need to **articulate the anticipated mitigation and/or adaptation impact**
- While GHG reductions from CRS interventions are likely, **do not promise specific reductions**
- CRS projects should **promote links with other sectors** (e.g., environment, health, agriculture)
- CRS infrastructure is not effective on its own – **projects should include systems strengthening**

CLIMATE RESILIENT SANITATION COALITION

HOW TO DEVELOP

a climate-resilient sanitation (CRS) project proposal for the GREEN CLIMATE FUND

Find out ... who can apply for GCF funding

Read ... the official annex on CRS in GCF's water security guide

STEP 1 Define a vision

Develop a vision statement prioritizing the climate challenge your sanitation project or activities address while acknowledging related social and environmental issues. Keep in mind GCF's climate focus, CRS approach, investment criteria, and key strategies.

STEP 3 Identify priority measures and strategies

Develop measures to address climate risks, and/or cut emissions, and maximize sustainable development. Actions should align with stakeholder priorities, policies, and promote cross-sectoral coordination for scalable solutions

See guidance ... on concrete adaptation, mitigation and systems strengthening measures across the sanitation service chain

STEP 2 Articulate the mitigation or adaptation impact of your project

Develop a strong climate science rationale by demonstrating how your CRS project contributes to climate adaptation or mitigation. Use clear data and evidence and ensure that climate-related activities are distinct from other development components.

Develop a climate risk assessment ... to contextualise adaptation activities

Map emissions ... to identify sources for reduction

STEP 4 Budget development

Demonstrate the value-for-money of proposed activities, emphasizing scalability, efficiency, long-term viability and country ownership (NAPs and NDCs). Distinguish between budgets for climate-related initiatives and broader development activities.

DISCUSSION

What next steps are most needed to increase financing for climate resilient sanitation investments in your context?

How realistic is climate financing might be as a potential source?

THANK YOU!

This session is a collaborative effort brought to you by the **Climate Resilient Sanitation Coalition**

Resources:
https://www.susana.org/community/themes/climate-resilient-sanitation-coalition

What is your finishing point in this session on climate resilient sanitation?