RESILIENT WATER SERVICES

From risk assessment to action

Convened by 1001fontaines & Institute of Sustainable Futures (UTS)

25 August 2026

World Water Week

ORGANIZED BY SIWI

Welcome!

We'll get started shortly — thanks for joining us!

TODAY'S PROGRAMME

Climate-Resilient WASH

1

Indicators

Global Indicators for Climate-Resilient WASH

JMP & GLAAS

2

Resilience in Practice

Cambodia & West African WASH SMEs — Climate Risk Assessment in the field

1001fontaines/Teuk Saat 1001, ISF/UTS, Aqua for All & FLUSH

3

Panel Discussion

Questions & Financing the Transition

All Speakers — moderated by UTS

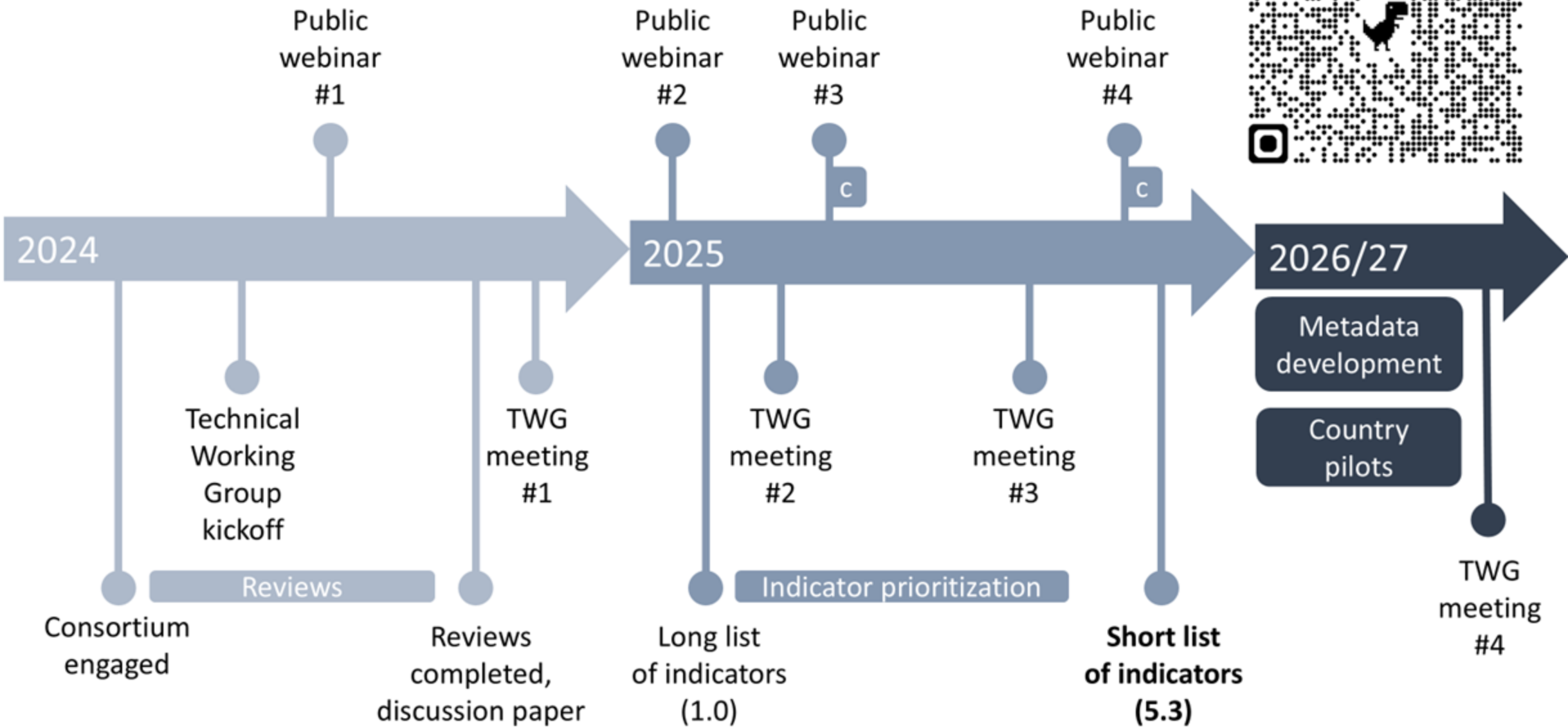
Audience Q&A

Defining the Terms: Global Indicators for Climate-Resilient WASH

Setting the analytical frame — the emerging indicator set (v5.3) and its link to the Global Goal on Adaptation (GGA)

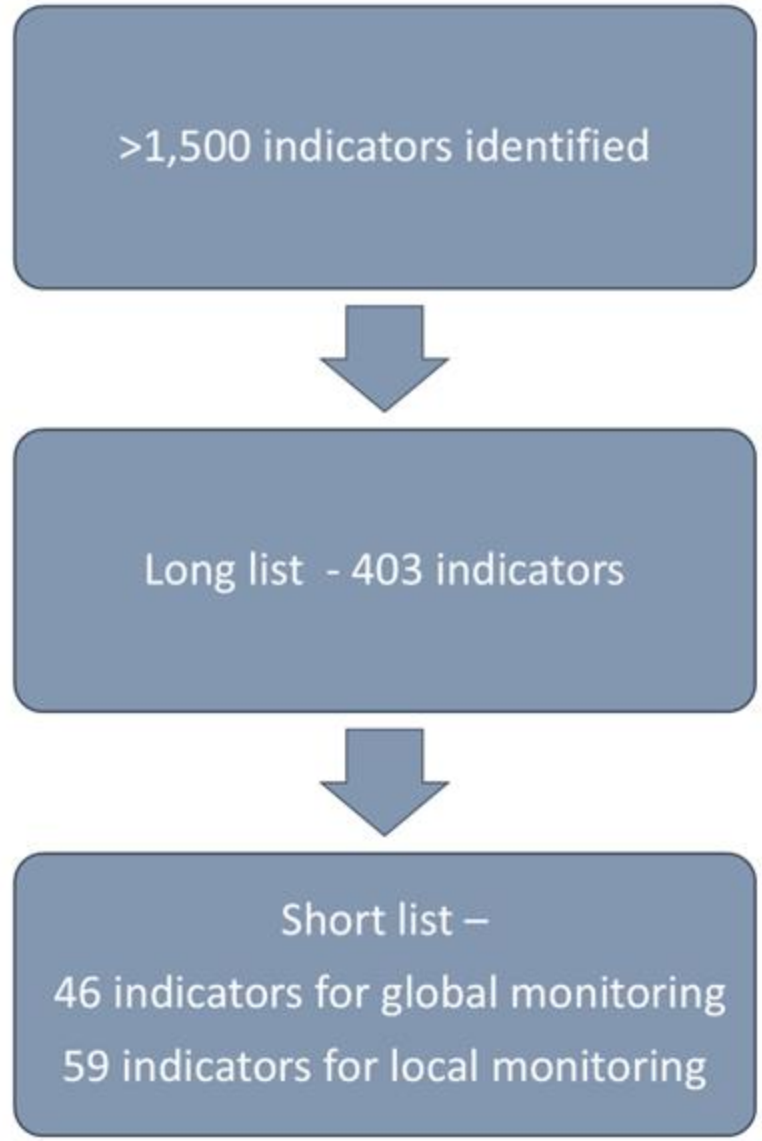
Rick Johnston
Co-Lead WHO/UNICEF Joint Monitoring Programme, ***World Health Organization***

Timeline and milestones



Progress so far: monitoring climate resilience and WASH

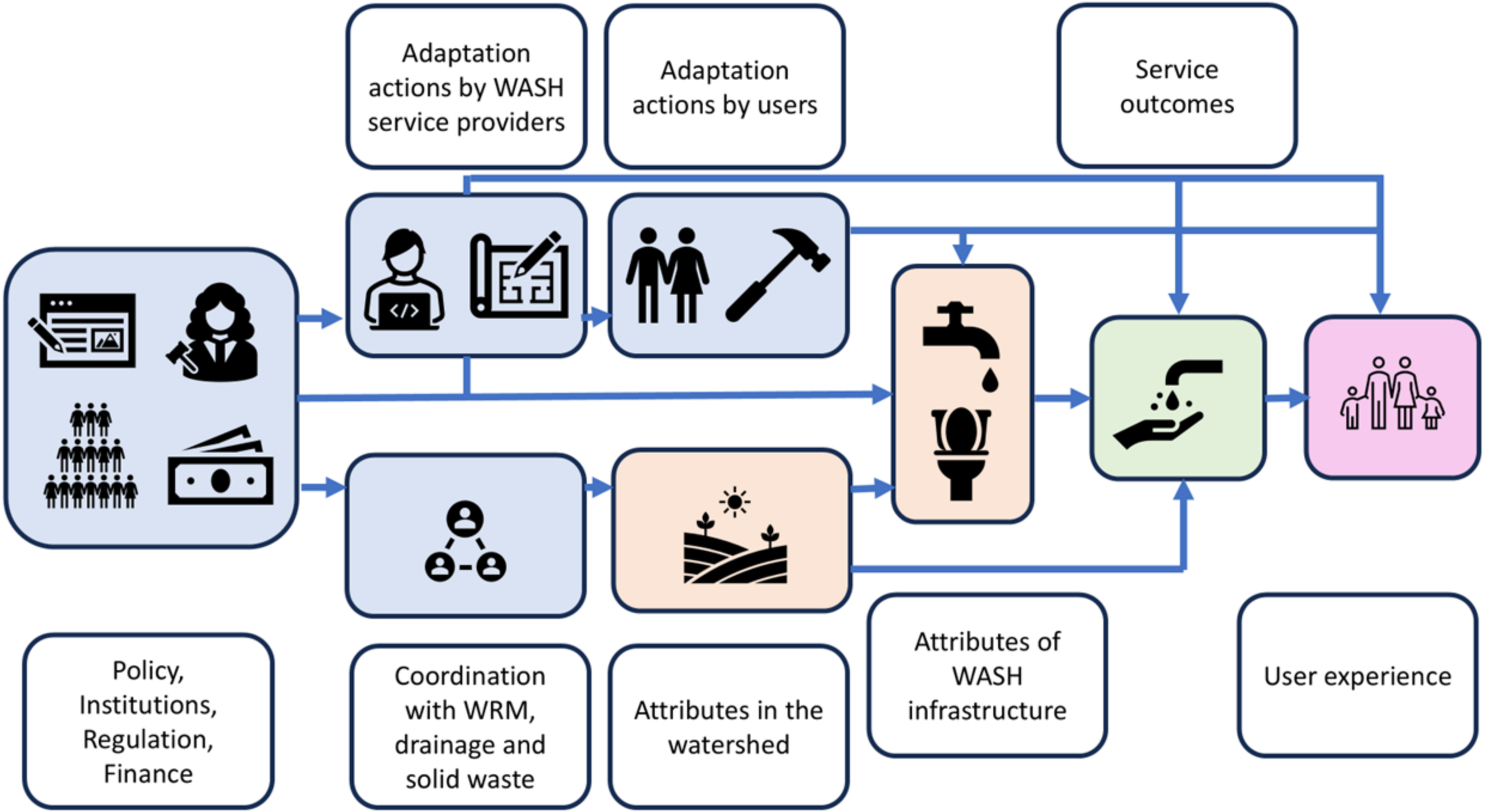
- Conducted 5 literature reviews to identify WASH (and WASH-adjacent) system attributes and adaptation actions that influence resilience
- Reviewed WASH Climate Resilience Frameworks
  - Developed a guiding conceptual framework
- Identified >1,500 potential indicators which were reduced to 403 indicators to consider for monitoring for CR WASH.
- Following public consultations and input from TWG developed shortlists (up to version 5.3)
  - 46 indicators for global monitoring of CR WASH
  - 59 indicators for local monitoring of CR WASH



Global indicators (Set A) and local indicators (Set B)

Set A (46): Global indicators for JMP/GLAAS Programmes	Set B (59): Local indicators
Comparable across countries	Tailored to local contexts
Suitable for JMP/GLAAS reporting	Supports programme and operational decisions
Limited number of core indicators	Greater level of detail
Feasible to collect routinely at scale	May require specialised or resource-intensive data collection
Focus on global trends and progress	Focus on local risks, performance and adaptation actions
Prioritised for development in this project	Valuable indicators for future development and use at national/sub-national level

Example global indicator	Example local indicator
0601/0701 - Proportion of population / schools / health care facilities served **by water or sanitation service providers** that implement **risk management plans** which **consider current and future climate**	0705 - Proportion of **sanitation service providers** that have protocols and procedures in place for **safe, appropriate and timely emptying of pits and tanks** on receipt of **early warning relating to a climate event**


Adaptation actions by WASH service providers
Adaptation actions by users
Service outcomes
Policy, Institutions, Regulation, Finance
Coordination with WRM, drainage and solid waste
Attributes in the watershed
Attributes of WASH infrastructure
User experience

46 Set A indicators

Policy, Institutions, Regulation, Finance

Adaptation actions by WASH service providers

Coordination with WRM, drainage and solid waste

Adaptation actions by users

Attributes in the watershed

Service outcomes

Attributes of WASH infrastructure

User experience

Global Goal on Adaptation

- Established in 2015 under the Paris Agreement to strengthen adaptive capacity and resilience worldwide
- UAE Framework for Global Climate Resilience
  - COP28 in 2023
  - Sets out targets, including on water and sanitation
- UAE-Belém Work Programme (2023-2025)
  - Involved expert teams to propose indicators for GGA targets
  - In 2025, COP30 adopted 59 Belém Adaptation Indicators
- Belém-Addis Vision on Adaptation (2025-2027)
  - Countries are encouraged to test the Belém Adaptation Indicators
  - Technical work to continue on metadata development
  - 2026 Bonn Climate Conference inconclusive

Belém Adaptation Indicators Paragraph 9(a)

Water resources / systems resilience

a) Level of water stress, including as an outcome of adaptation actions where applicable, accounting for relevant climate hazard intensity and/or frequency;

b) Level of water use efficiency, including as an outcome of adaptation actions where applicable;

c) Proportion of critical water and sanitation infrastructure systems that are resilient to climate-related hazards under different warming scenarios, as appropriate for regions and contexts, including as an outcome of adaptation actions where applicable;

d) Proportion of the total area of basins and cryosphere for which a climate adaptation plan has been developed and implemented on the basis of different warming scenarios, as appropriate for regions and contexts where applicable;

People-centred resilience

e) Proportion of the population using safe and affordable potable water services that are climate-resilient, including as an outcome of adaptation actions where applicable;

f) Proportion of the population using sanitation services that are safely managed and climate-resilient, including as an outcome of adaptation actions where applicable;

g) Extent of measures taken to improve and extend water, sanitation and hygiene services to populations disproportionately affected by climate change and to vulnerable groups relative to needs;

h) Proportion of bodies of water with good ambient water quality for drinking water supply, including as an outcome of adaptation actions where applicable;

i) Number of people per 100,000 supported in planned relocation processes in response to water-related hazards, where adaptation measures were taken to ensure safety of populations.

Belém Adaptation Indicators Paragraph 9(a)

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e) Proportion of the population using safe and affordable potable water services that are climate-resilient, including as an outcome of adaptation actions where applicable;

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e) **Proportion of the population using safe and affordable potable water services that are climate-resilient, including as an outcome of adaptation actions where applicable;**

f) **Proportion of the population using sanitation services that are safely managed and climate-resilient, including as an outcome of adaptation actions where applicable;**

Related indicators from JMP/GLAAS review
1703 Proportion of population / schools / health care facilities **within nationally determined climate hazard zones** using basic / safely managed drinking water services 1803 Proportion of population / schools / health care facilities **within nationally determined climate hazard zones** using basic / safely managed sanitation services *Similar to existing indicators monitored by JMP* 0101 WASH policies and plans integrate climate adaptation measures for households, schools and health care facilities and (i) identify current and future climate risks to WASH, (ii) **identify populations vulnerable to climate change**, (iii) include costed climate adaptation measures and (iv) mandate 'build-back-better' principles for post climate-event recovery (a) are in place; (b) align with national adaptation plans; and (c) are regularly revised using updated climate projections

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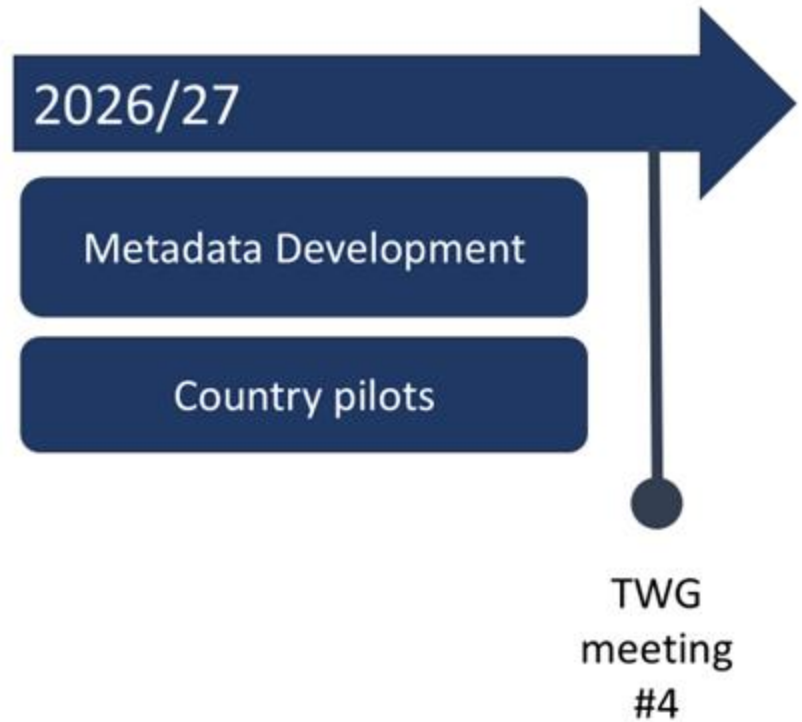
Related indicators from JMP/GLAAS review
0104 WASH plans include measures to ensure climate resilient WASH investments are focused on populations vulnerable to [and disproportionately affected by] climate change *Similar to existing indicators monitored by GLAAS (A9ii)* 0101 WASH policies and plans … (ii) identify populations vulnerable to climate change

Current and Future Work

Moving from indicator identification to indicator operationalisation

1. Developing indicator metadata
   - Definitions
   - Data sources
   - Collection methods
   - Disaggregation requirement
   - Reporting guidance

2. Pilot Testing
   - Countries are encouraged to test the Belém Adaptation Indicators
   - Assess data availability
   - Test collection methods
   - Engage national stakeholders
   - Identify implementation challenges
   - Refine indicators and metadata




Thank you!
Rick Johnston (WHO)

Resilience in Practice I — Cambodia: From Climate Data to Water Kiosk-Level Decisions

The CRA framework across 13 provinces — climate projections combined with operational vulnerability indicators into tiered risk profiles, with a live demo of the mapping tool

Eva Leneveu
Program manager, ***1001fontaines***

Tim Foster
Director, ***Institute of Sustainable Futures (UTS***

CAMBODIA ·

Teuk Saat 1001 - 20 years of supporting community-owned, entrepreneur-operated water kiosks

***350** water kiosks*

***1000+** entrepreneurs & operators*

Home delivery

Community committee

Convenience

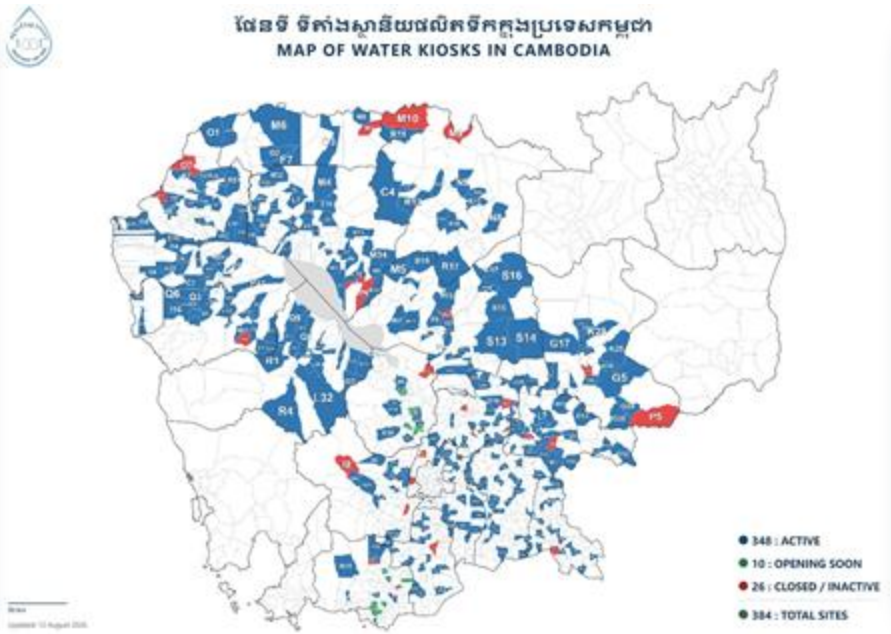
1.1 M consumers

CAMBODIA ·

Climate Risk Assessment: a groundbreaking study to strengthen resilience

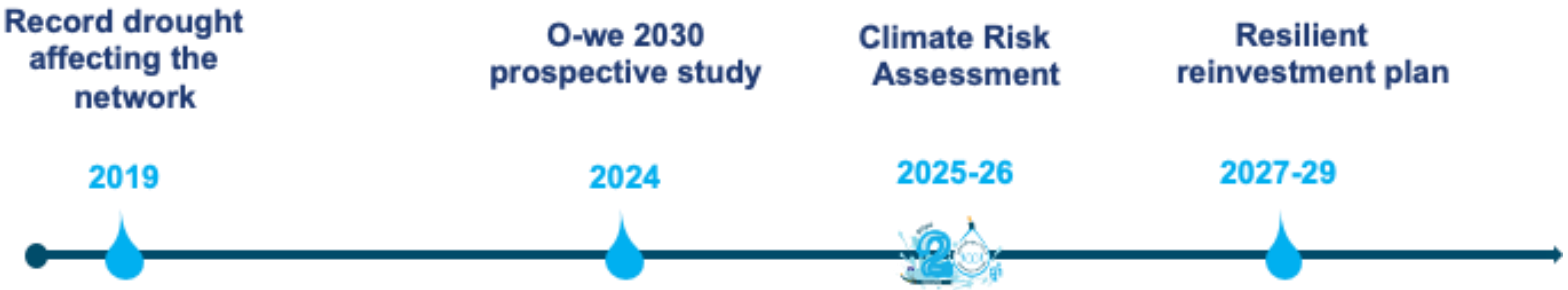
Why now?

- Increase in extreme weather events disrupting operations *(flooding, scarcity, raw water quality)*
- Evidence highlighting Cambodia's vulnerability to climate change
- Preparation for major reinvestment at a critical turning point in a 20-year-old network



Our approach

- Partner with ISF UTS experts
- Start from operational data and field immersion
- Ensure outputs are actionable - integrated into the in-house information system to support decision-making



Understanding climate-operational risks involved three step process

Rainfall at different lag-periods clearest predictor of operational risks

1 Site visits understand climate impacts

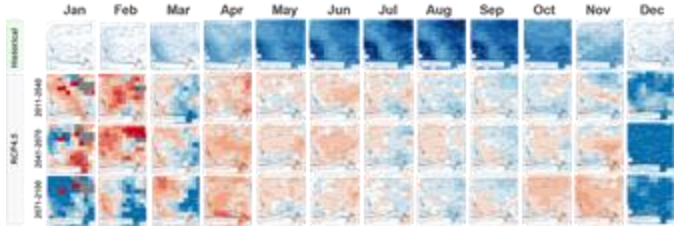
2 Link climate and operational data

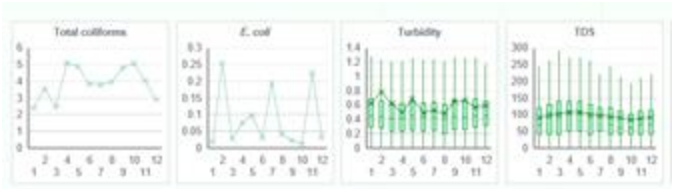
CMIP5-CORDEX E Asia ensemble:

- Discharge
- Soil moisture
- Aridity
- Rainfall
- Runoff

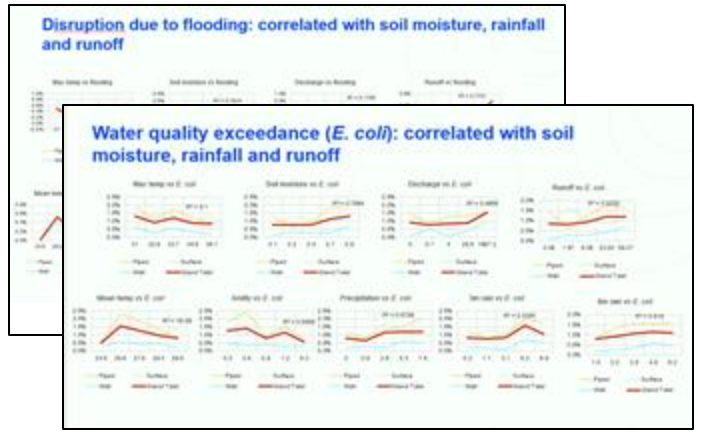
Operational data (>42,000 months)

- disruption: flooding, shortage
- microbial: *E.coli* TC
- chemical: manganese, nitrates etc



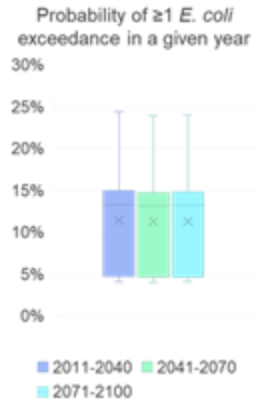


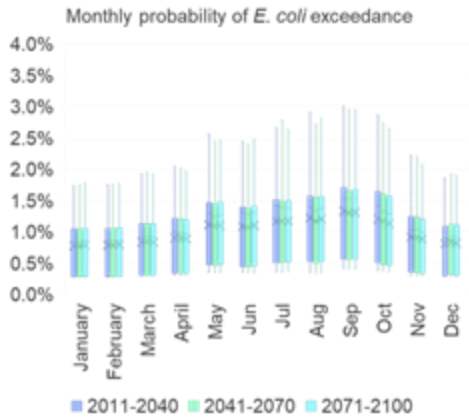
3 Quantify relationships & project forward

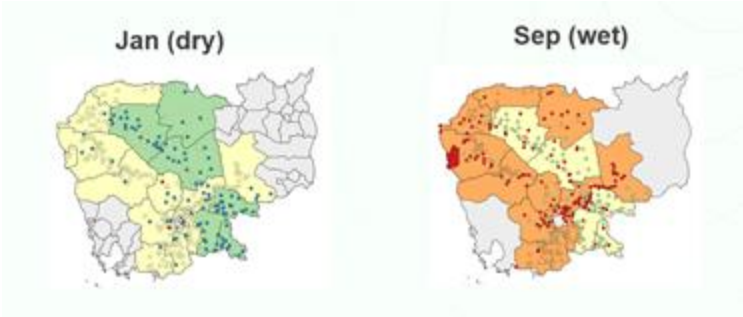


Operational risks modelled across seasons, time horizon and space

Risks will change over time but in a highly heterogeneous way







% increased in E. coli risk (to 2041-2070)	-1.2%	+0.2%	-0.1%	-0.4%	+1.3%	-1.8%	-1.7%	-0.2%	-4.1%	-1.8%	-3.2%	-1.0%	2.9%
% provinces with increased E. coli risk	0	9	10	4	4	3	2	6	0	3	0	3	18
% kiosks with increased risk	5	183	183	106	74	31	62	138	0	65	1	82	361

Linking data with operational performance can guide where and when to act and how to target investment in resilience measures

- **Plan seasonally:** Rainfall patterns over both short and medium-term can help to anticipate changing operational and water-quality risks
- **Think locally:** Network averages can conceal important differences between water systems and times of year
- **Tailor responses:** Match resilience measures to source type and local conditions
- **Target investment:** Prioritise monitoring and investment during higher-risk periods and at higher-risk locations.

Resilience in Practice II — Water & Sanitation SMEs: CRA for Business Continuity, Growth & Impact

Deployed across 10+ African countries — Risk = Hazard Likelihood × Impact, applied at enterprise level, with FLUSH as technical partner

Annemarie Mastenbroek
Manager Technical Assistance & Capacity Building, ***Aqua For All***

Kimberly Worsham
Founder & Principal, ***FLUSH***

Our dual approach

Sustainable. Inclusive. Climate-smart.

Market development

Supporting water and sanitation enterprises to scale and become sustainable and investment-ready.

Fund investments and capital structuring

Unlocking private capital for financing access to and delivery of water and sanitation services.

Cross cutting-themes

- Climate adaptation, mitigation and resilience
- Gender
- Impact focus

Assessment of adaptation and mitigation

Avoiding emissions. Reducing risks. Building resilience.

Adaptation impact

- Chronic climatic changes and acute hazards need to be **assessed by location** to understand the need to adapt operations to these risks.
- Resilience to climate change is looked at from two perspectives:
  - Resilience *of* Water & Sanitation services
  - Resilience created *through* Water & Sanitation services
- CRA to assess risks, identify vulnerabilities and design adaptation activities

Mitigation impact

- Interventions are assessed for possibilities to keep **emissions of greenhouse gasses** (GHGs) low
- List of questions to identify emissions and opportunities to reduce them

Process to assess adaptation impact:

1. Climate Risk Assessment (Resilience *of* Water & Sanitation)
2. Design of adaptation measures
3. Categorisation of adaptation impact (Resilience *through* Water and Sanitation)

Process to assess mitigation impact:

1. Assessment of operational emissions
2. Design of mitigation measures
3. Categorisation of mitigation impact

'Do-no-harm' verification

Assessment of adaptation and mitigation

Avoiding emissions. Reducing risks. Building resilience.

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Process to assess mitigation impact:

1. Assessment of operational emissions
2. Design of mitigation measures
3. Categorisation of mitigation impact

'Do-no-harm' verification

From understanding to adapting:

Aqua for All's Climate Risk Assessment (CRA)

- Developed by Aqua for All, building on existing climate risk and adaptation frameworks
  (incl. from UNEP FI & TFCD, UNICEF & GWP, Guy Howard et al.)
- Assesses site-specific climate risks and vulnerabilities, based on list of questions
- Suitable for small and large water and sanitation enterprises, but also relevant for financial service providers.
- Applies a systems perspective beyond technical infrastructure
- Supports climate adaptation planning and action prioritisation

How it works

Risk = Hazard Likelihood x Impact

Hazard Likelihood: The probability that a specific climate-related hazard will occur (such as flooding or drought) to which the WASH service may be exposed to within a defined time period

Impact: The severity of the negative effects on the WASH service, infrastructure, or users if the climate hazard occurs, and the capacity to recover from it.

Climate risks are assessed through the CRA by:

1. *Defining the local scope and service*
2. *Identifying climate hazards*
3. *Assessing vulnerability*
4. *Prioritising risks*

1. Enterprise & Location Information:
(Name, Sector, Country, Operational area description)

2. Climate Hazard Likelihood Assessment:
- a) Floods
- b) Water availability issues (e.g. drought, water scarcity)
- c) Water quality issues (e.g. salinity)
- d) Storms
- e) Extreme heat
- f) Other climate-related risks

3. Impact Assessment:
- a) Technical/Operational
- b) Environmental
- c) Social/Market
- d) Financial
- e) Other

4. Adaptive Capacity Assessment:
- a) Insurance availability
- b) Internal emergency procedures
- c) Early warning systems
- d) Institutional support
- e) Existing adaptation measures

5. Adaptation Planning:
(Priority list of adaptation activities & investments)

CRA survey & results in mWater

Aqua for All - Climate Risk Assessment

1. / 2. / 3. Climate Hazards

Climate Hazards

The first step is to identify the likelihood of the following climate hazards occuring i
your operations. For each of the following hazards, please score the likelihood of occ
very low to very high. Refer to resources such as **Think Hazard** for cross checking

N.B. This first step is only assessing the likelihood of the hazard occuring in the area
oppertions, not the impact of occurance.

Hazard

Floods
River/urban/coastal flood, extreme runoff

Water Availability
Drought, water scarcity, groundwater reduction

Water Quality
Saltwater intrusion, surface water quality risks, groundwater quality risks

Storms
Cyclones/ hurricanes/storms, hail

Extreme Heat

Other Climate Related Risks
Specify below

Climate Risk Assessment for Water and Sanitation Service Providers

Enterprise Name
All

Sector:

Sub-Sector:

Map of Location of Operations (click on marker to access full survey):

Results

Climate Risk = Likelihood × Impact

- Likelihood: the probability that a specific climate-related hazard will occur (such as flooding or drought) that the WASH service may be exposed to within a defined time period.
- Impact: The severity of the negative effects on the WASH service, infrastructure, or users if the climate hazard occurs, and the capacity to recover from it.

Likelihood and impact are calculated on a 5-point scale:

1. Very low likelihood/impact
2. Low likelihood/impact
3. Moderate likelihood/impact
4. High likelihood/impact
5. Very high likelihood/impact

The final hazard risk is calculated by multiplying the climate likelihood score by the average climate impact score. The risk ratings is based on the following scale:

- Under 5 = very low risk
- 5 or above and under 10 = low risk
- 10 or above and under 15 = medium risk
- 15 or above and under 20 = high risk
- 20 or above = very high risk

	Hazard Likelihood	Hazard Impact												Hazard Risk Rating	
		Technical			Environmental			Social			Financial			Risk Score	Risk Rating
		Infrastructure	*Supply Chains*	*Electricity*	*Natural Resources*	*Environmental Degradation*	*Hazard Prone*	*Market Demand*	*Ability to Pay*	*Workforce*	*Operational Costs*	*Downtime*	*Financial Viability*		
Flood	Very Low	-	-	-	-	-	-	-	-		-	-	-	14.33	Medium
Water Availability	Medium	High Impact	High Impact	Very High Impact	High Impact	High Impact	Low Impact	No Impact	No Impact	Medium Impact	Very High Impact	Medium Impact	Very High Impact	10.25	Medium
Water Quality	Medium	Medium Impact	Medium Impact	Medium Impact	Medium Impact	High Impact	Low Impact	Medium Impact	Medium Impact	Medium Impact	High Impact	High Impact	Medium Impact	9.50	Low
Storms	Very Low	-	-	-	-	-	-	-	-	-	-	-	-	22.50	Very High
Extreme Heat	Very Low	-	-	-	-	-	-	-	-	-	-	-	-	8.00	Low
Other Climate Related Disasters	Very Low	-	-	-	-	-	-	-	-	-	-	-	-	7.50	Low

Results & learnings

Phase 1 (2022-24): Climate in acceleration programmes

Aqua for All

Carried out as part of:

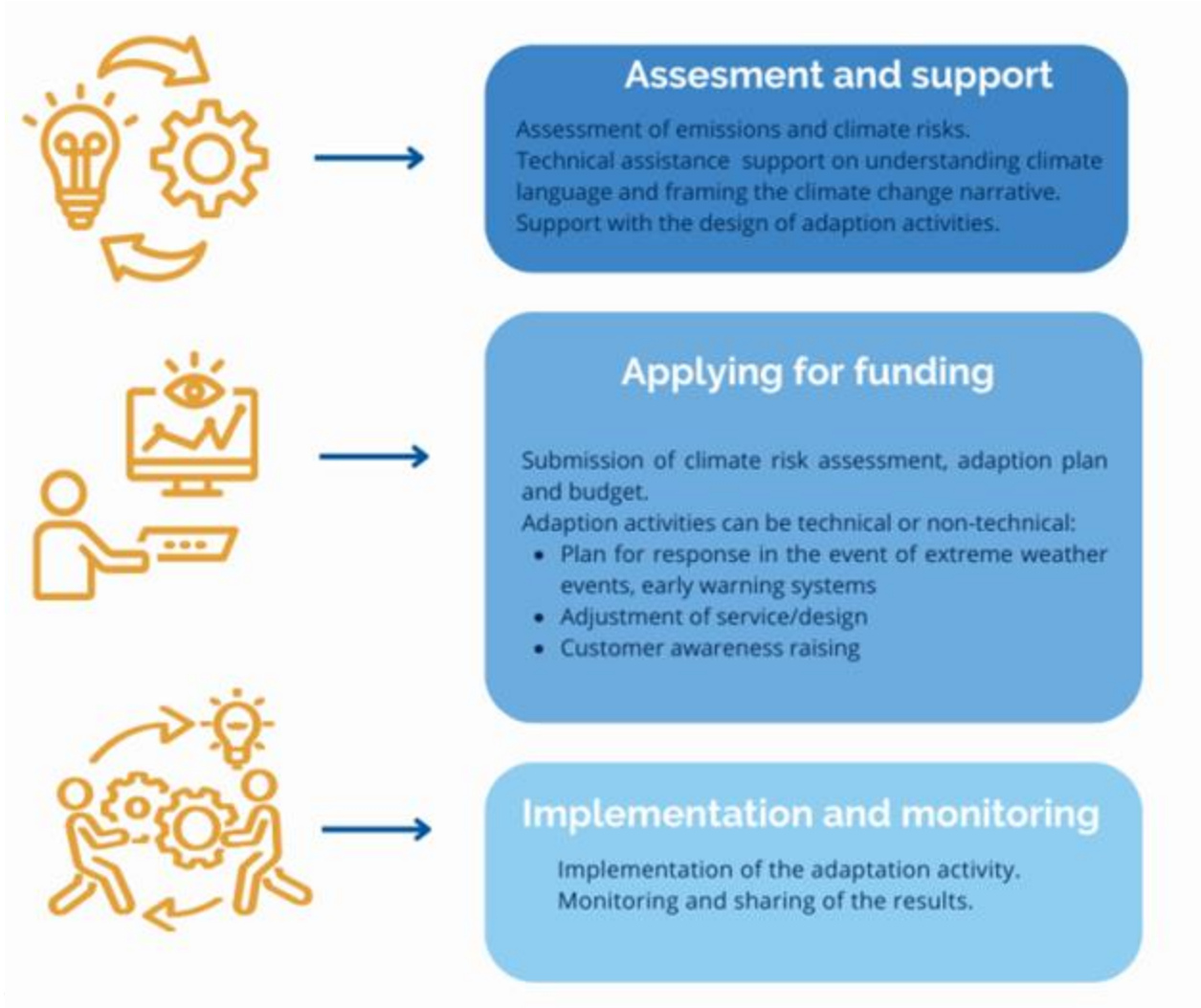
PME performantes WASH climate 2.0 accelerator in Burkina Faso

Rural Water Accelerator in Kenya/Uganda

Intervention:

CRA support, TA & funding to 6 enterprises in Burkina Faso, Kenya and Uganda

Total amount: ≈ € 45,000
(*excl. in-kind support*)



Phase 2 (2025-27): Climate in Results-Based Grants, TA & implementation grants

Carried out as part of:

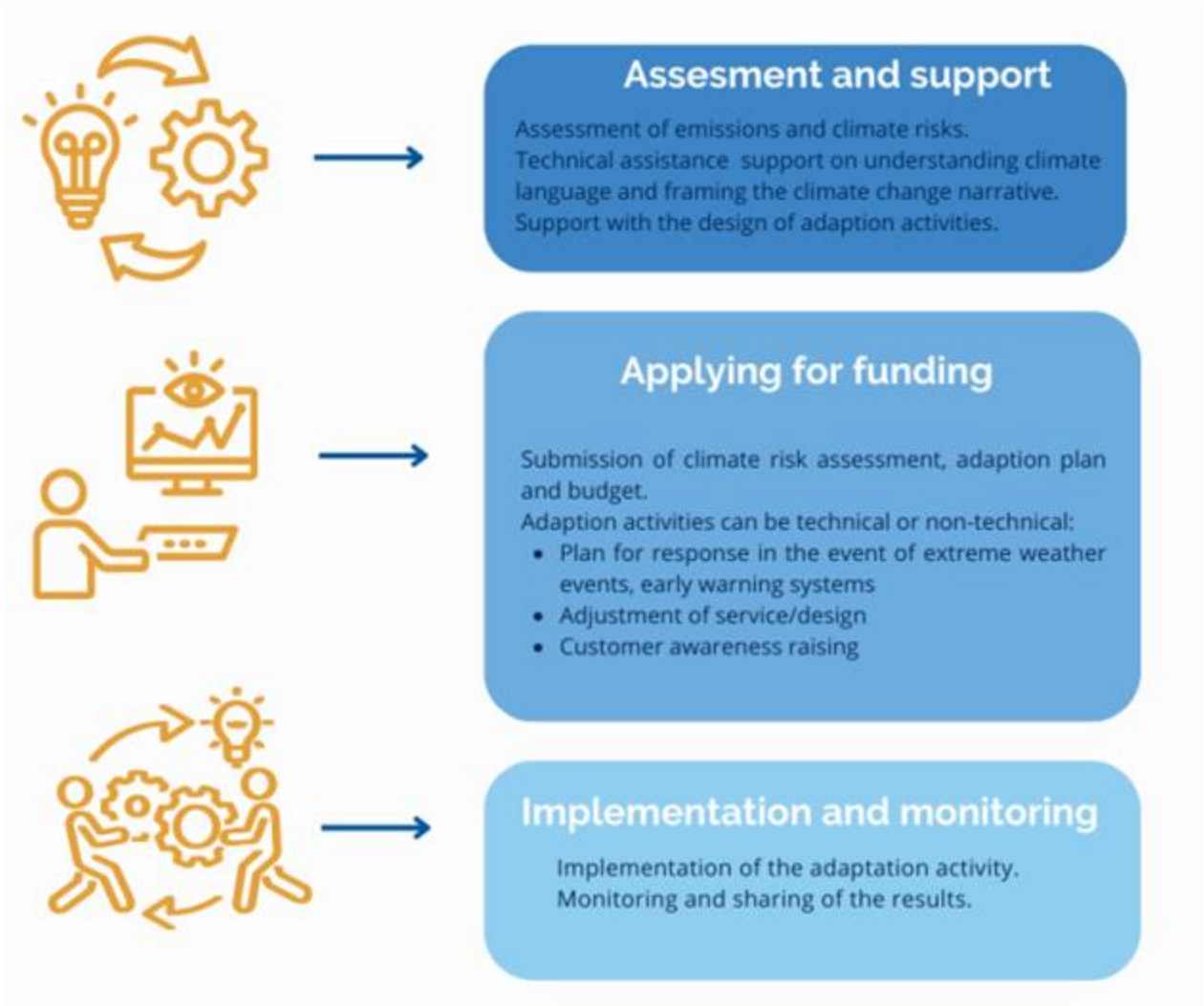
Scaling Climate-Resilient WASH Programme in West-Africa and Horn of Africa

Intervention:

CRA support to 12 enterprises in Burkina Faso, Ethiopia, Ghana, Mali, Nigeria, Senegal

TA & funding: TBD, to 4-6 enterprises (selection process ongoing)

Total amount: ≈ € 120,000



Aqua for All

Results & learnings Phase 1:
Promising Foundations with Limited Funding, Recourse Constraints Persist

Adaptation impact created	Result	No of projects that used this indicator
Number of people made more resilient through the activity, through:	92,980 ppl	6
Staff trained	49 ppl	4
Customers trained	5,331 ppl	5
Services made more resilient for (no) of customers	87,600 ppl	1
Other indicators used to measure resilience		
Additional water storage installed	226 m³	2
Climate risk team established	1 team	1
Tree nursery established	1 nursery	1
Parishes with reduced flood risks	3 parishes	1

1. **Climate adaptation TA filled important awareness & knowledge gap**
2. **All enterprises included capacity-building activities**
3. **Shortage of qualified climate trainers**
4. **Funding level may have favoured training-focused interventions**
5. **CRA and adaptation planning approach well received**
6. **Some enterprises considered funding Insufficient for long-term impact**

Snapshot of reflections from enterprises

*"We have learnt many practical aspects of **how best to install rainwater tanks**. For example, that the beginning of winter is the ideal time to install the equipment. Or that it is important to integrate a shading system on top of the polytank to protect it from the sun, and that we need to set up a system for monitoring and regular maintenance of the systems."*

Enterprise in Burkina Faso that supplies clean drinking water to urban and rural homes by building, equipping, and running water supply networks & kiosks.

- *Hazard(s) & vulnerability*: Groundwater reduction & Decrease in Rainfall: Reliance & lack of awareness on declining groundwater.
- *Adaptation strategy*: Commercialisation of rainwater harvesting, retention systems to reduce dependency on groundwater, awareness creation on water conservation

*"We realized the **importance of having a dedicated risk team** to assess, recommend, and approve project plans before implementation, which has started saving us considerably. It's not a one-person task, but rather a team effort. The only **challenge we faced was finding a skilled and competent trainer** for climate-resilient water infrastructure."*

Enterprise in Uganda that designs, builds, enterprise that builds and runs solar-powered water systems and farm irrigation networks.

- *Hazard(s) & vulnerability*: River floods: Frequent relocation of customers and damaged boreholes
- *Adaptation strategy*: Build flood resilient infrastructure, train staff and increase community awareness on floods

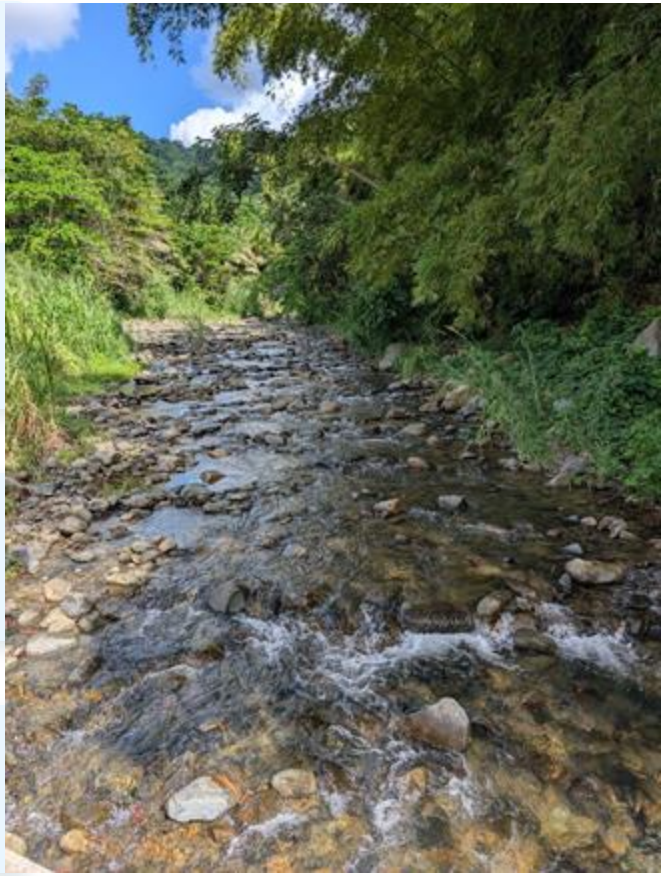
*"Through **early issue detection, preventive maintenance, and responsible water use**, the community has improved its ability to adapt to fluctuating water availability and quality. A major success was the **high level of community engagement**, with 450 members from Burani and Moyeni attending the workshops, reflecting strong interest and awareness of water quality issues."*

Enterprise in Kenya that installs, runs, and fixes solar-powered water purification and desalination systems.

- *Hazard(s) & vulnerability:* Water quality risks & Extreme heat: Reliance on more saline groundwater, increased membrane damage due to salinity.
- *Adaptation strategy*: Increase frequency of water quality testing to increase life span of membranes, sensitization of community to climate risks

Learnings phase 2:
Grounding Climate Resilience in Daily Operations

1. **SMEs often assume “climate solution = climate resilience”**
2. **AI-generated hazard text often lacks local context and clear pathways to action**
3. **SMEs identified risks not just about water (ex: like extreme heat affecting labor)**
4. **The CRA process requires hand holding, but key to integrating climate into business models**



Audience Q&A

Panel Discussion

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THANK YOU