Egroup discussion
Sustainable Urban Water Cycles (SUWC)

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Egroup discussion

Sustainable Urban Water Cycles (SUWC)

The Egroup discussion on Sustainable Urban Water Cycles ran on the snvwater Egroups platform from the 9th of February till the 28th of February. In total there were 58 countries, from 15 countries (Bangladesh, Mali, Tanzania, Switzerland, Bhutan, Australia, Indonesia, Zambia, Vietnam, Austria, Netherlands, Nepal, Laos, Ethiopia and Niger).

The Egroup was organised over a period of 3 weeks and divided in three topic blocks as follows:

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In each block, guiding questions were asked, but participants were also invited to speak more broadly about the topic or raise issues themselves.

The questions were:

**What forms a Sustainable Urban Water Cycle?**
1. How would you describe the urban water cycle in your city or the city where you work ?
2. Do you consider it is a sustainable urban water cycle ? Why ?
3. Which criteria would make an urban water cycle sustainable ?

**To integrate or not to integrate? *(That’s the question)***
1. Who is currently responsible for what parts of the urban water cycle in your city ?
2. What do you see as the stronger and weaker parts of institutional set-up of the urban water cycle in your city ? And why ?
3. What should be done to improve the institutional set-up ?
4. How will these improvements contribute to greater effectiveness, efficiency, accountability or transparency ?

**How to take inhabitants along?**
1. Which behaviours by city dwellers are most problematic for the sustainability of the water cycle in your city ?
2. Which strategies have been tried and been unsuccessful ? (you may speak about your city or from your general experience)
3. What do you see as more successful strategies to bring city dwellers along in the changes towards a more sustainable urban water cycle ?

Below is the summary of the discussion. Original contributions can be found at:

[https://snvwater.groups.io/g/Sustainable-urban-water-cycles/messages](https://snvwater.groups.io/g/Sustainable-urban-water-cycles/messages)
**TOPIC 1: WHAT IS A SUSTAINABLE URBAN WATER CYCLE?**

**HOW TO DESCRIBE AN URBAN WATER CYCLE CONCEPTUALLY?**

While we asked you to talk about the specific water cycle in your cities, I think it’s good to start with the concept as it emerges from the different contributions. There are different concepts:

1) **A more narrow concept of urban water cycle.** Here it starts with water capture and treatment, goes to distribution to users, collection of waste water, and then treatment/disposal of waste water (see the picture below adapted from Zhuo Chen et al.\(^1\)). As you can see, this more narrow concept is still a cycle. The water is taken from the groundwater and river, and it goes back to these sources downstream, being part of the overall hydrological cycle.

   Of course, in practice, it is rarely this neat. For example, not all premises are connected to water supply let alone to sewer. The quality of the treated waste water is not always up to standard, and drainage water also has an impact.

2) **Basic concept of urban water cycle with spotlight on urban run-off.** This concept of the urban water cycle includes the water supply and waste water management, but puts special emphasis on (polluted) urban run-off and storm water drainage in the city. This is particularly relevant in cities with high levels of paved surfaces, problems of water logging etc. The conventional water cycle picture of SWWM fits in this perspective.

3) **Basic concept of urban water cycle with spotlight on the water resource.** This is the perspective that historically was taken by organisations focusing on water supply and/or in places where water supply is getting scarce. It includes the water supply and waste water management, as well as a deeper

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\(^1\) Zhuo Chen, Guangxue Wu, Yinhu Wu, Qianyuan Wu, Qi Shi, Huu Hao Ngo, Oscar A. Vargas Saucedo, Hong-Ying Hu, Water Eco-Nexus Cycle System (WaterEcoNet) as a key solution for water shortage and water environment problems in urban areas, Water Cycle.
understanding of the water sources. This can evolve around recharge, protection and sometimes even full watershed conservation. Payment for environmental services also links to this perspective.

Also the water flow diagramme developed by Dorothee Spuhler and Lukas Bouman at EAWAG, puts a spotlight on the water resource and how it’s used. Digbijoy Dey from Bangladesh shared the diagramme for Dhaka (see the contribution by Digbijoy). (I am sharing below the diagramme from Santa Maria because it includes the link to the available and used water resource).

4) **Everything-integrated urban water cycle concept.** When the urban water cycle is described at a more abstract level, there is a tendency to include everything: the water source, water supply service chain, sanitation, solid waste service chains, grey water, stormwater. And course it is true that everything is connected. The diagramme shared by Ingeborg Krukkert from the Netherlands, is an example of this.
Abishek Narayan from Switzerland shared the following diagramme:

Within the everything-integrated urban water cycle concept, the spotlight often ends up on solid waste, because it interferes with drains as well as on-site/off-site sanitation. Many of you mention these interactions.

**HOW DOES THE URBAN WATER CYCLE CURRENTLY LOOK LIKE IN YOUR DIFFERENT CITIES?**

We probably need a holistic, everything-integrated urban water cycle concept to begin with, but for specific cities, we can focus on what is most relevant.

Jeremy Kohlitz from Sydney (Australia), Digbijoy from Dhaka (Bangladesh), Sonja Hofbauer from a town near Vienna (Austria) and Mahteme Tora from Addis (Ethiopia) all put a spotlight on the water resource in the urban water cycle. In Sydney, the water comes from 11 dams – 80% from one specific dam (Warragamba) – and there is a desalinisation plant to top up the water supply. In Dhaka, Digijoy shared that 35% comes from surface water and 65% from groundwater. The overall production is ample for the population it’s serving. In greater Vienna there is also sufficient water, coming from the mountains through gravity flow. Additionally there is a back-up supply of infiltration wells along the Danube river. There are concerns about the impacts of dry years and the unregulated abstraction of ground water for irrigation, hence household measures to allow for greater infiltration are encouraged. Also in Addis, there are large water supply needs requiring a combination of groundwater and surface water. The context is complex due to the altitude of the city affecting water pressure. Big water consumers are encouraged to self-supply from ground water which led to overabstraction and drying wellfields. Additionally Addis has (untreated) wastewater irrigation for the vegetable production. In addition to the re-use of water and nutrients, this contributes to a different cycle: the lifecycle of pathogens...
Yet there are a number of people who put a spotlight on the water cycle on urban run-off, such as Ruhul Munshi about Gazipur (Bangladesh), Gem Tshering about Thimphu (Bhutan), Kabir Rajbhandri about Kathmandu (Nepal) and Marc Casas on Hanoi (Vietnam). These are all places with more build-up area. Ruhul shares that in Gazipur there are few places for infiltration of water. Gem shares that Thimphu gets flooded with stormwater and surface run-off during every heavy rainfall. The development of the city took place before planning, and it is now difficult to add green spaces. In Hanoi domestic water is brought from km away from the city, while only a small part of the waste water is treated. Natural lakes within the city have been drained or reduced to expand urbanisation, as a result flooding is common.

Yet in some smaller cities urban run-off is less of a problem because there are still many open unpaved spaces. An example is given by George Wainaina based in Switzerland, who speaks about a small town in Kenya called Limuru. There are still large areas with vegetation in the town, so infiltration still happens. The challenge is around the quality of on-site sanitation.

However, the everything-integrated urban water cycle is a reality for many of you. Proshanto Roy from Dhaka, Merelin Keka Adhikari from Joypurhat Municipality (Bangladesh), Rachel Pringle based in Vientiane (Laos), Malan Abdou Nahiou from Niamey (Niger) and Afewerk Teklemariam and Andualem Anteneh writing jointly about Bahir Dar and Kunzila town in Ethiopia, all write about the interconnections and in particular the visible role of solid waste. Proshanto shares that Dhaka is surrounded by rivers and wetlands, which are affected by polluted run-off and poor on-site sanitation management. Solid waste clogs drains and channels, resulting in stagnated water in the city. Also, in Joypurhat, the conservancy inspector highlights the issues of septic tanks connected to drains, drains clogged and overflowing, as well as large amounts of solid waste. In Niamey, the drains are blocked by sand, plastic waste, and household waste, which leads to flooding. Also, the river carrying debris leads to flooding, while the use of shallow wells poses a health risk due to pollution from on-site sanitation. Both Bahir Dar city (about 180,000 people) and Kunzila (about 10,000 people) lay on flat land on the shores of Lake Tana. Bahir Dar takes its water from 38 boreholes and three spring sources, but these sources are insufficient due to population growth as well as lack of metering. The city is flat, and this contributes to water logging, polluted run-off flows into the Lake Tana and the Blue Nile River. For Kunzila, the source of water supply is a borehole near the lake and the Lake Tana itself. Sanitation is on-site and solid waste management is gradually improving. Still run-off flows back into the Lake Tana. The problem of lake’s pollution is obvious. In Vientiane the river is the source of water supply, but downstreams that same river is heavily polluted by the city. Flooding is a major issue due to poorly maintained drainage as well as the location of some parts of the city.

**DO YOU CONSIDER IT IS A SUSTAINABLE URBAN WATER CYCLE? WHY?**

The answers to this question were quite uniform, ranging from no, not really, to no not at all. Only Sonja from greater Vienna reflected that the system which has been in place for over a hundred years is fairly sustainable for now.

The reasons why you did not consider the urban water cycle sustainable can be sub-divided in having a problem today and expecting to have a problem tomorrow. The problems you mentioned follow broadly these lines:

1) Problem with shortage of water supply
2) Problem with services not reaching all
3) Problem with pollution of surroundings, water bodies, groundwater
4) Problem with flooding/ water logging

Matheme talked about the difficulty to find a balance as Addis Ababa is growing and developing quickly. This means the demand for water increases, but on the supply side the infrastructure is ageing, there are leakages, and waste water treatment is inadequate. Several of you (Ruhul, Gem, Jeremy, and Marc) spoke about the need for recharging groundwater, either to mitigate shortages today or in the future. Merelin Keka highlighted the
fact that services are not ensured for all city dwellers, which is linked to a range of factors. Others emphasised the growing problem of pollution. Patricia Solorzano, based in Dhaka, spoke about the enormous amounts of solid waste mixing with water and contaminating both surface and ground water. Ugyen Dorji from Dagona Dzonkag in Bhutan shared how chemicals, trash, and other contaminants in run-off go directly to the rivers and streams, affecting aquatic ecosystems and public health. Also, Allan Rushokana from Arusha in Tanzania highlighted the importance to consider health aspects in the urban water cycle. Afewerk, Andualem, and Kabir spoke about pollution, but also flooding. MD Gift Mbabai Monde from Zambia wrote about the factors that impede infiltration as city planning has not considered this during planning. Rachel spoke about potential future issues for Vientiane, which are not only caused by climate change, but also upstream development of hydropower, as well as uncertainties around development and maintenance of key infrastructure in the city itself.

**Which criteria make an urban water cycle sustainable?**

There is a wealth of information in the different contributions. I would like to distinguish between:

1) **Criteria**: when do we say an urban water cycle sustainable
2) **Measures**: how to get to that situation of greater sustainability

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### Criteria: when do we say an urban water cycle is sustainable?

Jeremy, Kabir, and Marc point to the need to find a balance. Jeremy and Kabir define a sustainable urban water cycle as:

> an urban water cycle that allows for sufficient amounts of clean water for meeting the needs of everyone and sustaining ecosystems, meeting the wants of society, and does not have economic costs that exceed the ability of society to pay for it, in the present and under future climate change scenarios.

The description provided by Afewerk and Andualem echoes this definition. Marc talks about an acceptable level of disruption of the natural water cycle, considering input, output, and quality of water.

The ‘balance perspective’ is explicit about water use for people and nature, the sustainability of the water resource as well as different aspects of pollution (sanitation, solid waste, polluted run-off). However, the need to protect people from water-related risks is not as present. Therefore, from SNV’s side, we consider four dimensions of water security as criteria for a sustainable urban water cycle.

### Measures: how to get to a situation of greater sustainability

Most of you talk about measures, activities that we need to do to make the urban water cycle more sustainable. As Abishek explained, measures can be varied. Many people emphasised the need for treatment, recharging of groundwater, and protecting the environment from pollution. Dorji also raised the need to increase responsible
water use. Gem suggested to distinguish between drinking water and water for other uses, e.g., in construction it is not needed to use water at the quality of drinking water. MD Gift Moonde wrote about the need to include gray and green development in city planning, and to find solutions for recharge and infiltration. However, he also pointed to the bigger picture, suggesting attention must be paid to development in rural areas to curb the very high rate of urbanisation.

Allan said that measures need to include all aspects and levels. Most people agreed with this, but some suggested to start or prioritise. Digbijoy recommended to prioritise services, in the context of Dhaka, especially on-site and off-site sanitation.

Patricia talked about striking a balance between affordability and cost-recovery, between environment and community needs. Merelin Keka and Rajeev Munankami emphasised that a range of social-organisational measures are needed to arrive at greater sustainability.
TOPIC 2: TO INTEGRATE OR NOT TO INTEGRATE? (THAT’S THE QUESTION)

Who is currently responsible for what parts of the urban water cycle in your city?

The institutional set-up for the urban water cycle is a means to an end. The objective is to manage the different services (water supply, off-site and on-site sanitation, solid waste) as well as drainage, floods and droughts in a way that provides (long term) water security for all people in the city.

There are few places where one entity is entirely responsible for all parts of the urban water cycle. From the description by Gem Tshering, it seems that Bhutan is the only country where all responsibility lies with the municipality.

Of course, water security is not the only concern a city has, there are also other objectives, roles, and responsibilities. Moreover, urban water intersects with other issues like housing and roads. Therefore, this Egroup is not suggesting that more integration always provides better outcomes. Rather the question is about the overall institutional architecture: finding the right degree of integration across different levels, functions and sectors. The “degree of integration” is found somewhere along the integration continuum, as in the figure below.

Below, I will first zoom into what you said about these levels, functions and sectors, and then try to summarise the stronger, weaker parts as well as ideas for improvement.

Levels or areas of jurisdiction

The question about institutional integration across levels is about the area of jurisdiction of each entity. This asks, for example, how much is managed at ward level, how much at city level, or perhaps how much regionally.

In most contributions, we saw that the different institutions operate in a similar jurisdiction, namely that of the city. However, in some cases, certain roles are with an entity that works in a smaller (ward) or broader area (region, catchment).

For example, Luckson Simumba, Gift Moond, and Emily Banda from Zambia, shared that commercial water utilities are responsible for water supply and sanitation across multiple cities, whereas solid waste and drainage is with the municipal authority of each city. As in most countries, land is one of the key issues, and this depends on the local government. Moreover, right now, as Luckson explained, commercial utilities report to two ministries: the Ministry of Local Government and the Ministry of Water.

In Dhaka, as explained by Digbijoy Dey and Proshanto Roy from Bangladesh, the Dhaka Water and Sewerage Authority (DWASA) is responsible for water and sewerage, but there are two city corporations (local governments) namely Dhaka North and Dhaka South. The city corporations are responsible for on-site sanitation, drainage, and municipal solid waste. The size of Dhaka (22.2 million people) may be the reason for having two city corporations.

In Tanzania, Hezron Magambo shared that Urban Water Supply and Sanitation Authorities (WSSAs) are responsible for water supply services, as well as off-site and on-site sanitation services. The city council (local government) is responsible for solid waste management, and certain aspects of sanitation like enforcement of regulations. The responsibility for the drainage system management is shared. The city council is responsible for planning and general maintenance, whereas the road agencies (TANURA and TANROADS) do construction and
major repairs. Yet, as Herieth Manyika explains water resource management sits with the water board. In the case of her region, the Simuyu Region of Tanzania, this is the Lake Victoria Basin Water Board.

In Mozambique, Horacio Quembo explains, the responsibility for administration of water supply and sewerage infrastructure in medium and smaller towns is with a central government institution (AIAS). AIAS then signed delegated management contracts with private sector to operate the systems in the city. Where needed, AIAS provides technical support.

There may be good reasons to make one institution responsible for a bigger area or to divide responsibilities across multiple institutions in smaller areas. Having a bigger area generally allows for more revenues, cross-subsidies between viable and less viable areas, and for greater technical capacity. However, it may also lead to the neglect of smaller, more remote areas (“not all children are loved equally!”) and bureaucratisation. Smaller entities responsible for a smaller area are expected to be closer to end users, less bureaucratic and more able to respond to the specific local needs or situation. However, they may struggle financially and not have access to all the required technical capacity.

However, if within the urban water cycle different roles and responsibilities are with entities at different levels, this may make coordination and alignment of – for example – investment more difficult. Organisations working in a broader area may feel they need too coordinate with a whole lot of small entities, whereas organisations working in a smaller area may feel that the larger entities are not always responsive to their needs.

**FUNCTIONS**

The question about institutional integration across functions is about **efficiency as well as accountability**. The most well-known example is the discussion about the separation of policy, regulation and operation of services. The idea is that the entity providing the service should not also be the one who regulates the service because that’s a potential conflict of interest (that’s like a student grading his/her own exam). Another reason to house certain functions in a separate entity, may be because it requires more attention or specialised knowledge. In addition to the well-known policy, regulation, operation functions, we also see separation of functions around planning, investment and financing in some countries.

The National Water Supply and Sanitation Council (NWASCO) in Zambia is an example of a strong national regulator, with a function separate from the operations, investment as well as policy, and also outreach across the country. However, not all countries have a regulator that has effective influence across the entire territory. In some countries or cities, the regulatory function is combined with policy making and housed at the city level. Digbijoy suggests that for Bangladesh the set-up of a regulatory authority for abstraction, drinking water and sanitation respectively, is a priority.

In Kathmandu, Nepal, as Sanju Lamichhane describes, the Kathmandu Valley Water Supply Management Board (KVWSMB) is an autonomous government body responsible for the water supply and sewerage assets in the city. It is responsible for policy development, licencing and monitoring of service providers. Kathmandu Upatyaka Khanepani Limited (KUKL) a public company tasked with the operation and management of water and waste water services. Under KVWSMB there is a specific Project Implementation Directorate that operates as an asset creator and oversees investment projects. However, the Ministry has initiated a process to delineate clearer lines for demarcation between the entities, and with the Federalisation into three tiers of government (Federal, Provincial, Local) further clarity may be needed among levels as well.

The regulatory functions needed for a sustainable urban water cycle go beyond the economic and service regulation of water supply and sewerage utilities. As Emily describes, Zambia Environment Management Agency (ZEMA) issues licences concerned with environmental and ecosystem protection, whereas the Water Resource Management Authority (WARMA) regulates water resource management for different uses. Both are at the national level.
Also in Mali, Lassaba Toure shares that there is a focus on policies and a gap in operations and regulation.

In a number of countries, investment is a function which lies with the operator, e.g. the water utility to expand the network or the local government to invest in solid waste. However, as Patricia Solorzano describes, in Bangladesh the City Development Authority is a separate, deconcentrated, government agency that approves planning, for example the construction of buildings and adherence of on-site sanitation to the national building code.

In Hanoi, Hang Dinh Thu explains that investment in drainage is managed by the Department of Construction at the city level, the People’s Committee of Hanoi. However, the management is done by the suburban district who signs contracts with a company (public or private). Further budget requirements can be submitted again to the Department of the city.

In Addis Ababa, Ethiopia, Mahteme Tora explains that there are two entities working on solid waste management: The Department of Sanitation and Beautification has the overall responsibility for the solid waste chain, city cleanliness and environmental hygiene. The Addis Ababa Cleansing Management Agency is responsible for maintaining cleanliness and sanitation in the city, including street cleaning.

Merelin Keka Adhikari from Bangladesh points out that many of the quality-oriented functions are not sufficiently ensured. These are functions such as public engagement, ensuring occupational health and safety of workers, transparency of decision making, but also data management. The question is whether these functions should be housed separately, or that responsible entities should be held more accountable for such aspects.

**SECTORS**

Institutional integration across sectors is what generally comes to mind when reflecting on the urban water cycle. It is about for example to bundling or separation of water and sanitation, or sanitation and solid waste.

Abishek Narayan from Switzerland shared two figures from the work that the EAWAG team has been doing on this. The figures show all the potential positive and negative interactions between the water supply, sanitation and solid waste value chains, as well their link with storm and grey water (please have a look back at this message). As you can see potentially there are a lot of interactions, the challenge for each city and country is to find the appropriate, feasible and priority interaction for their context. Or said otherwise, an institutional architecture that ensures coherence, maximizes synergies and allows for specialisation and efficiencies.

Your contributions show that in many countries water supply and sewerage (off-site sanitation) is housed separately (in a separate entity) from on-site sanitation and solid waste. In some countries, like Zambia and Tanzania, this changed over the past years: the utility has now become responsible for water supply, off-site as well as on-site sanitation. Solid waste tends to remain with the local government in all countries, but drainage can be housed together with roads in some contexts.

For example, Afewerk Tekelemariam and Andualem Anteneh from Ethiopia, explain that in Bahir Dar city there are three entities:

1. Bahir Dar City Water Utility: responsible for water supply and waste water. (It is not clear to me whether this includes the on-site sanitation chain.)
2. Bahir Dar City Road Authority: responsible for construction and maintenance of the drainage network.
3. Bahir Dar City Greenery and Beautification Office: responsible for the full solid waste management chain as well as a clean and aesthetically pleasing environment more generally.
Abishek zooms in on two small towns in Uganda, Wobulenzi and Kakoogi. In the Ugandan context, water supply is the mandate of the regional umbrella utility, whereas on-site sanitation and solid waste sit with the town council. Storm water drains along highway roads are with the transport department.

**STRONGER AND WEAKER PARTS OF THE CURRENT INSTITUTIONAL SET-UP, AND POTENTIAL IMPROVEMENTS**

You raised a large number of examples responding my question of what the stronger and weaker parts of the current institutional set-up in your city is. All of this is of course context specific and related to the specific institutional arrangements of the city and country. Yet, nearly every contribution refers to role clarity among stakeholders involved as one of the key issues.

The three contributions from Zambia converge around the point that Zambia has clear policies, a legal framework, dedicated ministries, a strong regulator and increasingly also clear policies for on-site sanitation. Issues that are seen as weaker is the reporting obligations of the commercial utilities to both the ministry of local government as well as water, and the challenges of utilities in finding land for expansion of services. Overlap or lack of clarity around roles in urban planning is related to that. Emily adds to that the sharing of data.

For these reasons, Luckson is proposing to have just one ministry in charge, while Emily is suggesting improvements could come from a review of roles and responsibilities, as well as a centralised data system.

At the national level in Bhutan, there is now a new Department of Water under the newly formed Ministry of Energy and Natural resources. This is a positive thing, but with exception of big projects, the investment is proposed by the municipalities and approved by the Ministry of finance, with limited linkage to the line agency (Department of Water). As a result, there are duplications in terms of financial and human resources. This is particularly sensitive because, As Dorji Ugen shares, the country is facing aging infrastructure.

For these reasons, both Gem and Dorji suggest that there should be a more comprehensive approach to planning, and possibly a policy to strengthen the linkages between national and local level.

From the collaborations on Ethiopia, it is felt that role clarity is generally present, though there is a bit of overlap among agencies in Addis, and in Bahir Dar mutual understanding and coordination could be improved. Afewerk and Andualem suggest consolidating the three entities (see above) under a single umbrella institution with distinct departments. Their aim is for them to work to a common goal. Mahteme suggests that coordinated decision making and resource allocation could be achieved by an integrated governance framework that coordinates water supply, sanitation, land use planning and environmental management. He further suggest to keep investing in technological innovations and the adoption of these.

In Dhaka, Proshanto sees a strong point in the higher-level structures (ministry, department etc.) as well as financial support from the government, but he is concern about the interministerial coordination and the lack of coordination between the utility and city corporations. Digbijoy says that in spite of the Institutional Regulatory Framework on Faecal Sludge Management, Dhaka still struggles to find a clear arrangement for on-site sanitation. Also water resource management and environmental agencies are not fully addressing water quantity and quality issues around the city. Digbijoy feels the main issue here is the lack of accountability, and hence his emphasis on regulation. For this reason, all contributions from Bangladesh align around the need for greater regulation, accountability and enforcement, including around inclusion practices.

In Vietnam there is a lot of capacity and specialised people working on the city, but the challenge is in the many different roles and levels. Just like Emily in Zambia, Hang is also suggesting that better centralised data management could help the city to do better and more transparent planning. She also suggests legislating criteria for resilient cities in water management, in order to hold the different entities accountable for that (not just encourage it).
Kabir Rajbhandari outlines a range of stronger and weaker points for the context of Nepal. This reflects the reality of these issues which are often multi-faceted. One point to highlight among all this is the need to improve the clarity of roles and responsibilities and invest in longer term infrastructure development plans. In this there should be greater attention to green technologies and development as well as to water quality issues.

In Tanzania, there is a shared feeling that the institutional reforms on on-site sanitation and faecal sludge management have clarified roles and responsibilities in that area. Hezron points out that the National Water Sector Development Programme and the National Water Investment Plan ensure alignment around priorities. Herieth adds to this that having strong utilities in place is certainly a positive. More could be improved around inter-institutional collaboration especially between the utility and the city, but also with the wider group of institutions responsible for environment, water resources. Alignment around planning, investment and the role of private sector will help.

Horacio shares the context of the city of Nampula in which water supply services are managed by the public company FIPAG. As the abstraction was installed in the 1950-1960s when the population of the city was 12 times smaller, water availability is becoming a challenge. Sanitation is separated from water supply and the waste water collection process is not functional. In this context Horacio feels that an equal and aligned development of both water and sanitation would be beneficial for the city.

**Conclusions?**

As you can see, the diversity of institutional arrangements, stronger and weaker points as well as directions for improvements is huge. There is no clear recipe for all. I feel that the starting point is to be aware of different possible arrangements and the pros and cons of each. We see a few emerging points such as the importance of having shared longer-term objectives – raised by Hezron and Hang among others, and the importance of coordinated/aligned spatial planning. The latter of course comes with greater sharing of data.

**Topic 3: How to take inhabitants along?**

**Which behaviours by city dwellers are most problematic for the sustainability of the water cycle in your city?**

The range and types of behaviours that you mentioned is very broad and that is just the reality in these cities. Before delving into the specific behaviours, I’d like to highlight one overarching trend that several of you (Mahteme Tora, Andualem Anteneh and Afewerk Tekelemariam from Ethiopia, Sanju Lamichhane and Kabir Rajbhandari from Nepal and Emily Banda from Zambia) mention, which is around urbanisation. The rapid urbanisation leads to informal settlements which do not have all services. Moreover, as Mahteme and Sanju both describe people in these settlements come from diverse cultural backgrounds and rural areas. They have other sanitation habits (10% open defecation says Mahteme) and other practices of water use. The rapid urbanisation also leads to an increase in hard surfaces, without much attention to the need to have green spaces (as Kabir writes), encroachment on water protection areas and unregulated drilling of shallow wells (Emily). This continuous influx of new people into the urban areas is creating an additional complexity for behavioural change interventions.

More generally, we see the following behaviours:

For drinking water supply, practically everybody raised the challenge of excessive water use. This manifests itself in using of drinking water for irrigation, car and pavement washing for example in Ethiopia, Bhutan and Nepal, but also in Australia. Jeremy Kohlitz says that in Australia where the per capita daily consumption is said to be 274 litres. This may be due to very low tariffs, Gem Tshering from Bhutan mentions 4.35 BTN per cubic metre (equiv. 0.048 Euro cents), lack of water meters in buildings. It may also be linked to the idea that water is free and should be free as explained by Horácio Quembo from Mozambique. In Addis, Mahteme explains, people store water due to unreliability of supply. Once the fresh water comes, they dispose this stored water. Ugyen
Dorji from Bhutan shares a similar story but adds to this the challenges posed by old leaking infrastructure and the maintenance at premise level. There seems to be a lack of commitment to responsible use of water. Horácio suggests that this attitude is due to the fact that people do not see themselves as active parts of the problem but rather passive victims of the water supply situation. This is exacerbated, as Hang Dinh Thu shares by low water tariffs.

In addition to excessive consumption of water by people with a household connection, there are also issues of tempering with meters and illegal connections Immaculata Senje from Tanzania explains. Andualem and Afewerk add to this the nighttime theft of water. In their city Bahir Dar, all these behaviours together lead to losses of around 40%.

Saniya Niska from Indonesia shares that in her area water supply is self-supply from ground water abstraction because the regional water company does not cover all administrative districts. As the ground water abstraction is not regulated sufficiently (in practice), this leads on the one hand to unsafe sources and on the other hand to overabstraction. Unregulated drilling of wells is also an issue in Zambia, Bangladesh and in Kathmandu, Nepal. In some areas it leads to land subsidence.

For sanitation, there are a range of issues, starting with the open defecation mentioned above. However, there are also challenge with the quality of containments not complying with building codes. Merelin Keka Adhikari and Proshanto Roy from Bangladesh shares the challenges around incompliance with Bangladesh National Building Code. Septic tanks have no soak well, are connected directly to the drain. Moreover, there are still households using manual emptying of their tanks. Putri Sortaria from Bali in Indonesia describes a similar problem of septic tanks without bottom, which are never desludged. Cafes and restaurants along the beach which do not have proper containment direct discharge into open water.

In Vietnam discharge of less than 5m3 of waste water per day is unregulated, but in practice- Hang writes- many premises, hotels, homestays, food production, discharge without any treatment. Grease from restaurants causes blockage in the sewer and overflows with heavy rainfall. In Hanoi, there are septic tanks with sewer lines to take away the effluent. However, septic tanks which are not emptied, will not provide any pre-treatment. The city built a separate sewer line for waste water, to avoid overflow of combined (rain and waste water) sewer into the lake, but willingness to connect is low. Therefore, the waste water treatment plant built for that purpose is only working at 50% of its design capacity.

Many of you are concerned about the pollution by small and large industries in the cities, many of which discharge liquid waste directly to drains or water bodies. Sometimes this includes hazardous waste or chemicals as Dorji and Mahteme share.

Solid waste is a huge behavioural issue. Practically all of you mention the challenges of littering and indiscriminate disposal: leaving solid waste “here and there”. In many places the solid waste is disposed or ends up in drains, ditched and in water bodies. It is exacerbated by the high use of plastics and Styrofoam as Saniya and Putri describe from Indonesia. Even though some plastics are banned, use remains high. Jeremy adds that in Australia the tap water is safe to drink but households do not trust it and buy bottled water which contributes to the plastic pollution. Putri is concern that due to inadequate management of plastics a lot still ends up in the ocean.

Solid waste disposal thus complicates drainage, but there are also other issues. Proshanto shares how people with political connections can fill channels and put their construction on top. This is very linked to the overall problem of rapid, uncontrolled urbanisation, where a lot of impervious surfaces are added and very few green spaces. Natural water bodies are filled to get the land for construction.

Emily points to issues upstream in the catchment which also affect the water cycle. People use charcoal to avoid high electricity costs, which in turn accelerates deforestation.
This already represents a vast array of behaviours, and you did not even touch upon behaviours related to preparedness for extreme events like floods.

**Which strategies have been tried and been unsuccessful? (You may speak about your city or from your general experience)**

You are remarkably aligned around what you saw as unsuccessful and more successful engagement.

Unsuccessful are short term and/or scattered campaigns, especially those that are top-down or not accompanied by enabling actions to change behaviour and enforcement.

*Not engaging people in a meaningful way*

Mahteme, Andualem, Afewerk, Kabir and Sanju all described top-down, investment and technology centred interventions which did not effectively engage the people. Or when they did engage the people, they did so passively, not creating responsibility. As Kabir describes, there needs to be a long-term vision of the city, not just patch work here and there. Immaculata shared about house-to-house operations and informers of illegal water usage to report to Authority.

*Short term and/or scattered campaigns*

Horacio gives the example of the installation of a community engagement department to promote payment for water. It worked for a while, Nampula recorded an increase in water payments, but when the campaign became weak the behaviour also dropped. Patricia shared the example of a 2-3 month solid waste campaign that provided containers for garbage collection in the homes. These containers are now used to store rice. Putri talked about scattered campaigns and lots of beach clean up initiatives.

*Partial interventions*

Merelin Keka shared how a number of initiatives did not work because they were not comprehensive. The block desludging without a good service to respond, the tariffs without a modality for low-income areas, the occupational health and safety training without budget for implementation. Saniya shared that there were zero-plastics campaigns but weak enforcement on shopkeepers giving out bags. Dorji shared how enforcement and fines around car washing, waste in drains, septic tank leakages have basically been faced persistent public non-compliance.

*Political or public barriers*

Gem shared how in Bhutan the new water tariff needs to be approved by the municipal committee which consists of elected representatives from the city and vote against increases. Jeremy shared how in the USA the promotion of reuse of waste water (including blackwater) was met with ferocious backlash from the general public. In Dhaka, the water utility still struggles to stop illegal connections to the drain, and the city corporation is facing variable success in preventing construction on water channels.

**What do you see as more successful strategies to bring city dwellers along in the changes towards a more sustainable urban water cycle?**

From the above it follows that many of you are proposing behavioural change interventions that are:

- Longer term
- Coherent
- Engage people in a meaningful way
- Represent a complete package of awareness, incentives/enablers as well as enforcement
- Reach all
- Have political backing
- Show a broader vision of living well in the city
You give a number of examples. Mahteme talks about a comprehensive project in Addis that represents not only a huge investment (900m USD) to rehabilitate the rivers, reduce pollution, work on green parks, floods and drought management. But also engages residents, community leaders and local organisations in all stages of the planning and decision making process. Also, Proshanto suggests engaging people in all stages of the process, making sure that the city dweller is not only a service recipient, but also jointly responsible for a sustainable urban water cycle. Emily also says that successful strategies manage to put communities in the driving seat. Patricia and Hang give examples of engaging the broader public in river clean ups or restoring the dead river.

Patricia also suggests that city leaders should lead the change, and they can bring others along. This is somewhat similar to an example given by Putri where in Metro city, the city first started with the engagement of their own staff in the sanitation programme, realising they are also part of the community.

Merelin Keka says that a strategy is more successful if the municipality takes a coordinated strategy of awareness raising, assurance of quality of service delivery and law enforcement simultaneously. Andualem and Afewerk also suggest a broad, coherent package of activities.

Dorji raises the importance of longer term broader education and awareness campaigns. Immaculata adds this needs to be frequent, whereas Horacio speaks of a continuous engagement.

Hang, Patricia and Gem have a number of specific proposals for their context which include metering in buildings, progressive water tariffs and more focus on circular water, including payment for water resources for all, shorter licences for abstraction and discharge. Among many points which are similar to the above, Kabir also mentions the importance of crisis preparedness behaviours among the public, and the need to work on green spaces.

So, there are plenty of good insights on what can be successful, but also a few words of caution. Jeremy feels that in his context it’s difficult for behavioural change to really result in other behaviour. So far only water saving technology adoption has worked. Saniya is conscious that some of the behavioural change may be confined to only a small bubble.