# Equitable Water Resource Management

## Proceedings

Nanyuki, Kenya | 12-16 June 2023

SNV

**ABOUT SNV**

SNV is a mission-driven global development partner working in more than 20 countries across Africa and Asia. Building on 60 years of experience and together with our team of over 1,600 people, we strengthen capacities and catalyse partnerships that transform the agri-food, energy, and water systems, which enable sustainable and more equitable lives for all.

Grounded in the 2030 Agenda for Sustainable Development, we work on the core themes of gender equality and social inclusion, climate adaptation and mitigation, and strong institutions and effective governance.

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*The following text is the unedited proceedings of the June 2023 equitable water resource management learning event prepared by Sandra Ryan, with input from Antoinette Kome. For more information, contact Sandra Ryan, Global Technical Advisor, Hydrology, SNV, sryan@snv.org.*

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# Introduction

This report provides a synthesis of the 'Equitable' Water Resources Management' learning event held in Nanyuki, Kenya from 12-16th June 2023 with over 50 participants from SNV program countries of Bhutan, Burkina Faso, Ethiopia, Kenya, Mali, Mozambique, Nepal, Niger, Tanzania, Vietnam, and Zambia. Participants were from local and national government, local water authorities, irrigation organisations, and SNV country and headquarter staff. The whole event was supported by official real-time French/English translation services.

The learning event focused on four specific aspects of water resource management, "IWRM, WRM in Kenya (host country), What data can do for equity, and Investment in Water Resource Development". It was organised by SNV together with the Wageningen University and Research (WUR) as part of SNV's EWRM Framework Approach development programme.

The purpose of this report is to provide a reference for participants as well as other practitioners, managers, local government, and other actors interested in SNV's Equitable Water Resources (EWRM) programme. It aims to capture the key content presented by experts, the water resource management situation of participating countries, challenges identified in participants' countries, as well as key discussions and reflections.

During the three weeks prior to the event participants had engaged in online e-group forums contributing information on the most pressing water resource problems in their countries, the role of data in creating equality in water resource management, and investment issues. The summary of the Egroup discussion is in **Appendix 2**.

It is hoped that this report will also serve as a resource for the broader Water sector.

## Official opening

***Honourable Joshua Oakoa Okoku***

The learning event was opened by a welcome from Laikipia County dignitaries including the governor (Honourable Joshua Oakoa Okoku) and the County minister of Water, Environment and Natural Resources, Leah Njeri.

Laikipia County has a long history working with SNV for many years and they expressed their gratitude and support to make the event a success. Specific thanks were given for SNVs LISTEN project in the area and he expressed his wishes to continue working together on this challenging topic. Attendees from all the various countries were welcomes, noting the range of water resource environments and eco-hydrological zones represented.

Leah Njeri, in a county Ministerial post for almost one year highlighted the recent terrible drought which as of June 2023 was still not over. She explained that most people in the area have memories of struggling to access water. Laikipia is a water scarce county and efforts to improve this include drilling boreholes, building dams, and catchment management, but they depend on u/s counties' goodwill to let required volumes of water enter. Environmental degradation is widespread and securing (protecting) the areas around water sources is a major priority.

Water resources are also under pressure from Non-Revenue Water (leaking pipes, unauthorised /unbilled use) within water utility networks leading to more water being diverted into these systems than is really necessary. Flood irrigation is an important agricultural technique but now conversations are needed to understand how much water farms are using and what the return has been for it (crop yields and associated financial returns). She continued by drawing attention to the 'Bamboo tree' a very water friendly tree with high economic value particularly for its use in construction.

She concluded her introduction by confirming that her department works very closely with the LISTEN project and the strong desire for Kenya to accelerate progress by learning lessons from other countries.

The Governor followed with his welcome speech to attendees. He mentioned his own personal history of interaction with SNV, describing how in 1997 when he was in charge of agriculture and livestock production his involvement with an SNV project created opportunities and he was able to develop the 'Semi-Arid Development Programme'. These early initiatives significantly contributed to the current institutional situation. Kenya started producing Water Acts and Forest Acts in 2002 after working with and learning from SNV.

In a speech the Governor confirmed his delight at being able to open the EWRM event in Laikipia County. Water is a precious resource and key to sustainable future. It has a critical role in supporting communities and ecosystems. Laikipa County is home to vibrant landscapes, animals, and communities but formidable challenges: climate change, rapid population growth, and competing demands for water. This demands a holistic approach to safeguard ecosystems. The county is taking action. Ten new boreholes have been drilled in partnerships providing 3500 litres of water to 65 schools and 22 health care facilities (HCFs). This initiative has kept children in school and HCFs running during the drought, but now more than ever a holistic approach to water management is needed.

Other actions being delivered by the county Government include an annual hydrological assessment to better understand the resource. In true partnerships they have implemented initiatives to protect sources, improve infrastructure, and strengthen governance. Further implementation will support >35,000 people. The county has also developed Climate Change Act, policy and regulations and attributes the LISTEN project for helping develop these pieces of legislation. They are providing ongoing support to farmers across the county to help them adapt to the local effects of climate change.

New and current actions include the County Integrated Development Plan (CIDP) which is being formed through consultation with the public with the aim to further mobilise and empower communities. Climate change is not in the future, it's here, and they recognise that they need more help to develop aspects of the CIDP, such as understanding the technicalities and feasibility of dam construction options and new infrastructure for irrigation.

Conservation of the environment is critical and this includes long-term commitment to 'growing trees, not just 'planting' trees, and keeping water free from pollution. They are looking to increase storage, including at the household level by enabling small scale but widespread rainwater harvesting. A local rural water company wants to solve the problem of 'dormant' water boreholes and regulating water services in towns can be very challenging. The county wants to be a model to show how rural communities can also regulate and manage their water supply, and how to govern this effectively. The CIDP is intended to be empowering. Communities are not just recipients of services. The intention is to enable local people to be in charge of some of the more local issues, in roles that mirror government. They are aiming to build 'Citizen Education Accountability'.

They also want feedback (from SNV) on how else they can improve and implementable strategies to take forward.

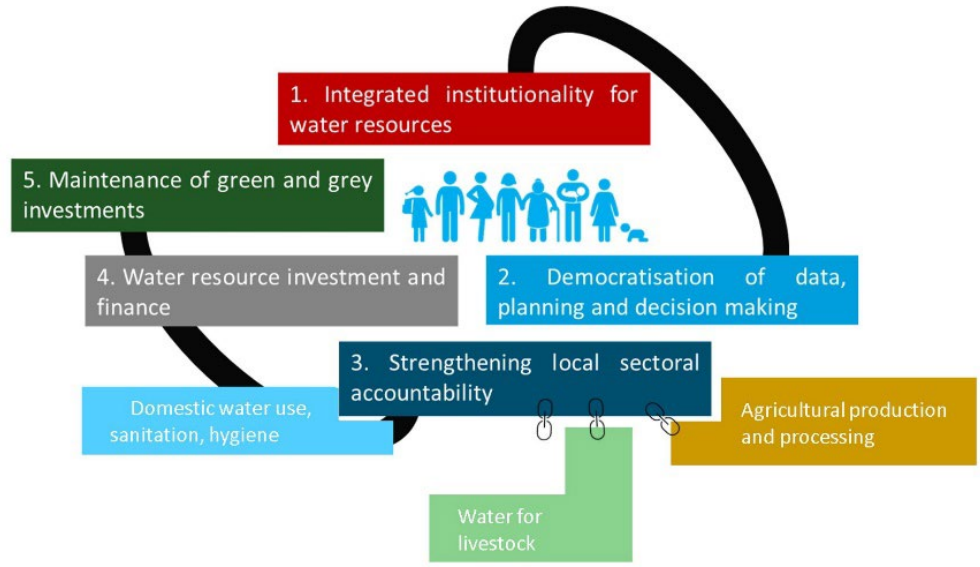
Finally, SNV was commended for bringing together practitioners and people with governance roles to work together during the event, so that "we can create a sustainable water future that leaves no one behind". This is key facet of the current Prime Minister of Kenya. He concluded with his vision for the future, in which the needs of ***all*** stakeholders are protected. They must be empowered to ensure all voices are heard and all rights respected to create a more robust and fair society for everyone.

## Introduction to the learning event

***Presentation by Antoinette Kome, Learning Event Facilitator and SNV's Global Sector Head***

Day 1 began by clarifying what 'Equitable' Water Resource Management means, beyond just Water Resource Management, and that it is **not an alternative to Integrated Water Resources Management (IWRM).**

**Figure 1** Framework Approach for Equitable Water Resource Management




IWRM is a globally recognised, well established process to improve how organisations and entities within countries integrate their policies and implementation both horizontally (i.e., integrating different departments and sectors) and vertically (integrating through national to local levels). The Equitable aspect of EWRM, aims to ensure that equality and fairness in terms of access to water is embedded within these increasingly integrated structures.

'Equitable' does not mean continuing to do the same but with a few added 'extras' for vulnerable groups. It is not about doing 'community projects'. Equity should be at the heart of water resource decision making and action, when

considering water allocations, agreeing processes for managing water during scarcity periods, and when developing new or existing resources.

Early references to IWRM date back to the 1930s to address "optimal" water management, mainly from a technical perspective, but also considering social goals, to fulfil basic needs and the total welfare of the population. The International Conference on Environment and Water in Dublin in 1992 targeted shortcomings in traditional water management: quality issues, overexploitation, ecosystem degradation, and social concerns. Water problems had become multidimensional, multi-sectoral, and multi-regional and filled with multi-interests, multi-agendas, and multi-causes. The Conference developed four IWRM Principles which became known as "the Dublin Principles". The current understanding of IWRM is strongly based on those principles.

The **E** of EWRM is fundamentally about re-thinking how IWRM in practice through the pursuit of integrated structural systems does not automatically lead to equitable management. We must always reflect on our water projects critically reviewing if we are we getting the outcome we want to see, equitable and sustainable water resource management. **Integration is not the ultimate aim; it is only the means to the end**. E is not an additional thing to aspire to after IWRM has been achieved.

**Learning Event Intention**

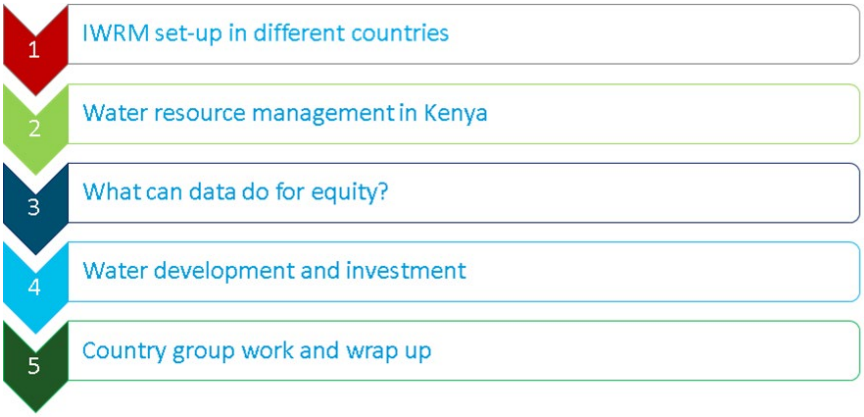
A significant amount and range of information was shared through a series of presentations, workshops, field visits, and discussion groups. Attendees were encouraged to harvest all the useful information shared during the event, and to proactively identify things they can do differently in practice after the event and for the long-term. They were requested to think critically about the Equity issues in WRM in their countries (not limited to SNV projects) but to promote discussion about best practices more widely. Exchange

**Event objectives**

The event had three specific objectives to realise its intentions:

1. Attendees exchange ideas and deepen understanding of equity issues within water resource management in different African and Asian countries.
2. Create references to recognise equity issues across a range of WRM work processes, especially in data management and in investment
3. Reflect about ways to innovate IWRM so that it has a greater focus on equity.

**Figure 2** The logic of the learning event




## Intro to the "Equitable Water Resource Management" learning event Questions & Answers (Q&A):

**Q1. Is there a country where we can say IWRM is fully implemented?**

It is "work in progress" everywhere. Different participants commented on their own country contexts:

- Netherlands – has a good technical reputation but we also recently had only of our Water Resource Authorities going effectively bankrupt[1]. Good water resource management is a continuous effort.
- Australia – after the millennium drought institutional progress looked positive, but things have unravelled in recent years,
- UK – constantly evolving as circumstances change and more sectors are realising it affects them and they either want to protect their interests and/or be part of the solution. National Government isn't leading it. Water utilities have realised it's not all their responsibility.
- Niger – it's a process, can't say a country is ever finished implementing. We keep adapting and evolving.
- Nepal – the governance levels are overwhelming. Local, National, international.
- Ethiopia – feels far behind (in terms of management).

[1] https://www.nrc.nl/nieuws/2023/07/21/waternet-probeerde-een-ultrasexy-bedrijf-te-zijn-maar-daar-hebben-de-dijken-weinig-aan-a4170168?utm_campaign=share&utm_medium=email&utm_source=email&utm_term=in-metabox

# Block 1. The IWRM set-up in different countries

## Introduction: IWRM set-up in different countries

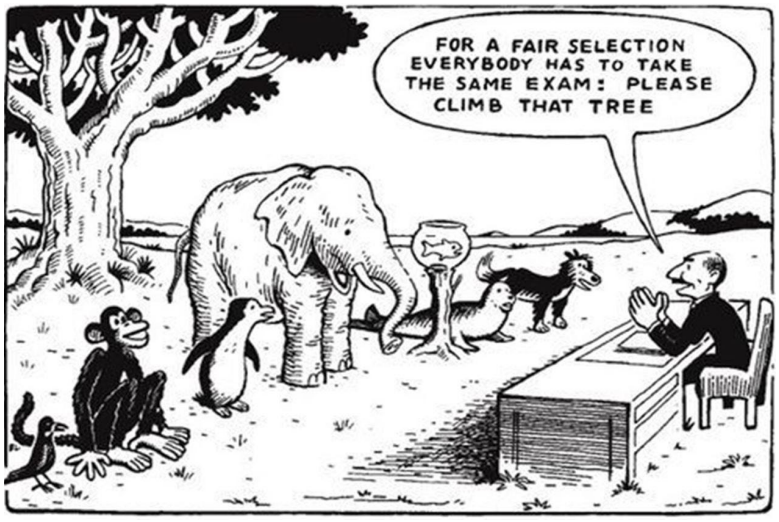
The first block of the learning event was about stocktaking and reflection on the current set-up of IWRM in the different countries. Whereas everybody understands that it's "work in progress", we cannot postpone questions about equitable and sustainable outcomes till we reach "the destination of our IWRM road".

The main question in this block is thus: how is our current set-up and to what extend is this *fit for purpose*?

To illustrate the key points around equitability in EWRM, the well-known image below was used. It illustrates that:

- Unfair processes may lead to unfair outcomes.
- In IWRM, not all water resource users have the same ability and space to influence the processes. Does the current IWRM set-up takes this sufficiently into account?

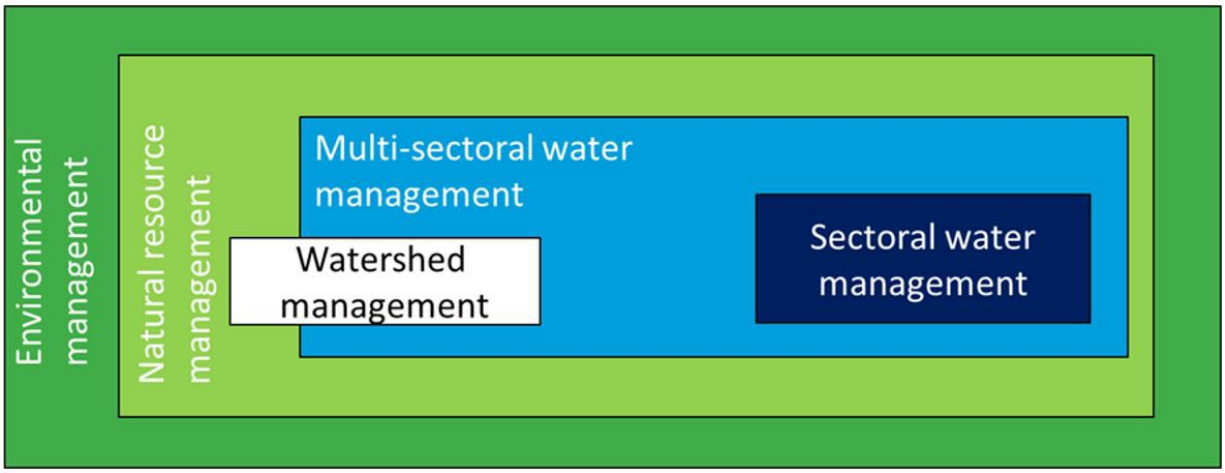
**Figure 3** A 'fair' selection process?




Integrated water resource management is of course about managing the water resource issues which affect multiple sectors or where the use from one sector affects the other. It's not a substitute for sectoral management. Even within an

IWRM structure each sector (e.g., drinking water utilities, river basin organisations, Irrigation Associations, Water User Associations etc) still needs to manage its specific issues and priorities and take responsibility for those components (**Figure 4**). For example, in a situation where a water utility has very high Non-Revenue Water, this remains the responsibility of the utility. The River Basin Organisation can hold the utility to account for its water footprint. This is what often doesn't happen.

Figure 4 Sectoral water management




It's good to realise how IWRM (or integrated multi-sectoral water resource management) relates to sectoral management, watershed management, natural resource management and so on.

The scope of IWRM is potentially very huge, and many countries are struggling to meaningfully address that whole scope. In that discussion, the WRM functions are often confused with the WRM problems. Depending on what the most pressing problem is you want an organisation that is fit for purpose in each country. Problems and priorities are not the same everywhere.

Antoinette gave a distilled overview of the issues that emerged from the Egroup discussion on pressing problems and issues relating to IWRM. There were many common issues but also clear regional/country differences in priorities. We may want to question our 'one-size-fits-all' approach to IWRM.

**Pressing problems**

The first observation is that 'problems' fall into two categories: 1) the actual environmental situation (e.g., climate change, drought, flood, deteriorating water quality, etc), and 2) the ability - of IWRM structures- to manage those problems (e.g., uncontrolled demand for water and uncontrolled abstraction, little understanding of groundwater, unregulated discharge, no water budgeting,

geopolitics etc). Both lead to ecosystem degradation such as water sources drying up or deteriorating to the point where they cannot provide ecosystem services. The subsequent consequences include loss of livelihoods, failed harvests and food insecurity, population without basic services, and conflict of all kinds. From the responses received, although countries experience similar types of problems **not all countries have the same priority problems**.

***Nepal and Bhutan:*** both countries are concerned about water quality (linked to pollution from cities, economic activity and agriculture), increasing ground water exploitation, and diminishing spring water. Sectoral (not integrates) water development takes place despite insufficient knowledge about the available water resources or current uses. Participants from Nepal highlight that current water agreements with India define to a large extent Nepal's water resource development possibilities, and more generally there should be more coordination and planning around water development investment. In Bhutan better water budgeting as well as linkages between source and end-users would be beneficial.

***Indonesia and Vietnam:*** Despite both countries having abundant water they experience water shortages and flooding in certain regions and seasons. Pollution due to industrial, agricultural and household waste disposal into water bodies is a major problem.

***Mali, Burkina Faso, and Niger:*** Participants identified several major problems affecting this region of west Africa. Diminishing water resources due to a combination of overexploitation and climate change is observed in surface water bodies gradually drying up and groundwater levels falling. Mali highlights that this is made worse by unfair allocation of water (in terms of quantity and quality) with large users (energy and irrigation) favoured by Government but also between smaller scale users, i.e., water is allocated for farmers but not for pastoralists.

In Niger this impacts rain-fed agriculture leading to chronic food insecurity every second year. At the other extreme flooding is also a major problem. All three countries are very concerned about pollution from growing populations, industry, and agriculture, and the impact this is having on livelihoods that depend on access to good quality water. Mali and Burkina Faso are also specifically concerned about pollution caused by artisanal gold miners**.** The other major water quality problems are the high levels of siltation in rivers and water bodies impacting water infrastructure and eutrophication.

***Ethiopia and Kenya:*** two dry countries which both face high levels of abstraction, degradation of water resources and pollution. In Ethiopia boreholes are drilled in towns for hotels, industries and different organisations without

sufficient study or oversight. In Kenya despite having water resource regulations rivers run dry due to the constant increase of urban water demand and irrigation development when there are also droughts. Both countries still face challenges in operationalising IWRM but at the same time sectoral water development is growing at an accelerated pace. Invasive species like water hyacinth poses a threat to water bodies.

***Uganda, Zambia, and Tanzania:*** Water resource development is not as rapid in these countries, in fact limited water infrastructure development is seen as a serious constraint to economic development. The countries' participants would like to see access to safe and clean drinking water realised, more investment in water storage infrastructure, climate-resilient water infrastructure, and water-efficient agricultural practices. Of course, water conservation, combatting pollution and eco-system degradation also remains on the agenda.

***Mozambique:*** Water resource constraints here are largely defined by being the most downstream country in a major river basin incorporating multiple countries. Water quality problems are severe and quality and volumes entering the country are completely dependent on upstream activities. Mozambique also suffers from regular extreme weather events (cyclones) and fluvial and coastal flooding are major problems. The country needs better flood management including forecasting services, and more capacity to respond to climate hazards. This should include greater storage to capture flood water and minimise flooding.

Figure 5 Main functions of water resource management


**Functional response**

Governments generally establish a range of functions to attempt to solve these problems (**Figure 5**). However, it can be very difficult to ensure that all functions are implemented well, with quality and with overall coherence, not in the least because some water resource interests are stronger than others. That can lead to a lack of shared

vision, conflicting priorities, some functions receiving less budget, and other functions overlapping.

Who delivers these functions varies depending on how the mandates are divided between different organisations in each country. Each hexagon raises questions about fairness. For example,

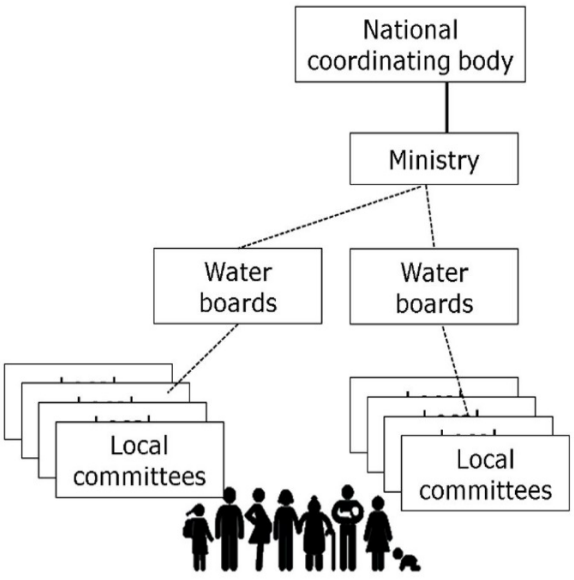
- 'Allocating WR' can determine which groups or individuals get abstraction licences or priority to water during rationing.
- In 'Planning and Investment' different policies (and biases) influence which areas get investment and which ones get less.
- Communication methods can include or exclude people. Problems can include forecasting and communicating drought or flood conditions using channels that are so sophisticated only people with a smartphone can access them etc. So functions transparency and performance issues.
- And so on…

The performance, transparency of procedures and decision making in each hexagon is a major issue to ensure equity.

## Practice of IWRM

The Egroup discussion confirmed that IWRM almost universally uses a cascading structure generally with a national or centralised coordinating body cascading WRM roles and delegating functions down to the local level (vertical integration). The specific structure of this varies from country to country depending on how centralised or decentralised is the government structure.

Figure 6 Generic cascading IWRM structure




However, in many countries, this cascading structure has difficulty to reach the ground and having a meaningful contribution to people's water security.

## Strengths and vulnerabilities

In terms of strengths all countries confirmed IWRM legislation is in place. The types of vulnerabilities are more varied. Whilst most country participants reported a lack of implementation other more specific vulnerabilities include:

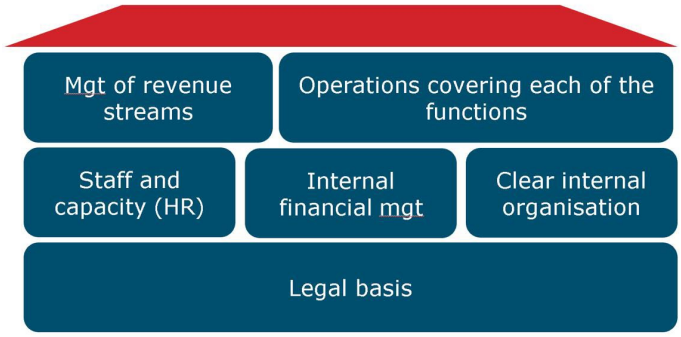
- ***Nepal:*** Federalisation came after WRM legislation which has complicated the structure;
- ***Ethiopia:*** only 3 out of 12 basin authorities exist and only one is functional. There are cross-regional challenges;
- ***Bhutan:*** IWRM operates at the higher levels, but outreach is a challenge
- ***Niger:*** transboundary organisations are functional, but limited capacities and financial resources inhibits implementation on the ground
- ***Burkina:*** Just five agencies cover the whole country (they have financial difficulties), and only one third of local organisations are functional.
- ***Kenya:*** WSS and WRM responsibilities have been separated and there are strong participatory structures between the 'deconcentrated' agencies and the WRUA's but there are challenges in financing, coordination with local government, and monitoring
- ***Mozambique:*** Water management is divided between three regional water authorities for the country (autonomous public institutions). Despite being equipped with staff and resource implementation of IWRM remains a challenge (poor monitoring groundwater is a particular issue).

**Internal building blocks to fulfil the functions**

The functions (**Figure 5**) required to target the various water resource problems are well understood but there are many practicalities that need to be in place for these functions to work effectively. Within the IWRM logic, management should be done within hydrological boundaries. Therefore, in many countries, most of the functions from **Figure 5** are housed in "Water Resource Authorities", "River Basin Organisations (RBOs)" or "Water Resource Committees". Some are more participatory in nature whereas others are in fact deconcentrated state agencies or independent authorities. Whereas the specific mandate and set-up differs, many of these organisations struggle to perform their functions. This is related to their internal organisational strength and funding sources.

From the Egroup discussion, we distilled the following internal building blocks (**Figure 7**, on next page) that a Water Resource Organisation needs to be able to function well. This starts with a strong legal basis for its mandate. A strong legal basis for water resource management functions should also clarify sustainable revenue streams that are needed to enable implementation. In the Egroup discussion it was observed that in the case of large water users in a catchment, such as a hydropower dam, these revenues generally go to the central government, rather than the RBO. Internal organisational strengthening often gets insufficient attention, while the demands on IWRM organisations are ever increasing.

Figure 7 Internal building blocks of WRM functions




**Whose needs are currently best served by the IWRM set up?**

The Egroup contributions indicated that theoretically IWRM should serve everyone's needs equally but in reality, it is often suspected that some benefit more than others, although it is difficult to know for sure. Groups that are thought to benefit the most from current systems include better connected groups, wealthier communities, people with influence, and people located in the heart of urban areas. Comments from Ethiopia noted people upstream and near water resources are generally better off whilst in Kenya high economic potential is prioritised

In contrast groups thought to be the least well served by current IWRM systems include traditional fishermen, boatsmen, people who live alongside the riverside, people who live in more remote areas (especially mountain communities). Ecological water needs are thought to be the least well recognised.

It is clear there needs to be a balance, but currently that balance is sometimes lost.

This question makes us reflect on what should be the nature of IWRM organisations? That could be:

- **An organisation providing services to the population** (e.g., coastal protection, flood early warning)
- **A representative decision-making body on water** (aimed at reaching consensus on how to use water, share water etc.
- **A vehicle to channel water investments to local areas** (e.g., investment for drinking water needs, irrigation needs).

## Expectations of participants by country

Participants from each country introduced themselves and shared their expectations of the Learning event, as summarised on the next page. The participant list is included in **Appendix 1**.

| Country | Expectations |
|---|---|
| Bhutan | • Learn best practice and inclusion in EWRM<br>• Build a community of practice with the experts in this room |
| Burkina Faso (and Mali) | • To understand how SNV works in other countries<br>• To understand the different IWRM institutions in other countries<br>• How to implement the Polluter Pays Principles<br>• How to measures IWRM and EWRM<br>• To be inspired by work in other countries<br>• To share 20 years' of experience to other countries |
| Ethiopia | • To learn critical difference between IWRM and EWRM (and the various 'nexus' considerations)<br>• To learn what data can do and ? for water management |
| Kenya | • To learn best practice to manage WR<br>• SNV Kenya to see what other countries are doing to engage governments etc on EWRM<br>• To contribute Kenyan experience on WRM<br>• To learn how to leverage finance and investments for EWRM developments |
| Mozambique | • To establish good relationships and communications with other countries<br>• to learn from other countries how they manage water and development |
| Nepal | • To see how WR boundaries are defined for projects by other countries |
| Niger | • To exchange on opportunities in EWRM<br>• To learn how to engage farmers in favour of IWRM<br>• To find out about level of IWRM implementation in other countries<br>• To share some concrete examples from Niger |
| Netherlands | • To understand how EWRM links to all other SNV water projects<br>• Role of data in EWRM<br>• To progress the e-forum discussions on EWRM |

| Country | Expectations |
|---|---|
| | • To learn how water connects with SNVs Ag/Food and Energy sections |
| Tanzania | • Learn successes and challenges faced by other countries<br>• Build knowledge of EWRM<br>• See the top of Mt Kenya |
| Vietnam | • To share information and learn from people in the same field<br>• To learn more about successful cases of ERWM<br>• To learn how to successfully set up financially sustainable RBOs<br>• How to monitor and manage a water system "can't manage what you don't monitor" |

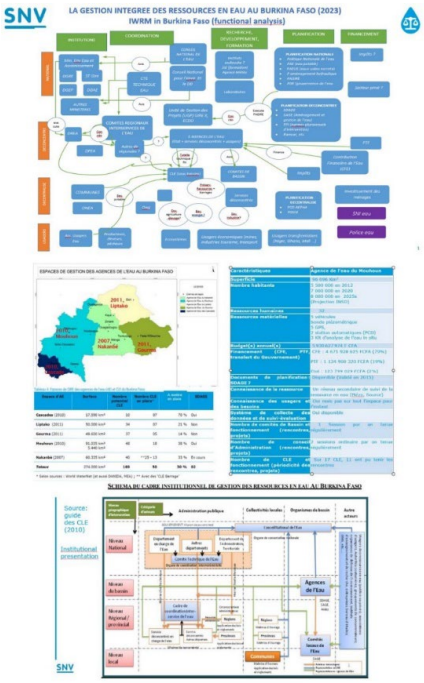
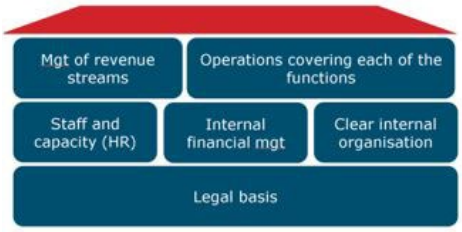
## Country Posters on the IWRM set-up in each country

Prior to the learning event, countries were invited to prepare a poster about the structure and functions of the IWRM organisations in their country. How their IWRM structures link to end-users and their local water resource management practices. Each country team presented their poster and national situation with Q&A.

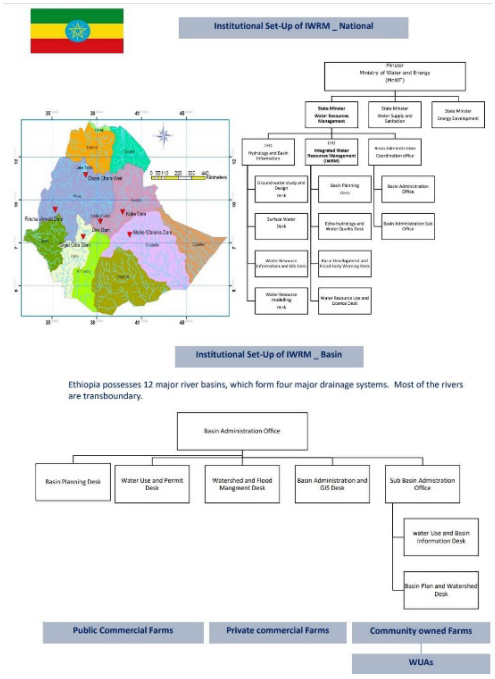
The following section includes an image of each poster with a summary of the main points. Larger copies of the posters are available in Appendix 3 and all original poster files are available within the E-Group system: EWRM@snvwater.groups.io | Files

**TRY THIS:** Look again at the posters. Think about your own country:

- Are there any geographic areas in the country which are not covered?
- Are there any social- economic or cultural groups which are less, or not at all engaged?
- Who is this structure best serving, currently ?

| BURKINA FASO: | MAIN ISSUES |
|---|---|
|   | 20 years of IWRM practice. A lot of institutional and functional aspects have been established.<br>**IWRM Structure:** There are many levels as IWRM is held at the national level but also decentralised to district level, and then to water user levels.<br>The Ministries of Economy, and Agriculture have dominant national roles. Technical issues are discussed within the ministries and then with the National Water Board.<br>The 5 regional agencies correspond to the country's river basins.<br>Coordination is done at national level.<br>Every actor has a role. Each level of the structure is managed through various regulations.<br>**WRM Functions:** Planning policies and tools are developed at the national level. Other regional organisations, universities etc can contribute to national policy.<br>The national budget is financed by the financial dept. There are different financing systems for the different tiers. |
| **Status of water resource organisations' internal building blocks:** | |
|   | At the regional level, the agencies were set up between 2007-2011 and so are at different stages of their work plan development. Some still need to be validated by the cabinet. The single largest agency is Mouhoun (covers one third of the country territory). With a budget of 5bn CFrancs (contributions from C.F EAU and other partners that need water services) this agency can fund equipment, 5 vehicles etc, and is fairly autonomous. |
| **Connection to Local WRM practices:** | |
| None stated. | |

**ETHIOPIA:**




**IWRM Structure:** Technically IWRM lies within the Ministry of Water and Energy but the sectoral components of IWRM have been split between the new ministries. Irrigation is now a separate ministry (due to expansion of workload and role). At the basin level WRM is split between 4 'desks'. At the sub-basin level these are combined.

There are 12 basins, but only 3 River Basin Organisations, in 1) Awash (due to high number of private competitors and location-based water problems, 2) the Rift Valley as it is key for tourism and species protection, and 3) Abbey due its very large volumes of water in.

The other 9 still have consideration at national level.

The Blue Nile dam is managed by the Ministry of Water and Energy.

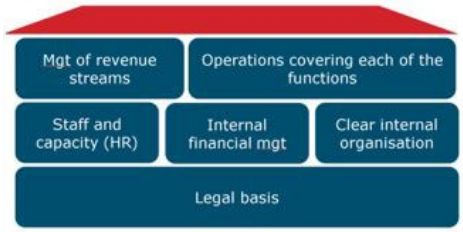
River basins do not align with administrative boundaries. The Basin Administration Office – has full responsibility for coordinating sectoral interests.

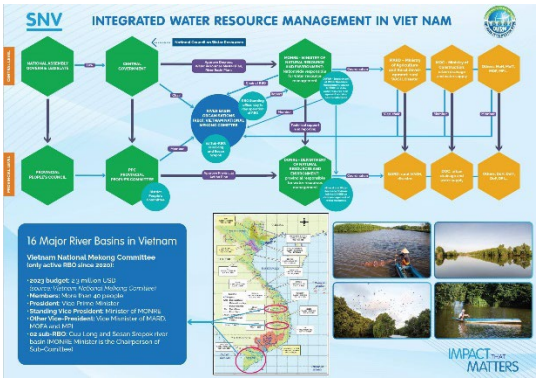
The task to set up WRU associations is currently back with the minister.

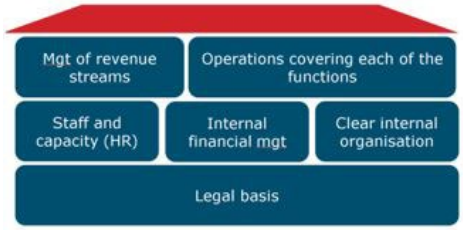
**WRM Functions:** The three RBOs each have a basin development officer and a **basin plan** (at various stages). Plans are being developed for the other 6 basins (but represented by the ministry whilst there is no RBO).

90% of energy comes from hydropower so agricultural and energy water users should pay their **water fees** to the Ministry via the RBO – but this is not set up yet. Only the north-west of the country implements **PES and Polluter Pays** principles and even that isn't fully implemented.

All responsibility for **data coordination** between the 9 basins (including the 6 without RBOs), and then sending it to the Ministry is with the Basin Administration Office. Anyone else who wants data then requests it. W**ater allocation** is assessed once per year (at a stakeholder meeting facilitated by the BDO, users can bring their water requirement applications). This is a pilot but intend to role this out to other basins.

| **Status of water resource organisations' internal building blocks:** | |
|---|---|
|  | See above. |
| **Connection to Local WRM practices:** | |
| None stated. | |

| **VIETNAM:** | |
|---|---|
|  | **IWRM Structure:** There is a central and provincial level structure. At the Central level – MONRE works with other ministries (each has its own mandate). The Ministry of Health is in charge of drinking water quality etc.<br><br>RBOs are intended to work at the Provincial level but out of 16 basins only the Mekong has a RBO (but it is not strong and was inherited from a former Mekong committee). RBOs in other basins failed because they are not financially sustainable. Money and power are kept in the Ministries. |
| **WRM Functions:** The Government Ministries still retain all the powers. The Mekong RBO is the only RBO and has existed since 2020. It has no powers to perform WRM functions. It simply provides advice and comments on plans etc. | |
| **Status of water resource organisations' internal building blocks:** | |
| | They are trying to mobilise funding to the RBO but it is hard to stop it from failing. They need to find solutions to make the RBO financially sustainable (beyond a donor project).<br><br>There is a lot of conflict between upstream and downstream water users and problems of floods and droughts. |



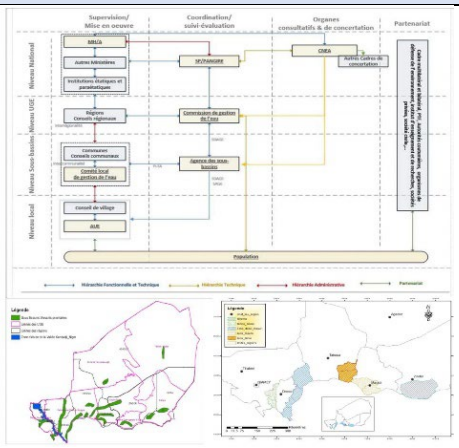

Functioning RBOs are really needed, but they first need people to recognise the Core value of an RBO.

**Connection to Local WRM practices:**

The poster presentation focused on coordination and governance and IWRM is not really being implemented. A participant asked, how are local level users organised to support or implement IWRM? Are there any formal or traditional structures?

There is little local organisation. Under the Provincial departments there are communal level agencies (lots of overlap) but no specific IWRM. Water still creates conflict as during drought the agriculture department wants it for irrigation, but the Department of Construction wants it for domestic use. Then the People's committee have a role to prioritise different users. They get advice from central government to deal with severe issues. (No implementation from RBO).

**NIGER:**

Niger is the 6th biggest countries in Africa. Approximately 95% of the urban population have access to potable water supplies, but only 49% of the rural population has access (29% of the population is rural).

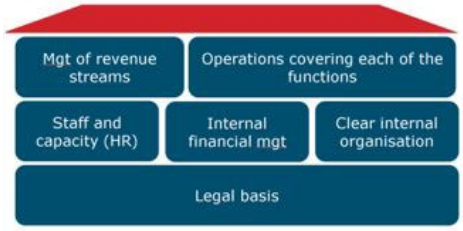
**IWRM Structure:** Niger has to several transboundary IWRM conventions. It has authority over the Niger river, it is part of the Chad basin authority, and the committee against drought in Sahel. Its borders with Burkina Faso and Mali are very insecure and water management is centralised at that level. There is a Joint Commission for water cooperation between Niger and Burkina Faso, as they share many resources (water, human, economic). **Niger shares a large groundwater aquifer the extends to North Africa** and participates in a relevant organisation. All these organisations have IWRM responsibilities.

Within Niger, water is split into 7 management units (each one is equivalent of a country), so management is very difficult. Water availability varies hugely in this units so they have been divided into 15 sub-basins to reach a level where sharing arrangements can be organised. Just 6 basins have functioning management units, but they intend to have all 15 functioning by 2030. All sub-basins are shared by two countries (Niger Pact). Supporting them so they can become operational.

**WRM Functions:** The poster presentation didn't really address WRM functions. There is huge potential in the shared groundwater resource. IWRM will take in all these issues at National, Provincial, Local level. The Government recently created a new WRM agency to work on access and use of water, quality and security of water. This agency will work on equitable access.

Having the biggest part of the large groundwater basin Niger could potentially over-exploit it, so the management model puts emphasis on Niger to protect other countries' water. However, now they are not able to mobilise agricultural production (would do it without limits if they had economic ability). Niger's options to exploit water resources are also limited by the protections given to the big national park. The biggest transboundary concern is security in the Mecru region.

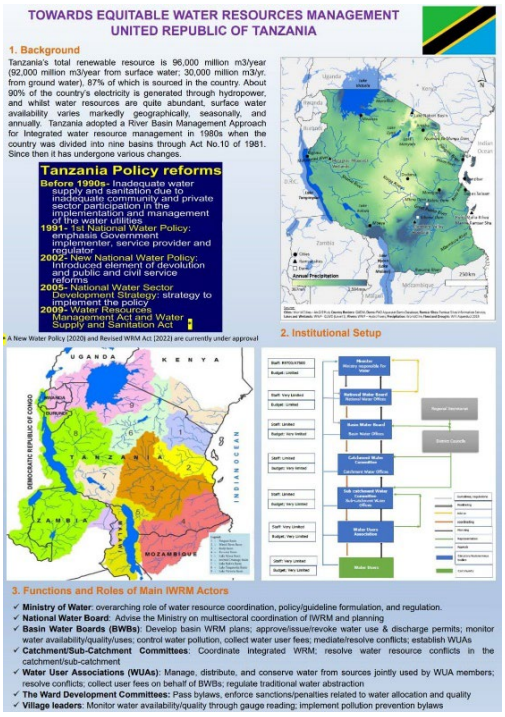
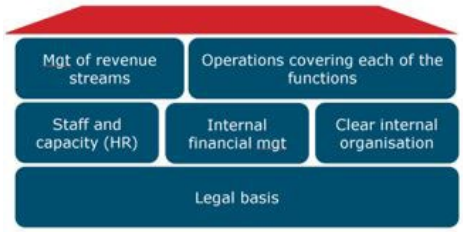
**Status of water resource organisations' internal building blocks:**

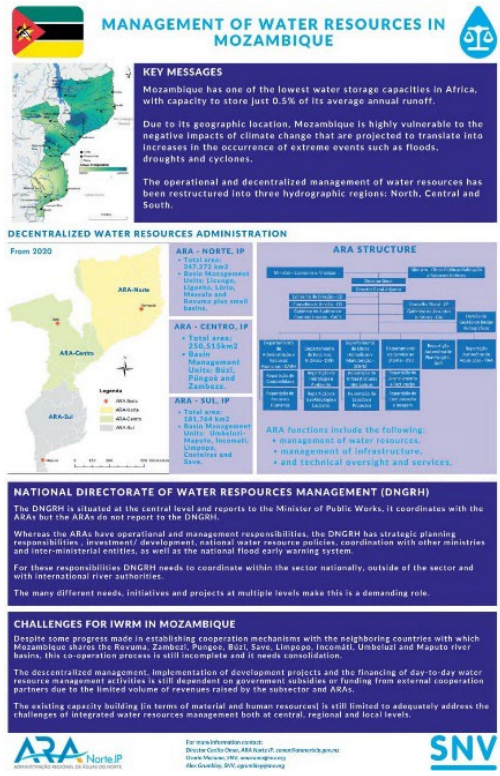
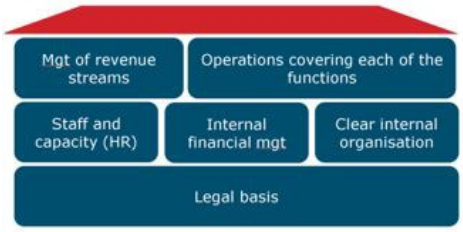



There are legal documents at national level specifying the geographic organisation of institutions, the water code, regulatory laws, and sectional water plans. The various ministries have legal documents, decrees etc to help with implementation. There is also a national master plan, to be implemented soon. Niger has a research centre on water management – with lots of water competencies.

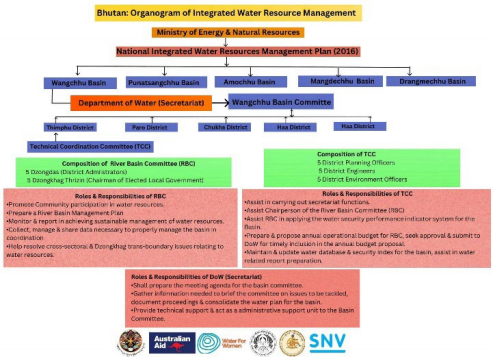
**Connection to Local WRM practices:**

Sub-basin leaders go to the local level to talk to people about allocation and management of water resources. There are commune, district or village water user associations).

| TANZANIA: | MAIN ISSUES |
|---|---|
|  | Population exceeds 64 million. Many rivers are perennial. 87% of water is sourced internally. Only 3% is groundwater. Most surface water runs into the ocean. The authorities don't yet consider water 'lost' to the ocean as a financial loss to the country.<br><br>**IWRM Structure:** Adopted the river basin approach 40+ years ago. There are 9 river basins and nearly all have functioning management organisations.<br><br>Tanzania is part of the Lake Tanganyika. Association (10 countries are members).<br><br>At national level the main IWRM body is the Ministry of Water. There is a National Water Board and National Water Board officers. Each basin has several committees.<br><br>**WRM Functions and Roles of main IWRM actors:** These are clear but a lack of finance is preventing implementation (limited staff with very limited budgets) from National through to local levels. |
| **Status of water resource organisations' internal building blocks:** | |
|  | Understaffing and a lack of budget is a key issue preventing IWRM implementation. They need 9000 staff and have approximately 7000. |
| **Connection to Local WRM practices:** | |
| Not stated. | |

| **MOZAMBIQUE:** | MAIN ISSUES |
|---|---|
|  | A downstream country with 15 river basins. It took a lot of work to reach agreements with neighbouring countries. It has no capacity to store flood water, then has the opposite problem of no water during the dry period. As the most downstream country its biggest water security issue is lack of control over quantity and quality entering the country. IWRM is driven by need. They had to do the talking to initiate and reach inter-country agreements.<br><br>**IWRM Structure:** Decentralised water resource administration: 3 ARA's with basin management units. The ARA structure (Ministry of Public Works and Housing, and Ministry of Finance). ARA's divide into river basin directorates.<br><br>**WRM Functions:** DNGRH has strategic planning responsibilities. 2014 Master Plan. Very challenged by the extreme fluctuations of flood and drought. |
| **Status of water resource organisations' internal building blocks:** | |
|  | ARA's get money from the Government but also from the fees (for large water user water rights) but the revenue raised is limited which impacts its functions. Capacity is too low to address all IWRM challenges.<br><br>How did Mozambique manage transboundary issues before the agreements? They worked collaboratively at technical levels but struggled at the political level. Mozambique then used the 'Ports' as part of the negotiations but there are still unresolved issues between the countries on EWRM. |
| **Connection to Local WRM practices:** | |
| None stated. | |

**BHUTAN:**




MAIN ISSUES: Bhutan has 5 major basins and a population of over 750 000. Most rainfall occurs in the summer monsoon. Forests are very important to land and water management (72% coverage). People experience water scarcity because settlements are in the hills not on the river floors.

**IWRM Structure:**

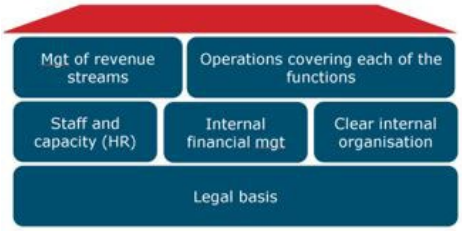
National: Ministry of Energy & Natural resources is in charge of IWRM. The 'Basin' management structure is only operating in the bigger Wangchhu basin, but they intend to roll it out in the other four as well.

Basin management consists of a River Basin Committees with an elected Chairperson. Below this is a Technical Coordination Committee (TCC) with an engineer, environment officer, and planner from each district. The health sector is also represented. Approvals within this system are hierarchical.

**WRM Functions:**

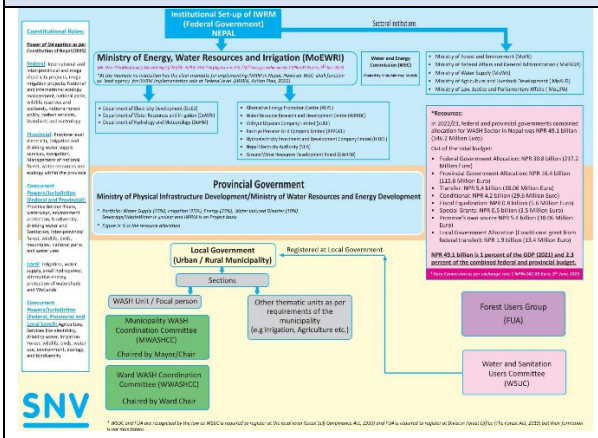
- NRW: so far they have not been able to do much about NRW. Donors are saying there will be support on this in one of the basins but that has happened yet.
- Payment for Ecosystem Services (PES): So far this approach is working very well.

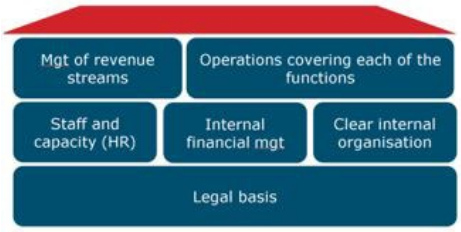
**Status of water resource organisations' internal building blocks:**

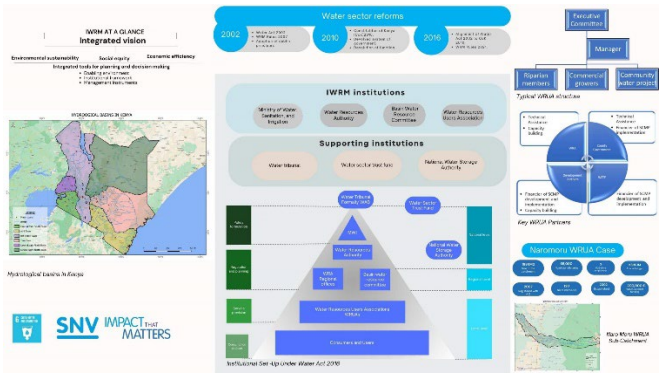


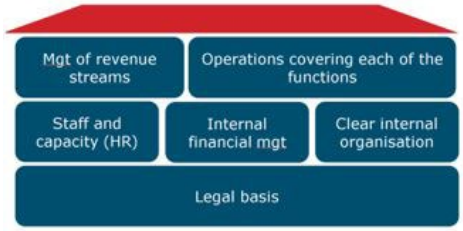

**Revenue:** money is generally only collected from urban areas (where there are some water meters) so revenue is very unilateral. The government only charges the minimum amount so there isn't enough money to carry out WRM functions. In rural areas there are some small revenue schemes (included in the by-laws). Large water users, such as hydropower generators pay 2% of their revenue to the Government of Bhutan for water resources but unfortunately it goes to a central pot rather than into local/basin budgets.

| **Connection to Local WRM practices:** |
|---|
| At the local level water resource management for drinking water is organised by communities. In contrast, a big irrigation scheme, or a cross border scheme needs the Government to be involved to build it and then it is handed back to the local water users. **This is a key challenge as no single local government body is in charge.** |

| **NEPAL:** | |
|---|---|
|  | **IWRM Structure:** In recent decades responsibility for WRM has been within different ministries, and their names have changed. The Ministry of Energy, Water Resources, and Irrigation (MoEWRI) is currently the lead for IWRM at federal level. The Water and Energy Commission (WEC) is the most important element of MoEWRI for water. It is responsible for reviewing mega projects and coordinating sectoral policy.<br><br>The new constitution since 2015 created a 3 tier governance structure: Federal, Provincial, Local. A structure to manage WR was set up and then like many countries it decentralised. A structure for IWRM was never created and no revenue streams are allocated to it (*participants mentioned that specific, 'isolated' IWRM departments can create as many problems as they solve).* |
| **WRM Functions:** The 2002 water strategy was never implemented. 18 years later (2020) a new policy highlighted the need for IWRM. It is all in place on paper but nothing is happening on the ground. They are waiting for the Implementation to start. A lot of the sectoral functions are missing within the new federal decentralised system. IWRM is just another missing element. | |
| **Status of water resource organisations' internal building blocks:** | |

| | |
|---|---|
|  | **Revenue:** Grants are made available to Provincial and Local levels. Most provinces either access it from the Ministry of Physical Infrastructure and Transport (MoPIT) and/or Ministry of Water Resources. However, neither Ministry takes responsibility for project management unless it is a big project.<br><br>**Legal:** The 1992 Act prioritised water uses. |
| **Connection to Local WRM practices:** | |
| The local level is where most of the IWRM work is done. Some local Water Use Master Plans exist (but there is no institutional hub so local plans often falter and committees stop functioning). | |

| **KENYA:** | |
|---|---|
|  | **IWRM Structure:** The Water Act 2002 separated water resources and water development. In 1999 it was realised that when the ministry was doing everything some functions of WR were forgotten and the focus was just on water development. This realisation contributed to the water sector reforms.<br><br>IWRM principles were adopted and WRM in Kenya was divided into 6 basins. Water Resource Management takes place at the basin level. County governments are supposed to synchronise with that structure.<br><br>The Constitution was reviewed in 2010 and the water law was re-aligned with this in 2016. That law created the WR Authority (WRA) to deal purely with water resources. The WRA regulates the basins. There are 26 sub-basins. The WRA is a deconcentrated entity (not |

| | |
|---|---|
| | decentralised) part of the Ministry *[this is very different to Mozambique].* |
| **WRM Functions:**<br>County water developments (including groundwater drilling) must be authorised by WRA after evaluating water resource availability and investigating the impact on downstream users. The WRA manages the water resource permitting system. | |
| **Status of water resource organisations' internal building blocks:** | |
|  Not presented or discussed. | |
| **Connection to Local WRM practices:** | |
| Local level WRUAs: clear functions in water act 2016 and regulations. | |

# Block 2. Water Resource Management in Kenya

***Presentation by John Ngila Munyao, Water Resources Authority - Ewaso Ngiro North Basin Area Coordinator (Nanyuki)***

Mr Munyao is an Area Coordinator for the Kenyan Water Resources Authority (WRA) in the Ewaso Ngiro North Basin (the area in which the learning event was hosted). He kindly gave a presentation in which he clarified the role of the WRA, described the physical context of water resources in the area, and then explained how water resources are managed and regulated. This provided valuable context for the subsequent group Field Assignments and insights for participants to use to consider how the Kenya approach compares to that of their own countries.

**Role of the WRA:** The WRA formed under Water act 2016 as a delegated authority under the national Government to safeguard water quality and quantity. It now serves as an agent of the Government **to regulate** use. The WRA scope of work does not include water resource development.

**Physical context:** Six major river basins cross Kenya, containing 26 sub-basins. The organisational structures at basin and sub-basin levels enable decision-making at the lowest appropriate level.

Figure 8 Kenya river sub-basins

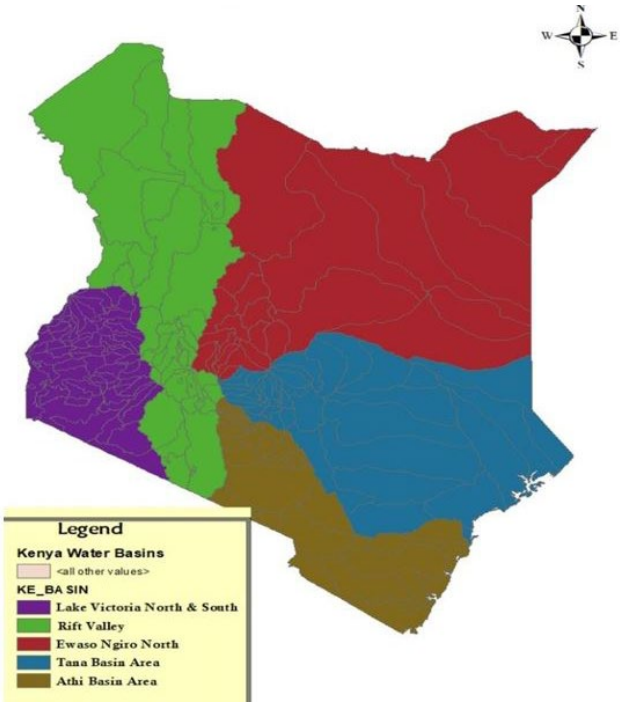
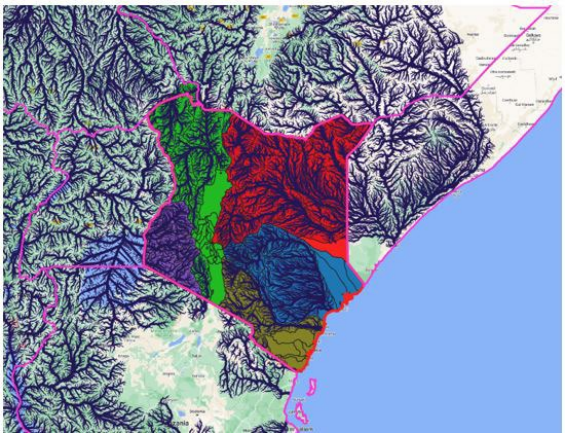



**Figure 8** shows the five river basins in Kenya, including the ***Ewaso Ngiro North Basin (red)***. This figure shows the river basins as they relate purely to the national administrative border of Kenya.

[The Basin covers an area of about 210 000 km$^2$, which is approximately 36% of the total area of Kenya, see CETRAD presentation in block 3].

*For extra context* **Figure 9** *shows how these river basins are hydrologically connected to / or part of basins in Ethiopia, Somalia, Tanzania, Uganda, and South Sudan.*

Figure 9 Regional context of Kenya's river basins and river networks



**Regulation:** The Government, through the WRA, coordinates the management of water resources across the various water use sectors within Kenya. Regulation is important as unregulated (uncontrolled) use is typically wasteful and unsustainable. Regulating how much water people can take and when helps to ensure water resources are available for multiple uses, and also ensures the quality and sustainability of water resources improves.

The WRA uses two mechanisms to regulate water resources:

1. Water allocation through permitting: Responsible permitting requires knowing how much water is available to allocate, and how much flow and of what quality the river needs to remain healthy. Therefore, the WRA is also responsible for data collection (water quality and quantity of surface water) at the basin level.
2. Water use charges: Charging water users based on the volume of water used ensures people conserve water and use it efficiently. Charging provides a tool for demand management.

**Management and Use:** Integrated management means that all the different uses of water resources are considered together; that water allocations and management decisions consider the effects of each use on the others and; it takes in to account the overall social and economic goals including achievement of sustainable development. The WRA and water stakeholders must not only focus on managing existing water resources but that resources must be developed in a way that ensures long-term sustainable use for future generations.

**WRA Role in regulating WRM:** The WRA applies the IWRM concept in WRM by incorporating participatory decision-making. This is done through a close relationship with the Water Resources Users Association (WRUA) which consists

of and represents different user groups: farmers, communities, environmentalists, etc). In this way the various WRUAs can influence strategies for water resource development and management. Additional benefits from meaningfully engaging with WRUAs include informed water users applying local self-regulation in relation to water conservation and catchment protections. This is achieved much more effectively than central regulation or surveillance could achieve.

Finally, the key water resources issues in Kenya, according to the WRA are:

- Water governance crisis (despite progress governance is not as strong or effective as it needs to be)
- Securing water for people (water shortages still occur and very difficult choices have to be made which leaves a lot of people struggling to access the water they need)
- Securing water for food production (more food is needed to achieve total food security but even the water needed to maintain food production in the growing season is under threat)
- Protecting vital ecosystems (ecosystems are very vulnerable to declining resources, deteriorating water quality, and increased demand and competition for water)
- Gender disparities (women and girls are disproportionately burdened with carrying water where supply is not available, and women are not always adequately represented or holding decision-making positions).

**WRA Q&A:**

**Q. Who is working to control pollution?** The WRA as an institution do WQ monitoring but the Polluter Pays Principle isn't yet embedded in the system so it can be difficult to stop a polluter even once they are identified.

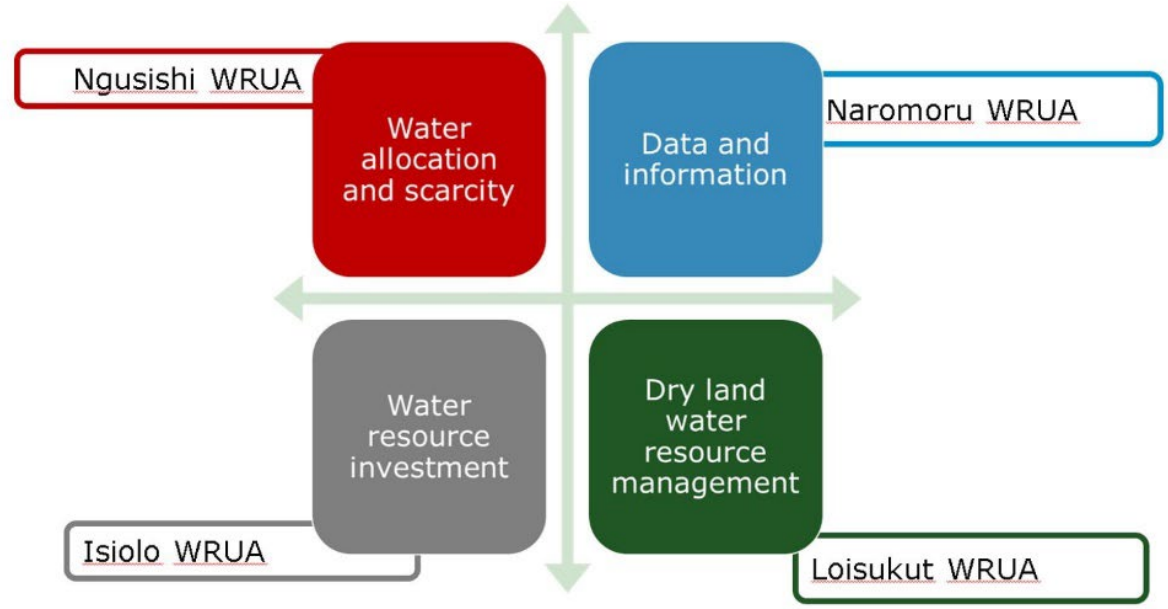
Very few abstractions are 100% consumptive (even irrigation returns some water to the catchment). So to be allocated water a potential user must show how they are going to control wastewater. They are required to have a disposal management plan. The law states that they should keep their own WQ and volume records (they are required to have a measurement device).

Unfortunately, there are many illegal abstractions that are completely unregulated that the WRA also has to try to manage.

## Field assignments

A key part of the learning process was to undertake field assignments to see different situations and meet with real people involved in locally using and/or managing water to actively uncover more of the issues that EWRM projects must respond to.  Participants were engaged in four groups assigned to different locations (still within Laikipia county, close to Mount Kenya) to capture the diversity of environments, human activities, issues, and challenges across the area.

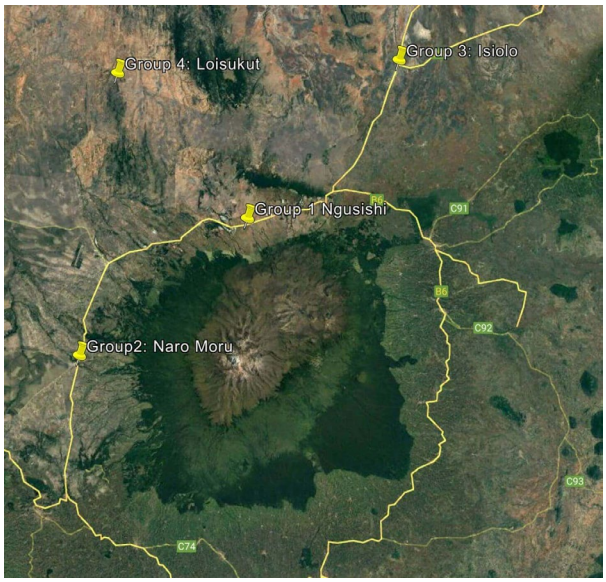
**Figure 10** Learning groups and topics




The outcomes of the field assignments are reported in their relevant block.

1. Water allocation and scarcity (Ngusishi WRUA)
2. Data and information (Naromoru WRUA)
3. Water resource investment (Isiolo WRUA)
4. Dry land water resource management (Loisukut WRUA) (driest part of the area).

**Figure 11** Location of group field assignments




## Objectives

The objectives for each group were to:

- See and learn from the experience in Kenya on water resource management both what goes well and what is difficult;
- Gather insights how different aspects of water resource management (water allocation, data, investment and dryland context) relate to equity issues; and
- Present findings and provide modest feedback and recommendations to Kenyan partners.

Each group consisted of men and women, from different countries, with different skills and backgrounds, from SNV and other organisations. They were given a short amount of time to prepare pertinent questions and then after the field day reported through: A photo diary, a 2-page case description, a testimony of a key stakeholder, a PowerPoint presentation with impressions and recommendations.

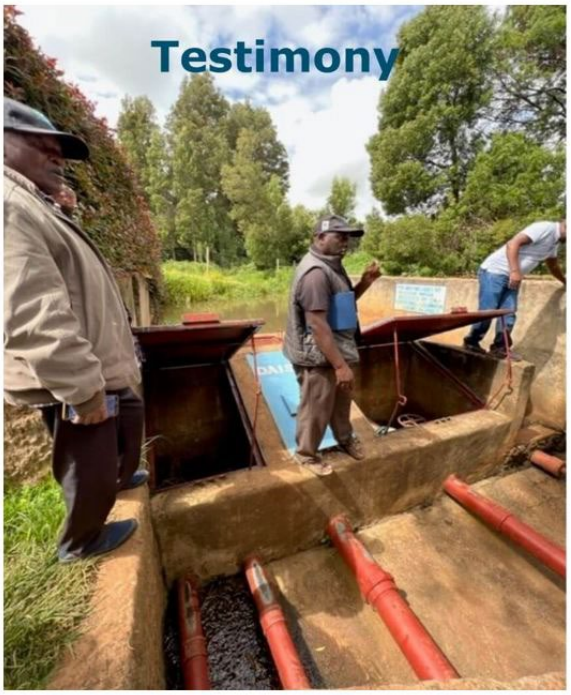
These outputs are available in the EGroup Group folders: https://snvwater.groups.io/g/EWRM/files/Presentations%20EWRM%202023

We welcomed two guests: Celine Achieng, Executive Director of the Laikipia Wildlife Forum, an organisation that plays a key role supporting the WRUAs; and Patrick Ekwan Ideal Advisory Services Director working on water projects in the area.

## Field Assignment group 1: Water allocation and scarcity (Ngusishi WRUA)

***Group 1 visited the Ngusishi Water Resource Users Association to find out about how water scarcity, unregulated use, and conflict transformed into a more sustainable system (but which is now under threat from pricing disputes with National Government)***

The Ngusishi sub catchment of the Ewaso Ngiro North Basin is highly productive agriculturally but is water scarce. During the 1990s significant unregulated water intakes left no water for users downstream, damage to infrastructure was a recurrent issue, and there was a lot of conflict. The Ngusishi Water Resources Users Association (WRUA) was set up in response to this, initially as a self-help group before registering as a CBO (a recognised authority) in 2003.




*Although it took 7 years of negotiation on water allocation for all users, with the establishment of WRUA and construction of the head intake tanks for 3 springs, 95% of all conflicts are resolved amicably through strict water allocation plans and monitoring.*

*- Mr. Muriithi, Treasurer Ngusishi*

**WRUAs and Financing:** Agreed water allocation principles, dialogue-based conflict management, and technical support on water conservation and land-use management has helped stabilise the situation. WRUAs are recognised authorities, not simply informal collectives. Farmers pay membership fees and then benefit from collective funds, technical support, and Government support. The Ngusishi WRUA charges small-scale farmers 0.5 KES/$m^3$ of water, and commercial farms pay a higher rate (4x) of 2 KES/$m^3$, which in 2022 generated a total income of 3.3 million KES (25,000 USD). Users pay the same amount to

the WRA but concerned by the difficulties they still face users agree that the price is too low for sustainability.

**Sustainability and pollution:** Regulatory requirements demand that every water allocation returns 30% of the volume to the local water environment. WRUAs are supported with members receiving training from the Government and quarterly water testing services by the WRA. Hotels and farms with significant runoff are required to treat the wastewater (supported by the WRA).

The WRA monitors volumes and quantities on commercial farms (but *it is not clear how this is measured or enforced on small farms).* There are problems with feeder springs being polluted by markets/pit latrines and one measure to reduce pollution is maintaining a riparian 'buffer zone' of 6m in which no human activity is permitted.

*Photo: Pollution from upstream market*

*Photo: Buffer, source is 200m from the intake with trees planted to protect the source*

*Photo: Water storage*

Farmers use groundwater and surface water and borehole monitoring shows that whilst groundwater levels fall during the dry season they recover during the wet season and no long-term declining trend has been observed. Surface water however is a problem with the WRUA regularly unable to supply enough water from surface water for all uses. Consequently farmers, via the WRUA are investing in more storage

**Commercial farm/WRUA relationship case study - Timaflor flower farm:**

Timaflor has an agreement and strong CSR relationship with the WRUA which has included constructing an office building for the WRUA and boreholes for the local schools. With 140 hectares of greenhouses for rose exports it relies on 18 metered boreholes, approximately 1 million $m^3$ of rainwater storage and an agreement to use flood water during the rainy season.

The farm itself is 100% consumptive (there is no effluent) but there is effluent from the plant cutting process. To meet Kenyan standards and EU accreditation processes all runoff is treated on site using carbon filters and wetlands which is ultimately is clean enough to be fully 100% reused.

Wastewater treatment from Timaflor is treated using charcoal and other natural filtration materials.

*Photo: Wastewater treatment on Timaflor farm*

The farm uses drip irrigation in its greenhouses to reduce water consumption which is still comparatively high at 30 $m^3$ per hectare per day. In a 'good year' the farm is supplied 50:50 from groundwater and surface water (storage) but in a 'dry year' the surface water dries up and the farm becomes reliant on the borehole (i.e., abstracting twice as much than normal). This will inevitably cause groundwater problems if a dry year is followed by another dry year etc.

*[Whilst reuse theoretically should reduce the volume of water that needs to be abstracted it also results in no water returning to the local environment. Similarly, drip irrigation reduces 'waste' but is typically 100% consumed by the crop, leaving little to no excess water for the soil, and no water being returned to the environment. The impact of 100% consumptive activities on the local water cycle must be taken into account when managing water resource allocation].*

**Conflict:** A small amount of inter-community conflict still occurs, usually due to illegal pumping from intakes and cattle entering rivers (causing channel erosion and water quality problems). The WRUA deals with this through by sending scouts/monitoring to catch perpetrators. However, the more significant conflict is with the Government. At a national level the Ministry of Water, Sanitation and Irrigation agreed with the World Bank to hike prices by 1000% without consulting the communities (0.5 KES/$m^3$ has become 5 KES/$m^3$). Whilst it was acknowledged that the tariff had not been raised for many years, was too low and would improve water conservation practices - this large an increase was seen as unfeasible. Currently the WRUA is in the process of taking legal action against the government at its own cost, diverting valuable time and resources. At a local level the WRUA argues there is a lack of capital investment from county government.

**Recommendations:**

| Challenges | Reflections |
|---|---|
| **Sustainability of WRM services:** Charges for water are low for sustainability of WRM services (acknowledged by users) | **Community dialogue** (RWUA) to decide on acceptable increase in charges, and over time, which would support improved water conservation practice |
| **Equity:** Flat tariffs of govt charges and RWUA susbscription - potential equity issues for the poorest and consumption between users | RWUA identified the opportunity to have **tiered charges** for household users. Is there an opportunity to supply household/user level meters with remote sensors) |
| **Weak linkage with county WASH planning and implementation:**<br>• Water distribution focuses on 'domestic' use, and not clean drinking water;<br>• Poor sanitation is polluting water sources | **Link with county planning and implementation for WASH** including drinking water treatment, and improved toilets |
| **Weak engagement between national ministry and communities:** Conflicts with Ministry of Water, Sanitation, and Irrigation and RWUA on hikes in charges | The **national government should engage** via the well established user groups in such decisions (e.g. WRUAs) |

## Field Assignment group 2: Data and information (Naromoru WRUA)

***Using data and data information systems to manage water resources.***

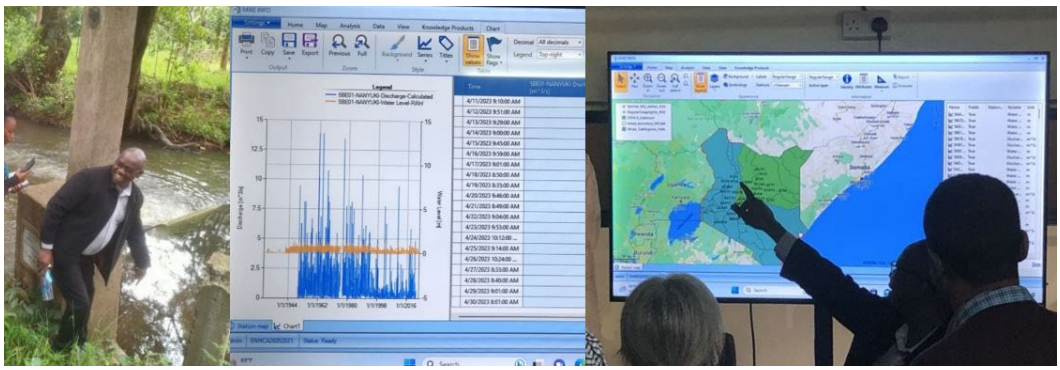
The area of Naromoru was used to focus on the availability and use of data to manage water resources and allocations between a large number of farmers and a rapidly growing urban area. Group 2 had a detailed technical conversation with the WRA area coordinator, met with CETRAD to discuss data collection, and discussed water resource allocations with the local WRUA and the urban water services company.



*Photos: Meeting the WRA North Basin Office*

The WRA explained that they own and operate 13 production boreholes, additional exploratory boreholes, and 52 surface stations. Groundwater, surface water stations' data are directly collected by WRA staff or transferred through telemetry. The WRA collates the data at the basin level office and analyses it using the MIKE Info system (held on their own server), which is later transferred to the national WRA.

The MIKE Info system license is paid by National WRA. WRA's data can be purchased by anyone, but it is provided freely to WRUA on demand basis (The WRUA visited has access to CETRAD stations and does not request data from the WRA).



*Photos: Gauging station & MIKE Info system*

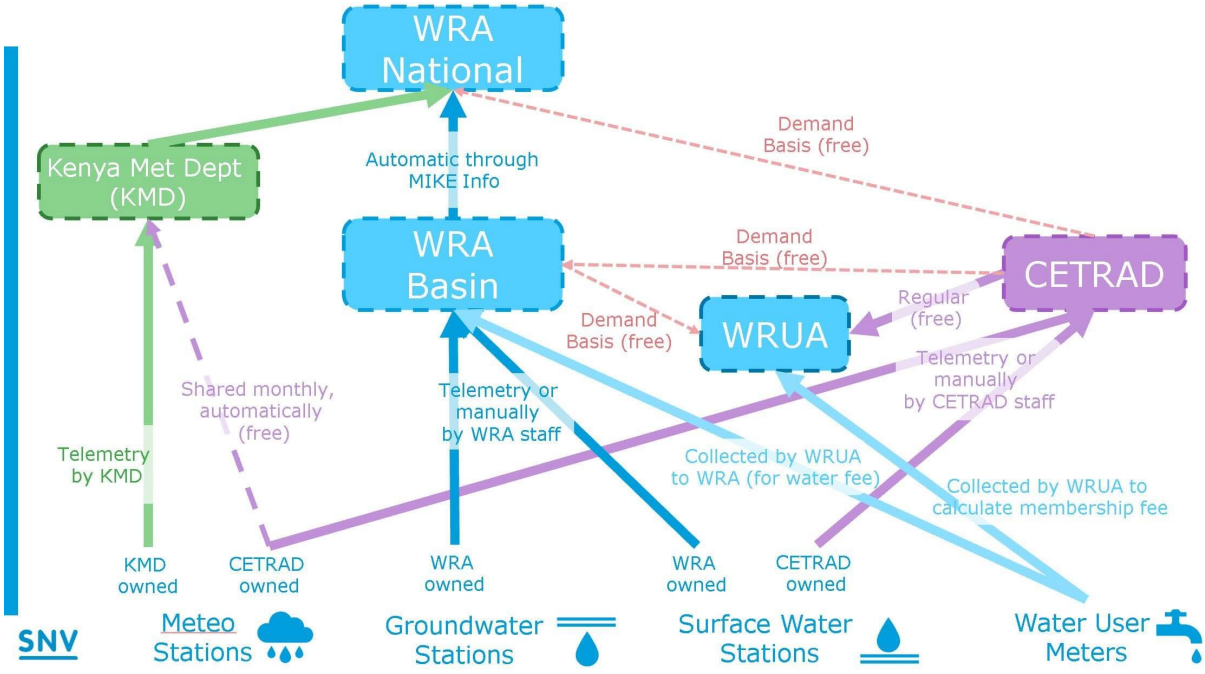
Data on water use is collected by a WRUA operator who is paid (per diem) by WRA. The water user data is used by WRA to charge fees.

Meteorological stations are owned by the Kenya Department of Meteorology (KMD), but CETRAS also owns 38 telemetered and manual meteorological and river gauge stations across the basin (4 river gauging stations and 1 weather station within the sub-basin visited). CETRAD collates and uses the data for its own research, and they share it freely to WRUA and also freely to WRA on need basis. CETRAD only shared weather station data (freely and monthly by default) to the KMD. CETRAD does not operate across Kenya, only in this region.

*Photo: CETRAD Weather Station*

The WRUA does not own any station, but they receive raw and analysed river gauging data (and technical support) from CETRAD. The WRUA collect water user data that is shared with the WRA (so they can calculate water use fees) and to calculate and charge their own membership fees (based on actual water use).

**Figure 12** Data sources and sharing



**Main findings:**

The team identified three major issues: data sharing, duplication of data and data use for decision making.

1. **Data Sharing:** Although data is well generated by different institutions, this is not regularly and freely accessible to all. CETRAD, as research institution and with external funding, does provide data freely to everyone, but only on systematically to WRA and the KMD. WRA data is centralised and free to the WRUA (on request) but at a cost to the general public. However, conversations with the WRUA suggest that the WRUA may have a limited understanding of what data is available and how it can be used for decision-making.

2. **Duplication of Data Collection:** Both the WRA and CETRAD collect streamflow and weather although the resolution, instrumentation, and level of detailed analysis varies. However, there are cases where their monitoring stations are adjacent to each other. This creates duplicate datasets where elsewhere there are gaps in coverage.

3. **Data use for decision making:** The different institutions use different software for data management: WRA uses MIKE Info, the WRUA uses HYDRAS to receive data from CETRAD stations, and CETRAD probably uses other software for their research work. It is possible that these systems are not as harmonised as they could be, which brings a question of consistency in model outputs.

   Moreover, data is processed on a day-to-day basis without adequate integration or links to climate and other related information. This would bring a question of long-term (on annual basis) validity of the water allocation process and decisions. Whatever quantity of water is available today may not be available after a couple of months or so. This would only be known if an adequate link is established between climatic variables, other required information and water availability. This isn't being done at the moment.

This group was specifically focused on identifying data related issues. However, during the field visit problems relating to catchment wide water (mis) management leading to conflict. The WRUAs report that occasionally the river runs dry because the water company takes it all to meet the urban demand. Soon after closing that intake the river returns to full flow. The WRUAs want the urban water company to take more responsibility to manage demand (leaks and people wasting water) and to make their own storage to reduce the intense pressure they put on the spring.

**Recommendations:**

***Improve data monitoring efficiency and harmonisation***

- Data gaps: There is limited information and monitoring of groundwater aquifers. Groundwater monitoring should be expanded and done more frequently.
- Duplicate (and sometimes conflicting) data and management: Data should not be collected from the same location by different organisations. Whilst WRA is clear that where there is duplication only WRA data is considered, it represents inefficient use of resources as many other locations are not monitored. It is understood that CETRAD's responsibility is research, and this requires state-of-the-art instruments and higher resolution data than is perhaps needed by the WRA. It would be worthwhile to consider use of the data collected by CETRAD in stations where the two are operating and the WRA to focus on enhancing its gauge coverage elsewhere there is no coverage.
- If data harmonisation is a problem, establish a common platform for data management in WRA, WRUA, and CETRAD.

***Improve data analyses for more sustainable permitting***

- Permitting process and related regulation needs to be more responsive to environmental conditions. Data models could be developed to enable forecasts of water resource availability (taking into account climate change and regularly updated permitted and actual water abstraction data).
- Permitting should consider wet season/dry season variability, with abstractors systematically encouraged to store during the wet season and reduce abstraction during the dry season.

***Improve data sharing***

- WRA does share with WRUA upon request, but access could be simplified, with analysed data that is designed to be useful for the WRUA shared on a regular basis. The important thing is to interpret the data in a meaningful way to communicate flow levels and impacts on abstraction restrictions to water users, not for example sending information about flow rates in terms of litres/second. With more regular use of data by the WRUA, this will reduce conflict in the basin and incentivise the WRUA to collect better quality data and collect data more regularly.

## Field Assignment group 3: WR development and investment (Isiolo WRUA and county)

***Investment and project development affecting the demand for water at different scales in Isiolo county.***

Group 3 visited the County Water Office – Rural Water Services, the Isiolo Water and Sewerage Board (office, water treatment plant, waste water treatment plant), the Isiolo WRUA (office, upper part of the Isiolo River), and the Ngara Nything WRUA (dam site only).

The town of Isiolo is said to geographically right in the centre of Kenya and is rapidly becoming a centre of interest because of its newly acquired status as a 'resort city' "(Future Las Vegas of Kenya"). From a water resources perspective this is a concern because it is a dry area landscape and very vulnerable to climate change.

Figure 13 Location of Isiolo


**Climate and Water Resources:**

Isiolo County is arid and semi-arid with rainfall varying between 150mm in the dry areas to 800mm in the very few semi-arid areas, averaging 350mm per annum. People mostly depend on boreholes and Isiolo River for their water supply. The groundwater situation is complex with low yields, high fluoride levels and salinity in a complex aquifer system. Isiolo town is located at the most north-eastern tip of the catchment area and so access by the competing interests of farmers, local communities and pastoralists to water is limited.

During the low-flow season demand in the catchment is much higher than supply and water rationing is common. Kenya's worst drought in 40 years is in its second year and at the time of the visit (June 2023) the water levels were well below where they should be for the time of year. Consequently, the WRA has directed Isiolo and Meru residents to prioritise water storage before the onset of


*Photo: Isiolo county water*

October-December rains, even as rationing of the precious commodity intensified. Pricing is also being used as a tool to suppress water use with water fees rising by 900% (50 cents/1000 litres has suddenly increased to 5 shillings/1000 litres), an increase that the majority of water users say is too punitive when they're already struggling.

**Conflict over water and social disruption:** Conflict occurs frequently with peaks in 2010, 2017, and 2022 and is expected to increase due to rapidly increasing demand (Isiolo Town has a 30% growth rate per annum), competing demands (upstream drinking water supply, irrigation, downstream livestock, wildlife), and limited resources based on increasing erratic rainfall patterns. In 2010 authorities were unable to resolve the conflict and the WRUA had to bring users to the table and agree on a rationing scheme.

Conflict is also sparked when livestock keepers (often armed) come to the area, allow their animals to eat farmers' crops, and let them enter the river to drink. The WRUA has done well to mediate between farmers and livestock keepers, but several casualties have occurred over the past year. The main compromise has been to agree sites where livestock can enter the river but where damage to the river and the sensitive water infrastructure is limited. However, better solutions are needed.

Lack of water in the sub-catchment drives livestock keepers to migrate. As the men migrate first, women and children often remain behind without any income and eventually need to follow, resulting in disrupted schooling, social networks, and livelihoods.

**Investments at vastly different scales:**

***National/international***

LAPSSET (Lamu Port, South Sudan, Ethiopia Transport Corridor) is Eastern Africa's largest and most ambitious infrastructure project involving Kenya, Ethiopia, and South Sudan. It is a mega project with seven key infrastructure projects including a new port, highways, oil pipelines, interregional railways, airports, and the multipurpose High Grand Falls Dam along the Tana River.

The project is a central government project and it is clear that local authorities are consulted to a very limited extent and that within the county, information does not reach the lower levels of County Government, which makes it difficult to feed project design by practical information on complementarity and context. Up to 30 new boreholes may be drilled to provide water to the new demands, but the worry is that the programme will be politically driven, not optimised, and not equitably benefitting communities. The resort city itself requires large scale water resources development. Authorities are planning to build 2 large dams including the multi-purpose Isiolo Dam (83m high, 215 million m3 capacity, water supply, irrigation, hydropower) to meet the forecast 60,000 m3/day demand by 2040. The tendency of large water development projects is that they benefit the rich whilst ignoring or even violating the rights local and marginalised people.

This mega project is intended to be financed by the national government and the private sector (i.e., through PPPs). However, PPP legislation in Kenya is not yet fully developed so PPP processes are not very transparent, and water resource developments are not always commercially feasible. Therefore, it is not likely that the private sector will fully engage in this project and the majority, or all of the costs will be borne by the Government (and tax payers for many years).

***WRUA scale:***

The **Isiolo WRUA** is balancing the interests of people being served by 67 individual projects. Problems they are trying to resolve include poorly designed weirs (that feed many irrigation pipelines) that are silting up and exposed pipes becoming brittle. Daily access to water is constrained by the poorly functioning infrastructure and the WRUA currently manages this by rationing water by connecting and disconnecting pipes by hand which is very labour intensive.


*Photo: Isiolo County Water Office*

The WRUA receives a lot of support from development partners, but a lack of coordination and sometimes super-imposed investments causes problems. For example, some weirs were developed by a water project without much consultation with the WRUA and later were simply handed over. The lack of consultation meant the designs were inappropriate (sub-standard) and there were many O&M challenges. More coordinated support by development partners on capacity development, management plan updates, and infrastructure development would be very beneficial. More investment in human capital is also a critical factor to consider in investment in water resources.

*Photo: IWRUA damaged water infrastructure*

The Ngara Nything WRUA is also trying to manage investment and development at the local scale. The idea for the Subuiga Dam originated 15 years ago, but the financing was only obtained last year with the help of private sector (Kisumu Farm and Lewa Conservancy). The proposed dam will be 18m high, with a storage capacity of 150,000 $m^3$, benefiting about 25,000 residents, and supplying 1500 ha of irrigated agriculture. This WRUA managed to mobilise about 80% of the KES 52Mio (Eur 350,000) through private sector which is a commendable effort.

*Photo: Subuiga dam*

The dam affects a limited number of landowners who have all been compensated for losing land. Part of that compensation includes being given access to water from the new reservoir, which has raised expectations to a high level. However,

as the river feeding the reservoir behind the dam is seasonal it is vital to manage expectations for how much water will be available during droughts. Unrealistic expectations and related use could easily lead to conflict.

**Summary of key learnings and challenges:**

| Learnings | Challenges |
|---|---|
| **Isiolo county water management:** | |
| Charged with rural water supply in 8 wards.<br>Financing is still not fully decentralised (National government has influence) despite decentralisation in the 1990s.<br>No investment plan (unable to control funding). | County has no influence on the national level projects.<br>County lacks data.<br>County has limited staff capacity (majority are about to retire).<br>They have a very limited budget.<br>Trying to manage competing demands (domestic vs livestock). |
| **Isiolo water and sewerage company (IWASCO):** | |
| Provides the only supply to Isiolo town (which has 2 wards, supply coverage 95%, sewerage 21%).<br>Active at WRUA level because of vulnerability at upstream and downstream.<br>Interdependent on the source hence impacting their supply. | Non-Revenue Water is high at 30% (benchmark is 25%).<br>Demand is $10m^3$ per day, but they can only supply half of this.<br>Management of on-site sanitation system. |
| **Isiolo water resources users' association (Isiolo WRUA):** | |
| It is a registered entity.<br>Inclusive Leadership selection (6 zones, one third female).<br>Has a well-developed SCAMP (sub-catchment management plan). | Has to deal with a different administrative boundary.<br>High demands and conflict between upstream and downstream users.<br>Poor quality of (existing) infrastructure.<br>Complex management practices, with limited resources (200 sq. km, 9 scouts, no motorbikes, voluntary executive committee).<br>Limited County engagement on source development (boreholes). |

| Learnings | Challenges |
|---|---|
| **IWRUA- water projects (including Subuiga dam):** | |
| Good dam site selection with saddle dams – reduction in cost.<br>Strong stakeholder engagement including regular monitoring by WRA.<br>Strong commitment from the communities. | Demand management- rationing.<br>Possibility of high siltation.<br>Site security.<br>Limited capacity to operate and maintain assets. |

**Recommendations**

- County Government (through Council of Governors) needs to lobby for earlier and more intensive participation in project planning, development, and implementation.
- County Government needs to disseminate information on project planning, design, and implementation broader through the county ministries and organisations like the WRUAs and consult with them on relevant aspects.
- Development partners need to coordinate support to Counties and WRUAs in a better way, to work more complimentarily and efficiently.
- Investments in water resources infrastructure should be done in consultation with WRUAs. In turn WRUAs should keep a long-term perspective in mind, trying to combine investments to come to more durable solutions.
- WRUAs would benefit from capacity development in resource mobilisation, not only from developing partners but also from private sector.

## Field Assignment group 4: Dry land water resource management (Loisukut, Sub County of Laikipia North)

***Community-led WRUA taking on challenges in dry land water resource management***

The conditions in this area are very different to other areas in the county. The landscape is very dry, farming is predominantly pastoralism with a low population density (14/km$^2$), and huge contrasts between the lush landscapes of private conservancies and the very arid community land.

*Photo: Contrasting Arid/Lush landscape*

Another difference is that the WRUA is different to other groups: it has just 210 members from a community of 1000 (approx. 21% membership) and members/non- members have the same access to projects. A lingering question is what are the defined benefits to becoming a member of this WRUA?

*Photo: Wildlife damage*

**The main issues in the area** are: 1) inadequate water infrastructure (not unusual in areas with low population density) with too few boreholes, limited storage etc to meet demand from humans; 2) overgrazing; 3) water pollution of shared resources; 4) conflicts over water allocation (huge area allocated to conservancy park); 5) water scarcity leading to water theft, and 6) destruction by wildlife of water facilities (including water tanks) as they search for water. These issues exacerbate water scarcity, degrade water quality, and hinder the socioeconomic development of the region.

The group met local groups, the WRUA, and a country representative with a water resources coordination role.

*Photo: Meeting with the Commissioner*

*Photo: Meeting with the WRUA*

The water resources management arrangement is relatively simple but with five levels of hierarchy.

**Figure 14** Water resources management hierarchy


**WRUA initiatives in the sub-catchment:**

a. Water Iastructure Development: The WRUA has collaborated with government agencies and non-governmental organizations to construct water storage such as sand dams and tanks, to enhance water availability during

dry seasons. However, the design and quality of the infrastructure is limited and the WRUA wants more guidance.

b. Water Conservation and Demand Management: The WRUA has implemented awareness campaigns and training programs to sensitise WRUA members to the importance of water conservation, and practical measures such as efficient water use, efficient irrigation techniques, and rainwater harvesting to minimise waste and optimise water availability.

c. Pollution Control Measures: To tackle water pollution, the WRUA has targeted point and non-point source pollution. They conduct regular monitoring and sensitization programs to discourage harmful practices, such as dumping waste into water bodies. One of the biggest challenges is the mixed use of water from the sand dam, troughs and boreholes by humans, livestock and wildlife that contaminate the water source.

d. Community Participation and Conflict Resolution: The WRUA encourages community participation through its 210 members. It provides a platform for stakeholders to voice concerns and contribute to decision-making. Additionally, the association facilitates conflict resolution among water users, ensuring equitable access to water resources.

**Outcomes and Impact:**

The initiatives undertaken by the Loisukut WRUA have yielded positive outcomes including:

a. Improved Water Availability: By constructing water storage the WRUA has enhanced water availability, particularly during dry seasons. However, due to very limited funds, demand outstrips supply, and even pastoralists from outside the area come to the boreholes to access water for their livestock during dry spells. The WRUA deals with this by charging 100 KES per cow per month, to avoid dependency and to discourage external pastoralists except during extremely dry periods.
b. Clear plans (but lack of investment): The WRUA is coming to the end of its second 5-year SCAMP, and by their own admission, the second one was a lot more informed and strategic. The SCAMP is very detailed with clear costing of different options. However, they lack the knowledge and opportunities to seek funding for the planned activities relying heavily on one source of funding, the Laikipia Wildlife Fund. The plan also appears to lack prioritisation.
c. Enhanced Community Engagement: Establishing the WRUA has greatly improved participatory decision-making processes and increased community engagement and ownership of water resource management. This has fostered a sense of responsibility and collaboration among stakeholders.

**Specific points of interest and sources of inspiration / lessons to learn include:**

- Participants from Vietnam noticed the clear rules and organisation, rules made in a smart manner, and collective management. In contrast investment and management in Vietnam is more individual/private.
- Participants from Burkina Faso found many similarities: all stakeholders are considered without exclusion, but some people are physically very far from the water, which raises the question, 'Do the systems here enable equitable access?' Also, the WRUA is equivalent to 'Local committees for water' in Burkina but their committees also include technical people from Government. Finally, they noticed that there are no manual pumps in Loisukut, and BF is also trying to move to more improved modes.
- Participants observed the WRA Sand-dam not functioning giving insights into how these structures can fail.
- The Women's Group Twala Tenepo is a great example of how an intervention can radically change lives. In this area women are the main water users but are not represented at the decision-making level.

*Photo: Women's group*

  The lack of reliable water had made women and children semi-nomadic, they had to walk 15km for water, and migrated to find grazing pasture in the dry season. Without water they had no other agricultural alternatives. After appealing to the male leaders they were given a small area of land and with help of NGOs they got their own borehole which has enabled them to stabilise in the village and they now sell water to the community. Their 100% pastoralism model has changed.
- In contrast to this, male pastoralists expressed less desire to diversify away from pastoralism. The mentality was captured by a statement from the WRUA Chair of Procurement, "without a cow I am nobody".

  The arid nature of the area is not able to support so many cattle, in a three-year period all the cows belonging to the pastoralists here died. Pastoralism as a lifestyle and (male) cultural attitudes can be a barrier to diversifying away from livestock dependency.
- Human-Animal and Animal-Animal conflict for water is ongoing.

- Participants from Burkina Faso noted that they also manage conflict at local level, they recognise that whilst going to court can fail and that negotiation is preferable, it is good to know that legal routes do exist.

**(Humble) Recommendations:**

- The WRUA could seek to increase membership by creating clear benefits and possibly including official (municipal) government representatives.
- They should resolve technical and strategic gaps in the next SCAMP (including actions targeting existing infrastructure).
- Stakeholders should work together to create a more sustainable financing model to enable more technical support for water quality and engineering support to prevent non-functioning sand dams.
- A lot of water is leaking from pipes and taps. Raising awareness and building capacity to fix leaks would save a lot of water.
- A wider range of rainwater storage (household and landscape level) would help augment resources.
- Widespread tree plantations would significantly help to protect watersheds (and riparian zones), increase groundwater, and improve soil health. There were very few trees in the area visited.
- More infrastructure designed to support wildlife and livestock access to water would help to protect water infrastructure for humans.
- Integrate wildlife conservation organisations in planning, WRM at community level and financing.
- Do research on invasive plants (cactus) management and revaluation / productive use of cactus ( e.g., biogas production in Ilopei).

Figure 15 Male pastoralist testimony

# Block 3: What can data do for equity?

## Introduction: What can data do for equity?

In this session Antoinette summarised the main outcomes from the E-group discussions on data and equity as an introduction to the block. Before launching into specific findings she clarified the need to recognise that there are different types of data in water management and these have different requirements in terms of quality, frequency, duration of data collection in order to provide generate valuable information. This should be kept in mind when discussing data for water resources.

1. Meteorological data
2. Hydrological and/ hydro-geological data

} Long time series

3. Asset data
4. Service level data

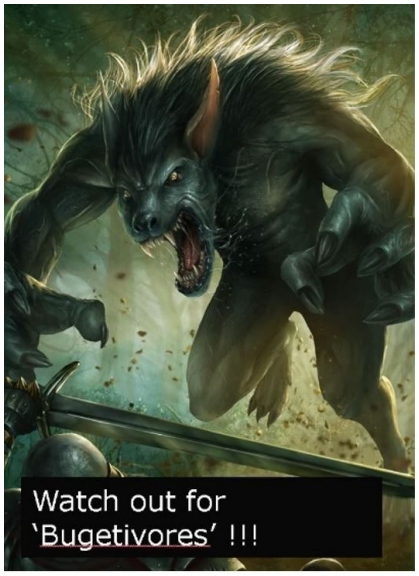
} Less demanding in terms of frequency, timeline, and capacity

From the E-group it is clear that all countries experience challenges in sharing and coordinating data. Also, this is a problem of all stakeholders. Most commonly the fractures exist within Government, between different departments, between different water users in a catchment, and with other organisations and institutions such as universities that generate a significant amount of data that would be beneficial to share if workable systems were in place.

Five specific issues emerged from within the considerable E-group contributions:

**1. Operational budget for data**

The is consensus that the lack of sustained operational budget for data collection, analysis, storage and use is one of the biggest structural problems. There is often a huge discrepancy between budgets available for infrastructure development and budgets for monitoring performance of assets for example (data collection, analysis, storage, use). Yet, good information is the basis for responsible infrastructure development.




Often the operational budgets for data systems only cover staff salaries but not equipment. Some of the more sophisticated data systems rely on spare parts that are not locally available can become too costly to maintain (a new term 'Budgetivore' has been coined which aptly describes the problem).

Even if budget is made available, the procurement processes can be too bureaucratic. Once a project ends and the 'top-up budget' disappears it is not uncommon to lose staff as their salaries are no longer funded externally.

Fundamentally it was agreed that whilst there is always lots of interest in water resource development, data (and thus monitoring) is undervalued and so there is less interest in investing time or money in it. This is creating a vicious circle where investment and design decisions aren't based on data, so data is undervalued and isn't collected, so isn't available to assess the performance of water infrastructure or to support new decision making.

**2. Project centred data and information systems**

There is also a generalised consensus about the damage of project centred data and information systems. This does not refer to project M&E systems which are about the project monitoring itself. This is about the monitoring systems for the sector that a project supports, such as a hydrological monitoring system, water quality monitoring system, asset management system or service level monitoring system. As many of these are set up within the context of a project, the choices made on financial, technical and content are not always appropriate and often difficult to sustain. Project driven data systems are often distorted by project needs, there can be a tendency to focus on CAPEX (capital expenditure) investment for measuring equipment, and specific interests in certain software do not always align with existing systems or consider longer-term capacity to maintain them. This is particularly a problem for data management systems that require ongoing payments for licences, support, or upgrades.

Every few years, countries see a joint effort between government and development partners to get data up to scratch. Usually this happens in the form of a large "inventory", such as the Water Resource Inventory project in Vietnam, the Ethiopian National WASH Inventory (NWI), and the SNI National Water information system in Burkina Faso which started in 2001 but is still not operational. Whereas such initiatives often generate high volumes of good

quality data, they usually face issues of comparability (with previous data) and continuity. Discrepancies between what information different inventory projects focus on and/or the technology used can lead to inconsistent data outputs. If the data is not shared (it rarely is) that can drive duplicate systems or continued perceptions of data gaps by other organisations or agencies with water management related responsibilities.

One area where there was less consensus in the Egroup discussion, is whether automation is a positive development. Arguments in favour of automation and digitalisation are that it significantly reduces the cost of data collection and the risk of human errors. A manual system in Mali was unreliable because there were no funds to send people to field, measurements were not always done at the same times of the day (irregular frequency) and input into the database was manual leading to data input errors and data gaps. Other experiences confirmed that sometimes data collection staff make up data instead of going to the field. A web-based data collection platform in Nepal is increasing data collection and making it accessible for all. Similarly, in Mozambique digitalisation has really increased accessibility and utilisation of data, e.g., through WhatsApp.

In contrast, critical or more cautious perspectives about automation and digitalisation recognised that whilst automated systems are perceived to be cheaper, they can simply represent a shift in the type of costs. Manual field staff costs are replaced with higher costs for equipment, specialised staff and maintenance. Automation equipment typically has a high CAPEX cost, are often linked to expensive data management systems and applications, calibration services, and expensive and difficult to access replacement parts. The IT aspects can demand highly skilled (expensive) staff which cannot be sustained after a project ends. Over time monitoring and data management system performance declines reducing the quality of the data and increasing distrust in the system.

Overall, it seems important to be aware that automation and digitalisation do not solve structural data challenges and is certainly not always low-cost. Technology will not solve issues around data sharing, commitment to manage data with quality, sustained funding for data management, nor general awareness of the value of data.

### 3. Ability of institutions to ensure consistent quality of Data Information Systems

There was consensus and concern over the lack of importance given by responsible authorities on the use of data for making important decisions. The issue of accountability was raised, specifically why there are never any consequences for mandated institutions if they fail to collect, analyse or use data. There seem to be no consequences for unsubstantiated investment

decisions. Other comments explained that decision makers don't value data, especially data whose value lies in long-term records with no obvious immediate value (e.g., compared to short-term hydro power data).

Attitudes within community's mirror those in government. There is usually little demand for monitoring or evidence-based decision making, and vandalism of equipment is unfortunately common. This can be driven by a market for parts, damage due to curiosity, animal encroachment although there was no further discussion on these issues. There was some consensus that is can be hard to motivate and mobilise people to take care of the water environment – until there is a problem. In some cases (Vietnam in particular raised this issue), even significant water pollution problems don't trigger demand for action as long as people continue to receive drinking water. Rather than valuing a shared resource, people don't feel personally connected to or responsible for it. This is summed up by a Vietnamese expression, "no one will cry for a common father", as water does not belong to anyone, no one cares.

With little demand from the population the authorities aren't required to prioritise data. Where monitoring and data collection does take place, the ability of institutions to ensure consistent data collection and management is hindered by frequent institutional restructuring. This disrupts any monitoring systems that may be in place, often shifting monitoring priorities and accompanied by problematic changes in technology.

**4. Use of data**

This all relates to the issue of use of data. The lack of data standards (including standardised data components, collection processes, and analyses) and standardised information systems is a major problem in every country. Data sets cannot be integrated or harmonised, different organisations sometimes duplicate some data monitoring whilst elsewhere there are gaps (spatial, temporal, and especially groundwater components).

This raises the point about knowing which data are needed for what purpose, and assessing whether the appropriate efforts are being made:

- are we focusing on the right data,
- are we collecting data at the right scale right frequency, and
- do we even agree on what is 'right'?

The issue of specific project objectives distorting the focus of our data systems was raised again in this context. Taking this one step further the point was made that sometimes data only represents part of reality, only certain water resources and/or certain users. It can give us a false sense of accuracy or an inaccurate

picture of what's going on, especially when a pocket of data is considerably different to the reality on the ground. A common example is using information on abstraction licences to determine the volume of water available for further allocation, whilst not taking any consideration of the actual volume of water those licensed water users are taking (i.e., over abstracting).

Recognising the persistent problems limiting monitoring and data collection and the importance to make sure data is used appropriately two alternative data approaches were defined:

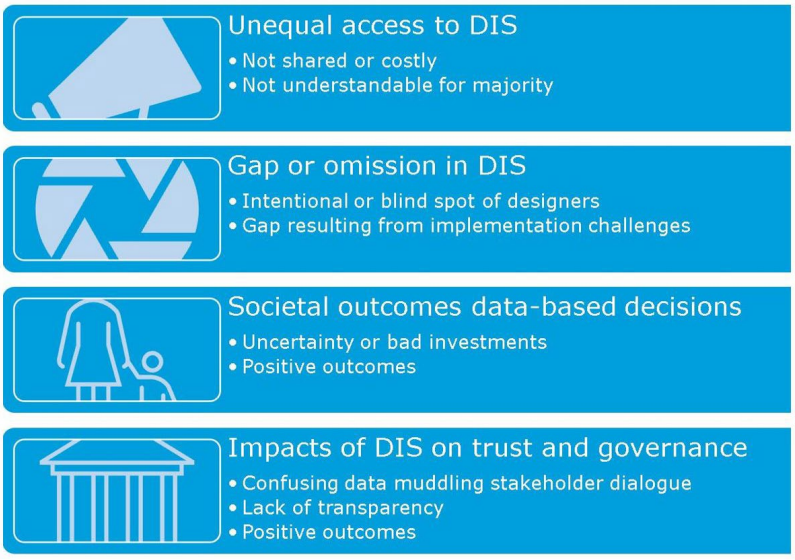
1. the "hydrological approach": a focus on building the **perfect data** and information for all possible needs.
2. the "pragmatic approach": a focus on building data systems from the perspective of the **most urgent uses.** Deciding whether to follow a hydrological or a pragmatic approach is of course easier said than done when there is no agreement about what type, quality, and period of data record are needed to make decisions.

Nevertheless, there seems to be a general feeling that the use and users of data should be more central in the design and implementation of data and information systems. Making data and information systems more fit-for-purpose should also avoid setting up systems that are too comprehensive and/or sophisticated that exceed what is needed and is unlikely to be sustained.

## 5. Data and inequality

The final major point emerging from this discussion topic was the reality that data can in fact drive or enhance inequality in water resource management.

Figure 16 Data and inequalities




*DIS = Data and Information System

From those that felt able to contribute four types of inequality were identified:

a. **Inequality due to unequal access:** Access to DIS is unequal if it is 1) not shared, 2) not equally understandable to everyone. Not everyone has access to or can use tools and systems well. This can include using mobile phones and apps or data only being presented in a complicated way. An example of not sharing information is flood risk information being shared with large investors or other influential people but not with local residents at risk of flooding.

b. **Inequality due to gaps in data** for example water quality testing only including chemical parameters, but not biological, or water resource data only looking at needs of larger water users, making small users effectively invisible. This could be deliberate to serve a purpose, or an accidental blind spot. Gaps may be due to implementation problems (data not collected, or full of errors).

c. **Social outcomes:** Good quality data can reduce uncertainty surrounding a problem and reduce the likelihood of bad investments. However, poor quality data, i.e., that is incorrect, or misleading can be used to support poor choices. Data and information can be used for different arguments, depending on how it's presented. The picture that is created by average can mask inequalities that would become evident from disaggregated data.

d. **Trust and governance:** Data can also be manipulated to serve a specific purpose and it is important to be alert to this. A lack of transparency may be a sign of weak governance or even deliberate deception. A lack of transparency therefore can undermine trust and lead to huge polarisation. If people don't trust data or the way it has been collected it can be very hard to get them on-board. Furthermore, there can be different opinions about the validity of data. For example community collected data may not always get the same level of recognition from government as data collected by government services.

Many examples across the countries are available within the full text of the Topic 2 discussion.

**What should be done better?**

After discussing the problems at length, the final part of this topic focused on what could be done better. Many participants mentioned decentralised data collection and centralised data storage (and analysis) which can be accessed again by all decentralised data users. Centralised platforms vary in nature but have shown to be of use especially for monitoring assets, service levels, and for example community ODF levels. Some people speak more about a portal or a

data repository. Others envision a specialised data centre under a Ministry or via universities. It is likely that different approaches would work in different countries.

There were also different ideas regarding decentralised collection. Contributions from Burkina focus on the role of municipalities in collecting data, others speak about regions, citizens or everybody collecting and uploading data.

Currently there are far fewer applications of centralised platforms for hydrological information due to the much higher frequency of hydrological data collection and the data quality requirements. A pre-requisite to making this workable would be to harmonise data standards and to focus on ensuring end users can use it, that includes using the right language and form for grass roots actors. Open access systems are seen as the way to go, to enable further technical development and analysis, but such systems should build in accountability to end-users.

Perhaps the amount of work involved in integrating and analysing data for the country should not be underestimated. The question is also whether this idea of a centralised system would apply for all water resource data. There are arguments for applying the subsidiarity principle, where data is "managed at the lowest possible level (appropriate levels of data can then be aggregated upwards through the system)." [*For example, a national system does not need to store 15 min interval flow data for every river in the country or water depth levels for every borehole, but probably should have data on the most important ones or data clarifying the overall status of each catchment].*

Another area where there is largely consensus is around the need to increase awareness about the importance of water resource data, both with the general public and with decision makers (see previous comments about the lack of value currently attributed to data). Decision makers need to be data literate and it is hoped that more awareness would push data up the political agenda and help channel investment.

The reality of increasing awareness of the importance of data means providing budget and ensuring staff capabilities. Mandated institutions need to be strengthened and stabilised including through Donors promoting continuity of equipment, software and systems, to end the problem of continuously changing systems. As it is the available budget that unfortunately defines the scope of most institutions (rather than the requirements) stabilising institutions should also involve determining and forecasting realistic institutional income/budget and clearly defining the scope of work appropriately (referred to as "**endogenous** financing"). A clear and realistic scope, with straightforward data

systems, and capable staff are key to establishing committed data collection behaviours.

Further to the debate on automation there is a general agreement on the need to keep systems simple and consistent, strengthening existing systems rather than making new ones, focusing more on generating data where it's needed (see comments on "the Pragmatic Approach"). Some participants advocate for a hybrid system, for example automating water quantity measurements but keeping water quality monitoring a manual process, with benefits including human back-up, human contact, and possible deterrent to vandalism and theft.

The final issue raised under this topic was the role of citizen science and local knowledge. Comments on citizens' science come too often from the perspective of mobilising local labour for data collection. This is a rather extractive view of engagement of local stakeholders. Learning to combine local knowledge with scientific approaches to environmental monitoring is a very important consideration.

## Hydrological-Meteorological (Hydro-Met) data transmission interface and sharing platforms

***Presentation by Milton Muriungi, (CETRAD) https://www.cetrad.org/***

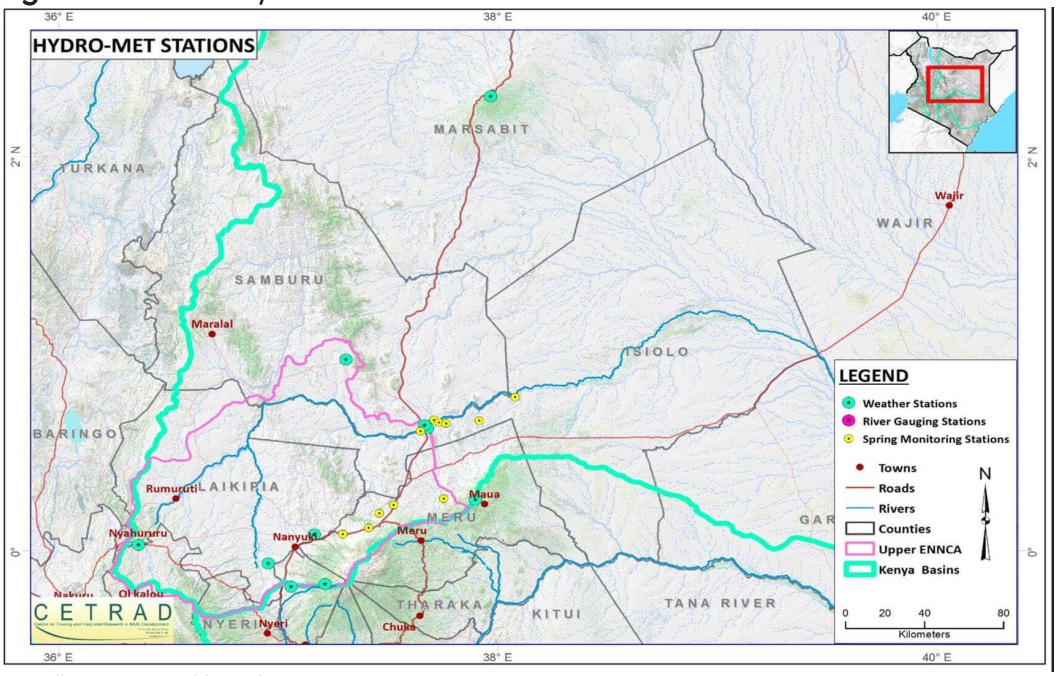
CETRAD is the Centre for Training and integrated Research in ASAL (Arid and Semi-Arid Lands) Development. Milton Muriungi, an operational leader at CETRAD gave a presentation outlining CETRAD's mandate and core functions, summarising the equipment they use and the data they collect, explaining how the data is used to help regulate water abstraction, and finally how they use electronic platforms to share data.

CETRAD is a Bilateral Institution between the Government of Kenya (through The Ministry of Water, Sanitation and Irrigation) and the Government of Switzerland, through the Centre for Development and Environment (CDE) at the University of Bern. Its core functions are: Research, Training, Influencing water policy, and Knowledge dissemination and technology transfer.

**CETRAD's mandate & scope:** Their mandate is to assess and evaluate the actual and the potential use of water resources in ASAL areas. Their current funding and focus are on the Ewaso Nyiro North catchment Area (over 80% of this catchment is classified as 'Arid and Semi-Arid Lands'. This area is shown in **Figure 8** (WRA presentation in block 2). Therefore, all of CETRADs 38 Hydro-Met monitoring stations are Located in Ewaso Nyiro North catchment Area. The

Basin covers an area of about 210 000 km$^2$, which is approximately 36% of the total area of Kenya.

**Figure 17** CETRAD hydro-met network




N.B. All 38 are not visible on this image.

**Equipment and Data:** CETRAD is currently running three types of automatic and telemetric Hydro-Met monitoring equipment:

- Automatic weather stations
- Surface level loggers, and
- Spring and groundwater level probes.

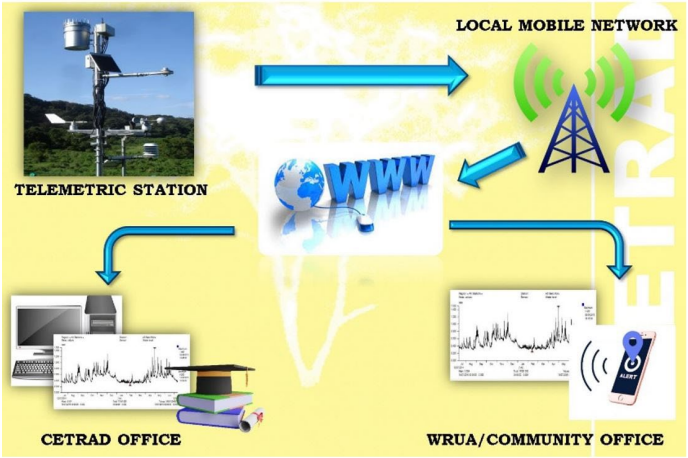
**Figure 18** Equipment used by CETRAD

The meteorological data collected by the weather stations are: rainfall (precipitation), air temperature, wind speed and direction, humidity levels, atmospheric pressure, and (solar) radiation. The hydrological data collected by the river and groundwater probes are: water Level (depth in metres), water temperature, electrical conductivity (EC), and salinity.

[*Measurements of electrical conductivity and salinity are related but they are not the same. Electrical conductivity is a measure of how well water can conduct an electrical current. It is affected by the presence of dissolved ions, such as salts, in the water. When water contains higher concentrations of dissolved salts, it will have higher electrical conductivity. Salinity, on the other hand, specifically refers to the concentration of dissolved salts in water. It is usually expressed in parts per thousand (ppt) or practical salinity units (PSU). Salinity is a measure of the total amount of dissolved salts in the water, including various ions like sodium, chloride, calcium, and others].*

Transmitting data from the field to where it can be analysed and interpreted is an important issue. **Figure 19** briefly illustrates the different parts of CETRAD's data transmission infrastructure. Getting this right is critical to good hydro-met data management. A telemetric (or 'telemetered) monitoring station is one where the data is automatically transferred without any manual requirements. As well as the various monitoring equipment there will be a data logger which is connected to a data transmission system. CETRAD uses the local mobile network to transmit data to its online server (https://www.cetrad.org/). From here the data can be accessed by CETRAD for processing and that data is then made available online, specifically to other recognised partners, e.g., the WRUAs. Data is available for free at the [Social and Hydrological Information Platform (wlrc-ken.org)]

Figure 19 CETRAD's data transmission infrastructure

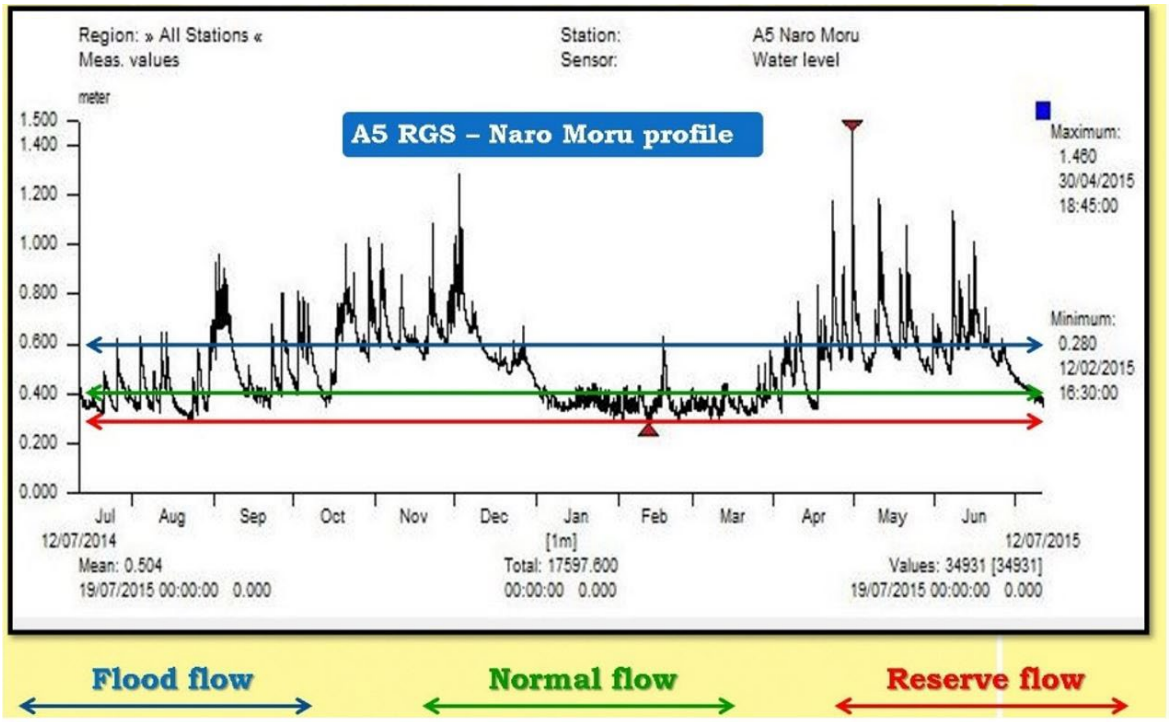


**<u>Using data to regulate water abstraction</u>:**

**Figure 20** shows how river level data is processed into an annual hydrograph. A hydrograph shows the flow level (or rate) of a river or stream at a specific location over a period of time. This image shows how the river level at Naro Moru (station A5) varies a little each day during a month and how it varies a lot seasonally. [*What this chart does not show is how much influence rainfall versus human activity has on the flow].*

This information on its own is of little interest to farmers who just want to know if they can take water for abstraction or not. To make the information more user-friendly CETRAD has calculated a flat rate (throughout the year) which represents 'normal' flow (green), very high, excessive, or 'flood' flow (blue), and the minimum water that the river needs to stay healthy and function, the 'reserve' flow (red). The presentation did not explain how these lines are calculated. However, farmers understand that at any time during the year if the river at this location is less than approximately 30cm deep they cannot abstract water.

Figure 20 Example Annual Hydrograph



**Electronic platforms:** CETRAD has several data websites where their data is shared and available for free:

| | |
|---|---|
| https://wlrc-ken.org/ | The SHIP (Social Hydrological Information Platform) provides access all water and land data and information generated by the Water and Land Resources Centre (WLRC) project of CETRAD |
| https://ews.wlrc-ken.org/ | An Early Warning System (warns about impending Reserve flows and Flood flows) |
| http://basindata.wlrc-ken.org/ | Shows **sub-basin** aggregated information about water, sanitation and economy from the national census 2009. |

**Outcomes of monitoring and sharing data:** CETRAD noted the following beneficial outcomes of the system (and service) they provide:

- Data has helped reduce water sharing related problems;
- The community can now understand the different river flow patterns and the actions necessary at each stage;
- Real-time data sharing has helped the community avoid possible disasters from flooding *(it doesn't stop the flood from happening, but the people can be much better prepared to respond);*
- The community can now use this data to mobilise their resources;
- Data is a very important tool when it comes to policy influencing both locally and nationally; and
- The data is being used by research and academics (to better understand the hydro-meteorological processes in the catchment).

**CETRAD Q&A**: The CETRAD presentation prompted several questions, comments, and ideas:

**Q1: How does CETRAD use it network to understand and manage groundwater?**

A1: They have equipment that monitors water levels at 'spring' sources, some sources have loggers installed to collect frequent data, but CETRAD does not have the resources to do this on all sources. CETRAD does not manage water resources. They are a research institute; they do not have a mandate to implement resource management. They do run pilot monitoring and assessment studies but then expect someone else to replicate it if it is seen as useful.

**Q2: Could CETRAD collect evidence to contrast good versus poorly managed systems?**

A2: As piped water supply services expand communities develop a mentality that water comes from the tap. Could the agencies involved do more analysis/thinking to support water resource management than just providing data to help development organisations' construction projects?

A2: Possibly but currently do not have resource or mandate for that.

**Q3: How rapid is the early warning system?**

A3: At the moment it's a few days, they are not able to issue high frequency or immediate alerts.

**Q4: Could the links with WRA be improved to make both organisations more efficient?**

A4: CETRAD has signed a Memorandum of Understanding (MoU) with WRA with the aim of looking for more efficiencies (stop duplicating monitoring).

**Q5: What is the cost of operating the online platforms: CETRAD and WRUA?**

A5: Costs include procuring kit, running it, monitoring every 3 months, and maintaining the websites. It costs approximately 5 million KES/year

(based on one station, e.g., Namo Roua, which currently covers 14 WRUAs).

**Q6: Does automation impact on viability of data**, e.g., as sometimes kit can be damaged? Also the WRUAs use your data. In the future **would CETRAD consider creating a tool so the WRUA's can do data collection at their own level?**

A6: Monitoring equipment is sensitive to positioning, and the system can detect tampering and so the team can quickly rectify it. Data intervals can be as little as 1 minute which means they can quickly spot a problem and resolve errors or gaps quickly. Flow readings are only taken twice per day which means it is possible they miss a peak level reading (if it occurs between the two readings).

Vandalism is a bit of a headache. They try to minimise this by collaborating with WRUAs (they are on site every day), talking to them before installing new equipment, and conveying the value and importance of the kit, to encourage better behaviour. They have seen cases of vandalism decline. CETRAD is also trying out vandal proof methods, e.g., reinforcing monitoring stations with concrete etc.

## Data and its use for EWRM

***Presentation by Alex Bolding, Wageningen University***

Alex Bolding joined online from the Netherlands to present this topic on how data can be used, particularly for EWRM.

Alex introduced his presentation by discussing a key point he had raised in the e-groups forum discussion, the issue that data must be fit-for-purpose, credible, and respected.

**A critical take on data & their use: Salience & legitimacy:**

Scientists and WRM agencies tend to focus on the credibility of data and the completeness of data sets (i.e., the technical quality of the data). In contrast water users tend to focus on whether data is salient, legitimate, and transparent.

'Salience' is a subjective description of how suitable a dataset is in relation to a particular purpose or action: e.g., too much data, too little data, or not the right data is non-salient. Too much can be overwhelming without adding extra value,

too little can be inadequate, and not the right data is irrelevant. To be 'salient' the Information needs to be timely, accurate, and specific to be useful for real-life applications.

Many decision-making models suffer from a lack of salience, e.g., the data input to the model does not align with the calculations that are needed or the considerations that should be included. This is often summarised as 'Rubbish in, rubbish out!'. A lack of salience often results in users rejecting or abandoning decision-making models.

***Legitimacy*** of data (collection) systems is about whether users consider the methods of data collection to be fair and appropriate. For a process to be legitimate, it needs to consider appropriate values, interest concerns, and specific circumstances from perspectives of different users.

***Transparency*** (through access and accountability). Data collection processes and the data itself needs to be accessible in an understandable way. Problems can emerge if data is only accessible to, and/or only understandable by experts. Basing decisions on 'data evidence' increases transparency, but decision-makers must be ready to be transparent on how that data has been used to influence the outcome (decisions must be accounted for).

**Specific challenges: knowledge=power; science=assumptions:**

The French philosopher Michel Foucault made the statement that 'Knowledge is Power' and this can lead to a number of 'knowledge related' specific challenges in Equitable WRM. It is not uncommon for (water) companies and government officials to see data as a source of power which may be one factor making them reluctant to share their data. (*Data can also be expensive to collate over a long time-period and so many organisations are not inclined to give it away freely or cheaply).*

Another important issue is the use of assumptions in many modern water resource management tools and applications. To function automatically or without requiring a lot of user inputs generic tools are developed with many embedded assumptions. This is not necessarily a problem as long as the assumptions and their impact on the tool's outputs are clearly identified (and can be modified if necessary).

The Food and Agriculture Organisation (FAO)'s WaPOR tool is used as an example to demonstrate the importance of using tools and apps with caution.

https://wapor.apps.fao.org/home/WAPOR_2/2

Figure 21 WaPOR extract


The WaPOR tool is an app that monitors water productivity through Open Source Remote Sensing. It is a publicly accessible near real time database using satellite data that monitors agricultural water productivity at different scales. It continues to be developed but there were concerns that early versions of WaPOR presented what looked like high quality maps, but closer inspection revealed each map pixel was larger than an individual field, meaning the detailed resolution was not as good as it seemed. Also the data underpinning the maps weren't specific to individual or certain crops further limiting the accuracy of the tool. This does not mean that we shouldn't use these apps, or that they won't continue to improve, but it is very important to be cautious and understand the limitations of tools.

**Moving towards *Pragmatic* WRM:**

There is a tendency in water resource management to collect and analyse almost limitless amounts of data. *This is giving rise to water resource professionals in many countries exploring how Artificial Intelligence can help process and analyse the vast quantities of environmental, network, and user behaviour data that they collect every day.* However, Alex Bolding argues that it is not necessary to collect huge amounts of detailed data on every aspect of water to manage a system. He argues that it is possible (and sensible) to achieve Integrated WRM targets in a Pragmatic way. This is summarised in **Table 1**.

Table 1 Pragmatic IWRM

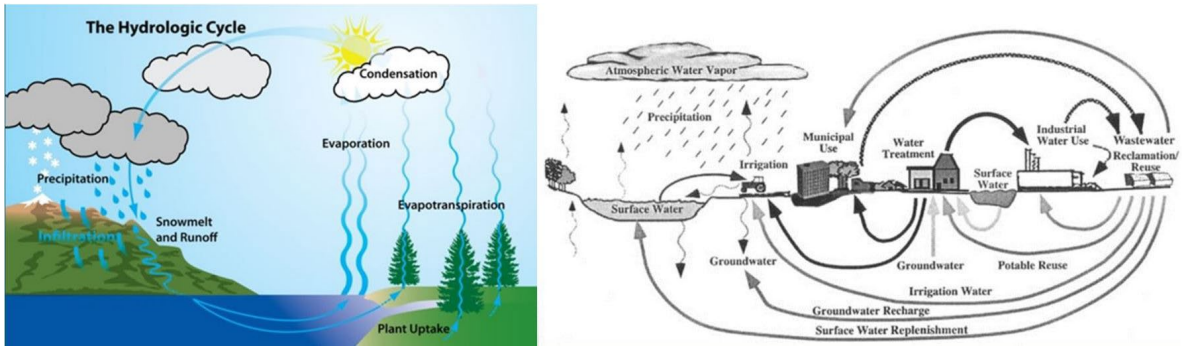
| **Integrate (WHAT)** | **HOW to do it Pragmatically** |
|---|---|
| Different uses of water:<br><br>• WRM vs Drinking water<br>• Water supply vs sanitation | Be real – **focus on hotspots**<br><br>• Make trade-offs where competition/ problem is acute |

| Integrate (WHAT) | HOW to do it Pragmatically |
|---|---|
| Institutional/administrative functions:<br><br>• Organisations that look strong, but have no powers, are not effective.<br>• Absence of democratic checks and balances | Use existing institutions:<br><br>• Local councils are key<br>• (Informal) user organisations |
| Geographical (up- and downstream):<br><br>• Prevalence of inter-basin transfers<br>• Failure of PES (Payment for Ecosystem Services) | Pragmatic charging & registration<br><br>• Big users pay per volume<br>• Reservations for small users |
| Development tied with WRM:<br><br>• Water development can be a distraction from the work of Water Resource Management, e.g., making sure everyone has access to the resource is often a managerial task, not a resource development task. | Focus on water development:<br><br>• Manage WR in closed basins;<br>• Develop new resources in other basins! |

**Hydrologic or hydro-social cycle:**

Alex highlighted the differences between the basic processes of the hydrological cycle (the natural water cycle) and the many more processes when human artificial influences are included (**Figure 22**).

Figure 22 Hydrological and Hydro-social cycles



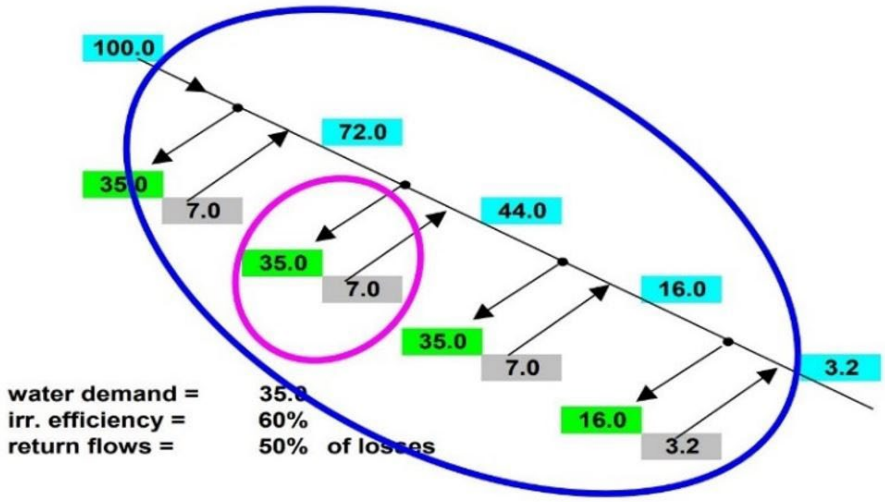

The human influenced water cycle still includes evapo-transpiration, precipitation, runoff etc but also includes abstraction from the surface and

groundwater, different types of use, treatment, and a whole range of water resource developments such as water reuse and artificial groundwater replenishment. There are many more types of artificial influence.

At this point the critical concept of **Return Flows** is introduced. A return flow is simply the water that a user returns to the environment when their demand has been met, if any water is left over. Regulators in many countries demand that a specific percentage of abstracted water is returned to the local water environment. Water users are not allowed to take every last drop. This is to ensure the environment has enough water to continue functioning and to ensure downstream users also have access to water.

**Figure 23** is a schematic diagram that illustrates the importance of return flows on a river catchment and summarises how to calculate the overall efficiency of users in a catchment (basin).

**Figure 23** The Importance of Return Flows




*100 units of water enter the catchment (top left). Four inefficient irrigation systems take water from the river. The first three all take 35 units of water with an irrigation efficiency of 60%. Of the losses, 50% or 7 units, flow back to the river to the benefit of downstream users. As a result, the last irrigation system can still take 16 units, 3.2 of which are returned to the river. At the bottom of the catchment still 3.2 units remain to flow into the next sub-basin (or to the sea). If the irrigation systems were all 100% efficient the final two would not have been able to satisfy their need for 35 units of water.*

***Total water used is 96.8** units (100 in, 3.2 out)*

***Total water losses** (7+7+7+3.2) =24.2 units. Downstream irrigators **reuse** some of the water 'lost' by the upstream irrigators. The more 'efficiently' upstream users use water, the less they should need to take from the river to ensure water is available downstream.*

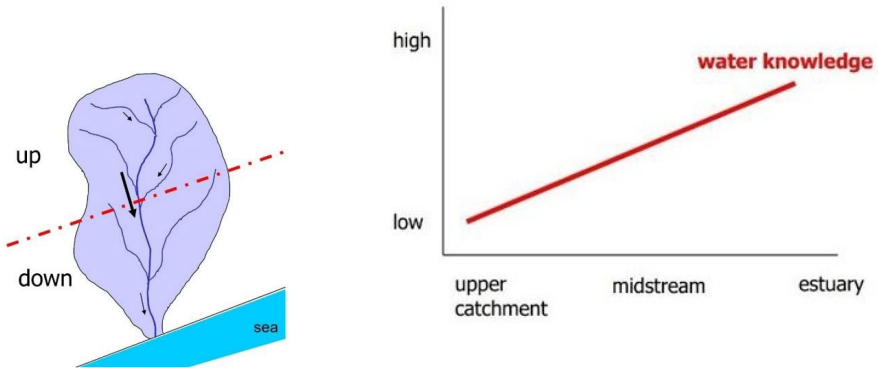
***Basin efficiency*** *∓ 75%*

What we can learn from this example is that the traditional focus of engineers on optimising water use efficiency at *system* level results in lower benefits for downstream users. In terms of equity a leaking, inefficient cascade of irrigation systems is more equitable than a series of super-efficient irrigation systems that deprive downstream users of water.

**The water asymmetry:**

This leads on to the next issue of asymmetrical relationships between water users within catchments (or whole river basins). This is about how people tend to think about water resources. They look upstream to worry about how much water (and of what quality) is coming to them but tend to think much less about how much water (and of what quality) subsequently flows downstream. Alex reasons that generally people at the most downstream points in a catchment are much more water aware than those upstream who are more able to take it for granted (and as a result are more likely to be the cause of catchment problems). Alex coins the term 'problem-sheds' (as an alternative to the US term for catchment 'watershed').

Figure 24 Water Asymmetry and 'Problem-sheds'




**Water allocation – local and national practices:**

***Different historical regimes*** emerged to manage the problems arising from water asymmetry.

- Local ("customary") water sharing arrangements. These were developed on principles of fairness, equity, respect for the environment, and respect for hydraulic property. This style of arrangement is still quite common in countries with very large, rural agricultural sectors. The degree to which they are recognised/incorporated by governments can vary a lot.

- Imposed (colonial) national water laws (e.g., riparian system, prior appropriation). These were typically on a first come first served basis (prior appropriation) or on a land ownership basis (riparian), thus excluding original inhabitants from access to water.
- Subsequently: comprehensive water sectors reforms.

***Consensus is emerging*** globally that 'access to water is a human right' and related to this that:

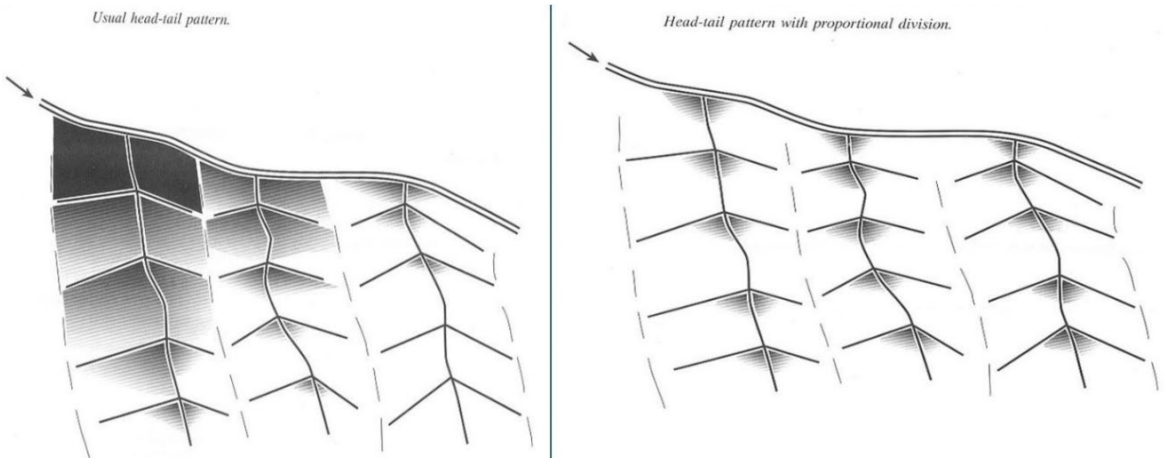
- the environment a legitimate water user
- transboundary commitments are recognised
- permits for non-primary requirements are also important
- water allocation should be equitable (proportional)

Specifically***, equity in water*** means: 'Affording everyone a fair and equal opportunity in the utilisation of the water resource according to one's needs'. This concept strongly leans on the principles of customary water allocation systems where water is allocated proportionally, according to need (not everyone having the right to an equal volume of water).

**Distribution of water scarcity: adjustable vs proportional water distribution technology**

**Figure 25** shows two alternative ways of allocating water within the same system.

Figure 25 Water distribution technologies




The Image on the left shows the outcome of water allocation using gated structures (see also image on left of 'Water allocation technologies in practice on below), where in principle water gates can be used to move water to where it is needed. In this diagram the farmer in the top left, closest to the source (e.g., a

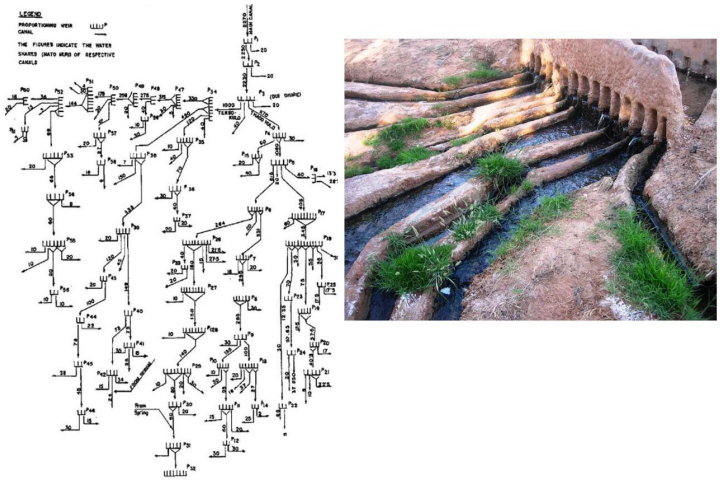
river) gets the most water. However, to make sure the farmer in the top left field doesn't just get more water by default requires knowledgeable staff to control the gates appropriately. They need complex formula (with lots of data) to work out where to release water to maintain equitable access. But farmers can also adjust gates, and hence the pattern of water scarcity distribution across the system often remains the same.

The image on the right illustrates proportional division, which is fixed. The basics of this is that far less data is needed to manage the system as everyone can clearly see which proportion of water is going to which section of the command area. The resultant water distribution pattern (right hand side picture of Figure 26) shows a more equitable division. The photo below shows these two alternative methods in practice.

*Photo: Water allocation technologies in practice*

The benefits of Proportional Division are that it is easy to monitor, doesn't need measured, and it distributes scarcity and abundance in a fair manner. Such fixed proportional division can often be found in traditional irrigation systems (see **Figure 26**).

Figure 26 A schematic layout of an irrigation system with proportioning weirs and user shares (photo from Algeria)



**River committees vs permits:** Permit systems are typically favoured by Governments and water planners who work in highly monitored, data rich systems. However, from a pragmatic point of view committee (local) systems relying on customary water rights offer some practical advantages (see Komakech et al, 2010 for Tanzania[2]). Table 2 highlights some of the pros and cons.

**Table 2** Permit vs committee systems

| **Permit systems** | **Committee systems** |
|---|---|
| High transaction costs | Ad hoc – only in times of scarcity |
| Difficult to monitor abstraction compliance | Limited in geographical scope and hence easier to monitor |
| Limited functionality in scarcity times | Use of commonly agreed standard (stick with carvings) |

## Citizen Science - scope for data collection?

The final topic in this presentation was citizen science and some of the key things to be aware of when considering the role of citizen science in boosting data collection (and dissemination). First of all this is an area of work which is increasingly rapidly, thanks to the proliferation of mobile phones, the evolution of social media networks, and the increasing ease to develop applications.

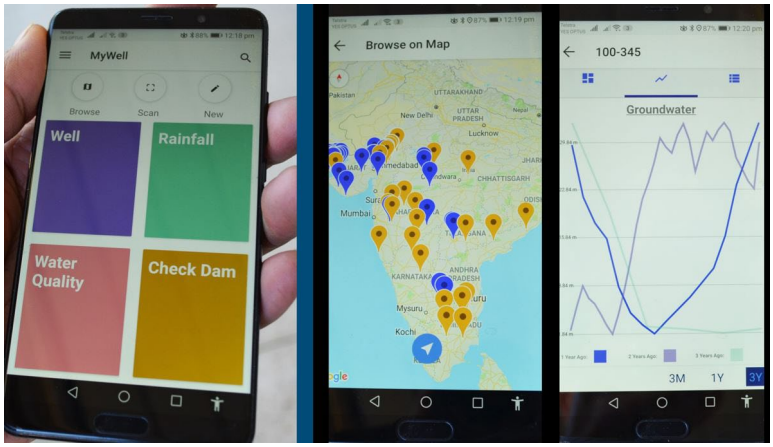



*Photo: Groundwater monitoring citizen science app*

There are applications that people can use to contribute to monitoring groundwater levels (pic), monitoring plastic pollution, and monitoring water leaks in urban water supply systems.

It is important to think seriously about what the purpose of a 'citizen

[2] The Last Will Be First: Water Transfers from Agriculture to Cities in the Pangani River Basin, Tanzania (water-alternatives.org)

science' project is. Basically, is it a cheap and extractive way to fill data gaps? Or does it provide a route to empowering local people regarding a local water related issue? The purpose and design of a citizen science approach needs to be clearly determined to avoid extractive transactions. There needs to be something in it for the users to maintain support and consistency in their contributions.

New approaches are much more empowering. The (Amsterdam) Schiphol airport noise monitoring app is an example of citizen science app that people were able to use to take the airport to court for breaching regulated airport noise. The benefits to users can be practical, educational, social, financial etc depending on how they are designed.

**Data and its use for EWRM Q&A**: Alex's presentation also triggered a large number of questions and ideas:

Comment 1: Traditional methods are not always equitable but are considered fair (e.g., people don't mind the village Chief getting more water) but proportionality reflects equity ( e.g., based on % of irrigated land).

Comment 2: Some models, using distance sensors (remote sensing) have been developed for data collection, such as for instance WaPOR (developed by FAO). This could be useful to apply in Africa (to map the WR potential) but the green space shown by the models was questionable. It is still necessary to go to the field to verify the satellite data, and it is still very far from reality. Ground truthing could improve the models. This sort of ground truthing should be discussed with people at the community level.

Response: Agree. Alex has criticised WaPOR for using faulty science. It needs to be calibrated with the field. We need access to the algorithms to understand it, but what he sees in the field is that people use these 'apps' without being critical of the data/science.

Q1: This learning event is inspiring discussion on what integration really means. The participant explained that they have one donor funding a groundwater investigation (should be done every year, but in reality, the outputs will be relied on for the next 10 years). **Who ideally should take lead on integrating all the different efforts?**

> A1: This is difficult to say. You need a coordinating organisation (probably at county level) to counter the disconnect between WRUAs. From there it should be a county plan for development.

Q2. Question about the irrigation efficiency paradox. **Water efficiency rarely reduces agricultural consumption. Why is that?**

A2: Drip irrigation can be very efficient at the field level. A farmer who saves water will then expand their area and so the total water volume used remains the same. Plus drip irrigation has far fewer return flows e.g., farrow irrigation results in lost water for the farmer, but that water then infiltrates and helps the groundwater table to refill.

Q3: **Efficiency in Asia needs to be looked at with the issue of salinity. Drip irrigation improves efficiency but also salinity. What should be done?**

A3: Drip irrigation work in Jordan shows efficient use leads to accumulation of salt in the soil (they only use treated wastewater). If this continues in the long run, the next step for Jordan is hydroponics (do away with the soil altogether!). There is a lot of fear around soil free farming.

**Q4. Water permitting is an expensive process – there are alternatives. In Kenya we find a lot of people can't meet the criteria that is set up to get a permit. Do you have a case where different alternatives are acceptable in a country?**

A4: Even if there is a permit system, during periods of water scarcity it's kind of abandoned/suspended (reflects the more customary system of sharing, can benefit from these).

**Follow-up question: Is there a co-existence example?**

A4: Yes, Limpopo river in Mozambique. Regional Water Authority gave permits to bigger farmers but not to the smaller farmers (who were more numerous). The medium sized farmers were also supposed to act as focal points to administer the permits of smaller farmers around them to cover all the users. This system proved exploitative. So instead, researchers proposed to look at the river's minimum flows needed to satisfy a specified number of small users. This resulted in a general reservation for small users. The really big users (private sugar estates) still need a proper permit and have to pay for the water to support the management system.

## Debating Game

Participants were put into two opposing teams to debate the Statement:

***"Grassroots organisations like WRUAs need information not data".***

The purpose of the game was to encourage participants to explore the ideas emerging from Block 3 and possibly to challenge their own internal views on the topic. Participants were allocated to a team and so were not necessarily debating their own personal view. One team were challenged to argue in favour of the Statement, the other team against. Three participants volunteered to form an 'honourable jury'. The objective: to convince the jury of the position of the group.

The debating game follows a series of instructions and strict rules:

- The decision of the jury is based on the consistency and coherence of the arguments as well as the response to the arguments of the other group.
- Each team has 3 mins each to present their arguments without interruption.
- After both teams have argued for 3 minutes the first team counters with 2 more minutes, and the second then follows.
- After both teams have used their total of 5 minutes they both retreat into their teams for 15 minutes to consider the flaws of the opposition and prepare their final counter arguments.
- The debate recommences with a further 2 minutes and then a final minute each.
- The 'Jury' then retreats to consider the quality of the arguments and decide on a winner.

The 'game' was very lively with very passionate arguments from both sides! The text in **Table 3***,* reflects participants' actual statements as closely as possible.

Table 3 Arguments from the Debating Game

**Round 1:**

| **AGREE** | **DISAGREE** |
|---|---|
| **First 3 minutes:** | |
| • WRUAs can't use data such as $m^3/s$, it is meaningless. They can | • WRUA members themselves say that data IS part of information. |

| AGREE | DISAGREE |
|---|---|
| only make decisions with information.<br>• They do not have capacity to generate information from the raw data. It needs to be processed and analysed to convert it into information. That requires data and skills.<br>• Critical point: the WRUAs do not have a mandate to create data.<br>• WRUAs are too busy to do the work to create usable data. They are understaffed, physically running up and down the river, leaves them no time to look at databases.<br>• Information is easier than 'data' to communicate with and to mobilise action. | • No data means people are uninformed. Data provides proof, such as proving salt is in the water.<br>• Many WRUA members are well educated. They CAN interpret data. They want it and need it. Example, Ex-civil engineers, etc used data to design and build their own dam. Relevant data includes hydro data to design capacity /size of dam etc.<br>• They understand raw data on levels – they observe it. They DO understand $m^3/s$.<br>• Info (on its own) can be misinterpreted |
| **Second 2 minutes:** | |
| • Changing behaviour is important and information works better than data, e.g., it is better to talk about the colour of water rather than the water quality data.<br>• Sharing data introduces favouritism towards only those who can understand data.<br>• Raw data can be interpreted incorrectly. | • Data is generated at grassroots level in the first place. If they can't understand the data they generate it has to go up a level, but they still want to see accurate and precise data.<br>• Why give us only half the information. You want to keep us in ignorance? To be disempowered. We need data to be able to TRUST the information.<br>• Just giving information gives no room for verification and interpretation.<br>*Fancy flood maps – then we provided more info – and saved more lives.* |


*Photo: Debating game*

**Round 2**

| AGREE | DISAGREE |
|---|---|
| **First 2 minutes:** | |
| • Systems change sounds great but we need to take action now…we don't want kids to die now.<br>• Data analysis is the WRA's job. If the WRUA can do it we don't need WRA.<br>• WRUAs have capacity and knowledge – but water users need trustable evidence that can only come from institutions.<br>• Not all WRUAs have the same skills, Data is very sensitive – imagine what would happen to a WRUA that can't interpret data correctly.<br>• Data on its own has no meaning. It is better to speak to the heart not to the mind. | • Needs data for monitoring<br>• Why don't share, if you don't share, we think you're against development. WRUA have mandates that need data<br>• It is factually incorrect that WRUA don't understand data (a lot are engineers)<br>• Information is democratising / Data is Empowering!!<br>• Why are you afraid??? What are you afraid of?<br>• If people don't understand data, build capacity, change the systems where needed.<br>• We care, we are passionate, that's why we need data!! |
| **Final 1 minute:** | |
| • unless data is processed you can't get information.<br>• We need miracles, we need collective public opinion, that is | • Why do you want to hide data? It is a dictatorial dynamic.<br>• Quality data does mean things to people. |

| AGREE | DISAGREE |
|---|---|
| best generated from information not data.<br>• WRUAs are run by volunteers.<br>• Even without data WRUAs can manage their systems. | • We need data. |

**Jury deliberation:** the jury members explained their reasons for awarding points to each team. In the first round the 'In favour' team took a long time to clarify their principal argument, that WRUAs don't have time to process data and therefore information on its own is enough. The 'Against' team were more convincing with the main arguments that information only represents half the knowledge and to build trust you need to provide data. Information on its own does not enable verification. The 'Against' team won 1: Nil.

In the second round both teams missed the opportunity to define the Statement in their rebuttals. The 'In favour' team returned with good legal arguments and a very strong message that data belongs with trusted institutions. The 'Against' team came back with clear rebuttals arguing that the WRUAs also need data to fulfil their mandate. In this round both teams had strong coherent arguments. However, the focus on legal arguments won the round for the 'in favour' team.

In Favour 1: Against 1.

To conclude, **neither team defined the statement which put them both at a disadvantage.** Overall the consistency and coherence of the 'Against' team was better and so the 'Against' team won the game.

TRY THIS: **REFLECT ON DATA IN RELATION TO WATER RESOURCE RIGHTS IN YOUR COUNTRY**

- What is the data and information system you use for allocation of water resource rights and making development decisions?
- What can be done better?

## Regional insights

Towards the end of this block participants formed regional groups to reflect on what they have learned so far and to think about water rights in their own countries and how those rights may be supported or undermined by data in some way.

Table 4, on next page summarises the notes taken during those discussions.

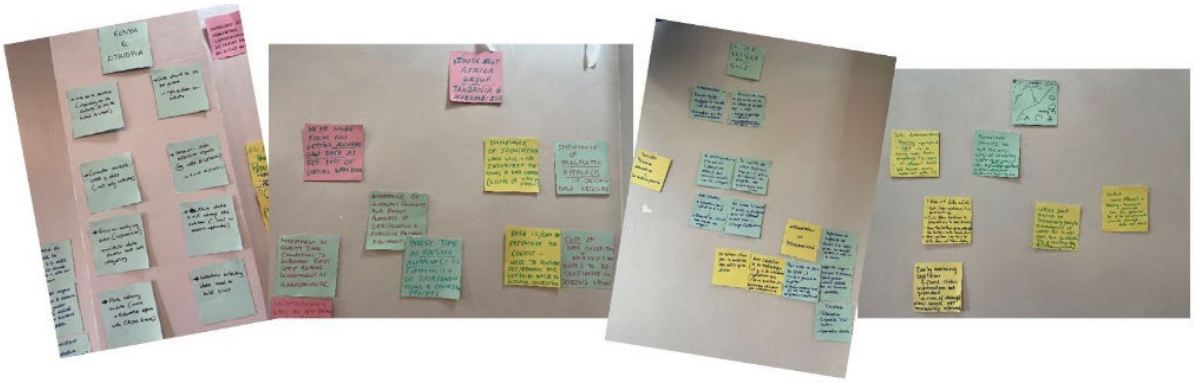


Table 4 Regional Insights on Relationship between DATA and Equitable Water Rights

| West Africa: Niger, Burkina Faso, Mali | Kenya & Ethiopia | SE Africa: Tanzania & Mozambique | Himalaya |
|---|---|---|---|
| Data is processed, analysed and can be transferred. Observation that data can be transmitted. | Data can be sensitive (depending on its contents it can be restricted or shared). | Need more focus on getting accurate groundwater data as a key part of the overall WRM process. | Formalised permits are not the only way of allocating water resources. Can explore a mix of proportional water allocation, customary systems etc. |
| The main problem is data collection, but there are 2 other problems: 1) a lack of sharing (power & control), and 2) applications are not always adopted. | Consider multiple users of data (not only WRUAs). | Investment in quality data collection is important first step before investment in infrastructure. | Data Governance/Access:<br>Sharing appropriate and correct info in timely way that's accessible to users, at different levels.<br>This will become more important with climate change. |
| Primary data is the raw material. | Focus on analysing data (turn it into information).<br>Multiple data sources that are not integrated is a problem. | Importance of involving community and raising awareness of data collection and expensive monitoring equipment. | Flow of data and Info:<br>Data flow upstream from grassroots organisations.<br>Information flows downstream to grassroots to make decisions.<br>The quality of information depends on the quality of data.<br>Systems can fail if info does not flow down. |
| The WRUA works well because the information | More advocacy on data is needed (more collaborative efforts with citizen science). | Invest time in raising community awareness of | Early warning system:<br>Flood risk information is provided. However, people are |

| West Africa: Niger, Burkina Faso, Mali | Kenya & Ethiopia | SE Africa: Tanzania & Mozambique | Himalaya |
|---|---|---|---|
| returned is recognised / accepted by users. | | data/info tools and collection process. | not normally informed of drought risks or notified about low water levels. |
| The WRUA model works well because it obtains data and restores relevant information. | Data should be fit for purpose (i.e., type of data for WRUAs). | Important to identify who will and can interpret the tools and data collected (village or Ward/District?). | WRUA good practice on subsidiarity principle of management of water at lowest level, but sustainability is a challenge ( e.g., financing modality). |
| With CETRAD: importance of data collection -> translated into information to give to users | Harmonise data collection efforts ( e.g., WRA & CETRAD).<br>Avoid duplication. | Importance of pragmatic approach in deciding what data is required. | |
| At the horizontal level exists a dialogue between the different actors with an exchange of information. | More data is not always the solution (local vs modern approaches). | Data is/can be expensive to collect. Need to consider fee/revenue for certain data to sustain collection. | |
| The actors do not have the mastery of the tools that we use. | Institutions collecting data need to build trust. | Cost of data collection and analysis tools needs to be considered when selecting options. | |
| With the evolution of technology there are a number of applications that the actors using the platforms don't master. | | Understanding who you are speaking to / or presenting to is key to the level of detail & processing required to turn into information. | |

| West Africa: Niger, Burkina Faso, Mali | Kenya & Ethiopia | SE Africa: Tanzania & Mozambique | Himalaya |
|---|---|---|---|
| Integration vs Pragmatism. | | Make data accessibility clear with several options for users. | |
| To set up IWRM two systems that complement each other: a modern system based on data, and a traditional system. | | Recognise indigenous tools in data collection as low-cost alternative / complementary to modern data collection methods. | |
| Importance of verifying data with reality e.g., comparing satellite data with info from the field. | | Importance of combining citizens' science with technical tools for lower cost & ownership. | |
| Despite the technical means available we must continue using humans to collect data. | | | |
| 3 levels of monitoring: remote sensing, PCD sensor devices, direct observation. | | | |

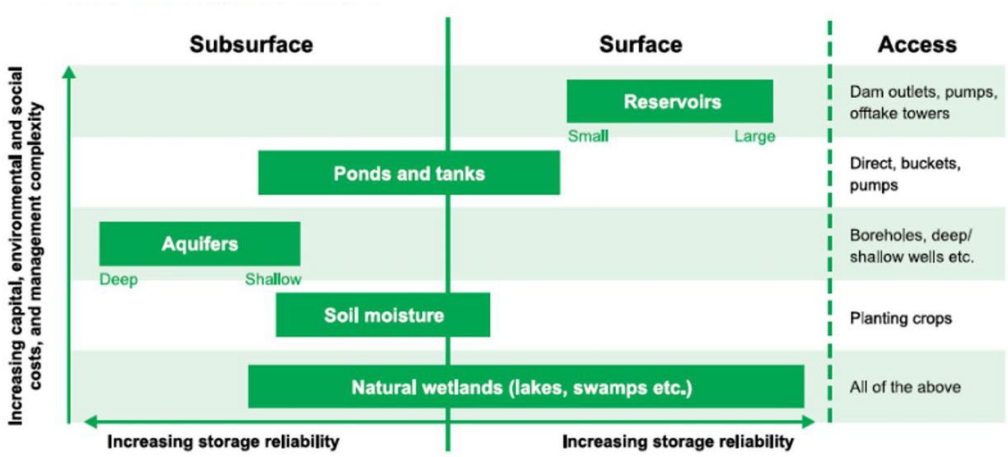
# Block 4: Water development and investment

## Introduction: Water development and investment

Antoinette gave an overview of the issues that emerged from the E-group discussion on Topic 3: Water Resource Development and Investment. Of course everyone said that investment in shared WR developments is very important as well as sectoral water developments. With finite budgets priorities must be set but the forum discussions revealed how uncomfortable it can be to specify which water uses and users get priority. Most participants preferred to say that everything is a priority. This is a major challenge, because when there are water shortages prioritisation is necessary.

Attention turned to what *sort* of developments should be prioritised and on that topic the consensus is to focus on increasing water storage capacity by building dams. This is also reflected in the national water development plans of several countries. Very few participants suggested targeting water pollution as an option to make more water available, and few participants suggested nature-based solutions such as restoring forest cover to maximise water retention in soil and groundwater. However, dams are highly problematic infrastructure within a river catchment. Antoinette presented the "water storage continuum" to draw attention to some alternatives to dams.[3]

**Figure 27** Water storage continuum




[3] The scope of this learning event was not able to include a detailed session on Dams, the problems they can cause, the problems they can themselves suffer, and how to determine if a dam is the right solution. SNV intends to focus on this and other specific aspects of EWRM separately.

Egroup contributions also spoke about the importance of less visible investments or 'soft investments' referring to:

- Investments to improve the functions, and therefore the implementation of IWRM (**Figure 5**);
- Developing human capacity, skills and coordination;
- Investments in environmental monitoring (water quality, river flows, groundwater levels); and
- Investments in pollution control.

**Many needs, many plans, but where is the money?**

In several countries, efforts have been made to consolidate needs for water development into a "National water development plan". The challenge for countries is to find the funding to implement these plans as they tend to be very ambitious and costly. Potential funding sources are from tax income, loans from multi-lateral banks, project-based investment by donors and NGOs, self-investment by communities and local organisations. Other options are a government-managed Water Development Fund, or to attract private funding through a Public-Private-Partnership (PPP) model. Of course, private funding will always need to be recovered through tariffs or other payments, no private entity is going to invest without getting a return.

There are many more routes to money, and different funding models may apply in different locations and under different circumstances. Each one should be scrutinised in terms of impact on equitable based decision making. The following questions should be considered as a minimum:

**Does the funding source dictate the solution?**

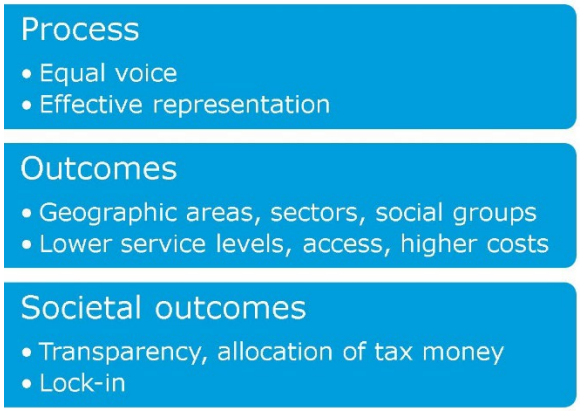
The short answer unfortunately is 'Yes' but it very much depends on the source of the funding and the awareness and/or agenda of the decision-makers regarding water resource needs. Participants from Tanzania confirmed that current investments happening now are typically focused on constructing big dams, despite little supporting data on potential inflows, impact on downstream hydrology (during construction and during operation), and even on the demand volumes and patterns of the various water users linked to those developments. Large scale investment in one sort of development is also thought to significantly influence the plans and intentions of everyone else within the catchment. It is important to remember that solutions do not always have to involve major resource development. Investment can be as simple as making intakes easier to operate, installing connection valves etc, that make it easier to only use the volume of water that a demand actually requires.

**Is there a fair balance between who receives benefits (or between financial contributions and benefits received)?**

During the discussions everyone agreed that in principle contributions and benefits should be balanced but the E-group identified a range of inequalities. A prime example of inequality is that generally people who live in the middle of town get water supplied direct to their house (they receive a high level of service), whereas people living in outer areas tend to have to walk a little way to the nearest tap, and rural areas are typically left with no connection.

**Figure 28** summarises some of the disparities that can exist between the decision-making process, the outcome, and the long-term impact on society.

Figure 28 Fair balance between who benefits and bears the costs of water development?




Inter-generational equity is a major issue as water resource development schemes funded by the Government will still be being paid for by future generations through their taxes that won't go to other service needs.

This will be especially unfair if those developments are found to be unnecessary, sub-optimal, or otherwise not meeting future needs. Major developments are typically inflexible and lock communities into long-term debts.

**Is the decision-making process transparent and can investment decisions be audited?**

The discussions largely confirmed that currently decision-making is rarely if ever based on evidence which inevitably means it will be politically based. This increases the risk of decisions not being equitable either consciously or sub-consciously. Even in the absence of data/science-based evidence, decision making processes should be transparent with clarity on the range of potential solutions identified, the criteria used to evaluate and select solutions, and the outcomes of that process

## Investments and EWRM

***Presentation by Alex Bolding, Wageningen University***

In his second presentation Alex Bolding focused on the contrasts between traditional locally-led irrigation systems and more formal 'modern' systems with a particular focus on how attitudes and perceptions drive investment models. He described the pros and cons of different approaches and investment models and the important lessons that 'outsider' investors should learn to ensure that investments in water resources are appropriate and sustainable in the long-term after the initial investment phase is over.

The first main point is: **How can we ensure that asset management is incorporated into investment?** A major problem is that too often investment focuses on the initial capital expenditure with little consideration of the longer-term operational and maintenance costs and how they will be paid for. To open up the topic Alex highlighted three specific points:

- What explains the resilience of FLID?
- Coward's theory of hydraulic property creation
- Indirect investments through use of water funds

The second point is whether **Public-Private-Partnerships (PPPs) for WRM are good for equity?**

To explore these topics Alex began by presenting the old view of traditional irrigation in Kenya. There is a huge imbalance between the small number of hectares under modern irrigation versus the large number under traditional irrigation. One of the reasons for this was the collapse of the National Irrigation Board (NIB) and the collapse of big schemes during the 1990s due to lack of maintenance. The rice marketing monopoly was abolished under pressure from the IMF/WB which meant irrigators could finally get a fair price on the market, but it also meant the NIB lost a significant source of income and then schemes started to collapse due to lack of maintenance etc.

Smaller schemes did not collapse. They proved themselves more resilient and durable but despite this, attitudes towards them are still often negative. FMIS[4]/Farmer Led Irrigation Development (FLID) are seen as wasteful; inefficient, unproductive, illegal, and not worth considering.

[4] Farmer Managed Irrigation Systems

The main characteristics of FMIS are:

- They use simple technology ( e.g., furrows, river diversions using sandbags)
- They are user initiated, operated and maintained
- They are often informal
- Efficiencies and productivity are low
- They are typically confined to certain locations, such as on hills or at the foot of hills.
- They are durable and resilient.

**FMIS are durable and resilient**

The question of why FMIS are so durable is very important. The fundamental explanation is that when local water users have a strong sense of ownership of the infrastructure they use they are much more inclined to take of it. Investment in irrigation creates 'hydraulic property' (infrastructure & water)[5]. When hydraulic property is created people organise their relationships with the structures and if they have a sense of ownership they organise their collective action to take care of their property (O&M). There are two types of hydraulic property relations:

- Object-user relationship (exclusive)
- User-user relationships

Experience in Asia reveals five different types of HP ownership: communal, investor group, atar[6], government, or elite-owned but they all share two general principles.

1. Ownership and responsibilities for O&M coincide
2. Water users who are non-owners have to pay for the water to owners OR buy a share and become co-owner.

   'Owners' those who created the hydraulic property allow others to become members of the scheme but they have to pay their share (to cover the original

[5] This concept it taken from Coward (1986) *State and Locality in Asian Irrigation Development: The Property Factor*

[6] Atar is a portion of land obtained in exchange for guaranteeing an irrigation water flow. Hence the original landowner, provides land use rights to the person providing irrigation water, for as long as the water flows. In the Philippines this system has existed for more than 200 years, with atar land being passed on to a next generation as if it's inheritance.

labour costs etc) and they have to contribute to the maintenance. It's a relationship between the technology and people, and between people.

**External 'interference'**

However, this type of approach and local agreements are often ignored when outsiders 'improve' things using external funding and typically engineering structures that are very different to the traditional local system. This often leads to 'dependency syndrome' where local people no longer feel like they 'own' the new structure and assume or consider the investor will be responsible for its long-term maintenance.

It is easy to understand the mentality with an analogy of driving a hire car which is given to you shiny and new and in great condition, and so you enjoy driving it, you push it hard, and you don't worry too much about it because it's not your car. Your behaviour is very different when you own it.

When outsiders 'interfere' in water resource or irrigation system development HP relations, rights, and obligations can get very mixed up and unclear with investors and recipients having very different ideas about ownership and responsibilities. This can lead to 'Hydraulic Property Extinction' where users start to refuse to do (or are unable to do) O&M and then the structures start to break down and are ultimately abandoned.

**Indirect investment**

One proposed way to avoid this situation is through 'Indirect Investment'. The idea is that this gives the best of both worlds, where external investment is channelled through internal systems to create 'real ownership' rather than just a 'sense' of ownership. Advice for external investors is to:

- Understand existing property relations (and plan and design investments that work with this);
- Work with indirect forms of investment: subsidies, tax abatements, water funds, provide technical assistance, invest in work to regulate water rights
- Assist in formation of WUAs to strengthen local management and accountability. The improvements will be slower paced than just investing in e.g., a big construction scheme but are more likely to be appropriate and sustained in the much longer-term.

**Public-private partnerships: A new panacea**

Public-private partnerships is another popular form of investment. They are widely accepted and promoted by organisations such as the World Bank, IFC, ADB, and directly by governments, typically on sanitation projects, water supply utilities etc,

but there are fewer examples and seemingly less interest in PPPs for irrigation and water resources projects.

There are three classic PPP models:

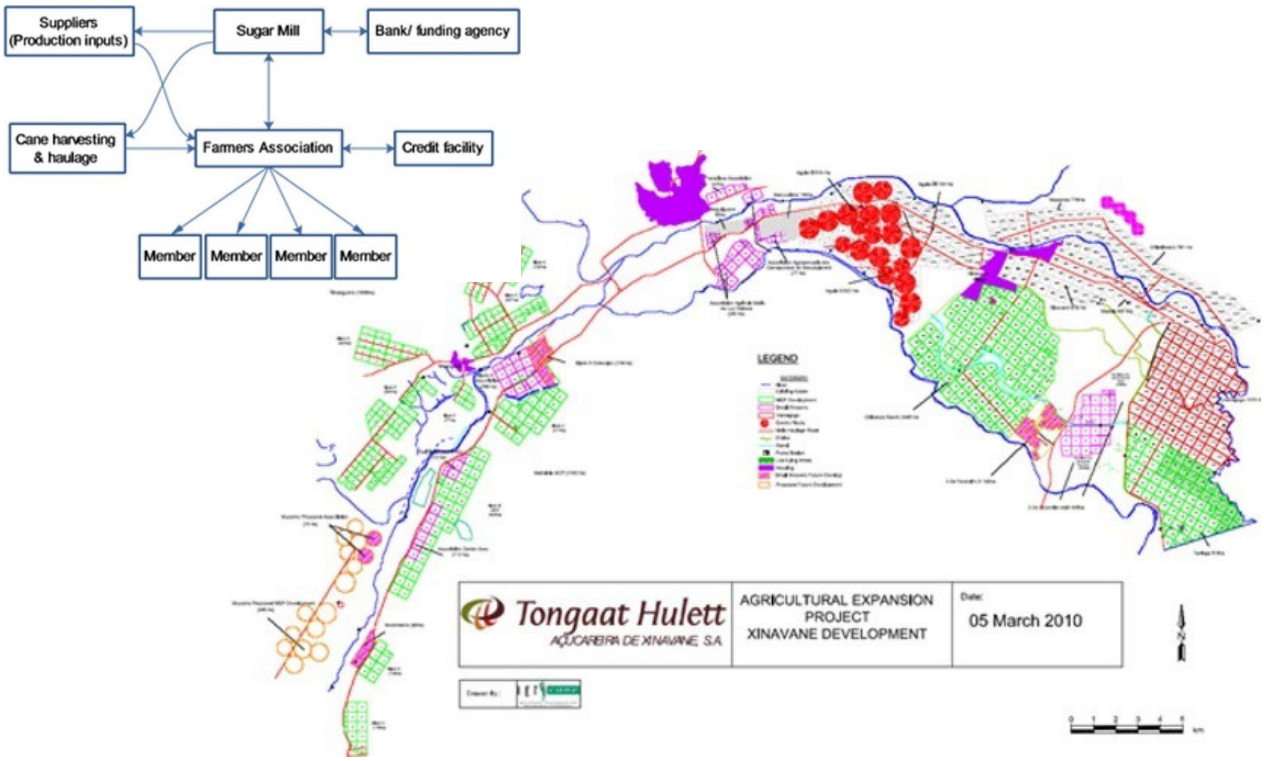
- BOT: Build, Operate, Transfer
- BOO: Build, Own, Operate
- Plantation/Core Estate/Outgrower schemes

But broader sets of models are possible.

## Outgrower scheme – Malawi Case Study

A Sugar Plantations example from Malawi describes the 'Outgrower Scheme' model. The Outgrower model is based on 'core estates' out of which development corridors will (hopefully) expand. Each core estate is supported so that the various components needed for it to function are in place, such as having a Farmers Association, a credit facility, a suppliers' network, harvesting and transport facilities, a production mill, and a bank. **Figure 29** shows how the various components of a Sugar Plantation Outgrower model Core Estate integrate and expand into a development corridor.

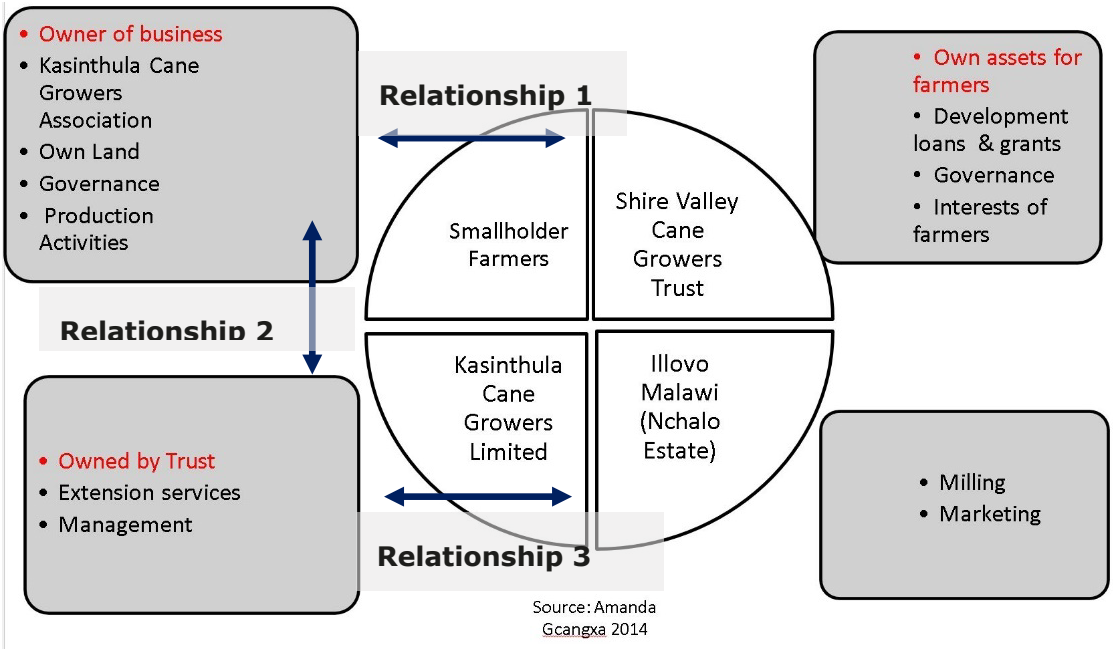
Figure 29 An 'Outgrower' Core Estate (In Mozambique, Xinavane)



Positive aspects of this example include that the private sugar estates provide money for infrastructure where the public sector lacks funds, it is seen as pro-poor, it creates a secure market for smallholder outgrowers, it easily enables knowledge transfer between different stakeholders and service providers. However, this model does not necessarily automatically resolve equity concerns.

In the presented Malawi case there are four main 'entities': Smallholder farmers, the Shire Valley Cane Growers Trust, the Kasinthula Cane Growers Limited, and the (owner company) Illovo Malawi (Nchalo Estate). Each one is responsible for different activities and owns different assets, and there are different relationships between the entities in the system. The main activities, ownership rights, and relationships between the four entities are summarised in **Figure 30**. The power dynamics between the relationships vary as do the risks and rewards to each entity of each relationship.

Figure 30 Summary of Malawi Sugar Outgrower Scheme Entities




***Relationship 1:*** *B*usiness model is Farmer owned businesses. The farmers own their land, manage their own production activities, and have formed their own farmers association to help protect their rights and their interests. The Trust supports farmers to access funds and owns assets on behalf of the farmers can use.

| | Smallholder farmers | Shire Valley Cane Growers Trust |
|---|---|---|
| **Ownership** | Land | All assets (land)<br>Kasinthula Cane Growers Limited |
| **Voice** | Higher voice in decision making | Inform farmers on all decisions taken |
| **Risk** | Investment loans<br>Land ownership<br>Transparency | Power struggles<br>Land grabbing |
| **Rewards** | Access to irrigation<br>Access to development grants<br>Access to personal loans<br>Networking | 2.38% administration fee from revenue |

The business model underpinning relationship 2 is more commercial, it is a relationship structured by Management contracts.

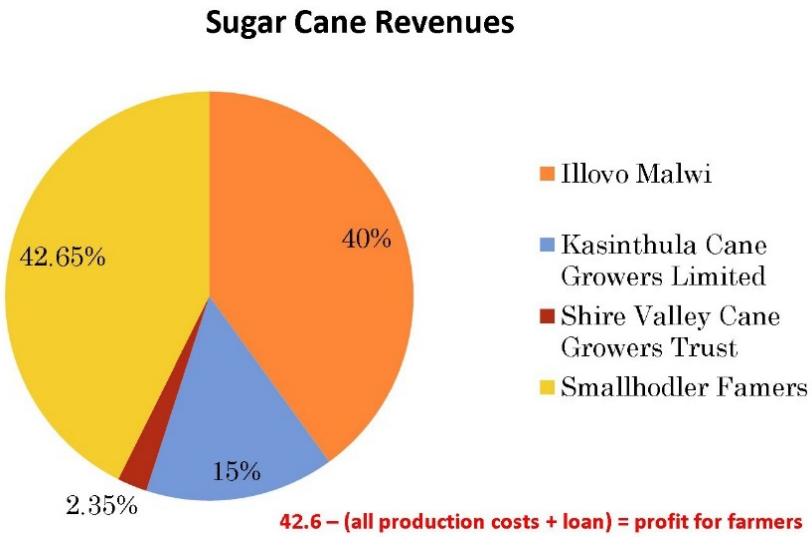
| | Smallholder farmers | Kasinthula Cane Growers Limited |
|---|---|---|
| **Ownership** | Land | Land<br>Sugar cane |
| **Voice** | Shire Valley Cane Growers Trust<br>One–on-one basis | Day-to-day business decisions<br>Board |
| **Risk** | Production<br>Lack of transparency | Power struggles<br>Mismanagement of finances |
| **Rewards** | Profit<br>Employment | 15% management from total revenue |

The business model underpinning relationship 3 is a Cane supply agreement.

| | Kasinthula Cane Growers Limited | Illovo Malawi |
|---|---|---|
| Ownership | Sugarcane | Processing factory<br>Marketing |
| Voice | x | All terms and conditions set by Illovo |
| Risk | Sugar industry unregulated<br>Market availability<br>Market prices fluctuation | Collapse of the smallholders' scheme<br>Stealing from farmers |

| | Kasinthula Cane Growers Limited | Illovo Malawi |
|---|---|---|
| | Uncertainty of the CSA contents<br>Abide to CSA | Power struggle |
| Rewards | 60% from total revenue<br>Access to processing factory<br>Access to markets<br>Fairtrade premiums | 40% revenue<br>5% shares of Kasinthula Cane Growers Limited<br>100% profit by products<br>0% investment costs |

Figure 31 Results: Revenue Distribution




The results from this case study are from 2014. What they show is that most of the risks were on the smallholders and after four years of production they still hadn't started to get any of the rewards. In addition they realised they were not being included adequately in decision making and their land rights were being contested. Moreover the fair trade subsidies that the Company received on behalf of the outgrower farmers was used to assure some monthly pay-out to the smallholder farmers (keeping them motivated).

These are sobering findings. How can we make this more equitable? Two big steps forward would be to 1) provide farmers with more legal support to get better contracts with more equitable distribution of risk, and support in legal negotiations particularly concerning the Cane supply agreement, and 2) provide technical and process assistance to build strong accountable farmer associations.

This presentation triggered many comments and questions.

Comment: Most of the examples in this presentation were about the irrigation sector. There are many variations of types of investment. The participant referred to two projects in Ethiopia (that have lots of problems) where the population has been left with lots of maintenance issues. However, this is usually not the case for big projects like hydropower etc.

> Response: Everyone is convinced that participation by future users helps to secure long-term O&M support from recipients/long-term users. For investment to work long-term users need to 'own' it. Investors should develop resources and systems jointly with future users *in all kinds of water system.*

Comment: It is important that investors respond to the Kenyan Government's plan (which needs funding). A key aspect is the major irrigation plan to pursue food security. The plan includes 100 big dams (water, power, or irrigation) ideally funded and implemented through PPPs. It also includes 1000 smaller dams, and action on Non-Revenue Water also through PPPs. Kenya has a huge challenge securing PPP in irrigation. It's a new way of doing things and capacity building is needed. Lastly, there are opportunities for the Private sector, possibly to strengthen the WRUAs and County Irrigation Development Units. The Government is looking to establish a water fund to encourage private investors.

> Response: The content of the presentation was deliberately cautious. PPP partnerships need to be strong. At the scale of 1000 small dams **the people involved on the side of Government need to be strong (technically competent and confident)**, to not be led by external parties. The Government must ensure that local people will really benefit from investments. The risk is that corporations benefit, not the local communities. **As soon as you work with corporates you need strong legal support** – they are very strong.

Comment: Investment often does not favour the small community. Investors position themselves at early stages. On the other side we have the smaller users. These local beneficiaries need to be involved in all discussions from the start. Unfortunately bias can creep in at all levels: at the WRUA level not even all members all always truly represented. At a geographical level there can be sectoral bias, e.g., a sugar company vs pastoralists Representation must be based on the range and number of users, not a geographical representation.

There are also big challenges when trying to make PPPs to get water to people in rural areas, as many rural areas only have one negotiator between them. We **need to strengthen state's negotiation skills** to get value for the water that corporations take. Local users can end up paying much more for water, which is a right. It is important to recognise the social value rather than economic value of water.

> Response: It is strange to think of PPPs in such a context. The private partner wants return and a profit. It can be very hard to broker a good deal. The market has a lot to do. You can look at concession contracts, service contracts etc – but it may be best to provide it for social value. We can learn a lot from South. Africa (not for profit models).

Q1: Ownership is common and fine for smaller scale systems, but at a larger scale it becomes more important to be financially sustainable with cost recovery. Are there any examples of storage investments, and how they can be sustained?

> A1. At the larger scale the Coward principle doesn't work. The contexts are very different, so investment models are more likely to follow the World Bank's Build-Own-Transfer Model where the asset *eventually* becomes a community or publicly owned asset.

Comment: Ownership. In Kenya we consider a community contribution to avoid Dependency Syndrome (labour, in kind etc). This enhances ownership and then they take over the project once completed.

> Response. One of Coward's principles, if you demand a community contribution, you're much less likely to get dependency syndrome. However, it needs to avoid tokenism, and there must be a very clear handover so there is no misunderstanding about actual ownership.

## WR development and investment Q&A

**Water Development and Investment - Plenary**

The final learning activity at the end of Block 4 was a country-based group plenary. Participants reconvened in their four different groups to discuss one of the following four types of investment to discuss:

- Investments initiated by national government
- Investments initiated by local government

- Investments initiated by local groups
- Investments done by private individuals HH

The questions each group had to discuss were:

1. How is development funded at this level of water management?
2. Who decides on what development takes place?
3. How significant are the monies involved?
4. Who owns the assets?
5. Who maintains the assets?
6. How long does it typically take to progress from initial idea to construction and operation?
7. What could be done better?

Each group then they presented their discussions to the whole group (the matrix of responses is summarised in **Table 5**).

**Summary:** Private individuals up to national government are all investing in the same space and water. So the big question is, '**What does all this mean when you look at what a catchment needs?'**.

There is a complicated patchwork of needs and projects at different scales, with different funding routes, using different technology etc. Within this there is a lot of confusion about ultimate ownership and responsibility for water infrastructure. Operational and Asset Management is weak and by default it falls to local public sector. There is a lot of talk about PPP but legislation to provide PPP rigor is lacking. Decision-making processes need to be improved at country and local level clarifying who should be involved and how should decisions be made. There is potential for a lot of conflict, and also conflict of interest between the many trade-offs that this management patchwork creates. It is important to have an overarching plan. It is clear from the plenary discussions that this is a very difficult and **we all have to do more homework**

Table 5 Key Points Raised from Group Discussions on Investment in Water Development

| **Investment by private individuals** | **Local NGO groups** | **Local Government** | **National Government** |
|---|---|---|---|
| **How is development funded?** | | | |
| In **Vietnam** many farmers invest in private boreholes, sometimes collectively. They take loans from microfinance/banks.<br><br>Individuals in **Tanzania** access bank loans. The Gov also subsidises local groups (>5 people) ( e.g., with interest free loans from a revolving fund, and priority to women and youth). The PASS initiative help guarantee loans especially if the investment is Climate Smart or Green. It is similar in **Kenya.** At the small scale, where risk is shared across a group, members are accountable to each other. In **Ethiopia** domestic water supply is largely self-supplied. HHs are encouraged to self-invest with Government technical assistance. For irrigation there is a national | Examples: small scale water schemes, springshed management, small scale irrigation, dams, storage facilities.<br><br>There are different funding models:<br><br>• Membership models.<br>• State funding<br>• Non-monetary (land, labour, materials)<br>• Bank loans (Moz)<br>• Private sector (Moz)capital<br>• Micro Finance Institutions.<br>• International funds. | It varies but in many countries powers to manage natural resources have been transferred from national to the district level so Districts can now invest. **Niger** and **Burkina Faso** have national agencies that fund local government; communities can also request access to the fund. In **Nepal** the Regional Government can propose projects but has no budget and no mechanism to get budget.<br><br>In **Tanzania** the regional WASA has competency to invest on water and sanitation related. It receives national funding for development, but also national irrigation funding, then it transfers to the local community Funding for dams comes from national budgets. | National Government often funds the bigger projects that benefit larger areas (e.g., Transboundary, or strategic developments). However, they are often difficult to finance domestically. Taxes can contribute but usually a grant or loan from international development partners is required. Governments typically have their own smaller budgets, can work with PPPs, and utilise the local labour force: e.g., volunteers, the army. |

| Investment by private individuals | Local NGO groups | Local Government | National Government |
|---|---|---|---|
| programme and subsidy system. In **Niger** there is a new system that regulates private systems, and the state invests in private supplies. | | In **Kenya** the Water Works Development Agency (6 agencies across country) do CAPEX development with national government funding.<br><br>There is also funding from the National Irrigation Authority for big irrigation schemes and the National Storage and Harvesting Agency (responsible for dams). County Irrigation Units can manage schemes at medium/small size, who can be managed by Irrigation water user associations. The county can do PPP, with the guarantee from the national government.<br><br>In **Ethiopia** diversion weirs and small/medium dams invested at sub-national level. Mainly donors or from local budgets<br><br>Some investments are community managed, other (LG owned) water utilities. In **Bhutan** it is mainly public investment. There are no private investments on water. No water tariff for irrigation users and rural users. | |

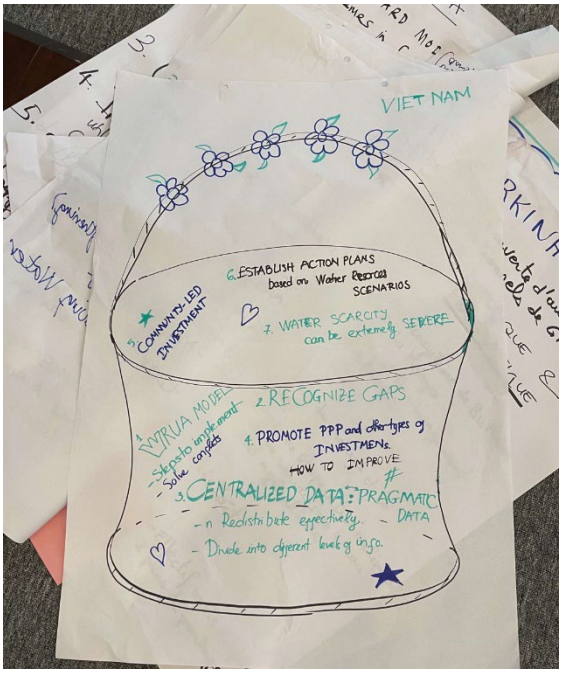
| Investment by private individuals | Local NGO groups | Local Government | National Government |
|---|---|---|---|
| **Who decides on what development takes place?** | | | |
| Generally the Government sets criteria and then the individual decides. However, in **Bhutan** there is much more Government investment and therefore influence in local supplies. Decisions based on where water is scarce. In **Ethiopia** the Government 'promotes' farmer loans for irrigation pumps. | Usually by community (assembly) or a private company (alone). Consultation with Local government licensing processes. The size of the project determines the decision-making process.<br><br>In **Mozambique** the Government authorises projects. | Depends on the type of funding. If it's district level the District usually decides on the programme.<br><br>In **Ethiopia** decisions come from the water bureau.<br><br>**Niger** is a pastoralist country and funding is very low. There is some arrangement between the Government and financial partners (some big companies have started investing in water).<br><br>In **Mozambique** the ARA authorities have the capacity to build and operate dams, up to a certain size.<br><br>In **Tanzania** dams are decided/invested at national level.<br><br>In **Bhutan** the system is centralised, but decisions/plans are bottom-up. At the end needs to be approved by the national assembly. | At the Parliament level. There may be political influence from politicians, lenders, or other sources of funding. It has to be presented by the relevant ministry. |

| Investment by private individuals | Local NGO groups | Local Government | National Government |
|---|---|---|---|
| | | Drinking water has been transferred to local level/commune but complications mean developments are not always built where people really need them. | |
| **How significant are the monies involved?** | | | |
| In **Kenya** it's quite significant (60% is private investment), less so in other countries (up to 10% private investment). | It's usually small, not always sustainable (depends on how the community was involved at start). | - | - |
| **Who owns the assets?** This is very important but often very unclear. | | | |
| In **Kenya** a HH usually owns their assets (with a deed), but community ownership is weaker.<br>In **Burkina Faso** community ownership is very weak. They follow the Principle of Subsidiary. The WRUA equivalents focus on the conservation of sub-catchment. At the municipal level they focus on water supply. Outcomes are | In **Kenya** it's not always clear (especially when there is no asset plan).<br>In **Tanzania** ownership is based on permits.<br>In **Ethiopia** there is a 3-way ownership system. | State investment, but management is transferred to municipality for hydro projects to regional councils. Things are separated.<br>In **Mozambique** the ARAs are responsible for investment and operation of assets. CAPEX mainly comes from national budget, or donors. OPEX/O&M is covered from the water tariff charged to users. | Often owned by the Government or a service provider (SP). The Government might delegate ownership to a SP. If it is partly PPP financed, some kind of lease agreement exists between the Government and the PPP partners. There is a diversity of B.O.T.s, e.g., Government owned corporations. In most |

| Investment by private individuals | Local NGO groups | Local Government | National Government |
|---|---|---|---|
| not fair between rural and urban communities. | | | countries the agreement is NOT clear. |
| **Who maintains the assets?** | | | |
| Normally the individual/HH. Accountability in small group ownership models is easiest. | If revenue comes from the asset e.g., a borehole, then a community may maintain it, but if it is a sand-dam etc often no one takes responsibility.<br>In **Burkina** Faso even when people contribute, they don't take care of the assets. | Communities sometimes maintain smaller scale district level assets.<br>Power has been delegated to mayors who sign contracts for maintenance. They receive revenue from the water, which will be shared (though defined criteria) so the maintenance will be done. Bigger assets need national influence.<br>In **Tanzania c**ommunity/user groups operate schemes, charging 5% fee to users. The Commission provides backstopping and CAPEX for repairs. | It is not always clear. O&M by Government or SP depending on who owns it. |
| **How long does it typically take to progress from initial idea to construction and operation?** | | | |

| **Investment by private individuals** | **Local NGO groups** | **Local Government** | **National Government** |
|---|---|---|---|
| The group focused on payback period rather than rollout timeline. Small loans average 1-2 years, loans for irrigation pumps usually take 5 years to payback. HHs usually take 3-5 years to pay off a loan. In Vietnam abstraction permits are usually for 10 years. | Irrigation 10 yr from idea to construction.<br>Water supply projects are usually faster (1-2 yrs) often because they are emergency projects. | It depends on the programme. | In most countries it takes 5-10 years to progress to operation. |
| **What could be done better?** Being clear about process. | | | |
| Stop 'gifting' development.<br>Create a clearer structure for O&M.<br>Increase transparency on what is done and where the money goes.<br>Incentivise individuals to invest. | - | Provide/transfer resources to the Districts to support the power (responsibility) that has been transferred to manage water infrastructure.<br>Provide more information on how investments are decided and increase consultation. Conflict of interest between regulators vs developers needs to be removed. Need to develop capacity on PPP. | Ideas/planning would be better to be bottom up, not top down.<br>Evidence-based planning with lifecycle costing. Transparent, good communications to bring development forward. Negotiating capacity and bringing relevant stakeholders to the table. |

# Country shopping bags




At the end of the learning event participant country teams were asked to consider what things they have learned that they will immediately take back to try to apply in their home countries.

**Kenya:**

1. After listening to Alex Bolding, we want to apply the Coward model to select from NIA schemes in Sombanu, Isiolo, and Masabat counties and convert flood irrigation to drip.
2. Involve private sector in WRM. PPCP arrangements on management and resource mobilisation.
3. Coordinate data sharing approaches for effective decision making.
4. Increase bee keeping to improve biodiversity and ultimately manage human/ elephant conflict.
5. Set up and support PPP (Project Implementation Team) at county and national level to make them work in a better way.
6. Support the operationalisation and capacity building of basin water resource committees (BNRC). We still have a gap. Building this will help us take a large step forward to improve.

**Bhutan:**

1. Try to replicate the WRUA and governance structure. It is more systematic in Kenya than in Bhutan.
2. Water scheme management model.
3. Data and information sharing. There is no systematic system in Bhutan.
4. Water resource allocation through various options. Water allocation processes in Bhutan are weak.
5. Networks and relationships established at the learning event.

**Burkina Faso: (some principal elements):**

1. Have learned about IWRM models in other countries. The Kenyan structure is different to BF and there are things we can take home. BF has organisations

at all levels that are operational with missions, but we still can learn lessons to improve their functions and functionality.

2. Reform IWEM thinking **to be more practical** to better engage stakeholders.
3. New things: We can learn more from Bhutan's integration of ecosystem services - to integrate ecosystems thinking into IWRM
4. WRUAs in Kenya: functions and mode of Governance. Special mention to women in ILOPEI area for their info on community integration in IWRM that we can take away.
5. Polluter pays – Kenya and Tanzania are good examples of organisational and institutional set up to use laws and regulations to be able to impose social responsibility (brief discussions that we can take forward).
6. Payment for water services in the agriculture sector: learning factors that would support this type of system. Still not operationally doing well on this in BF, despite the laws.
7. How to measure EWRM: Still not satisfied we know how to do this, what are the indicators etc? There has been a lot of conversation on data. This remains an area that needs more thinking and work. This expectation has still not been met. BF invites other countries to share experience and tools, platforms etc to measure this.
8. BF's initial expectation to receive lots of concrete examples from other countries has not quite been met. Would like to continue discussing this.

**Vietnam: this list is not comprehensive. The main things they to want to take away are:**

1. The WRUA model. Vietnam does not have this model. We only have sectoral specific groups. Will find out the steps to gradually introduce a similar model.
2. Data management gap. We need to review the current data management situation in Vietnam. It is still fragmented, in government departments, it is not free to the public.
3. To try to set up a more coherent centralised Government data system, populate, and then distribute to areas and in different formats for different people.
4. To promote the PPP model, now we know the weaknesses and strengths from the lessons learned.
5. Community led investment for small scale infrastructure. We will try to encourage more of this.

6. Try to establish different development plans for different water resource scenarios (e.g., what to do in different levels of scarcity). Comparing the problems of abundant resources in Vietnam compared to the resilience of people here in arid ASAL.

**Ethiopia: the main highlights:**

1. Both original expectations 100% met. We now understand the difference between IWRM and EWRM. We also better understand the data needed for EIWRM. The learning event exceeded expectation (Alex Bolding's data presentation was excellent).
2. Kenya was an excellent county for this visit offering a lot of learnings.

Things to take home:

1. Functional WRA in Kenya. There is a strong permitting system.
2. WRUA is a strong organisation. In Ethiopia associations are usually small sectoral, not one organisation for all. The Government has given due attention to this entity.
3. Water tariffs are the basis for equity, to ensure sensible use and minimise conflict.

**Mozambique: expectations:**

1. Established links to exchange knowledge and experience with new contacts
2. There is limited experience managing groundwater resources

Things to take home:

1. Engage negotiation mechanisms to improve trans-boundary WRM cooperation.
2. Improve data management to have evidence for negotiation.
3. Improve the PPP law to be clear on opportunities to recoup investments (feel that private sector wants to take too much after investing).
4. Investment in infrastructure should be phased.

**Niger: main lessons learned:**

1. We were very happy with WRUA experience (IWRM) in Niger we have associations, but they are not as equipped as the Kenyan counterparts. Important to apply this way to strengthen our associations' abilities. They lack the autonomy of the Kenyans (under public administration).
2. Need to improve data collection. Learned there are many models developed to do this. Niger is vast – we need to mobilise data, its power, its baseline evidence.

3. Experience shared during the field visit: we have a station for used water for agriculture, treatment that doesn't use much energy, but unfortunately, they break down and we need to apply the Kenyan experience.
4. Use of groundwater: we need to conduct advocacy (we wanted to know how to use groundwater for agriculture or other uses as we have challenges). Groundwater requires a lot of energy to use. We have created a new agency to manage groundwater so we need to be assured that the energy will always be there. We need to use solar energy (cheap). We need to think about storage once the energy to pump water has been secured.
5. Learned a new method of knowledge sharing: interaction not just PowerPoint. We were able to share our experiences and were very impressed with this new experience!!!:)

**Nepal: (an exceptional location, we learned so much)**

Lessons to take home:

1. In the Nepal Terai there is a lot of groundwater data that is neither used nor shared. We have more ideas now about how to use that data.
2. Nepal has a lot of homework to do. Nepal doesn't have IWRM set up, so there is a lot of preparation to do. We need to figure out where SNVs niche is, e.g., on 'data governance'
3. WRM can be well structure and financed. Thinking about how to apply that.
4. More data is not always the best thing, Pragmatism is key.
5. We still need to explore the SNV products and how EWRM fits in practically (e.g., in WASH products).

**Tanzania:**

1. Use of existing indigenous methods and knowledge on water management.
2. Adoption of water recycling and reuse e.g., Greenhouse Flower Farm.
3. Increased critical questioning of digital options and adopting pragmatic approach to data collection.
4. Use of common metered intake with provision for e-flow (environmental minimum flow).
5. Pilot the polluter pays principle.
6. Water storage practice during rainy season and during rationing.

# Closing remarks

His Excellency Deputy Governor of Laikipia County made the final closing remarks commenting on how special it is to share information on water resource management. Laikipia County is current working on its County Special Plans and now they can see how important it will be that the Plan has the maps, the GIS system, to enable data sharing.

Water Governance is important and the WRUA was applauded as a vital organisation, really working with and assisting the Government. The WRUA is a good thing for all of us.

Water storage is an important part of water resource management, and now the County can see that it also has to be managed in the right manner. Water reuse is another tool to close the water cycle and make the most of every drop of water that is available.

Laikipia County wants a system where no one should have to travel more than 4km for water for any purpose. More boreholes will play a key part in achieving this, but they also want to improve agriculture, move towards 'smart' agriculture such as automatic drip irrigation, to make better use of the water available.

PPP's are a pertinent point and it's important to the County that the model is strengthened to maximise investment and outcomes.

To conclude, the Governor reconfirmed the county's passion to improve water resources, as it is a major step to solve food security. Water security solves social and economic challenges.

# Appendix 1: List of participants

| Attendee: | | Country | Organisation |
|---|---|---|---|
| Jigme | Choden | Bhutan | SNV |
| Kencho | Wangdi | Bhutan | SNV |
| Dorji | Gyaltshen | Bhutan | Water Resources and Management Division, Department of Water |
| Tsheten | Dorji | Bhutan | Sustainable Livelihood Division, Royal Society for Protection of Nature (RSPN) |
| Cecile | Laborderie | Burkina Faso | SNV |
| Ousmane | Ibrahim | Burkina Faso | SNV |
| Jacques | Guigma | Burkina Faso | SNV |
| Coulibaly | Soumahila | Burkina Faso | SNV |
| Adama | Ilboudo | Burkina Faso | l'Agence de l'Eau du Nakanbé |
| Omar | Tall | Burkina Faso | Agence de l'Eau du Mouhoun |
| Ghislain | Kabore | Burkina Faso | World Water Net / Faso Koom |
| Mahteme | Tora | Ethiopia | SNV |
| Befekadu | Temesgen | Ethiopia | SNV |
| Afewerk | Ayele | Ethiopia | SNV |
| Michael Mehari | Moges | Ethiopia | Ministry of Water, Irrigation and Energy (MoWE) |
| Andre | De Jager | Kenya | SNV |
| Jeen | Kootstra | Kenya | SNV |
| James | Mwangi | Kenya | SNV |
| Vandana | Thottoli | Kenya | SNV |
| David | Wanyoike | Kenya | SNV |
| John | Kinyanjui | Kenya | WRA |
| Carolyne | Ouko | Kenya | CETRAD |
| Brian | Muthoka | Kenya | Natural Resources Management Committee (Water, Forestry , Mining, |

| Attendee: | | Country | Organisation |
|---|---|---|---|
| | | | Environment and Climate Change, Council of Governors) |
| Jackson | Wandera | Kenya | SNV |
| Joshua | Irungu | Kenya | |
| John | Kinyanjui | Kenya | WRA |
| Malesi | Shivaji | Kenya | KEWASNET |
| Boniface | Kiteme | Kenya | CETRAD |
| Jairus | Serede | Kenya | (Principal irrigation engineer) |
| Catharina | van Dorp | Mali | SNV |
| Alexander | Grumbley | Mozambique | SNV |
| Osorio | Macamo | Mozambique | SNV |
| Silvino | Timbane | Mozambique | National Directorate of Water Resources management (DNGRH) |
| Carlitos | Omar | Mozambique | Administracao Regional de Aguas do Norte |
| Nadira | Khawaja | Nepal | SNV |
| Issoufou | Sandao | Niger | PANGIRE Plan d'Action National de Gestion Intégrée des Ressources en Eau, Ministère de l'Hydraulique et de l'Assainissement |
| Maman | Issaka | Niger | Secrétariat Exécutif du CNEDD au Cabinet du Premier Ministre. |
| Labo | Magoudou | Niger | Directeur |
| Mamadou | Diallo | Niger | SNV |
| Antoinette | Kome | Netherlands | SNV |
| Walter | van Opzeeland | Netherlands | SNV |
| Sandra | Ryan | Netherlands | SNV |
| Gabrielle | Halcrow | Netherlands | SNV |
| Alexander | Bolding | Netherlands | WUR (Wageningen University and Research) |
| Olivier | Germain | Tanzania | SNV |
| Nasra | Daffa | Tanzania | Lake Rukwa Basin Water Board |

| Attendee: | | Country | Organisation |
|---|---|---|---|
| Yusufu | Mukhandy | Tanzania | Tanganyika District Council |
| Donald | Mpuya | Tanzania | SNV |
| Richard | Bruno | Tanzania | SNV |
| Thu Hang | Dinh | Vietnam | SNV |
| Thuy Anh | Nguyen | Vietnam | Department of Water Resources Management (DWRM) of the Ministry of Natural Resources and Environment (MONRE) |
| Marc | Perez Casas | Vietnam | SNV |
| Rajeev | Munankami | Zambia | SNV |

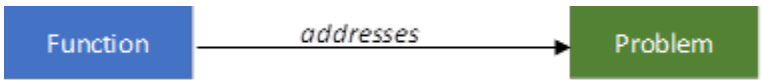
# Appendix 2: Summary Analysis of EGroup Discussions

## Topic 1: Integrated Water Resource Management structures and vulnerabilities

**What do you consider the most pressing problems IWRM should address in your country?**

You were all very clear that Integrated Water Resource Management problems, are multi-sectoral water management problems. IWRM is not a substitute for sectoral water policies and management but is complementary to it. Sectoral water use can be domestic, industrial, productive, hydropower, transport and water for eco-systems.

To organise our thinking, it is good to make a distinction between IWRM functions (what IWRM organisations do) and the problems of the country they aim to address. Functions are for example coordination or water allocation, whereas problems are for example pollution and the drying up of resources.




It is correct that some functions are not fulfilled well, and that itself becomes a barrier to solving the problem. This is discussed in the second question.

Though the type of problems are similar, not all countries have the same problems.

For Nepal, Abhaya Sigdel, Krishna Hari and Ram Prakash Singh share their concerns about the water quality (linked to pollution from cities, economic activity and agriculture), increasing ground water exploitation and reducing spring water. This is also mentioned by Droji Gyaltshen and Tsheten Dorji from Bhutan. Colleagues from both countries reflect upon the ongoing (sectoral) water development taking place without sufficient knowledge about the available water resources or current uses. Giri Khatri from Nepal emphasises there should be more coordination and planning around this investment, Tsheten would like to see better water budgeting as well as linkages between source and end-users. Raju Shrestha and Khrisna from Nepal mention the agreements that this country has with India. These agreements define to a large extent its water resource development possibilities.

Both Marina from Indonesia and Hang Dinh Thu from Vietnam explain that they live in water abundant countries, yet shortages exists in certain regions and seasons, as does flooding. The big issue in both countries is pollution due to industrial, agricultural and household waste disposal into water bodies.

In Mali, Burkina and Niger, the impact of climate change is very visible due to the southward decent of isohyets, gradual drying of surface water bodies and streams, as well as general lowering of ground water levels. This is explained by Issoufou Sandao from Niger. He shares that this is felt in rain-fed agriculture leading to chronic food insecurity every second year. Ousmane Ibrahim from Niger add to this the problems of floods, overexploitation of water resources and pollution. Rianne van Dorp shares that in Mali the issue of pollution is caused by artisanal gold miners, which in turn threatens the livelihoods of fisherman. She sees (un)fair allocation of water resources in terms of quantity and quality as the biggest problem. This is valid for large users (energy and irrigation) managed by the government, but also at small scale as water is allocated for farmers but not for pastoralists. Artisanal gold mining is also a cause of pollution in the Mouhoun Basin of Burkina, Omar Kodo Tall explains, but water pollution is also linked to population growth, industrial development and domestic and agricultural waste. Additionally, the rivers, water bodies and dams suffer from siltation and eutrophication, Adama Ilboudou explains about his Nakanbé Basin in Burkina. Cécile Laborderie and her colleagues from the water sector team echo these same issues.

For Mozambique, it is felt that the fact of being a downstream country defines – in part- its water constraints. Moreover, there are needs for greater water storage and better management of floods Alex Grumbley and Osorio Macambo. Carlitos Omar explains how the country suffers from regular extreme weather events (cyclones) and thus the need for better forecasting and response capacity.

Ethiopia and Kenya are both dry countries which face uncontrolled abstraction, degradation of water resources and pollution as Michael Mehari from Ethiopia explains. Afewerk Tekelemariam from Ethiopia further explains how currently a number of boreholes are drilled in towns for hotels, industries and different organisations without sufficient study or oversight. James Mwangi from Kenya explains that droughts have led to rivers running dry, that water resource regulation exists in the country, but that urban water demands and irrigation development keeps expanding. It seems that both countries still face challenges in operationalising IWRM but at the same time sectoral water development is growing at an accelerated pace. Invasive species like water hyacinth poses a threat to water bodies Mahteme Tora from Ethiopia explains.

It seems that water development does not have the same pace in Uganda, Zambia and Tanzania. Moffat Tembo from Zambia sees the limited water infrastructure development as a serious constraint for economic development.  This is also mentioned by John Twesige from Uganda who would like to see access to safe and clean drinking water realised, more investment in water storage infrastructure, climate-resilient water infrastructure, promoting water-efficient agricultural practices. Of course water conservation, combatting pollution and eco-system degradation also remains on the agenda.

All the above problems provide a large agenda of work for IWRM structures. You mentioned many different roles and functions, which could be summarised in these 7 functions for example:


Below are the types of problems you mentioned in terms of fulfilling those functions:

| Function | Challenges in fulfilling those functions |
|---|---|
| Coordination (horizontal and vertical) | Negotiation in transboundary water management (Nepal, Mozambique)<br>Coordination between ministries/ sectors (Nepal, Vietnam, Ethiopia)<br>Coordination national/local (Nepal)<br>Coordination between water resource organisations and local government (Kenya, Vietnam, Ethiopia) |

| Function | Challenges in fulfilling those functions |
|---|---|
| | Coordination with different users e.g. also pastoralists (Mali, Ethiopia, Kenya) |
| Data and information management | Lack of knowledge about water resources (Bhutan, Burkina, Niger, Ethiopia, Tanzania)<br>No water budgeting (Bhutan)<br>Improving data availability for better river flood modelling (Mozambique)<br>Comprehensive basin information management system (Ethiopia)<br>Information sharing (Ethiopia) |
| Allocation and oversight of uses | Allocation of water resources is uneven (Bhutan, Burkina, Mali, Nepal, Indonesia, Kenya)<br>Pollution control insufficient(all) |
| Planning and investment | Quality of planning (Nepal)<br>Quality and management of infrastructure (including maintenance e.g. siltation) (Burkina, Indonesia)<br>Water quality for use (Mali, Zambia)<br>Limited level of investment (Nepal, Zambia, Uganda, Tanzania)<br>Increased water storage (Mozambique, Ethiopia)<br>Coordination with sectoral investments (Ethiopia, Kenya) |
| Protection and conservation | Water resource quality preservation (Ethiopia, Mali, Niger, Zambia)<br>Eutrophication improvement measures (Burkina, Ethiopia)<br>Ecosystem restoration and sustainable land management (Uganda)<br>Counter deforestation and erosion (Indonesia) |
| Management of water related risks | Better flood control and better early warning (Mozambique)<br>Better disaster preparedness (Burkina, Nepal) |
| Communication and participation | Engagement with community structures (Burkina, Nepal)<br>Awareness and mindsets of users and general population (Nepal, Ethiopia, Vietnam, Tanzania)<br>Affordability and WTP (Nepal) |

**What do you see as the strengths and vulnerabilities of the IWRM structure in your country?**

All countries have legislation in place for IWRM and generally this is seen as comprehensive. An exception is Nepal. Ratan Budhathoki explains that in Nepal where after the Federalisation process it is still unclear how the three tiers of government (federal, provincial, and local) relate to water resource management. Abhaya also explains that there are no binding policies for the sectors and that the overarching commission for water sources (WECS) was

established in 1981 but it largely dysfunctional. Both Giri and Abhaya highlight the complicated role of donors in the relation between water resource management and sectoral investments. There does not seem to be consensus in the country about the need for better coordination around water resource management. As a response, the Finnish development cooperation developed water resource management planning at local government level ("WUMP"'s).

There are a number of other countries where the legal framework does exist, but the implementation on the ground is lacking. For example in Mali, Rianne explains that the focus is at the regional level, data is collected at regional levels (and not in hydrologically defined areas). Local governments naturally have a priority for WASH and there is limited multi-sectoral coordination. The national IWRM entity is a department within the Ministry.

Also in Ethiopia the legal set-up is clear, but only three out of 12 basin authorities exist Michael says. Mahteme adds that only one of these, Awash Basin Authority, is functional. Different contributions from Ethiopia explain that this is not just a lack of resources or capacity, but also linked to the role of the regions. Cross-regional coordination on water resource management is weak, there is no comprehensive basin planning or vision on water allocation. Most resources go to sector water development like WASH, irrigation, hydropower, and less to water resource monitoring or conservation. This also affects Ethiopia's ability to negotiate with neighbouring countries. Moreover, the connection to local organisation and people on the ground is limited, especially when it comes to women and youth.

Similarly, Donald Limbe from Tanzania explains that the legal framework is there but the IWRM structures at "meso level" and the IWRM investment is largely absent. Likewise in Vietnam and Indonesia the implementation on the ground is lagging.

In Bhutan, Zambia and Niger, more is happening on the ground. Moffat Tembo from Zambia explains that the country has a Water resource regulator (WARMA) and an IWRM resource centre. Yet there are still challenges in human and financial resources, monitoring capacities, commitment from the broader group of stakeholders and unclear transboundary relations. In Bhutan, water resource management does exist at the higher level, but it faces issues with high turnover of staff and limited resources. Also stakeholder participation is a challenge. In Niger, the challenge is different. There is political will and the transboundary basin organisations are functional. However, there still challenges in capacities, financial resources and implementation on the ground.

Kenya, Burkina and Mozambique could be seen as countries with more mature IWRM organisations but these still have large challenges. Burkina has 5 water

agencies in place, covering the whole country and approximately 1/3 of the local level organisations is functional. The water agencies still face difficulties in funding because the legislation of its revenue streams is incomplete Omar explains. Moreover, the water agencies face difficulty in ensuring compliance with regulations as a result of their large span of control and limited resources Adama adds. The context of Burkina is challenging with conflicts and movement of populations.  Also here we see that sectoral development happens in parallel.

The strength in Kenya is that WRM and Water Supply Services have been separated institutionally. Moreover, water resource management structures have been deconcentrated and stakeholder participation structures are strong in some areas of the country. Also in Kenya, IWRM structures face challenges in terms of financing, monitoring and coordination with local governments James Mwangi writes.

Mozambique has 3 water resource management authorities and these thus have an extremely large span of control. Nevertheless water resource management authorities have been equipped with staff and resources and are autonomous public institutions. They still face implementation challenges, for example in monitoring, groundwater in particular. Peter Letitre from Mozambique has highlighted the limited in terms of flood management and early warning functions.

With IWRM structures struggling to find their place and financial sustainability, there were no explicit contributions discussing the nature of the IWRM organisations such as:

- an organisation providing services to the population
- as a representative decision making entity
- as a vehicle to channel water investments to the areas

From the explanations given, it is emerging that many of you look at IWRM organisations as an organisation providing services to the population.

**In your opinion, whose needs and perspectives are best served by the current set-up of IWRM in your country? Whose are less served?**

Whereas several of you remark that the intention of IWRM policies and structures is to serve all and balance interests, this does not always happen in practice. As Moffat from Zambia writes, in theory all benefit, but in practice most attention goes to the areas with high economic potential and potential for foreign exchange.

In Nepal, as the water resource management is largely dysfunctional, it is mostly the better connected entities from government, NGO, research institutions, private sector, who have better access and benefit from investments. Traditional fisherman, boatsman, families at the riverside, uphill or remote populations have less opportunity to get their needs heard. Also the environment tends to get less attention.

Nepal has national pride infrastructure projects under the motto of "Prosperous Nepal, Happy Nepali''. These are large water supply, hydropower, irrigation, and multi-purpose projects. The intention is that these projects benefit the whole population through economic development.

Large water projects, like hydropower, should invest 1% in local social development or CSE, but due to local power dynamics this does not always benefit the ones most in need.

The focus of Mozambique is on large infrastructure development such as dams and flood protection. The idea is to set-up public private partnerships for investment and management. Legally the space for small holder farmers and household water supply is protected, because that is a free allocation. In practice this is not visible. There is also a challenge to achieve sustainable resettlement of people affected by floods.

In Ethiopia, investment in water supply, irrigation and the hydropower sector have priority. At the individual level, people who live upstream and near water sources are generally better off. Water for irrigation, especially the state-owned sugar cane and other large scale cash farms get priority. Small farmers have difficulty engaging in the decision making process. Ecological water resource needs are also less heard. A further trade-off in water resource management exists between investments for the large mass and for communities, e.g. a micro-dam benefits mostly the people around it.

In Kenya, urban and areas of high economic potential are prioritised. These are areas also have better catchment management as users are often better off and better educated. Areas with high poverty, high water scarcity tend to also have bad roads, low literacy, and long distances, which makes local water resource management harder.

In Indonesia, areas that receive less attention are the more remote islands and rural communities. Also the urban areas which are prone to flooding do not always receive sufficient priority.

In Niger, the focus is on WASH needs, after that mining and thirdly agriculture.

## Topic 2: What can Data do for Equality in Water Resource Management?

**Why are water resource data and information systems often unsustainable in practice?**

Within your different responses, you have touched upon different types of data which have different purpose and collection requirements. For example meteorological data and hydrological data typically need long time series and regular collection, such. Rainfall and streamflow vary between days, between months and between years. To say something about future availability, requires long term data. Data about assets (e.g. water infrastructures) and water service levels do not vary from day to day and have other requirements in terms of frequency and quality.

There is a general consensus that the lack of sustained operational budget for data collection, analysis, storage and use is one of the biggest structural problems. As Afewerk Tekelemariam from Ethiopia and Sandao Issoufou from Niger highlight the huge discrepancy between budgets for infrastructure development and budgets for data collection, which would provide the basis for responsible infrastructure development.

The lack of operational budget for data and information systems is exacerbated if these systems need sophisticated spare parts/ equipment or technical skills. Ghislain Kabore from Burkina calls such systems "Budgetivore systems" which is a fitting word. Bobby Russell from the Netherlands agrees with this issue and highlights that often the operational budgets for data systems are only for staff salaries and not for equipment, spare parts, travel or service contracts. And even if that budget is available, there are many cases where the administrative processes to release it are so cumbersome and slow that systems fail before they can be maintained. Bobby also mentions that a lack of understanding of the value of data collection sometimes means that staff is allocated to other (urgent) tasks.

There is also a generalised consensus about the damage of project centred data and information systems. Being set up in the context of a project often leads to financial, technical and content choices which are difficult to sustain Dorji Gyaltshen from Bhutan explains.

Every so many years, countries see a big joint effort between government and development partners to get data up to scratch. Usually this happens in the form of a large "inventory". Hang Dinh Thu from Vietnam mentions the National

Water Resource Inventory project, Merga Regassa refers to the Ethiopian National WASH Inventory (NWI) and on Burkina, Cécile Laborderie and her team share SNI National Water information system which started in 2001 but is not yet operational. Moreover, the World bank and the Government of Burkina recently launched a water resource inventory. Such initiatives do not automatically lead to a huge availability of data nor to comparable data because the data are not always shared. As there's quite some time between these inventory efforts, there can be a change in focus and/or technology. Merga shares the differences between the first inventory in 2011 and the current one.

Aside from the issues around operational budgets and project centred data system efforts, you all agree on the challenges in data sharing and coordination. There is a level of exhaustion that the data that do exist are scattered and not shared. Thuy Anh Nguyen from Vietnam mentions the lack of coordination and collaboration of stakeholders such as governments, water management organizations and local communities. David Wanyoike from Kenya talks about data sharing between state and county. From Ethiopia, Mahteme Tora mentions the lack of sharing between different ministries and Befekadu Kassahun gives the example of all the information collected by the students from Addis Ababa University which is not accessible.

However, there is no general consensus on the benefits of automating data collection. Arguments in favour of automation and digitalisation are that it significantly reduces the cost of data collection and the risk of human errors. Rianne van Dorp shares how in Mali the manual system was unreliable because there were no funds to send people to field, measurements were not always done at the same times of the day (irregular frequency) and input into the database was manual. As the database was not always functional, this also led to gaps in data (in addition to input errors). Rens Verstappen from the Netherland echoed these types of problems and added that from his experience, data collection staff would sometimes not go to the field but make up the data. Aashta Chhetri from Nepal shares how web-based data collection platforms led by the Ministry can increase data collection and make it accessible for all. She shares the experience of the N-WASH-MIS (management information systems) to which already 380 out of 753 municipalities in Nepal have entered data. Similar portals exist for other Ministries and topics.

Alex Grumbley and Osorio Macambo described how in Mozambique digitalisation has really increased accessibility and utilisation of data e.g. through What's App. However, they also shared how performance of this system declined because of projects ending which were providing IT support and other resources. This led then to a decline in trust in the data.

The critical or more cautious perspectives about automation and digitalisation came with a different view. Bobby explains how automated systems are perceived to be cheaper, but in fact often represent a shift in the type of costs. So the costs are no longer about field staff monitoring manually, but there are higher equipment costs as well as higher costs for specialised staff and maintenance. Rianne shares a story of successful data collection on a central platform and through a mobile App (Akvo) in Mali. The challenge came after the project, as there was no money to sustain the Akvo subscription to store the data.

Overall it seems important to be aware that automation and digitalisation does not solve all data challenges and is certainly not always low-cost. Several of you mentioned also that the technology will not solve issues around data sharing, commitment to manage data with quality nor general awareness.

Jackson Wandera from Kenya brings up the issue of accountability. He asks why there are never any consequences for mandated institutions if they fail to collect, analyse or use data. Why are there no consequences for unsubstantiated investment decisions he asks. Hang from Vietnam and Yemane Gebreegziabher from Ethiopia echo this. They say that too often managers and decision makers don't understand the value of data management. Michael Mehari from Ethiopia adds to this the disruptive impacts of frequent restructuring of mandated institutions on data systems, especially those that need long time series.

These impacts include loss of institutional memory, loss of staff, of data sharing protocols and even loss of existing data storage and analysis. He reflects that somehow meteorological data systems seem to be more stable, which of course raises the question why… Aside from institutional changes, Donald Limbe Mpuya from Tanzania mentions the frequent changes in technology, making long term consistent data collection, storage, analysis and use difficult.

Lita Istiyanti from Indonesia writes that for her the big underlying issue is the lack of value given to data, which results in a lack of commitment at political as well as professional level to ensure quality and consistency. She says that if people would understand that data is GOLD (i.e. the importance of data for good decisions), this would change the way of working. Ousmane Ibrahim from Niger also writes about the low demand for good data and low awareness. Omar Kodo Tall from Burkina explains how this low awareness even leads to vandalism by communities. Hang sees an even more fundamental problem. She says that people simply don't care even if their water of the river next to their house is polluted, because they still get safe drinking water. They don't care unless it

directly affects them. She shares a saying from Vietnam that "no one will cry for a common father", it could be understood that water do not belong to anyone' responsibly, so no one cares.

This all relates to the issue of use of data which Aastha rightly highlighted. Yentemma Lompo from Burkina writes about the non-standardisation of data and information systems. Mahteme, David and Ousmane say the same thing. It is difficult to harmonise and integrate data sets because there is a lack of standardisation. Sometimes there is even overlapping data collection! Afewerk states that typical quality issues are the temporal and spatial coverage of data and the inability to collect data over time. In particular groundwater data are neglected.

This raises the question that Alex Bolding brought up about which data we need for what, and whether we put our efforts in the right place. He calls this “salience of information”: are we focusing on the right data, the right scale right frequency, and do we even agree on what is right? Or is the focus of our data systems distorted due to project needs (Dorji), thinking about reporting rather than use (Hang) or enthusiasm about largely inappropriate technologies (Ghislain).

Jacques Guigma from Burkina takes the reflection a step further. He points out that sometimes data only represents part of reality, only certain water resources and/or certain users. It gives us a false sense of accuracy. Moreover, there are situations where data divert substantially from reality on the ground. For example if water abstraction licences are given based on data about available water resources, but there is no action on over abstraction within those licenses.

Alex Bolding shared two different ways of looking at data, which he calls the “hydrological approach” and the “pragmatic approach”. The hydrological approach would be to focus on building the perfect data and information for all possible needs. The pragmatic approach would be to focus on building that data systems from the perspective of the most urgent uses. This is of course easier said than done when there is no agreement about what the right data are and at the same time longer time series are needed to make decisions.

Nevertheless, there seems to be a general feeling that the  use and users of data should be more central in the design and implementation of data and information systems. Making data and information systems more fit-for-purpose would also mean not setting up too comprehensive systems that in practice will not delivery or be sustained.

**Have you seen examples of where data and information systems are positively or negatively affecting equality among users in water resource management ?**

Several of you find it difficult to answer this question, which is understandable because it is a complex question. In general, answers can be organised like this:

1. Inequality because of unequal access to data and information systems. This can happen either because data are not shared, or that not all users have the same ability and knowledge to access and use them.
2. Inequalities resulting from a gap or omission in the data and information system. This can either be a blind spot (something which was forgotten) during design or a gap which results in practice due to the realities of implementation.
3. More general positive and negative consequences for society resulting from the absence or lack of use of data and information systems.
4. Impacts of data and information systems on trust in society, overall governance, and polarisation

A number of good examples were given about how unequal access to data affects equality.

Both Omar Kodo and Mahteme explained how digital information provision may exclude communities who do not have the tools and technologies, and thereby aggravate existing inequalities in the management of water resources and prevent some users from having an equal voice in decision-making processes. Thu Nga Nguyen also explained how a lack of sharing affects research outcomes.

Ghislain shared an example how flood maps from Ouagadougou are only accessible to the services that produce them and large investors, but not to others like town halls, communities. Sujaya Rathi shared how in a water starved area of Bangalore, peri-urban stakeholders did not want greater sharing of data because of fear that real estate developers would come in and exclude them. There were also a number of examples of how a gap in the data and information system had implications for certain groups or topics.

David shared examples from Western Kenya lower Nzoia Irrigation project where the data and information system did not consider the water needs of neighbouring communities and small-scale farmers. Another example from the Kenyan coastal area, from Mombasa and Kilifi where water needs of informal settlements were not considered. This may be by omission or by design.

Sandao shared the example of the Water Resources Inventory (IRH) database which has been operational at national and regional level since 1991. Whereas this database has many important elements, it does not consider sanitation nor water needs of agriculture and mining. Perhaps these were less prominent at the time. This shows that the focus of data and information systems may need to be adjusted over time to avoid blind spots.

A gap which cannot be seen so easily, is mentioned by Alex Bolding. Recently many Apps are emerging to provide data on water flows or efficient water use. The Apps are very attractive and often provide good visualisations. However, they may not be as robust as they look. Questions are about the quality of the science, the type of assumptions that were done, the resolution, as well as the quality of data input into the App. All this is a black box, because commercial Apps do not share what's behind it and even if they would, it's not easy to understand.

Some data and information systems are intended as comprehensive and addressing all needs, but in practice their limited functionality ends up affecting some groups negatively. Michael shared the example of farmer managed small-scale irrigation systems and other small holder institution managed irrigation systems, where the measurement devices at the inlets of plots are not working. This limits information available for water allocation. In some places, farmers agree on their system of measuring water allocations through an agreed height of the water. Another example are water allocation plans in schemes with only a few measuring devices and only a few participating stakeholders. This leads to huge complaints.

Alex Bolding shares the example of government-led water allocation plan, which due to a lack of people and measuring capacity, is only able to implement water allocations to farmers on an annual basis and thus unable to live up to the expectation of fair allocation in times of scarcity.

In general, the lack of data, unreliable data, or failure to store and manage data can lead to potentially wrong decisions with bad societal outcomes. Afewerk shows how issues of quality of data and analysis, as well as differing methods, lead to different conclusions about the state of rivers (whether the flow is decreasing over time or not) as well as abstraction volumes, thereby undermining the basis for investment plans.

Yemane shares how a failure to store data about earlier borehole drilling in a community, can lead to drilling again in the same place. This is investment which doesn't go to other communities.  Omar shares a very positive examples

about the consultation framework for Water Management of Samendéni- Sourou in his Water Board (Mouhoun). In this space all users share their information about their needs and the availability of water. This has led to better balance of upstream/downstream needs, as well as better regulation of the Lery dam.

Other examples of how data and information systems have led to improved societal outcomes are from David about the water service delivery and billing in Nairobi, about the water levels in dams and reservoirs of Kerio Valley Development Authority in the Rift Valley and about the lake Tana Water Resource Users' association initiative to monitor abstraction and compliance. Also Yemane gave examples of better societal outcomes like better information about the causes of the rising water levels in Awassa lake through use of remote sensing and hydrometeorological data, and the functionality sensors in rural water supply systems leading to faster information about breakdowns.

Aside from societal outcomes, the way we manage and share data also influences the trust in collective decisions, what Alex Bolding called legitimacy of data. Lita explains how a lack of (good) data muddles the discussion among stakeholders. Rianne shared there is a reluctance to share data in her context, out of fear this may lead to polarisation of issues. Cécile and the team also write how a lack of transparency of information can lead to politicisation of decisions, political investment choices and potentially a source of conflict.

Alex Bolding, Alex Grumbley and Osorio gave positive examples of how good management contributed to greater trust. Alex Bolding shared the story about the Pangani River Committee which measures data allocations through a stick with carved water levels. This method is easily understood by everybody and has been agreed among all. Alex Grumbley and Osorio write how integrated data management has improved multi-sectoral coordination, capacity and awareness in the context of Mozambique.

Many of you talk about decentralised data collection, centralised data storage (and analysis) which can be accessed again by all decentralised data users. This can be a central data platform or portal where the whole country uploads and accesses information. Such platforms have been used especially for monitoring of assets and monitoring of service levels. Also for example to monitor ODF communities. For hydrological information it has been used less because of the frequency of hydrological data collection and the data quality requirements, but of course it is possible.  A pre-requisite would be to harmonise data standards as Jackson says.

Aastha and Rianne emphasise the usability of such a platform, whereas Omar highlights that usability also includes using the right language and form for grass roots actors. Ghislain goes a step further and states the need to build in accountability to end-users. Whereas Donald and Bobby emphasise open access as the way to go, not in the least to better develop demand side data tools.

Another area where there is largely consensus is around the need to increase awareness about the importance of water resource data, both with the general public and with decision makers. This is mentioned by David, Lita, Sandao, Mahteme and Ousmane among others. Befekadu speaks about data literacy of decision makers. Rianne would like to see this awareness result in greater political priority resulting in greater investment. There is probably a consensus there as well.

Another point is the need to strengthen mandated institutions for data and information management. This involves budget, staff with capacity and, as Michael emphasises, ensuring institutional stability. Dorji further emphasises the need to ensure motivation of staff. In the ideal world, the available budget is defined based on the requirements of the institution, in practice the available budget often defines the scope of the institution and not the other way around. Sandou therefore suggests "endogenous financing mechanisms" and my interpretation is that this is also about right sizing the institutions' scope for the budget that can be sustainably raised. Bobby adds that donor support for data and information systems should be programmatic and aligned. This should ensure continuity of equipment, software and systems, instead of continuous switching.

The centralised storage that you talk about varies in nature. Some people speak more about a portal or a data repository (Alex G and Osorio). Others envision a specialised data centre under the ministry (Yemane) or via universities (Merga).

In terms of decentralised collection there are different ideas as well. Contributions from Burkina focus on the role of municipalities in, others speak about regions, citizens or everybody collecting and uploading data.

Perhaps the amount of work involved in integrating and analysing data for the country should not be underestimated. The question is also whether this idea of a centralised system would apply for all water resource data. Omar raised the need to apply the subsidiarity principle ("manage at the lowest possible level") and this also seems to be what Alex B proposes.

There is also no full consensus about automation. A number of contributions put faith in greater automation and new apps such as Discharge (Michael), remote real time monitoring stations. Also Merga proposes more automation. Others

want to move away intentionally from this. Ghislain argues for simple technologies (and not trying to keep up with the technology rat race – my choice of words). Cecile and team argue for strengthening existing systems and not making new ones. Others advocate for a hybrid system: automated plus manual. Rianne suggests automated monitoring of water quantity measurements and manual monitoring of water quality, she says "less is more".

Bobby nicely outlines the benefits of hybrid systems in terms of:

- Useful to have a human back-up system when automated systems fail,
- When something happens, there's someone to call,
- Maybe a deterrent to vandalism and theft.

Citizens' science is also mentioned several times as something which could help to improve data and information systems. Generally this is from the perspective of mobilising local labour and not so much to include local perspectives more though that may also be the intention.

## Topic 3: Water resource development and investment

**In your view, which water resource development investments should be a priority in your country ? (and why?)**

You were all very clear that Investments in water resource development are needed in all countries represented, certainly when considering the potential offered by available water resources and the urgent need for various sectors in the country to increase access to water for various purposes (agricultural, industrial, urban, poverty alleviation, climate change adaptation & mitigation, economic growth). We asked you to reflect on the type of investments, scale, modalities of investment, sources of funding and objectives of the required investments – these are discussed briefly below. Perhaps because of the holistic and comprehensive nature IWRM driven policies, many of you touch on virtually all sectors and aspects of Water Resources Management when identifying needs. This is not surprising but does kind of avoid the question of your opinion of priorities.

In general contributors advocate investments to increase access to water by constructing water storage infrastructure, in the soil or in reservoirs, like dams. Many proposed investments seek to deal with the nexus between water security-energy-climate change resilience (including pollution control and catchment protection). At the local scale investments in rainwater harvesting, small scale water systems and boreholes are advocated, whereas at the bigger (urban conglomerate, regional/national/transboundary) scale investments in huge hydraulic infrastructure is advocated in water supply and sanitation, irrigation

and hydropower development (see for instance Bhutan, Ethiopia, Mozambique, Tanzania). Some contributors pay special attention to the need for waste water treatment and re-use facilities (e.g. Burkina, Ethiopia, Kenya, Vietnam).

If we look at the more 'software and governance oriented' of the seven functions of IWRM as depicted below, a number of observations are made.


Many of you emphasise the need to invest in capacity building for coordination and integrated governance of water resources, which is weak or lacking in Tanzania, Burkina and Niger. Water quality and quantity monitoring and data management is another function which requires explicit attention for investment/improvement, as mentioned for Burkina, Mali, Niger, and Zambia. Groundwater monitoring and water quality control systems are mentioned explicitly by some. Finally, Richard Bruno points at the need for funding water infrastructure maintenance and rehabilitation.

Several modalities for investment have been identified, ranging from private co-investment in Public Private Partnerships for urban water supply and in dams, National plans that spell out priorities for water development, or regional water funds that facilitate both local allocation and dispensing of water development funds. Many investments at local level are done on a project basis by NGOs or concern forms of self-investment by communities and CBOs.

Are these prioritised investment opportunities also the investments that are taking place in the country (why?)

Most contributors observe that investment priorities as defined in National WRM&D plans are being met with an MDG/SDG emphasis on WASH systems, Climate Change adaptation & mitigation, and productive water uses (Irrigation, Hydropower). What lacks, as stated for Kenya, but applicable for many more

countries, is sufficient private sector investment and ODA funding to meet the national targets.

- For Tanzania, Mpuya notes that a number of big dam projects are financed by the African Development bank, providing new impetus to infrastructure development, but funds for restoration of ecosystems and catchment protection are lacking. Richard Bruno notes that the Tanzanian government lacks the technical and institutional capacity to fulfil its water development targets.
- In Bhutan, the government and partners are upscaling its new concept of springshed management.
- In Nepal, the World Bank is funding many irrigation projects and a new WASH project that also seeks to promote IWRM.
- Michael Mehari notes for Ethiopia that a recent shift in focus is occurring from large dams to small dams: ODA support for construction of large dams in transboundary rivers is waning.
- For Vietnam it is noted that many mega cities have plans for establishing wastewater treatment plants but that financial support is slow in forthcoming.
- For Mozambique the National Water Resources Management plan (PNRH 2019) legally gazetted the construction of many needed large scale water infrastructure developments, but at present lacks the funds to go ahead with these.
- For Zambia, Agamemnon observes that despite the Zambia water sector investment programme's ambition to mobilise 5.75 billion USD for investment in rural communities, there is no mechanism to put these communities in the driving seat.
- For Niger, Ousmane observes that there is a bottom-up planning structure in place to meet the various sector priorities, but that virtually all investments are dedicated to new constructions rather than operation and maintenance of existing infrastructure.
- The Burkina team observes that despite existing rural water supply plans that pay respect to locally defined priorities, there is a difference between theory and practice. In practice there is a lack of knowledge of groundwater resources (which should be linked to economic water shortage) and a lack of financial resources, creating a dependency on external aid.
- Rianne observes for Mali that Investments in water quality and quantity data monitoring is often done on a project basis rather than funded by government in a systematic and sustainable manner. Also investments in the Office du Niger

irrigation scheme benefit private operators and companies rather than smallholder farmers meeting Mali's food security targets.

**Do you think there is a fair balance between who benefits and who bears the cost of current investments?**

Most contributors observe that the bulk of investments originates from government funding (raised from general taxes) and external funders, like the World Bank, African Development Bank, bilateral donors, through sovereign loan and gifts. By implication this means the taxpayers and global community bear the costs. It is observed for several countries (Kenya, Burkina, Mali) that external funders bear the bulk of the costs of public investments in water development. A possible exception is observed for Zambia, where Agamemnon observes that private sector investment with an aim to maximise returns seems to be the dominant strategy. This gives community organisations very little power to drive the process.

Many contributors observe that especially publicly guided investments tend to be to the benefit of the general population, guided by publicly determined investment priorities and regional plans. This is a fair principle. What lacks in some cases, like in Kenya, is that donor agencies do not align their efforts with the nationally established funding priorities. Both for Bhutan, Nepal, Niger, Tanzania and Vietnam it is observed that while government bears the brunt of the investment burden, little attention is paid to cost recovery efforts often at the expense of the upkeep of newly established water infrastructure.

Besides a lack of cost recovery, Richard Bruno observes for Tanzania, that costs to cover ecological and environmental damage caused by infrastructural projects are not factored in. Monique Zwiers points at the possibility to promote Nature Based solutions, which may be less damaging to the environment than conventional hardware projects.

Most contributors also observe imbalances in benefit distribution – these may be related to spread of benefits in different geographical regions, across different segments of society, or between populations upstream and downstream of the investment object. For instance in Ethiopia, where large hydropower dams cause displacement and loss of land for the upstream population, and the population directly downstream benefits through irrigation as well as the general population that is connected to the central electricity grid. In general in Ethiopia, Merga observes that there is no fair balance in benefits derived from water investment between the rural and the urban zones, pastoral areas and regions. In arid regions like Afar and Somali extreme water scarcity is experienced and not addressed sufficiently. Urbanisation deepens the disbalance: urban inhabitants tend to benefit more than rural populations. For Nepal, Ram Prakash observes

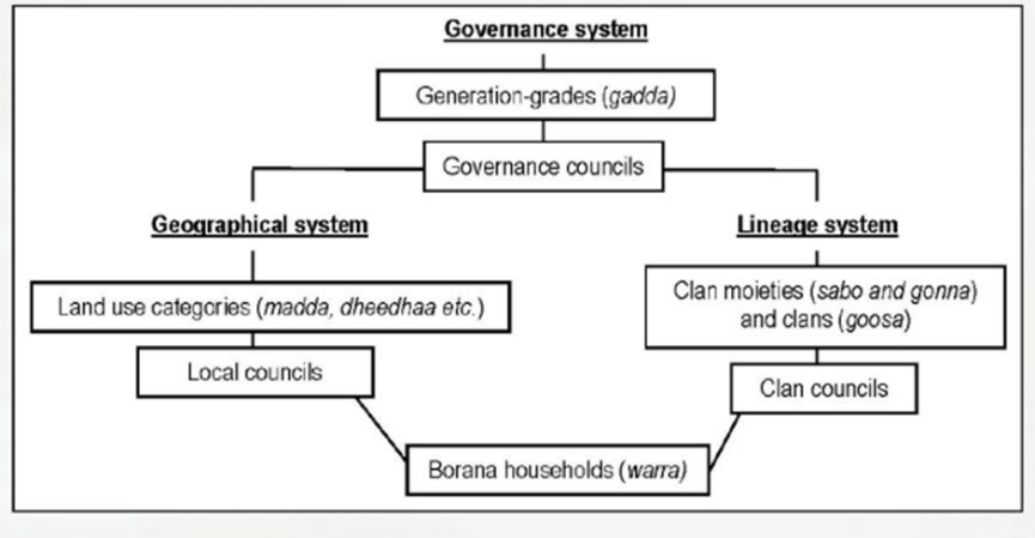
inequities especially suffered in marginal rural areas and among low-income households. These imbalances are also observed for Niger, where Ousmane adds the imbalance between agriculturalists and pastoralists, whereby the latter derive less benefits, a phenomenon also observed for Ethiopia. Often marginal groups in society bear proportionally higher costs to secure their water supply, both urban and rural, and yet suffer from unreliable and/or polluted sources.

For Burkina, Nepal and Mali it is also observed that there are no suitable transparency and accountability mechanisms in place to ensure a fair allocation and distribution of benefits from public funding. The Burkina Faso team notes that it is unclear how CFE funds are allocated and spent. Rianne for Mali observes that publicly directed investments in the office du Niger irrigation scheme tend to benefit private operators in the scheme rather than smallholder farmers. Ram Prakash points at the need for transparent procurement process, public disclosure of project information and mechanisms for holding accountable those responsible for managing investments, in Nepal. To ensure a fair balance, inclusive and meaningful participation in decision making on investments may help identify and prevent imbalances.

Many contributors point at the possibility to establish water funds at regional or district level that could either finance multi-stakeholder collaboration for such decision making processes or inclusive management and governance for taking care of newly created water infrastructure.

**Extra question: What do you see as a role for traditional water resource management arrangements or practices in your country?**

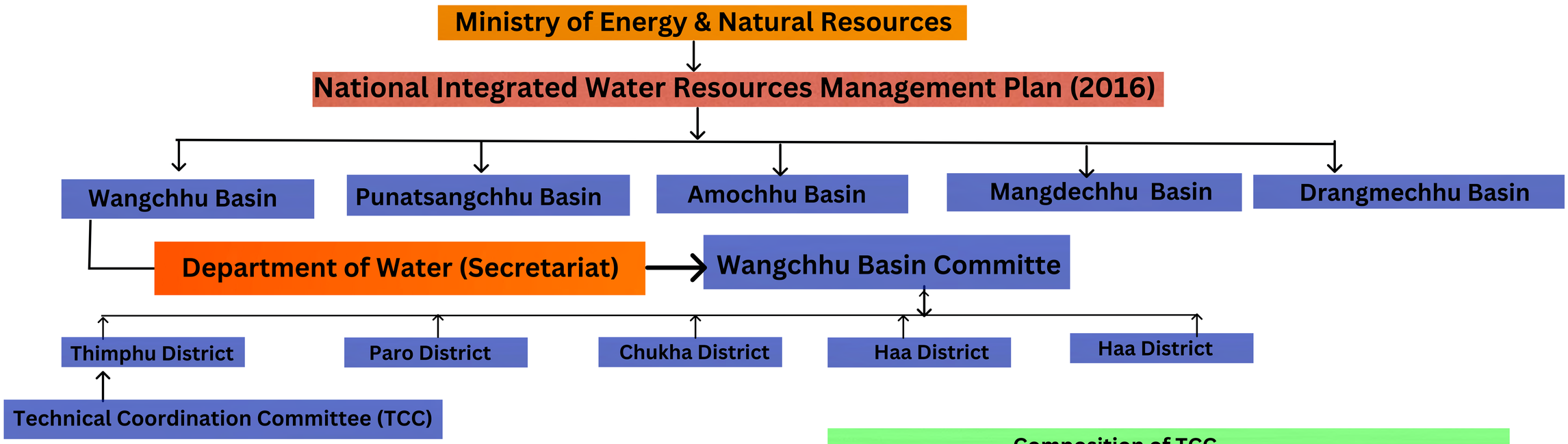
Not many contributions were made on this extra question. We suspect many of you missed out on it. Nevertheless, in Ethiopia, it was noted that these forms of traditional water resource management arrangements are practised by most arid-area populations. For example, Borana pastoralists, operating in a harsh arid environment have developed indigenous institutions for the administration of critical pastures and the governance of two primary water sources, namely wells and ponds. The emphasis is on a combination of maintenance of the source and equitable distribution of the available water to community members. Various local institutions combine a land and clan based system of governance as depicted in the figure below (after Sabine Homman 2004).




Yet these indigenous systems of water resource governance are under threat of (1) outsiders imposing their own solutions, and (2) local armed conflicts with neighbouring pastoralists.

# Appendix 3: Country poster presentations

# Bhutan: Organogram of Integrated Water Resource Management




**Composition of River Basin Committee (RBC)**

5 Dzongdas (District Admiistrators)

5 Dzongkhag Thrizin (Chairman of Elected Local Government)

**Composition of TCC**

5 District Planning Officers

5 District Engineers

5 District Environment Officers

**Roles & Responsibilities of RBC**

- Promote Community participation in water resources.
- Prepare a River Basin Management Plan
- Monitor & report in achieving sustainable management of water resources.
- Collect, manage & share data necessary to properly manage the basin in coordination
- Help resolve cross-sectoral & Dzongkhag trans-boundary issues relating to water resources.

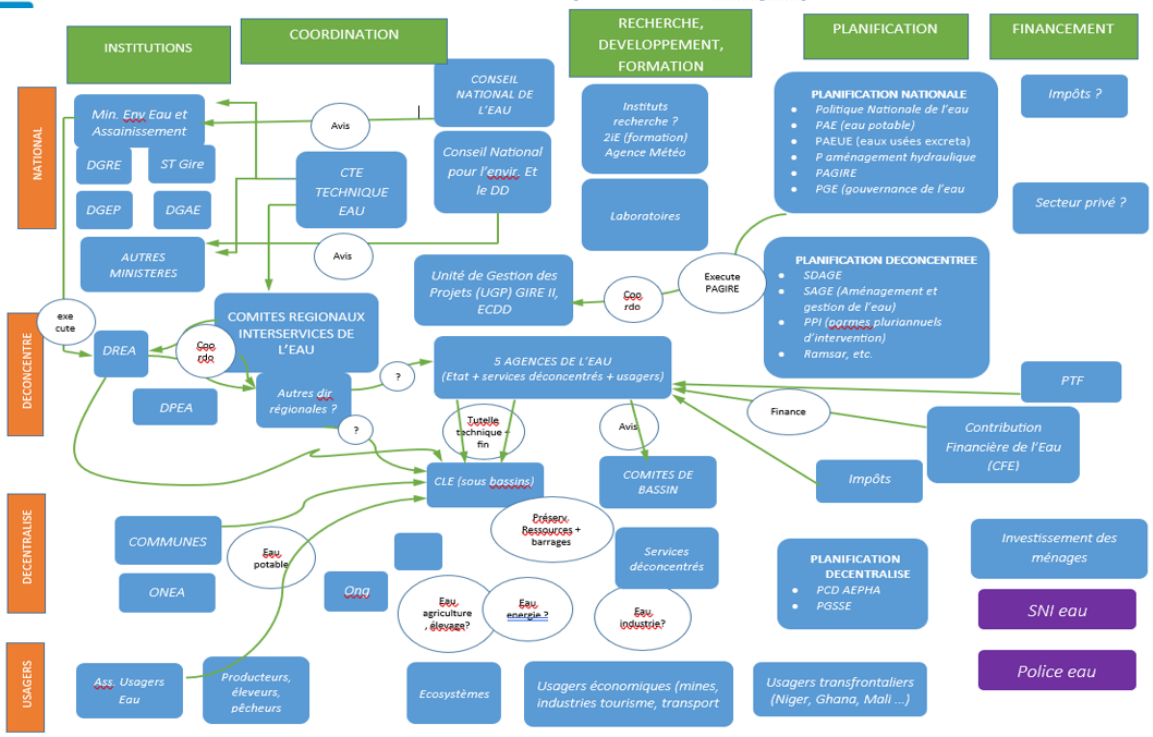
**Roles & Responsibilities of TCC**

- Assist in carrying out secretariat functions.
- Assist Chairperson of the River Basin Committee (RBC)
- Assist RBC in applying the water security performance indicator system for the Basin.
- Prepare & propose annual operational budget for RBC, seek approval & submit to DoW for timely inclusion in the annual budget proposal.
- Maintain & update water database & security Index for the basin, assist in water related report preparation.

**Roles & Responsibilities of DoW (Secretariat)**

- Shall prepare the meeting agenda for the basin committee.
- Gather information needed to brief the committee on issues to be tackled, document proceedings & consolidate the water plan for the basin.
- Provide technical support & act as a administrative support unit to the Basin Committee.

# LA GESTION INTEGREE DES RESSOURCES EN EAU AU BURKINA FASO (2023)
## IWRM in Burkina Faso (functional analysis)





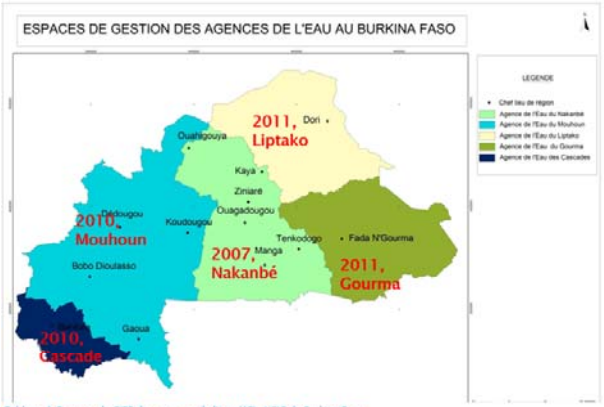




Tableau 4. Espaces de GIRE des agences de l'eau (AE) et CLE du Burkina Faso

| Espace d'AE | Surface | Nombre potentiel CLE | Nombre CLE en place* | A mettre en place | SDAGE |
|---|---|---|---|---|---|
| **Cascades** (2010) | 17.590 km² | 10 | 07 | 70 % | Oui |
| **Liptako** (2011) | 50.000 km² | 34 | 07 | 21 % | Non |
| **Gourma** (2011) | 49.600 km² | 37 | 05 | 14 % | Non |
| **Mouhoun** (2010) | 91.035 km²<br>5.440 km² | 48 | 18 | 38 % | Oui |
| **Nakanbé** (2007) | 60.335 km² | 40 | **25 - 13 | 33 % | En cours |
| ***Totaux*** | 274.000 km² | **169** | **50** | **30 %** | **02** |

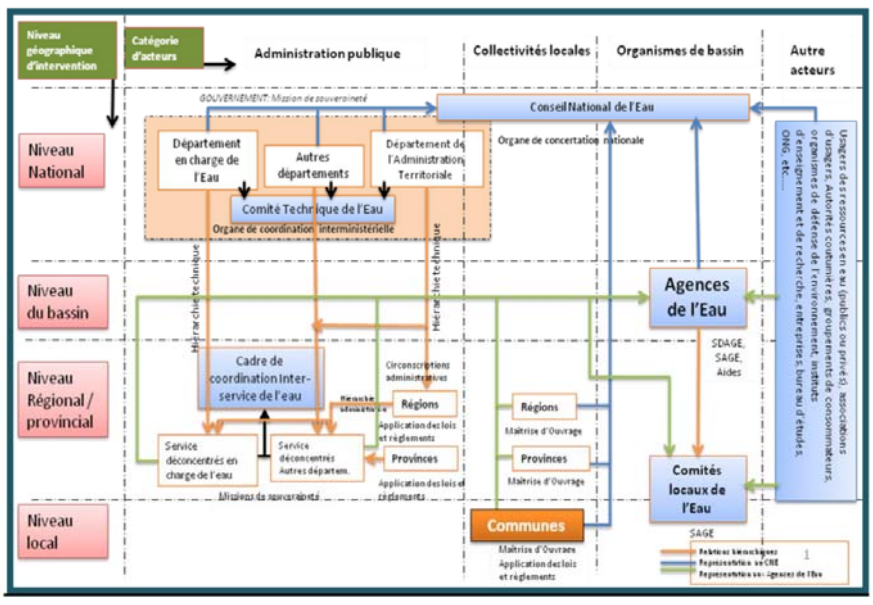
* Selon sources : World WaterNet (et aussi DANIDA, MEA) ; ** Avec des 'CLE Barrage'

| Caractéristiques | Agence de l'eau du Mouhoun |
|---|---|
| Superficie | 96 096 Km² |
| Nombre habitants | 5 500 000 en 2012<br>7 000 000 en 2020<br>8 000 000 en 2025s<br>(Projection INSD) |
| Ressources humaines | 32 |
| Ressources matérielles | 5 véhicules<br>Sonde piézométrique<br>5 GPS,<br>2 station automatiques (PCD)<br>3 Kit d'analyse de l'eau in situ |
| Budget(s) annuel(s) | 5 930 627 974 F CFA |
| Financement (CFE, PTF, transfert du Gouvernement) | CFE : 4 671 928 625 FCFA (79%)<br>PTF : 1 134 900 320 FCFA (19%)<br>Etat : 123 799 029 FCFA (2%) |
| Documents de planification : SDAGE ? | Disponible (Validé en 2015) |
| Connaissance de la ressource | Un réseau secondaire de suivi de la ressource en eau (Piézo, Source) |
| Connaissance des usagers et des besoins | Oui mais pas sur tout l'espace pour l'instant |
| Système de collecte des données et de suivi-évaluation | Oui disponible |
| Nombre de comités de Bassin et fonctionnement (rencontres, projets) | 1 Session par an tenue régulièrement |
| Nombre de conseil d'Administration (rencontres, projets) | 2 sessions ordinaire par an tenue régulièrement |
| Nombre de CLE et fonctionnement (périodicité des rencontres, projets) | Sur 17 CLE, 11 ont pu tenir les rencontres |

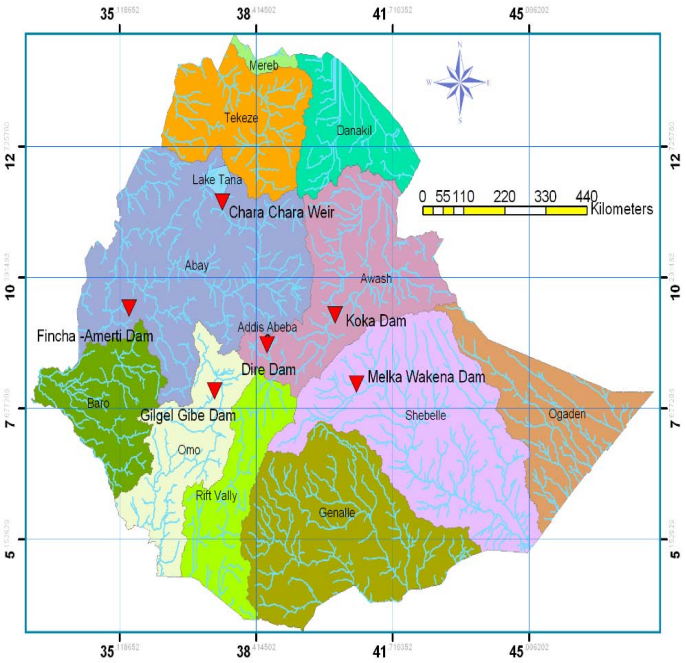
## SCHEMA DU CADRE INSTITUTIONNEL DE GESTION DES RESSOURCES EN EAU AU BURKINA FASO

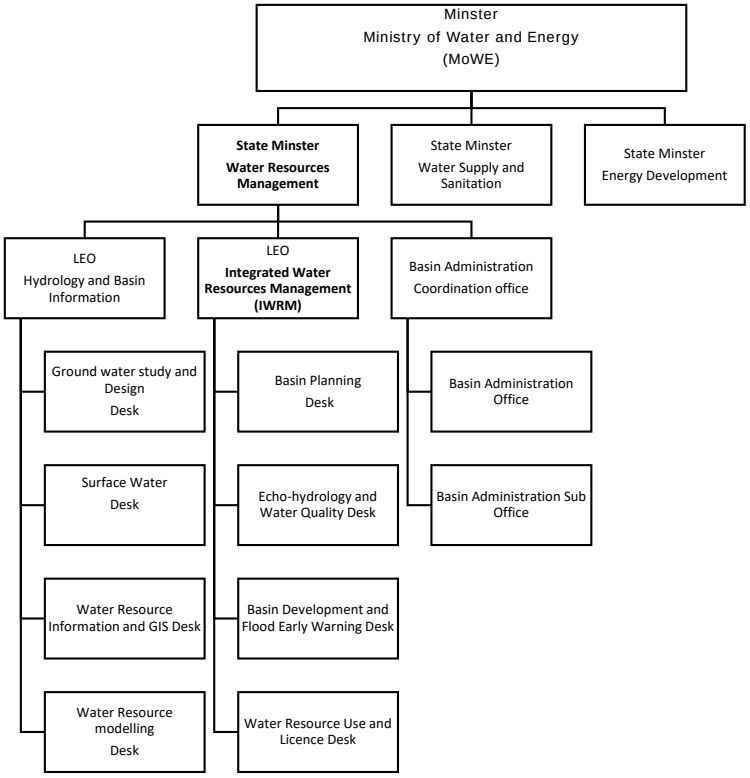
Source: guide des CLE (2010)

Institutional presentation



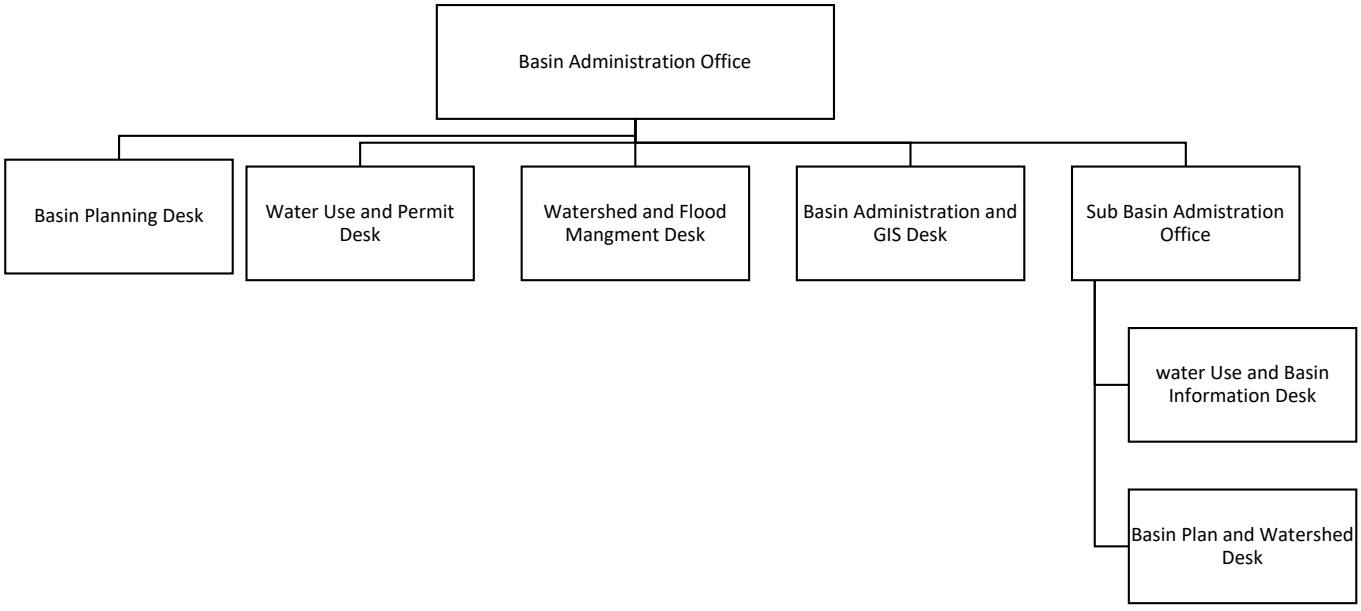
## Institutional Set-Up of IWRM _ National




## Institutional Set-Up of IWRM _ Basin

Ethiopia possesses 12 major river basins, which form four major drainage systems. Most of the rivers are transboundary.




**Public Commercial Farms** | **Private commercial Farms** | **Community owned Farms**

**WUAs**

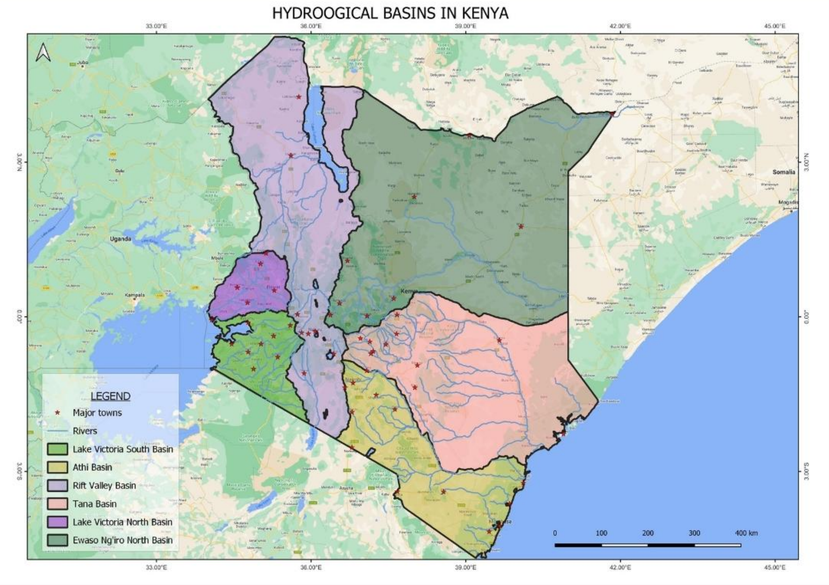
## IWRM AT A GLANCE

### Integrated vision

**Environmental sustainability** | **Social equity** | **Economic efficiency**

**Integrated tools for planning and decision making**

- Enabling environment
- Institutional framework
- Management instruments



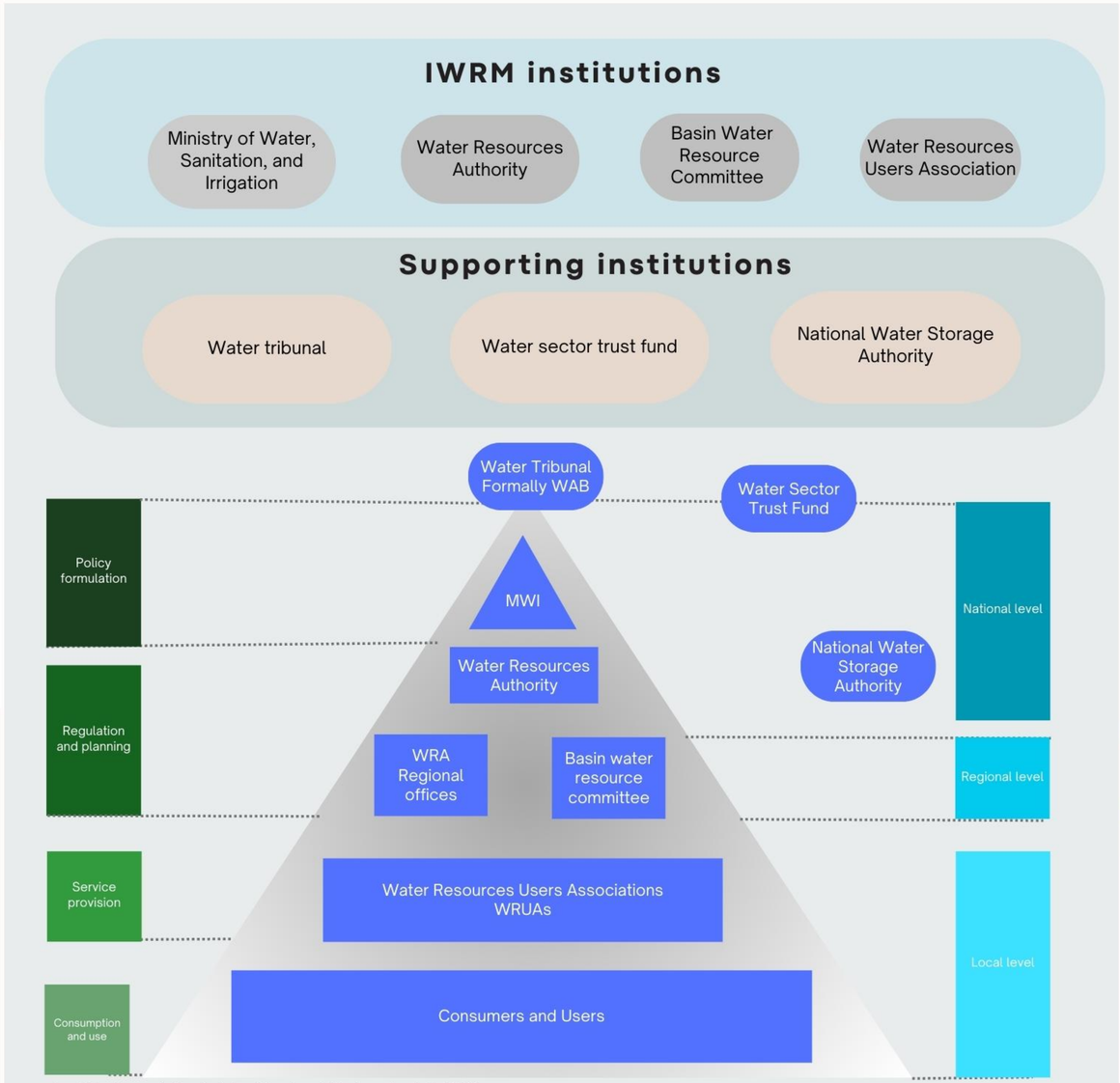

*Hydrological basins in Kenya*

## Water sector reforms

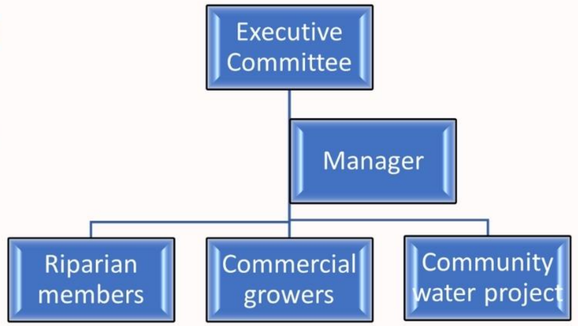
**2002**
- Water Act 2002
- WRM Rules 2007
- Adoption of dublin principles

**2010**
- Constitutiton of Kenya (CoK)2010.
- Devolved system of government.
- Devolution of function.

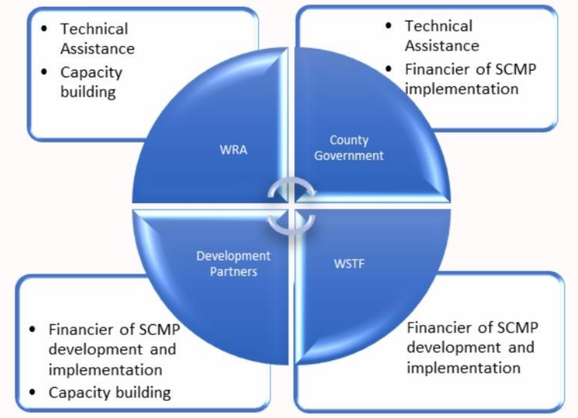
**2016**
- Alignment of Water Act 2002 to CoK 2010.
- WRM Rules 2021.




*Institutional Set -Up Under Water Act 2016*



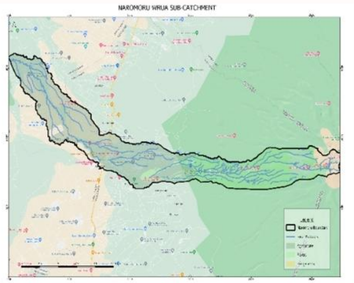

*Typical WRUA structure*




*Key WRUA Partners*

## Naromoru WRUA Case

| | | | |
|---|---|---|---|
| 188KM2 Size of the catchment | 65,000 No.of beneficiaries | 2 Full-time employees | KSHS IM Annual budget |
| 2007 Registered with A.G | 120 No.of members | 2002 Established | 200,000 € WRUA external funding |

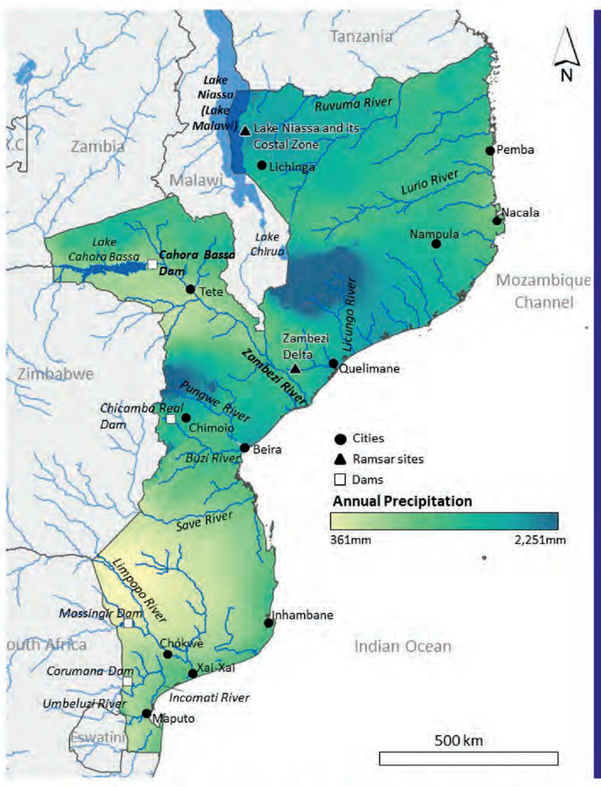



*Naro Moru WRUA Sub-Catchment*

6 CLEAN WATER AND SANITATION

SNV IMPACT THAT MATTERS

# MANAGEMENT OF WATER RESOURCES IN MOZAMBIQUE




## KEY MESSAGES

Mozambique has one of the lowest water storage capacities in Africa, with capacity to store just 0.5% of its average annual runoff.

Due to its geographic location, Mozambique is highly vulnerable to the negative impacts of climate change that are projected to translate into increases in the occurrence of extreme events such as floods, droughts and cyclones.

The operational and decentralized management of water resources has been restructured into three hydrographic regions: North, Central and South.

## DECENTRALIZED WATER RESOURCES ADMINISTRATION


### ARA - NORTE, IP

- Total area: 347,272 km2
- Basin Management Units: Licungo, Ligonha, Lúrio, Messalo and Rovuma plus small basins.

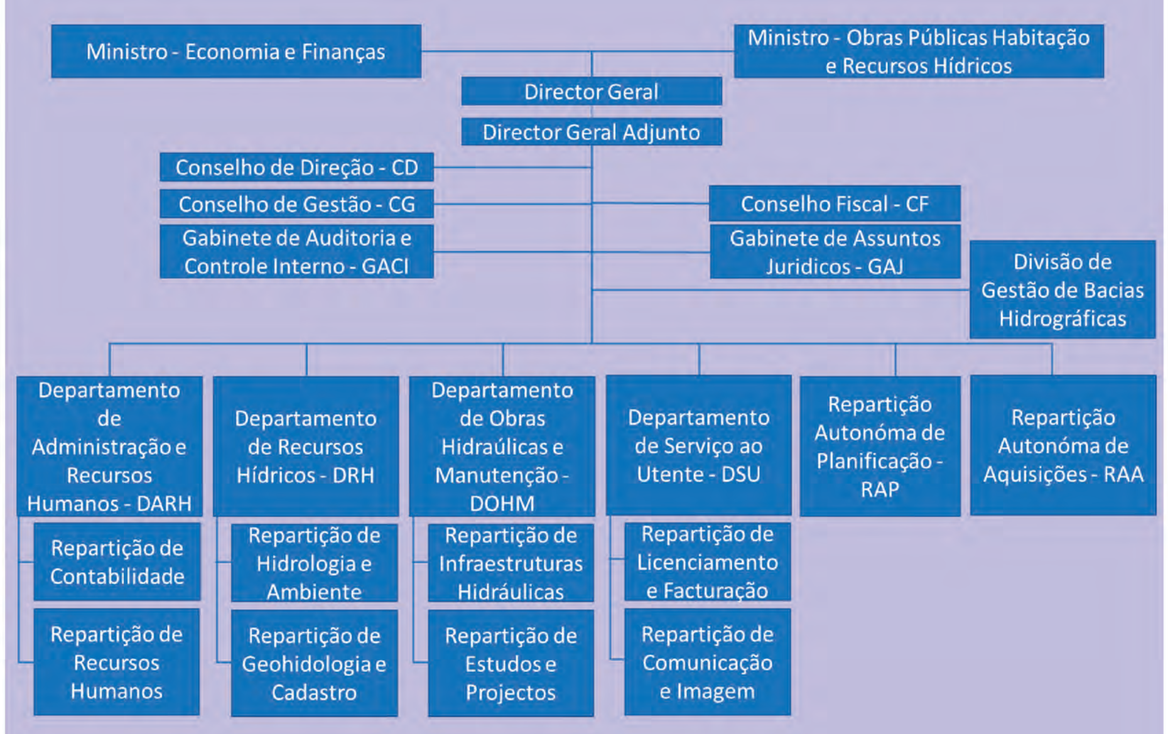
### ARA - CENTRO, IP

- Total area: 250,515km2
- Basin Management Units: Búzi, Púngoè and Zambeze.

### ARA - SUL, IP

- Total area: 181,764 km2
- Basin Management Units: Umbeluzi-Maputo, Incomati, Limpopo, Costeiras and Save.

### ARA STRUCTURE




ARA functions include the following:

- management of water resources,
- management of infrastructure,
- and technical oversight and services.

## NATIONAL DIRECTORATE OF WATER RESPOURCES MANAGEMENT (DNGRH)

The DNGRH is situated at the central level and reports to the Minister of Public Works, it coordinates with the ARAs but the ARAs do not report to the DNGRH.

Whereas the ARAs have operational and management responsibilities, the DNGRH has strategic planning responsibilities , investment/ development, national water resource policies, coordination with other ministries and inter-ministerial entities, as well as the national flood early warning system.

For these responsibilities DNGRH needs to coordinate within the sector nationally, outside of the sector and with international river authorities.

The many different needs, initiatives and projects at multiple levels make this is a demanding role.

## CHALLENGES FOR IWRM IN MOZAMBIQUE

Despite some progress made in establishing cooperation mechanisms with the neighboring countries with which Mozambique shares the Rovuma, Zambezi, Pungoe, Búzi, Save, Limpopo, Incomáti, Umbeluzi and Maputo river basins, this co-operation process is still incomplete and it needs consolidation.

The descentralized management, implementation of development projects and the financing of day-to-day water resource management activities is still dependent on government subsidies or funding from external cooperation partners due to the limited volume of revenues raised by the subsector and ARAs.

The existing capacity building (in terms of material and human resources) is still limited to adequately address the challenges of integrated water resources management both at central, regional and local levels.

ARA Norte,IP
ADMINISTRAÇÃO REGIONAL DE ÁGUAS DO NORTE


For more information contact:
*Director Carlito Omar, ARA Norte IP, comar@aranorteip.gov.mz*
*Osorio Macamo, SNV, omacamo@snv.org*
*Alex Grumbley, SNV, agrumbley@snv.org*


SNV

# Institutional Set-up of IWRM (Federal Government) NEPAL

## Constitutional Roles:

**Power of Delegation as per Constitution of Nepal (2015)**

**Federal**: International and Inter-provincial and mega electricity projects, mega irrigation projects, National and international ecology management, national parks, wildlife reserves and wetlands, national forest policy, carbon services, Standards and metrology

**Provincial**: Province level electricity, irrigation and drinking water supply services, navigation, Management of national forest, water resources and ecology within the province

**Concurrent Powers/Jurisdiction (Federal and Provincial):** Province border Rivers, waterways, environment protection, biodiversity, drinking water and Sanitation, Inter-provincial forest, wildlife, birds, mountains, national parks and water uses

**Local**: Irrigation, water supply, small hydropower, alternative energy, protection of watersheds and Wetlands

**Concurrent Powers/Jurisdiction (Federal, Provincial and Local Level):** Agriculture, Services like electricity, drinking water, irrigation. Forest, wildlife, birds, water use, environment, ecology, and biodiversity

## Ministry of Energy, Water Resources and Irrigation (MoEWRI)

*(HR- Over 70 in Ministry only, Annual Budget (2023/24 – NPR 87.45 Billion (Approx Euro 618.7 Million as per exchange rate 1 NPR=141.85 Euro, 5th June 2023)*

**At the moment no institution has the clear mandate for implementing IWRM in Nepal, However WEC shall function as lead agency for IWRM Implementation role at Federal level (IWRM, Action Plan, 2022).*

**Water and Energy Commission (WEC)**

**Chaired by H'ble Minister, MoWRI**

Sectoral Institutions

- Ministry of Forest and Environment (MoFE)
- Ministry of Federal Affairs and General Administration ( MoFAGA)
- Ministry of Water Supply (MoWS)
- Ministry of Agriculture and Livestock Development ( MoALD)
- Ministry of Law, Justice and Parliamentary Affairs ( MoLJPA)

- Department of Electricity Development (DoED)
- Department of Water Resources and Irrigation (DoWRI)
- Department of Hydrology and Meteorology (DoHM)

- Alternative Energy Promotion Centre (AEPC)
- Water Resource Research and Development Centre (WRRDC)
- Vidhyut Utpadan Company Limited (VUCL)
- Rastriya Prasaran Grid Company Limited (RRPGCL)
- Hydroelectricity Investment and Development Company limited (HIDCL)
- Nepal Electricity Authority (NEA)
- Ground Water Resources Development Board (GWRDB)

## Provincial Government

### Ministry of Physical Infrastructure Development/Ministry of Water Resources and Energy Development

* *Portfolio: Water Supply (25%), Irrigation (25%), Energy (25%), Water induced Disaster (10%) Sewerage/WasteWater is unclear and IWRM is on Project basis*

* *Figure in % is the resource allocation*

***Resources:**

In 2022/23, federal and provincial governments combined allocation for WASH Sector in Nepal was NPR 49.1 billion (346.2 Million Euro).

Out of the total budget:

- Federal Government Allocation: NPR 30.8 billion (217.2 Million Euro)
- Provincial Government Allocation: NPR 16.4 billion (115.6 Million Euro)
- Transfer: NPR 5.4 billion (38.06 Million Euro)
- Conditional: NPR 4.2 billion (29.6 Million Euro)
- Fiscal Equalization: NPR 0.8 billion (5.6 Million Euro)
- Special Grants: NPR 0.5 billion (3.5 Million Euro)
- Province's own source NPR 5.4 billion (38.06 Million Euro)
- Local Government Allocation (Conditional grant from federal transfer): NPR 1.9 billion (13.4 Million Euro)

**NPR 49.1 billion is 1 percent of the GDP (2021) and 2.3 percent of the combined federal and provincial budget.**

** Euro Conversion as per exchange rate 1 NPR=141.85 Euro, 5th June 2023*

## Local Government (Urban / Rural Municipality)

Registered at Local Government

Sections

- WASH Unit / Focal person
- Municipality WASH Coordination Committee (MWASHCC) — Chaired by Mayor/Chair
- Ward WASH Coordination Committee (WWASHCC) — Chaired by Ward Chair
- Other thematic units as per requirements of the municipality (e.g Irrigation, Agriculture etc.)

Forest Users Group (FUA)

Water and Sanitation Users Committee (WSUC)

SNV

** WSUC and FUA are recognised by the law as WSUC is required to register at the local level (Local Self Governance Act, 1999) and FUA is required to register at Division Forest Office (The Forest Act, 2019) but their formation is not mandatory.*

REPUBLIQUE DU NIGER
Ministère de l'Hydraulique et de l'Assainissement

# Plan d'Action National de Gestion Intégrée des Ressources en Eau–PANGIRE

## INTRODUCTION

Issu d'un processus participatif, le PANGIRE fait la synthèse des principaux résultats du bilan-diagnostic de l'état des lieux de la gestion des ressources en eau au Niger, dressé dans le cadre du rapport de capitalisation.

Il définit le cadre national de gestion des ressources en eau et sert d'outil opérationnel pour la mise en œuvre de la Politique nationale de l'eau. Il permet également de mieux intégrer les actions projetées de différentes stratégies et programmes sectoriels et intersectoriels de l'eau .


## Défis/enjeux de la Gestion Intégrée des Ressources en Eau

**Défi 1**: Connaissance et suivi des ressources en eau

**Défi 2**:Gestion des ressources en eau partagées des bassins transfrontaliers

**Défi 3**: Préservation et valorisation des ressources en eaux pour soutenir le développement socio-économique du pays et la satisfaction durable des besoins en eau

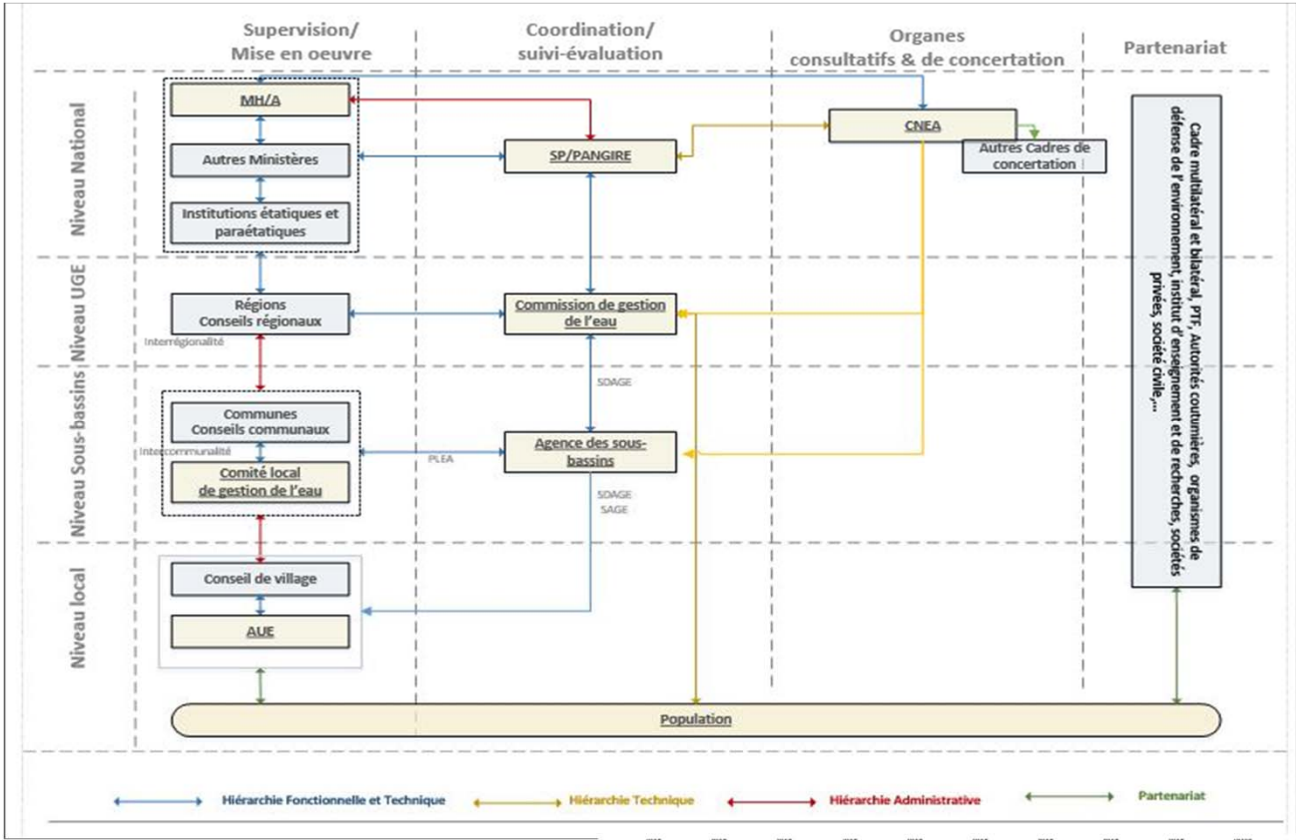
**Défi 6:** Préservation de l'environnement et développement de la résilience des écosystèmes et des populations aux effets des changements climatiques

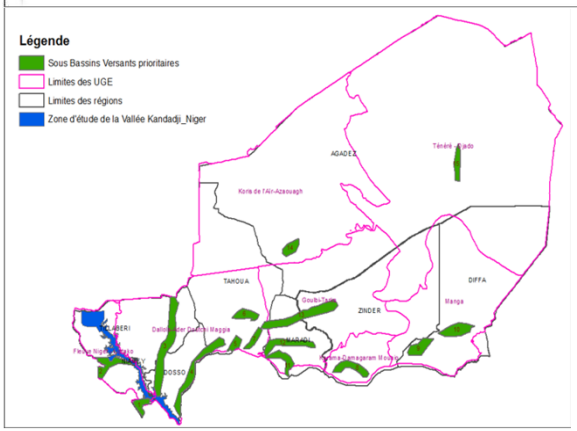
SOLUTIONS ENVISAGEABLES

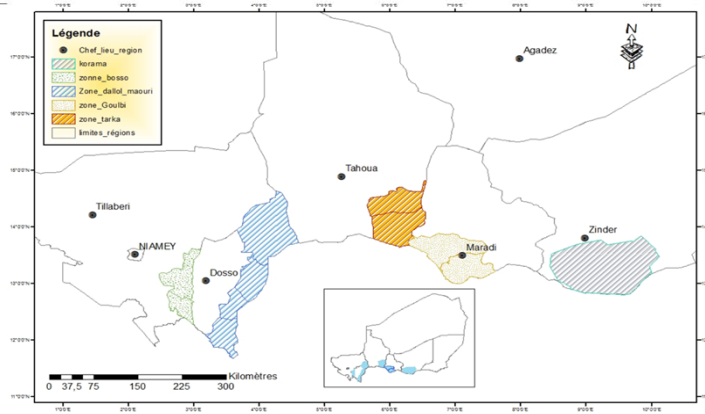
**Pour relever ces défis , les Parties Prenantes ont donné la priorité à des projets d'investissement à impact visible de mobilisation/valorisation des Ressources en Eau (RE) et des projets/mesures d'amélioration des connaissances et de suivi des RE, de bonne gouvernance et de renforcement des capacités des acteurs.**

**Défi 4**: Gestion des risques liés à l'eau

**Défi 5:** Gouvernance de l'eau



# TOWARDS EQUITABLE WATER RESOURCES MANAGEMENT
# UNITED REPUBLIC OF TANZANIA

## 1. Background

Tanzania's total renewable resource is 96,000 million m3/year (92,000 million m3/year from surface water; 30,000 million m3/yr. from ground water), 87% of which is sourced in the country. About 90% of the country's electricity is generated through hydropower, and whilst water resources are quite abundant, surface water availability varies markedly geographically, seasonally, and annually. Tanzania adopted a River Basin Management Approach for Integrated water resource management in 1980s when the country was divided into nine basins through Act No.10 of 1981. Since then it has undergone various changes.

### Tanzania Policy reforms

**Before 1990s-** Inadequate water supply and sanitation due to inadequate community and private sector participation in the implementation and management of the water utilities

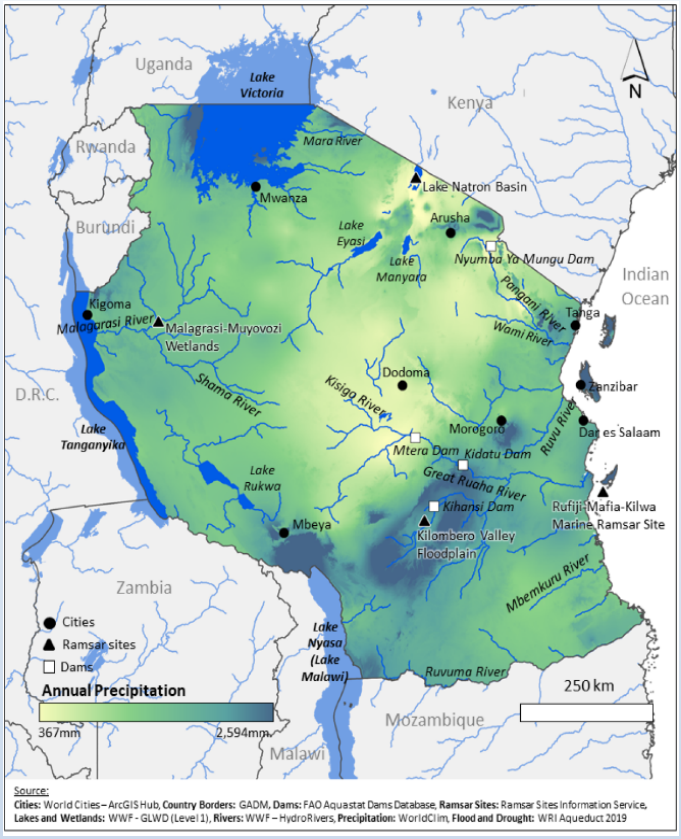
**1991-** 1st National Water Policy: emphasis Government implementer, service provider and regulator

**2002-** New National Water Policy: Introduced element of devolution and public and civil service reforms

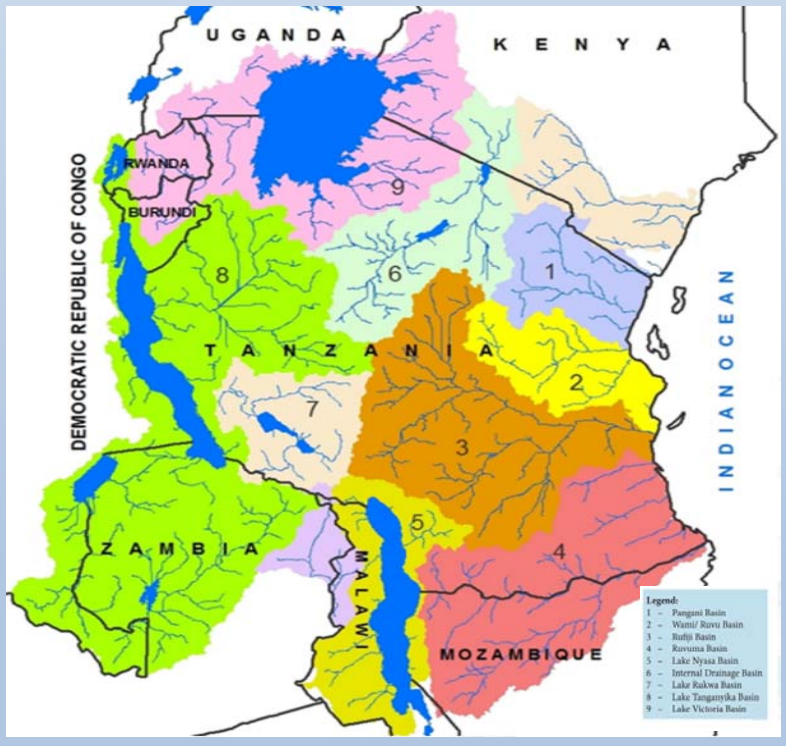
**2005-** National Water Sector Development Strategy: strategy to implement the policy

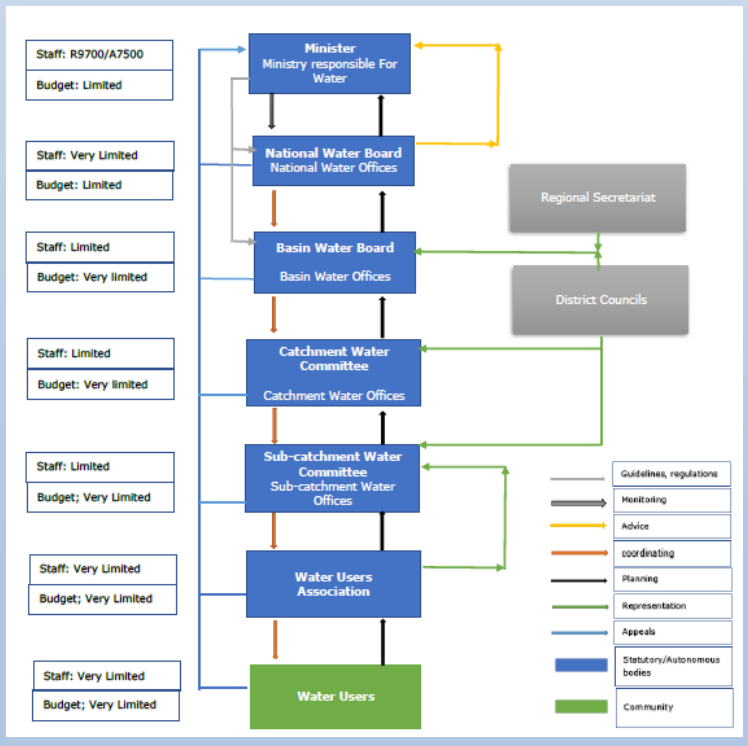
**2009-** Water Resources Management Act and Water Supply and Sanitation Act *

* A New Water Policy (2020) and Revised WRM Act (2022) are currently under approval




## 2. Institutional Setup




## 3. Functions and Roles of Main IWRM Actors

- ✓ **Ministry of Water**: overarching role of water resource coordination, policy/guideline formulation, and regulation.
- ✓ **National Water Board**: Advise the Ministry on multisectoral coordination of IWRM and planning
- ✓ **Basin Water Boards (BWBs)**: Develop basin WRM plans; approve/issue/revoke water use & discharge permits; monitor water availability/quality/uses; control water pollution, collect water user fees; mediate/resolve conflicts; establish WUAs
- ✓ **Catchment/Sub-Catchment Committees**: Coordinate integrated WRM; resolve water resource conflicts in the catchment/sub-catchment
- ✓ **Water User Associations (WUAs)**: Manage, distribute, and conserve water from sources jointly used by WUA members; resolve conflicts; collect user fees on behalf of BWBs; regulate traditional water abstraction
- ✓ **The Ward Development Committees:** Pass bylaws, enforce sanctions/penalties related to water allocation and quality
- ✓ **Village leaders**: Monitor water availability/quality through gauge reading; implement pollution prevention bylaws

# SNV

# INTEGRATED WATER RESOURCE MANAGEMENT IN VIET NAM

CENTRAL LEVEL

PROVINCIAL LEVEL

NATIONAL ASSEMBLY GOVERN & LEGISLATE

Law

CENTRAL GOVERNMENT

National Council on Water Resources

Approve Decrees, Water Resources Master Plan, River Basin Plans

MONRE - MINISTRY OF NATURAL RESOURCE AND ENVIRONMENT: Nationwide responsible for water resource management

DWRM - Department of Water Resource Management: advise MONRE on state water resource management and river basins nationwide

Coordination

MARD – Ministry of Agriculture and Rural Development: rural WASH, disaster

MOC - Ministry of Construction: urban drainage and water supply

Others: MoH, MoIT, MOF, MPI...

Chair of RBO

Chair

Report

RIVER BASIN ORGANISATIONS (RBO): VIETNAM NATIONAL MEKONG COMITTEE

RBO Standing office: day to day operation of RBO

Member

02 Sub-RBO: Cuu Long and Sesan Srepok

Vice-chair

Member

Member

Technical support and reporting

PROVINCIAL PEOPLE'S COUNCIL

PPC PROVINCIAL PEOPLE'S COMMITTEE

District People's Committee

Member

Approve Provincial Action Plan

DONRE - DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENT: provincial responsible for water resources management

Mineral and Water Resource Division: Advice DONRE on state management of water resources

Coordination

DARD: rural WASH, disaster

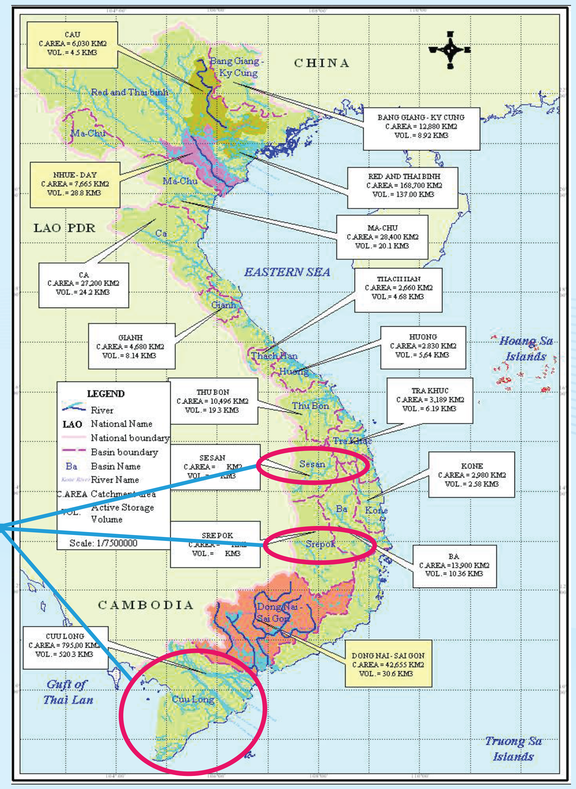
DOC: urban drainage and water supply

Others: DoH, DoIT, DoF, DPI,...

## 16 Major River Basins in Vietnam

**Vietnam National Mekong Committee (only active RBO since 2020):**

- **2023 budget:** 2.3 million USD *(source: Vietnam National Mekong Comittee)*
- **Members:** More than 40 people
- **President:** Vice Prime Minister
- **Standing Vice President:** Minister of MONRE
- **Other Vice-President:** Vice Misnister of MARD, MOFA and MPI
- **02 sub-RBO:** Cuu Long and Sesan Srepok river basin (MONRE Minister is the Chairperson of Sub-Comittee)




IMPACT THAT MATTERS