THE GLOBAL WATER BENCHMARKING STUDY FOR KENYA

Kenya Markets Trust (KMT) undertook this study to capture examples of good practice from countries that have successfully transformed aspects of their water sector. The purpose of the study is to provide a rich source of information for Kenyan water stakeholders to draw upon while developing strategies for strengthening Kenya’s water sector. The study will also inform KMT’s work and how we might bring new ideas and practical recommendations to our partnerships.

The study consists of 5 reports:

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<th>2 country case studies</th>
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<td>• Governance</td>
<td>• Colombia</td>
</tr>
<tr>
<td>• Water Service Delivery</td>
<td>• Republic of Korea</td>
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<tr>
<td>• Water Resources Management</td>
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ACKNOWLEDGEMENTS

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We thank Aguaconsult Ltd, the consultancy that undertook this study for KMT and the authors of this thematic report: Nathaniel Mason, Harold Lockwood and Dirk Schaefer.

Lastly, we wish to acknowledge Gatsby Africa, our partner and funder, who provided input into the study methodology and who continue to support our work in the water sector.
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<td>BWRCs</td>
<td>Basin Water Resources Committees (Kenya)</td>
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<td>CbIWRM</td>
<td>Catchment-based IWRM (Uganda)</td>
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<td>DWRM</td>
<td>Directorate of Water Resources Management; Ministry of Water and Environment (Uganda)</td>
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<tr>
<td>EA</td>
<td>Environment Agency (England)</td>
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<td>FOEN</td>
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<td>IWRM</td>
<td>Integrated Water Resources Management</td>
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<td>JUSH</td>
<td>Junta de Usuarios del Sector Hidráulico or Water User Boards (Peru)</td>
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<td>K-Water</td>
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<td>MoWSI</td>
<td>Ministry of Water, Sanitation and Irrigation (Kenya)</td>
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<td>MWE</td>
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<tr>
<td>NWB</td>
<td>Netherlands Water Board Bank (Netherlands)</td>
</tr>
<tr>
<td>ODA</td>
<td>Official Development Assistance</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<tr>
<td>PES</td>
<td>Payment for Ecosystem Services</td>
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<td>PPP</td>
<td>Public Private Partnership</td>
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<td>RWAs</td>
<td>Regional Water Authorities (Netherlands)</td>
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<td>SDGs</td>
<td>Sustainable Development Goals</td>
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<tr>
<td>WCWSS</td>
<td>Western Cape Water Supply System (South Africa)</td>
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<tr>
<td>WRM</td>
<td>Water Resources Management</td>
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<td>WRA</td>
<td>Water Resources Authority (Kenya)</td>
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<td>WRUAs</td>
<td>Water Resources Users Associations (Kenya)</td>
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CHAPTER 01

Introduction

As part of Kenya Market Trust’s (KMT) ongoing mission to catalyse the transformation of the Kenyan water sector, it has commissioned an international study of countries that have successfully transformed parts or aspects of their water sectors.

Examples of good-practice and lessons from what has worked elsewhere will, it is hoped, provide useful insights as to how Kenya can continue to strengthen its water sector.

**The Kenyan water sector**

Kenya has the ambition to achieve universal access to water for human consumption by 2030 (SDG 6), but water also plays a fundamental part in enabling broader economic growth and social development and is a critical input for agriculture, industry, and household productivity. Sustainable development and management of water resources is therefore vital for the country, the environment and society at large. Despite significant advances and investment in recent years, major challenges remain. With 412 m³/capita, Kenya ranks between Somalia and Syria in terms of available internal renewable water resources (World Bank, 2021). If the business-as-usual approach prevails, Kenyans are projected to face a 30% gap between demand and practically available water supply by 2030 (2030 WRG, 2015).

Sector reforms in the early 2000s led to the separation between water resources management (WRM) and water services, with these two components characterised by different governance arrangements. The Ministry of Water & Sanitation and Irrigation’s role is focused on policy formulation, coordination, financing, implementation and monitoring; leaving the detailed regulation to a number of parastatal bodies who report to their respective board of directors that represent different stakeholders’ interests. Under the 2016 Water Act, the devolved County governments in Kenya assumed central importance in terms of their statutory mandate for water management and implementation of the national government’s policies on water resources conservation. A key stakeholder is the Water Resources Authority (WRA), established under the Water Act 2016, which is mandated by the National government to safeguard the right to clean water by ensuring that there is proper regulation of the management and use of water resources.
Focus of the study

The purpose of the benchmarking study is to provide a rich source of information for Kenyan water stakeholders to draw upon while developing strategies for strengthening Kenya’s water sector. The study will also inform KMT’s work and how we might bring new ideas and practical recommendations to our partnerships and interventions.

Following consultation with key sector stakeholders in Kenya, it was agreed to focus on the two main sub-sectors of water resources management (the focus of this report) and water service delivery (which is the subject of a parallel report). For each of these two main reports, three thematic areas of interest have been identified as being of most relevance for Kenya in this benchmarking exercise:

- Firstly, **governance** arrangements, both in terms of national intra-sectoral and intra-ministerial relations and the vertical integration between central and decentralised levels of government, particularly relevant considering the strong devolution process in Kenya.
- Secondly, experiences with **investment planning** undertaken in other countries particularly where these have been systematic in nature and looked at long-term costs, as well as the commensurate measures to generate **financing**, both from public sources through repayable financing as well as attracting private investments.
- Lastly, examples where there have been successful **innovations** in the use of technologies and data production and – as importantly – the use of better data for improved decision making.

This report concerns the **water resources management** sub-sector and presents positive examples from different countries for each of the above three thematic areas, illustrating details of current arrangements and evidence of success that may provide insights for the Kenya sector. Under each of the above topics, more specific subtopics have been identified through interviews with key representatives of Government of Kenya institutions and development partners involved in WRM.

In consultation with Kenyan water stakeholders, 14 countries were selected for the benchmarking exercise, as outlined below.

In presenting good practice, the risks in transferring ‘policy best practice’ and ‘reform blueprints’ between different country contexts should be recognised (Andrews et al. 2017). In relation to water resources, these risks have been well demonstrated by the decade-long attempts to promote approaches such as integrated water resources management, with mixed success (Molle, 2008; Shah, 2016). Where relevant (and according to space limitations) this analysis also refers to key aspects of the context and process of historical transformation, insofar as it is important in allowing Kenyan stakeholders to judge what may be most applicable for them.

### Table 1: Shortlist of countries for investigation

<table>
<thead>
<tr>
<th>Income Classification Groupings (World Bank, 2020)</th>
<th>Long-list case study countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>High income (&gt; $12,535)</td>
<td>Israel, Japan, The Netherlands, Republic of Korea and Switzerland</td>
</tr>
<tr>
<td>Upper middle income ($4,046 - $12,535)</td>
<td>Colombia, Malaysia and South Africa</td>
</tr>
<tr>
<td>Lower-middle income ($1,036 - $4,045)</td>
<td>Cambodia, Senegal, Vietnam and Zambia</td>
</tr>
<tr>
<td>Low-income (&lt; $1,036)</td>
<td>Rwanda and Uganda</td>
</tr>
</tbody>
</table>

1 Drawn mainly from the shortlist in Table 1. Examples from the UK (England) and Peru are included where the 14 countries did not provide a sufficiently strong example.
While this paper is focused on external examples rather than the situation in Kenya, brief reference is made to key evidence on the WRM situation in the country, in order to situate examples. This includes the 2017 and 2020 assessment by Government of Kenya and sector stakeholders against SDG indicator 6.5.1 (implementation of integrated water resources management) (GoK, 2017; GoK, 2020).

The benchmarking study follows the conceptual framework for understanding and analysing a water sector developed for this study (see Annex 1). The findings with examples from countries for each of the three themes of governance and decentralisation, financing and investment planning, and data and innovation are presented in the following three chapters. The fifth and final chapter concludes with the most salient lessons for Kenya for strengthening water resources management.

A mother and son from Mt Elgon area enjoy access to clean and safe drinking water in their farm.

Source: Kenya Markets Trust (KMT)
It is now widely recognised that, as with inadequate water services, water resources management challenges are often primarily challenges of governance (UNDP, 2006; OECD, 2015). The need for improved governance around water resources arises in part from intrinsic features of the resource – including the multiplicity of values and interests, the non-alignment of hydrological and administrative boundaries, and the public good characteristics of water and associated market failures. Several pressures also increase the need for improved water governance to coordinate and adjudicate between users and policy objectives – including economic and population growth, ecological deterioration and climate change. Added to this, many countries have sought to decentralise water resource management functions to lower levels, with an intention to tailor policy and implementation to local contexts and enhance accountability and transparency. Alongside the pattern familiar from wider decentralisation – whereby responsibilities are often transferred without the required finance or powers to fulfil them – decentralisation of water resources management can multiply and aggravate challenges of coordination between hydrological and administrative boundaries (OECD, 2015).

Despite an array of good practice principles available (OECD, 2015; UNEP, 2018), it is important to recognise that water governance is an inherently political undertaking, and that emphasising technocratic functions such as coordination of water resource responsibilities and uses is unlikely to work, without sensitivity to power asymmetries, vested interests and other political economy considerations (Allen, 2003).

Kenya reports relatively good progress on the first two areas of indicator 6.5.1, ‘enabling environment’ and ‘institutions and participation’, which are most closely associated with governance for water resources management, both in relative (2017-2020) and absolute terms.

This chapter on governance and decentralisation contains 4 examples of global good-practice as summarised below.

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IT IS NOW WIDELY RECOGNISED THAT, WATER RESOURCES MANAGEMENT CHALLENGES ARE OFTEN PRIMARILY CHALLENGES OF GOVERNANCE

~ UNDP, 2006; OECD, 2015
Within WRM, three main variants of the challenge for balancing interests and coordinating actors across boundaries and between levels can be identified. Firstly, what can be called ‘hydro-territorial coordination’, between hydrological (i.e. basin or catchment) and administrative units. Secondly, ‘horizontal coordination’ between different sectors, stakeholders and institutions operating at the same ‘level’. Finally, there is the issue of ‘vertical coordination’, with ongoing decentralisation of WRM implementation functions to basin or catchment-based entities in many countries, as well as decentralisation of wider government functions.

Kenya faces variants of all these challenges, including hydro-territorial coordination between basin and county boundaries, horizontal coordination between the Ministry of Water, Sanitation and Irrigation (MoWSI) and Water Resources Authority (WRA) and other sectoral ministries, agencies and interests, and vertical coordination, including in relation to Basin Water Resources Committees and Water Resources User Associations (WRA, 2019; GoK, 2020).
Background

The Netherlands’ system of water governance is globally well-regarded (OECD, 2014). The current system can trace its roots to the 13th century and reflects the specific hydrological situation of the Netherlands as a delta country and the importance of flood protection (DWA, 2017). This, as well as broader economic and institutional strength in the Netherlands as compared to many countries, may limit the transferability of lessons. However, the Netherlands is well-advanced in devolving both general and hydrological governance, and has long experience addressing the different coordination challenges that arise – hydro-territorial, horizontal and vertical. As such, its responses, in particular the development of ‘Administrative Agreements’ with clear incentives for cooperation and coordination, provide a number of points for consideration.

The water management regime in The Netherlands has devolved water functions both to provincial and municipal governments, and to Regional Water Authorities (RWAs), decentralised government institutions specifically for water management functions. The RWAs have extensive enforcement powers and can make their own bye-laws (administrative decentralisation); their own boards, partially selected through popular elections (political decentralisation); and their own tax system, lending them considerable independence and capacity (fiscal decentralisation). While the RWAs are not organised strictly on a catchment basis, their boundaries primarily reflect hydrological factors and do not generally align with provincial or municipal boundaries. Despite decentralisation, there is still a considerable role for national government. The water companies make up the last key institutional group with a key water function, with responsibility for drinking water services.

In many respects, decentralisation to dedicated water management entities – across administrative, fiscal and political dimensions – can be regarded as good practice for water governance. By establishing strong and independent RWAs, alongside similarly powerful and autonomous provinces and municipalities that also have core WRM functions, there are inevitably areas where well-coordinated, joint working is required. The Netherlands case therefore illustrates some challenges that could arise along the path which Kenya and many other countries are also travelling, as they establish and strengthen basin-level WRM structures.

Response

To manage coordination challenges, the Netherlands has used three approaches that are extensively used elsewhere, as well as one that is more novel. Firstly, it has long relied on provisions in successive water-related laws, policies and plans, which separate out roles and responsibilities. Table 2 provides a summary. Secondly, checks and balances are provided within each institution (e.g. RWA board elections) and between them (e.g. provincial and national supervision of RWAs). And thirdly, it has established dedicated dialogue platforms, for example the Water Steering Group comprising all five of the groupings in Table 2 below, for regular discussions of water policy, chaired by Minister of Infrastructure and Environment.

While the three mechanisms have been reasonably effective, particular coordination pinch-points have been identified and resolved through additional ‘administrative agreements’. The key development came in 2003 when a National Administrative Agreement on Water was put in place by central government.

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2 See DWA (2017) for an explanation of the election system. Popular elections for seats on the RWA governing boards are held for the seats allocated to local residents, which always represent the majority of seats. Seats for other interest categories (owners of open land, especially farmers; owners of natural areas; and businesses) are made by appointment by respective class organisations.

3 Reflecting extensive hydrological engineering: “The boundaries of the regional water authorities are... primarily determined by factors relating to water management: catchment and sub-catchment basins, dyke rings, pumping and storage areas, etc.” (RWAs, 2017, p.12).
provinces, RWAs and municipalities\(^4\). The 2003 Administrative Agreement set a clear norm for joint working and collaboration (Havekes et al. 2016). A revised version in 2011 set quantitative targets for economic efficiency gains, to reach EUR 750 million p.a. by 2020, representing over 10% of total sector costs (DWA, 2017). Other, more nebulous goals include increased transparency, effectiveness and reduced vulnerability. It is the close association of better coordination with cost savings, which has arguably played the largest role in galvanising action. Financial autonomy means it is directly in the interests of the decentralised units to achieve these savings. Under the 2011 Administrative Agreement, various more specific sub-agreements have been made on specific coordination challenges.

**Table 2: Allocation of key WRM functions in the Netherlands (DWA, 2017)**

<table>
<thead>
<tr>
<th>National government</th>
<th>Regional Water Authority</th>
<th>Pro vincial government</th>
<th>Municipalities</th>
<th>Water companies(^5)</th>
<th>Key policy and legal instruments specifying roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood protection</td>
<td>Coast and dams protecting estuaries in west Netherlands</td>
<td>Dykes, dunes, storage embankments</td>
<td></td>
<td></td>
<td>Delta Programme sets framework for implementation up to 2050</td>
</tr>
<tr>
<td>Surface water management – quantity</td>
<td>Main water resource system</td>
<td>Water bodies of regional and local interest</td>
<td></td>
<td></td>
<td>Water Regulation defines management boundaries</td>
</tr>
<tr>
<td>Surface water management – quality</td>
<td>Main water resource system; some bathing waters</td>
<td>Water bodies of regional and local interest; construct and operate wastewater infrastructure; most bathing waters</td>
<td>Designate locations for bathing water</td>
<td>Construction, management and maintenance of sewerage</td>
<td>Water Act and RWA Act; Environmental Protection Act for municipalities’ sewerage responsibilities</td>
</tr>
<tr>
<td>Groundwater management</td>
<td>Operational groundwater management</td>
<td>Permitting some uses e.g. industrial and drinking; can introduce a groundwater tax; groundwater protection</td>
<td></td>
<td>Urban groundwater and rainwater runoff; groundwater protection</td>
<td>Water Act; Soil Protection Act</td>
</tr>
<tr>
<td>Drinking water services</td>
<td></td>
<td></td>
<td></td>
<td>Manage water supply system</td>
<td>Drinking water Act</td>
</tr>
</tbody>
</table>

**Impacts and current challenges**

The overarching 2011 Administrative Agreement over-achieved against the EUR 750 million target, with savings of EUR 1.25 billion by 2019. Sub-agreements pertaining to coordination of sewerage (municipalities) and wastewater treatment (RWAs) and joint administration and collection of RWA and municipal taxes, have reportedly been most effective in leveraging financial savings.

Some areas remain challenging, however, especially those outside the direct power of the institutions listed in Table 2. These include diffuse pollution from agriculture. The Netherlands is a leading global exporter of food, and the associated agricultural economy is politically important. The government recognises that there is a tension between the objectives of the Ministry of Agriculture, Nature and Food Quality, which is reluctant to impose stricter norms on nutrient emissions, and the Ministry of Infrastructure and Water Management, which is attempting to meet water quality targets under European Union Directives (GoN, 2020). This illustrates that, even in the most economically advanced contexts, coordination challenges persist, and that these challenges often have political economy factors underlying them, making it crucial to further align political, economic and other incentives.

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\(^4\) The ‘administrative agreement’ instrument had been used previously for specific policy tasks e.g. phosphate removal.

\(^5\) Mostly private companies with shares publicly owned.
Incentivising devolved administrations to coordinate across basins

Background

In contrast to The Netherlands, Switzerland has no separate decentralised structures dedicated to water resources management, although wider government is highly devolved. The autonomy of the 26 cantons, which make up the Swiss federation, has been a defining feature for centuries. Sub-national cantons and communes (municipalities) are responsible for substantive policy, planning and implementation aspects of WRM. There is a relatively simple three-layer institutional framework, with well-defined responsibilities and relationships between the different vertical layers. However, because of the cantons’ autonomy, the approach to WRM is highly variable between them, creating some issues of horizontal coordination – as well as ‘hydro-territorial’ coordination given limited alignment of catchment and cantonal boundaries (Miranda and Reynard, 2020; Mauch and Reynard 2002).

Table 3: Main institutions and functions for WRM in Switzerland (Miranda and Reynard, 2020)

<table>
<thead>
<tr>
<th>Level</th>
<th>Institution</th>
<th>Functions for WRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central government</td>
<td>Federal Office for the Environment</td>
<td>Principles concerning water uses, protection and prevention against damaging water actions.</td>
</tr>
<tr>
<td>Canton</td>
<td>Varies by canton</td>
<td>Control and monitoring role. Responsible for water protection, water allocation, and river management.</td>
</tr>
<tr>
<td>Municipality</td>
<td>Varies by canton</td>
<td>In most cantons, the municipality is responsible for local spatial planning and water supply and sewage (almost entirely public all over Switzerland).</td>
</tr>
</tbody>
</table>

Response

Several laws have been put in place at the federal level with the aim of encouraging integration on water issues. Notably, in 1991 with the Federal Law on the Protection of Waters, which brought in quantitative protection such as minimum flow regulations and signalled a shift to view water bodies as ecosystems and as having landscape functions (Mauch and Reynard, 2002). However, there is no overarching federal water law (Miranda and Reynard, 2020), nor is water an area where the federal level can undertake master-planning. To the extent that canton governments generally have high capacity in terms of financial and human resources, their varied approach to WRM is not always a problem. However, given the political need to respect canton independence, the Federal Office for the Environment (FOEN) has sought to utilise a range of soft guidance and other instruments to encourage a more consistent, basin-oriented and integrative approach to water resources management at lower levels.

- Policy guidance: For example, in 2011, FOEN issued a framing set of principles for watershed-based, integrated water management, to serve “as a policy framework for the water management stakeholders in cantons, regions and communes” (FOEN, 2011, p.2).
- Monitoring: The FOEN has responsibilities for assuring water body quality based on a number of monitoring programmes including rivers (NADUF) and surface water (NADUF; FOEN, 2021).
- Instruments: while the FOEN has limited formal powers, it can use a range of incentives and sanctions to encourage cantons to take action on WRM issues, including federal subsidies, regulations on pollution, and some planning requirements, for example for discharge plans at different levels (Mauch and Reynard, 2002). Certain laws can also be used to encourage regions to specify their plans on water related matters. For example, the Ordinance on the Safeguarding of

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6 Switzerland has officially been a federation since 1848 but official documents still refer to it as a confederation (Miranda and Reynard, 2020).
the Drinking Water Supply in Emergencies requires the development of explicit strategies to ensure safe drinking water by subnational entities, for example at times of drought (Müller and Beer, 2013).

**Impact and current challenges**

The Swiss approach stands out as an example of how national authorities can encourage coordination through indirect and non-binding means, where there is strong devolution and local levels are wary of interference. In Switzerland, the perception that there is no water crisis requiring national intervention, as well as the abundance of existing participation opportunities for citizens (e.g. referenda), may further increase political resistance towards top-down, archetypal models of WRM that push coordination and integration (Miranda and Reynard, 2020). The resulting diversity of approaches at cantonal and commune levels does leave gaps in co-ordination, however, and there are arguments that this will become a more pressing challenge as climate change alters flow and storage regimes (Kellner et al. 2019).

### 2.2 Improving implementation of WRM policy and regulation through capacity building, enforcement and incentives for compliance

Whatever WRM policies and regulations exist on paper, there can be a considerable gap in terms of implementation. The decentralisation of WRM functions to basin and catchment-level entities, as well as decentralised bodies of government, has often multiplied the capacity challenges (OECD, 2015).

This is also the case in Kenya where the WRA’s 2018–2022 strategy highlights several areas to enhance implementation capacity. These include ensuring compliance with water allocation and rights (particularly to tackle illegal abstraction – see also section 4.1), enforcement of water quality and pollution control measures, and assessment and monitoring of ground and surface water resources. The strategy implies that the continued setup and further strengthening of basin and sub-basin level entities, namely the Basin Water Resources Committees (BWRCs) and Water Resources Users Associations (WRUAs) as well as the WRA’s own sub-offices, will be critical (WRA, 2019).
ISRAEL

Improving sanctions and incentives for waste water management

Background

Israel has combined strong sanctions with positive incentives and enabling measures in several WRM areas, including enforcement of water resource quantity and quality regulations. The Water Law of 1959 made water public property and assigned state organisations the authority to allocate and regulate consumption, applying “heavy-handed control of abstraction permits” (Marin et al. 2017, p.33, Hophmayer-Tokich, 2013). The mechanisms for regulating water quantity, both positive incentives and sanctions, are further discussed in section 3.3. This section therefore focuses more on managing threats to water quality, especially from wastewater. Some of the measures deployed may be specific to an economically advanced context like Israel with its greater availability of finance, human resource capacity and popular demand for environmental quality. The Government of Israel has provided notably strong support for water resources management from inception of the new state, due to the association between water and national security (Marin et al. 2017). The general approach to sanctions and incentives for sound water use should also be seen in the context of the water crisis arising in the Occupied Palestinian Territories (B’Tselem, 2020). However, despite these specific aspects of the political economy, several factors can be instructive to other countries.

Response

Legislation put in place early in the State of Israel’s formation provided ample tools for managing water quality as well as quantity issues, especially the Water Law (1959) and Local Authorities (Sewerage) Law (1962). The Water Law created the Water Commission (which became the Water Authority) and a Water Commissioner (latterly the Director of the Water Authority) with significant regulatory and sanctioning powers. It prescribed protection of all water sources from pollution, as well as depletion and, since a 1971 amendment, defined pollution more precisely and expansively, covering direct and indirect pollution regardless of the water body’s pre-existing state. The amendment gave the Water Commissioner further sanctioning powers. These include being able to require any polluter to repair the situation at their own cost within reasonable time, to order a polluter to provide a disposal plan, and to fine or restrict the water supply of someone failing to provide, or deviating from, the plan. Criminal charges could also be brought against polluters, including Mayors as the heads of local municipalities (Hophmayer-Tokich, 2013). However, the Water Commission was located under the Ministry of Agriculture, which enjoyed considerable political support both for economic and ideological reasons and was oriented more to supporting the agricultural sector and food production. The strong agricultural lobby suppressed political appetite to tighten the instruments for enforcement of standards for wastewater treatment.

From the 1990s onward there has been a significant shift towards strong enforcement, with wastewater treatment substantially improving (Hophmayer-Tokich 2013). This coincided with – and was likely stimulated by – several external events: consecutive droughts and falling prices for non-food crops like cotton sharpened the incentive for agricultural interests to demand higher-quality effluent for irrigation; health scares associated with reuse of low-quality effluent increased public appetite; significant immigration from former Soviet Bloc countries increased population and pressure on existing (inadequate) infrastructure; and fragile coalition governments led to creation of a new environment-focused ministry. The net effect of these drivers was a realignment of the incentives for various actors: the Ministry of Agriculture acknowledged a need for utilization of high quality effluent for non-restricted irrigation, 7

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7 Regulation of water resource quantity and quality are intrinsically linked, because poor quality water can be economically unusable. In Israel’s case extreme water scarcity has created fertile ground for wastewater re-use. This became an underlying driver of the push to improve enforcement and compliance on the water quality side.

8 “Change to any of the qualities of the water (physical, chemical, biological, etc.) that endangers human health as well as flora and fauna, and that makes it less suitable for its intended purpose” (Hophmayer-Tokich, 2013, p.5).
and ceded overall control of water issues; a new actor was established in the form of the Ministry of Environmental Protection (MoEP), with high motivation and focus on environmental quality; and the incentive for mayors as the elected heads of municipalities to ensure compliance increased markedly, as MoEP began to deploy the sanctions already available (Hophmeyer-Tokich, 2013). Key innovations of wider interest include:

• **Deployment of a spectrum of enforcement measures.** The Water Law was amended to give mayors and industrialists personal legal responsibility, backed by high fines and even imprisonment. However, criminal measures act as an effective deterrent and it is generally sufficient for MoEP to provide or threaten legal notice on this basis, rather than actually prosecuting (Zask, n.d). Softer measures available include refusing permission to populate newly-built housing developments, which became a major issue for mayors looking to take part in the economic activity stimulated by immigration from Soviet countries (Hophmeyer-Tokich, 2013).

• **‘Sticks’ complemented by ‘carrots’.** In addition to the above enforcement measures, significant finance was made available to municipalities to improve sewerage and wastewater infrastructure. This was only initially provided as grants – specifically to incentivise municipalities to apply for loans, and to begin a process of corporatisation of water and sewerage services. From 2008, state loans in the water sector have only been available to water and sewerage corporations. The corporatisation process, more broadly, correlates with dramatic improvements in pollution parameters, introducing a commercial motive for performance and scope for private investment via tariffs regulated and approved by the Water Authority, against their obligations to meet service standards (Zask, n.d.).

• **Continuous evolution of standards.** In line with scientific evidence, effluent standards have been progressively increased. In 2010, new standards with 37 quality parameters were introduced, including heavy metals and salinity. Where standards are met, the Ministry of Health permits unlimited wastewater re-use for crop cultivation (Zask, n.d).

**Impacts and current challenges**

The combination of economic incentives (corporatisation, access to finance, regulated tariffs) and strict sanctions has yielded progressive improvement in Israel’s wastewater management. The majority of wastewater in Israel now undergoes tertiary treatment (Figure 2). However, challenges remain. Groundwater quality is a continuous issue, including increased salinity due to lack of return-flow from irrigation, and the Government has responded with water conservation maps restricting land-use activities over groundwater resources, with regular monitoring of chloride and nitrate among other parameters (MoFA, 2013). There remain significant inequalities in both quality and quantity of water available to the Occupied Palestinian Territories, with 96% of household water provided from the Gaza Strip’s only aquifer being non-potable (B’Tselem, 2020).
2.3 Climate adaptation

Whatever WRM policies and regulations exist on paper, there can be a considerable gap in terms of implementation. The decentralisation of WRM functions to basin and catchment-level entities, as well as decentralised bodies of government, has often multiplied the capacity challenges (OECD, 2015).

This is also the case in Kenya where the WRA’s 2018-2022 strategy highlights several areas to enhance implementation capacity. These include ensuring compliance with water allocation and rights (particularly to tackle illegal abstraction – see also section 4.1), enforcement of water quality and pollution control measures, and assessment and monitoring of ground and surface water resources. The strategy implies that the continued setup and further strengthening of basin and sub-basin level entities, namely the Basin Water Resources Committees (BWRCs) and Water Resources Users Associations (WRUAs) as well as the WRA’s own sub-offices, will be critical (WRA, 2019).

**SOUTH AFRICA**

**Water resources planning under climate uncertainty in Cape Town**

**Background**

As in Kenya, climate change impacts are expected to vary within South Africa. While the country could see an overall increase in run-off by 2050, the Western Cape may see a decline of 13% if global emissions are not restricted. South Africa has a relatively strong system of water resources planning, and a well-integrated national water storage and supply network that allows water to be transferred between different regions to meet demand (UNU-WIDER, 2016). Cape Town, situated within the Western Cape and dependent on surface water largely sourced from the Western Cape Water Supply System, has long recognised water scarcity as a threat, and sought to manage this through both supply and demand side measures (City of Cape Town 2019; UNICEF 2021). However, the drought that extended over three consecutive years (2015-2017) and prompted dire warnings of a ‘day zero’ when the city would run out of water, has led to a re-appraisal of strategy and several innovative responses.

Cape Town’s 2019 Water Strategy recognises climate uncertainty as the most crucial contextual factor for water resources planning, but also that this is not a new threat. Cape Town faces high spatial and inter-annual variability of rainfall, and frequent droughts and localised floods. The 2015-2017 drought was regarded as a 1-in-590 year event based on historical rainfall records, and the city did succeed reducing water use by 50% over the drought period, from 220 l/p/d to 120 l/p/d. However, the Water Strategy acknowledges that historical rainfall and short-term demand management successes can no longer be used with such confidence: “nobody is able to accurately predict the future climate and water availability, so Cape Town needs to make plans that are robust in the context of this uncertainty” (City of Cape Town 2019, p.3). Importantly, climate change is situated in the strategy as one of two “twin challenges”, the other being economic and social marginalisation.

**Response**

The Strategy itself is based around five commitments:

i. Safe access to water and sanitation.
ii. Wise use.
iii. Sufficient, reliable water from diverse sources.
iv. Shared benefits from regional water resources.
v. The aspiration to become a ‘water-sensitive city’.
The challenge of climate change is recognised throughout, with the following features exemplifying the pivot towards greater ‘robustness’ in the face of uncertainty:

- **Scenario planning to test assumptions.** The scenarios on which the strategy is based recognise uncertainty in two key respects: climate and demand (Figure 3). A ‘base-case’ scenario assumes a gradual change in climate, increased assurance of supply through supply side measures, sound management of the Western Cape Water Supply System (WCWSS) and a moderate rebound in water use as drought restrictions are lifted. The plan was then tested against three ‘stress-test’ scenarios: (1) high demand and gradual climate change, (2) low demand with gradual climate change, and (3) low demand with a step-change in climate. Required adaptations to the strategy under each scenario are laid out, for example under the third stress test, significant demand restrictions would be needed, as well as acceleration of augmentation schemes, including establishing desalination plants. The Strategy commits to carefully monitor rainfall and demand and regularly update demand-supply reconciliations.

![Figure 3: Scenarios and the appropriate choice of assurance of supply (City of Cape Town, 2019)](image)

- **A portfolio of demand management measures.** Cape town has experience with water conservation and demand management, holding total water supplied steady from 2000, despite population growth of 3% per year (UNICEF, 2021). However, in the wake of the recent drought it has reaffirmed the importance of water conservation through the ‘wise use’ commitment, which entails an array of measures. As a first mechanism, the Strategy commits to pricing based on long-run marginal cost, while allowing for the national policy commitment of ‘free basic water’ received by around a third of the city population. A second measure is the review of by-laws and other incentives for promoting water efficiency and use of groundwater, stormwater and wastewater (for example debt write-offs linked to leak repairs and responsible payment). Thirdly, the promotion of alternative sources for non-drinking purposes. Fourth, active customer engagement, acknowledging the learnings from the drought, when water management devices, which cut off water after a daily allocation is reached.

9 The Strategy assumes that under a ‘step change in climate’ significant restrictions would be needed, enforcing suppression of demand.
generated a huge number of complaints. And finally, improvements in water network management including further reductions in non-revenue water and the use of smart pressure controllers to vary water pressure across 102 separate water supply zones.

- **A pragmatic approach to future uncertainty.** Faced with twin uncertainties of future rainfall under climate change and how far demand reductions will be sustained, the Strategy takes a simple approach to water supply assurance. Rather than attempting to project into the future, the Strategy aims to increase assurance against the historical rainfall record. Whereas dams and related water supply systems in the Western Cape and across South Africa are generally designed with a 98% level of supply assurance\(^{10}\), the new water strategy plans for 99.5% supply assurance.

- **Diversified approach to water resources development and governance.** The Strategy seeks to develop a more diverse portfolio of supply measures “with relatively uncorrelated risks”, reducing dependence on surface water from the WCWSS (Figure 4). Under commitment (4), shared benefits from regional water resources, it also recognises the diversity of water users and the shared interests, benefits and risks for those users across the WCWSS. In response, the Strategy lays out several water governance measures. Some require further exploration (e.g. new legal agreements on water rights in the WCWSS) while other more specific commitments are made (e.g. improving integrated planning with other actors in the WCWSS and Western Cape Province together with the Department of Water and Sanitation, the national ministry).

- **Risk-based dispatch and restrictions.** Learning from other cities such as Sydney and Barcelona, the Strategy commits to ‘risk-based dispatch and restrictions’. On this basis, supply is augmented, and restrictions introduced, progressively as tightly defined thresholds are reached. Although the Strategy does not detail the specific thresholds and responses – it is explicitly framed as a guiding document rather than detailed implementation plan – it does suggest that the alternative water supplies could be commissioned in order of operating cost, avoiding more expensive options if they are not needed.

- **Concept of the water-sensitive city.** The Strategy aims ultimately to make Cape Town a ‘water-sensitive city’ through integrated urban water cycle management. In the context of climate change, better management of stormwater is highlighted as a key priority, both to reduce flooding, and improve water availability through aquifer recharge. The Strategy also recognises the need to use a range of mechanisms – financial incentives, regulation, and infrastructure – across both water and urban planning, to achieve the transition.

\(^{10}\) A 98% probability of providing sufficient water to meet demand in any given year.
Despite several studies convincingly linking water resources management and economic growth (Brown and Lall, 2006; Grey and Sadoff, 2007; Sadoff et al. 2015), the sector faces numerous challenges attracting and coordinating investment. Key barriers include (OECD, 2016):

i. High-sunk costs and long payback periods.

ii. Difficulty in evaluating and monetising the full range of risks and benefits, which makes it harder for investors to assess the risk-return profile of prospective investments.

iii. Politicisation of key economic instruments, for example, pricing of water or of externalities such as pollution of water resources.

For Kenya, the financing area of SDG indicator 6.5.1 is the lowest scoring in its 2017 and 2020 self-assessments, and the only area to show no overall progress. The 2020 questionnaire response highlights a number of challenges, including low disbursements for water resources infrastructure; insufficient allocations for WRM functions, both nationally and at basin level; low revenue from water use charges; and absence of ring-fencing of WRA’s revenues for WRM functions (GoK, 2020).

The WRA estimates that it, alone, faced a cumulative net financing gap of KES 6.7 billion in the period 2012/13-2016/17, between budgeted expenditure and disbursed funds from the public fiscus, plus contributions from external partners (WRA, 2020).

This chapter on financing and investment planning contains 3 examples of global good-practice as summarised below.

<table>
<thead>
<tr>
<th>Sub-theme</th>
<th>Country</th>
<th>Summary of case study</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Financing WRM plans and frameworks for private investment</td>
<td>Netherlands</td>
<td>Public sources of finance – taxes levied by Regional Water Authorities – provide secure revenue streams or otherwise improve the risk profile to make private finance feasible, and ultimately cheaper, by driving down the cost of borrowing. RWA performance is benchmarked via an online dashboard.</td>
</tr>
<tr>
<td></td>
<td>Uganda</td>
<td>A resource mobilisation strategy by the Directorate of Water Resources Management (DWRM) – taking a bottom-up and realistic approach – identifies traditional and innovative financing mechanisms for water resources management.</td>
</tr>
<tr>
<td>3.2 Incentives for water conservation, re-use and circular economy</td>
<td>Peru</td>
<td>A legally backed compensation mechanism – Redistribution mechanism for Ecosystem Services, or Mecanismos de Retribución por Servicios Ecosistémicos (MERESE) – through which water users pay for upstream catchment conservation; the funds can be used flexibly on interventions including reforestation, agricultural practices and enhanced wastewater treatment.</td>
</tr>
</tbody>
</table>
3.1 Financing WRM plans and frameworks for private investment

Developing effective financing plans for water resources is technically and practically challenging. The OECD advocates the concept of an “investment pathway” for water, in which the task of governments is to (OECD, 2018):

i. Take a long-term perspective, matching the asset lifetimes of 80-100 years of much water resources infrastructure.

ii. Utilise sound economic techniques such as cost-benefit analysis while taking account of path-dependencies and risks such as climatic and socio-economic shifts.

iii. Strengthen data and institutions for design, financing, management and accountability.

iv. Situate ‘pipelines’ of investable water projects within broader policy and development strategies

Developing a set of costed project proposals, and even converting these into a pipeline, portfolio, and ultimately an overall investment pathway, is only a first step. The diversity of financing sources needs to be frequently reappraised and matched to project opportunities on an ongoing basis. Many countries have developed some form of investment plan – such as Kenya’s National Water Master Plan issued in 2014. In this context, the development of a Resource Mobilisation Strategy by WRA in 2020 is an important step forward. However, as the strategy acknowledges, an updated national water master plan is required, setting an effective framework to link the contribution of water to ongoing growth and development, with how this contribution can be financed (WRA, 2020).

Kamburu Dam on the Tana River, Kenya. | Source: Google Images
Context

The Netherlands has a well-established and sophisticated system for financing water resources management, with most finance raised and managed at decentralised levels. In 2016, the central government was responsible for only 17% of total expenditure on water activities, while Regional Water Authorities (RWAs) constituted the largest share (Figure 5). Although the provincial and municipal expenditure is dependent on transfers from central government, the RWAs and water companies recoup most of their costs through taxes levied to households, farmers and businesses, and regulated tariffs, respectively.

The evolution of this system has taken centuries; however, it illustrates several important lessons. Above all, that while repayable private finance can play a role in sustainable financing frameworks for WRM, it is public sources of finance – taxes, tariffs and transfers – which provide the foundation. These need to provide secure revenue streams or otherwise improve the risk profile to make private finance feasible, and ultimately cheaper, by driving down the cost of borrowing.

Figure 5: Distribution of expenditure for water activities in the Netherlands, 2016 (DWA, 2017)

11 The OECD has also been a proponent of blended finance for water, including in emerging and developing markets (OECD, 2019). However, this and other ‘innovations’ to increase private finance to the sector, such as use of financial intermediaries and local capital markets, have faced significant hurdles, due to the risk profiles of investments and related factors (Alaerts 2019).
12 https://live-waves.databank.nl/dashboard/dashboard/belastingen/. The OECD has suggested that presentation of financial data could be further improved (OECD, 2014).
Response

The overall financing framework and strategy is not set out in a single document; it is distributed across various plans and programmes (Delta Programme, River Basin Management Plans, Flood Protection Programmes; GoN, 2015). With strong institutions that have evolved over time, and a relatively small geographic area in which stakeholders can engage readily, overall coordination of these plans and the finance required to implement them is not reported to be the major challenge. However, the high costs do require a considered approach to sourcing finance, and various efficiency, transparency and equity measures to maintain legitimacy with the public, who foot most of the bill through tax and tariff payments. High standards, for example, for flood protection, water quality, water supply and wastewater, mean that the total costs of water management and services average around EUR 7 billion per annum. In 2016, the average household paid EUR 805 in total tariffs and taxes for water, with about 40% constituted by RWA taxes.

Within The Netherlands’ water financing framework, and particularly those for the WRM functions of the RWAs, the following features stand out as securing the continued sustainability of finance despite significant costs:

- **Efficiency through cooperation.** The essentially public financing arrangements and lack of a direct profit motive does not remove the need to keep costs low, to maintain legitimacy with taxpayers. As mentioned above, the financial efficiency targets under the 2011 Administrative Agreement have been a critical driver of cost savings (Section 2.1.1).

- **Transparency to taxpayers.** RWA performance is benchmarked via an online dashboard, which includes accessible data on the taxes levied, costs and investments. Equity considerations are also considered through remissions to low-income households.

- **Accountable tax setting process.** Under the ‘interest-pay-say’ principle, the different categories of water taxpayers (residents, farmers, businesses and managers of nature areas) have seats on RWA boards, which are in turn responsible for approving the taxes set by each RWA.

- **Strong public finance equals cheaper private finance.** RWAs can access private finance for their investments from the dedicated Netherlands Water Board Bank (Netherlands NWB) as well as other financial institutions. While Netherlands NWB is a public bank and thus does not need to generate significant shareholder profits, it funds its activities on the international money and capital markets, and issues bonds that can be bought by private investors. As such, it is an important channel for private, bridging finance. An excellent credit rating (AAA/Aaa) allows it to provide long-term finance cheaply and, in turn, this permits the RWAs to smooth the burden of lumpy water resource investments for taxpayers. The high credit rating in turn depends in part on the dependability of the RWA tax revenues. While the NWB is a specific institutional arrangement that may not be fully transferable to other countries, it shows how strong public financing, including reliable cost recovery from fees and taxes, is a pre-requisite for attracting private finance to the water sector at scale.

Impacts and current challenges

The Netherlands has managed to keep total water costs more-or-less constant in recent years, even with new safety standards for 1,500 km of primary dikes brought in (2017), requiring a major programme of investment to 2050. Nevertheless, other areas of reform to the financing framework may require consideration, including the equity, economic efficiency and financial sustainability of current low charges for surface water and groundwater abstraction and diffuse water pollution. Also, despite the board oversight and transparency measures described above, there have previously been calls to institute an independent regulator to ensure oversight of performance, charges and costs (OECD, 2014).
UGANDA
A bottom-up and realistic approach to mobilising funds for WRM

Context

Uganda has undertaken significant decentralisation both of wider government functions and of WRM (Nicol and Odinga, 2013). Although there are major differences with its neighbour Kenya – Uganda has around twice the internal renewable freshwater resources per capita of Kenya, and half the GDP per capita – there are therefore some similarities in terms of the water and wider governance situation and, in parallel, the challenges for financing water resources management functions. Uganda's experience has recently led to the development of a resource mobilisation strategy by the Directorate of Water Resources Management (DWRM) within the Ministry of Water and Environment. While there is fertile ground for mutual learning between Kenya and Uganda, given WRA’s recent development of the same, this example focuses on what lessons Uganda’s approach might hold for Kenya. The emphasis of the resource mobilisation strategy is on the financing of water resources management functions, as opposed to water resources development/infrastructure.

Response

While there have been several top-down attempts to cost water-related investments in Uganda, they have tended to focus on infrastructure costs rather than WRM functions (MoWE, 2009; IEC, 2018). More detail in this respect comes in Catchment Management Plans, of which approximately 16 have been developed to date, which cost interventions in a more bottom-up manner. As acknowledged in the DWRM’s implementation strategy, there are significant funding gaps for Uganda’s ‘catchment-based’ IWRM (CbIWRM) strategy, attributed to low government funding to WRM, declining support from donors and inefficiencies relating to poor horizontal and vertical coordination of different actors (DWRM, 2020). It is in this context that the DWRM’s resource mobilisation plan aims to specify how the funding gap for water resources management functions, at least, could be filled.

The objective of the resource mobilisation strategy is to: “ensure that there is a clear, systematic, predictable and well-co-ordinated approach to soliciting, acquiring, utilising, managing, reporting and monitoring of resources for sustainable implementation of the CbIWRM”. As such it attempts to take a broad approach covering the full cycle of resource management as well as mobilisation. The strategy identifies eight key sources including a number of more innovative areas (Table 4). The mix of sources and mobilisation approaches is differentiated for different WRM functional areas.

Table 6: Sources of finance identified in Uganda’s Resource Mobilisation Strategy for CbIWRM (DWRM, 2020)

<table>
<thead>
<tr>
<th>Source</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditional financing mechanisms</strong></td>
<td></td>
</tr>
<tr>
<td>Funding from Government of Uganda (increase in sector MTEF; financing of water)</td>
<td>15%</td>
</tr>
<tr>
<td>Leveraging local government Conditional Grants and area specific funds</td>
<td>4%</td>
</tr>
<tr>
<td>Non-tax revenues (payments by polluters and water users through Water Permit System); Payment for WRM services (sales of data, laboratory services etc.)</td>
<td>2%</td>
</tr>
<tr>
<td>Development Partner support</td>
<td>9%</td>
</tr>
<tr>
<td>Climate Financing (Adaptation Fund and Green Climate Fund)</td>
<td>22%</td>
</tr>
<tr>
<td>Financing and support from Civil Society Organisations</td>
<td>14%</td>
</tr>
<tr>
<td><strong>Innovative financing mechanisms</strong></td>
<td></td>
</tr>
<tr>
<td>Private Sector support through Payment for Ecological Services and Corporate Social Responsibility</td>
<td>7%</td>
</tr>
<tr>
<td>Payment for water source protection (3% of water related investment costs based on Water Source Protection Guidelines)</td>
<td>17%</td>
</tr>
<tr>
<td>Sectoral charges for water use – energy, tourism, works and transport</td>
<td>11%</td>
</tr>
</tbody>
</table>
Overall, the resource mobilisation strategy takes a pragmatic approach; key features include:

- **Tried and tested as well as novel forms of finance.** As shown in Table 3, the majority of ‘mechanisms’ or sources are those where finance is already sourced in some form, though there may be existing issues that need to be resolved – for example non-tax revenues for water use and services currently go to the main Consolidated Fund of the National Treasury, rather than being reserved for CbIWRM activities. While similar ‘innovative’ mechanisms are identified in the resource mobilisation strategy of Kenya’s WRA, the amount they could generate and the policy/legal precedent on which they could do so are not. There is a particular focus on climate finance, with an aim for this source to meet over a fifth of the total need. Notably, Uganda’s Ministry of Water and Environment is the National Designated Authority for the Green Climate Fund and as such may be well positioned to engage (in Kenya, the National Designated Authority is the Treasury).

- **A conservative approach.** The resource mobilisation strategy arrives at a total resource envelope of USD 271 million from 2020-2030, or approximately USD 27 million per annum. It suggests this total is ‘conservative’, and effort is taken to specify the assumptions and historical evidence for ‘traditional’ financing mechanisms, or in the case of more innovative mechanisms, to identify the policy or legal precedent. For example, Uganda’s Water Source Protection Guidelines of 2013 specify that developers of water infrastructure should contribute a minimum of 3% of the investment cost towards water source protection.

- **A phased and realistic approach to implementation.** The strategy implementation plan is divided in three phases, in which the first, foundational stage (2020-2023) acknowledges the time needed to build momentum, and focuses on establishing basic mechanisms, advocating, and enhancing visibility. There is also explicit recognition of risks including political interference and un-sustained commitment.

**Impacts and current challenges**

It is too early to assess whether the resource mobilisation strategy will be enough to push WRM in Uganda onto a more sustainable financial footing. Several of the envisaged mechanisms will require skilful political navigation, including realising the 3% water source protection levy, and ensuring retention or earmarking of water-related non-tax revenues. There will also be a need for mechanisms to ensure mobilised finance reaches catchment and sub-catchment levels, including through the envisaged catchment management fund. Additionally, the financial impact of COVID-19 may also require further adjustment of expectations.
3.2 Incentives for water conservation, re-use and circular economy

Financial instruments for WRM need to be designed with as much consideration of their effects on water user behaviour, as their revenue-raising potential, social equity and technical feasibility. This is not always emphasised enough in policy guidance. For example, while the OECD's Water Governance Principles mention payment for ecosystem services (PES) and the polluter-pays and user-pays principles, they do so in the context of helping water institutions raise revenue (OECD, 2015). In practice almost all interventions which involve a price signal will shape the behaviour of citizens, businesses, farmers and other stakeholders, when it comes to how they use both water and related resources like land. The additional task is therefore to situate these signals within governance arrangements and mechanisms that are effective, equitable and transparent, capturing externalities and distributing costs and benefits between multiple users.

PERU

Institutionalising payments for water ecosystem services

Background

Despite being one of the most water-rich countries in the world, 65% of Peru’s population and most economic activity, including agriculture, is located in the Pacific Hydrographic Region, which generates less than 2% of the country’s available freshwater. Numerous droughts and floods have occurred in recent years. Facing significant water challenges, Peru has been consolidating its legal and institutional framework for WRM. Among the financial and economic instruments adopted, is the Redistribution mechanism for Ecosystem Services, or Mecanismos de Retribución por Servicios Ecosistémicos (MERESE), a legally backed compensation mechanism for ecosystem services which promotes ecosystem service conservation by private and public sectors (TNC, 2016).

Challenges of water availability and quality, as well as floods, are compounded by catchment degradation and upstream pollution. The capital Lima, for example, has very low rainfall and the population of over 10 million depends on three large main rivers for its water supply. The largest, the Rimac, is considered one of the most polluted in the world due to mining, industrial, domestic and agricultural activities in the upper and middle catchments (Stern and Echavarria, 2013).

Response

The MERESE is the latest in a series of institutional innovations in Peru which aim to address catchment degradation: in essence, getting water users, as beneficiaries of more reliable and cleaner water flows, to pay for upstream catchment conservation. A Sanitation Services Modernisation Act of 2013 requires Peru’s 50 water and sanitation service companies to specify mechanisms for watershed management and environmental compensation in their 30-year master plans and take this into account in five-year tariff increases. The regulator SUNASS approves the tariff, including the share to be allocated to MERESE. Since 2016 a specific MERESE Act has also been in place, which also allows Water User Boards (Junta de Usuarios del Sector Hidráulico, JUSH) to participate in the financing of water source conservation on a voluntary basis. Key features of Peru’s approach to embed PES for watershed conservation include:
• A sound legal basis with the two successive Acts (2013 Sanitation Services Modernisation Act and 2016 MERESE Act), plus various supporting regulations and decrees.

• Checks and balances to balance social and environmental objectives: PES contributions from water and wastewater service bills are approved by SUNASS in the context of other tariff regulation priorities. In the case of Water User Boards, participation in MERESE mechanisms is approved by assemblies of irrigators.

• Flexibility of modalities: The legislation provides for MERESE funds to be spent via public investment, direct payment to PES suppliers; subcontracting to specialised private entities; and procurement of goods and services. MERESE funds established to date have focused on interventions including reforestation, agricultural practices and enhanced wastewater treatment (OECD, 2021a).

Impacts and current challenges

By the end of 2020, 80% of water and sanitation utilities had a regulator-approved resolution for creating a MERESE reserve fund. Funds already established represent up to 11% of utility turnover and have raised USD 44 million nationwide. Costs to users are modest – often under PEN 1 per month (<30 KSh) – although this has limited the size of the fund in some cases. Lima has one of the larger reserve funds because of the much bigger customer base. Areas to strengthen, as identified by OECD (2021a), include:

i. Greater empiricism in the identification of water risks and ecosystem service interventions;

ii. Ensuring greater compliance by upstream communities with the measures paid for;

iii. Increasing willingness to pay among beneficiaries; and

iv. Improving coherence between the various PES systems.
There is broad consensus across the academic literature on water resources management and governance, that innovation, research and data play a crucial role. Although this theme contains several distinct topics, collectively their value lies in enhancing efficiency and synergies, managing trade-offs and uncertainty, and supporting evidence-informed and transparent decisions concerning water (Batchelor 2007; McDonnell, 2008; Goonetilleke and Vithanage, 2017). The multi-scale, multi-objective nature of WRM also speaks to the importance of not only improving different sources and forms of innovation, research and data for WRM in isolation, but bringing them together effectively (McDonnell, 2008).

Several questions under the ‘management instruments’ area, that form part of SDG indicator 6.5.1 assessment, pertain to the collation and use of data and information for different aspects of water resources and their use. Concerns highlighted in Kenya’s 2020 response to the relevant questions broadly align with issues raised during stakeholder discussions, which identified two key areas under this theme where international learning could be valuable: identifying illegal abstraction, and frameworks for data sharing and coordination13.

This chapter on technological innovation, research and use of data contains 2 examples of global good-practice as summarised below.

<table>
<thead>
<tr>
<th>Sub-theme</th>
<th>Country</th>
<th>Summary of case study</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Use of monitoring and data flows to identify illegal abstraction</td>
<td>England</td>
<td>A risk-based, tiered approach to monitoring compliance (from voluntary reporting to spot checks) with a range of sanctions available, which are set according to separate culpability and harm scales as well as the size of the company.</td>
</tr>
<tr>
<td>4.2 Improved data sharing and coordination for WRM</td>
<td>South Korea</td>
<td>‘Smart Water Management’ technology – Water’s Hydro-Intelligent Toolkit (K-HIT) – that supports the management of Korea’s dams. The system aids in monitoring, forecasting of risk and decision-making to manage flood and drought risk. Korea has invested in the human resources and ICT capacity to ensure the K-HIT system is used effectively.</td>
</tr>
</tbody>
</table>

13 Aspects that might be regarded as innovations are addressed elsewhere, for example payment for ecosystem services.
4.1 Use of monitoring and data flows to identify illegal abstraction

Identifying (and, by implication, discouraging) illegal abstraction should be seen as a sub-component of a broader system of water allocation, and it is in this context that the example below is presented. This includes establishing an administrative and legal basis for managing abstraction, in view of various considerations including competing needs, variability and quality; and then monitoring compliance and enforcing regulations where abstraction takes place without, or in breach of, a permit.

In Kenya, water allocation and abstraction monitoring and management responsibilities lie with WRA, which manages a system of water use authorisations and permits through its national, regional and subnational offices (WRA, 2021). The legal and administrative framework for abstraction management is therefore in place, and monitoring infrastructure (e.g. water meters, telemetric monitoring of water levels and flows) is reportedly evolving. However, this monitoring infrastructure, and capacity for enforcement, requires further strengthening to help WRA target investigation and enforcement.

14 The OECD Council’s Recommendation on Water for example, defines a water allocation regime as “the combination of policies, mechanisms, and governance arrangements (e.g. entitlements, licenses, permits) used to determine who is allowed to abstract water from a resource pool, how much may be taken and when, as well as how much must be returned (and of what quality; e.g. to protect and restore water-related ecosystems), and the conditions associated with the use of this water” (OECD 2016).
ENGLAND

Tiered sanctions based on sound data

Context

England has a mature approach to water allocation and licensing built upon the Water Resources Act 1963 and successive revisions (1991, 2003).\textsuperscript{15} It also has a comparatively well-resourced and high-capacity regulator in the form of the Environment Agency (EA), which is responsible for managing the abstraction licensing regime as well as several other WRM areas. Water withdrawals are dominated by around 30 companies that provide drinking water services and represent over half of total abstraction (Defra, 2019). However, other categories of use make up a significant proportion of licenses and require sound management for overall sustainability of water resources. This example focuses on lessons from England’s system for issuing, monitoring and enforcing abstraction licenses.

While abstractions for non-municipal use including agriculture, energy and industry are lower than in Kenya, they are significant in aggregate, make up a majority of licenses issued, and can have a large impact on the water environment. For example, despite a temperate climate, agricultural abstraction is significant in some areas and critical to crop production in the summer months in the more water stressed parts of the country (Richards, 2020). Agricultural withdrawals also tend to increase in dry periods as crop water demand increases (DEFRA, 2019). As such, the EA needs to manage the issuance, monitoring and enforcement of licensing with a risk-based approach.

\textbf{Figure 6: Estimated abstractions from non-tidal surface water and groundwater in England, 2000 to 2017 (DEFRA, 2019).}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure6.png}
\caption{Estimated abstractions from non-tidal surface water and groundwater in England, 2000 to 2017 (DEFRA, 2019).}
\end{figure}

\textbf{Note:} ‘All other’ includes Spray irrigation, Agriculture, Private water supply, Other industry and Other

\textbf{Source:} Environment Agency

\textsuperscript{15} Devolution means that the abstraction licensing regime in the UK is handled by different regulators in England, Wales, Scotland and Northern Ireland. This example focuses on England.
Response

In England water licenses are set according to the water context. They generally specify: the permitted rate of abstraction (litres per second); amount (annual and usually daily); season (all year, winter-only, summer-only); the purpose of use; the expiry (usually 12 year) and any special conditions (e.g. river flow thresholds below which abstraction must stop, defined using flow duration curves and usually stricter if abstraction takes place near an ecosystem). Although the issuing of the licenses themselves precedes any monitoring of compliance, tailoring the licenses to the hydrological context has implications for how they must be monitored. When it comes to monitoring and enforcement, the following key features stand out:

• **A strong network for in-situ monitoring water resources.** England and the UK generally has an extensive and well-maintained river gauging network, which provides the basis for water resources management and allocation policy. The EA is increasingly upgrading monitoring with telemetry to reduce data collection costs and allow more frequent updates. Abstractors must be metered and can also take advantage of an increasing array of analogue and digital monitoring solutions that can be used to help demonstrate compliance and make a case for alterations at renewal (Richards, 2020).

• **A risk-based, tiered approach to monitoring compliance.** The first tier is essentially voluntary reporting. License issuance now requires metering of abstraction and an annual return to the EA, which is checked electronically against the license conditions (paper-based licenses have been progressively digitised). The second tier is spot checks undertaken by the EA, to check meters are installed properly, and that readings on the day are consistent with returned readings. As a third tier, the EA steps up spot checks in times of water stress. Aerial (drone) surveys have recently been introduced to identify potential breaches (EA, 2019).

• **A spectrum of sanctions:** The EA can issue written warnings, civil sanctions, or prosecute. It can also refer breaches to the Rural Payments Agency resulting in reduced agricultural subsidy payments (EA, 2019). Sanctions are set according to separate culpability and harm scales as well as the size of the company (Dobson, 2021).

• **Making compliance easier:** As well as sanctions, there are positive incentives for compliance. These include the option to apply to vary licenses if needed, provision of reminders, advice and guidance, and digitisation of the application, amendment, and payment processes.

Impact and current challenges

The full impact of the abstraction licensing regime on compliance is difficult to assess, because within a complex hydrological system some breaches may go undetected, even with relatively sophisticated monitoring in place. However, whilst rare, prosecutions for illegal abstraction do happen. The abstraction licensing regime is currently undergoing significant changes as envisaged by the 2017 Water Abstraction Plan, which aims to modernise the abstraction service, strengthen the catchment focus (e.g. to better reflect water availability in catchments) and improve ground and surface water bodies by reducing unsustainable abstraction (Defra, 2020). The plan also envisages moving licensing under the Environmental Protection Regime established by the Environment Act, which is viewed as a more ‘modern and consistent legal framework’, though this is yet to be completed. This is also likely to offer greater revenue raising powers but may not be as flexible. Costs of water for abstractors are likely to increase significantly from their current low levels.
4.2 Improved data sharing and coordination for WRM

An array of hydrological and other biophysical and socio-economic data is required to manage water resources effectively, which must be translated into decision-relevant information. As well as the production of data and information, from both in-situ monitoring and remote sensing, accessibility of consistent and comparable water data and information is essential if users are to make evidence-informed decisions, including assessing performance and appraising future options (OECD, 2021b). Many countries have moved to consolidate water-related data and information under a single management information system, taking advantage of digital technologies where relevant.

Kenya, meanwhile, identifies its ongoing challenges in this area as including inadequate monitoring of water availability and quality (attributed to funding limitations), and limited sharing of data outside specific programmes involving transboundary waters (GoK, 2020).

SOUTH KOREA

‘Smart Water Management’ technology to support monitoring, forecasting, risk assessment and decision-making

Context

The Republic of Korea features high variability of rainfall between regions and seasons, and generally short and steep water courses. The need to manage variability and water-related extremes, including both droughts and floods, and to manage demand from industrialisation and urbanisation from the 1960s, led to significant public investment in water infrastructure, especially multi-purpose dams.

Korea now has an advanced system of water infrastructure and an institutional framework to match, with the Korea Water Resources Corporation (K-Water) as a high-capacity and well-resourced single institution for implementation and operation. K-Water manages the multi-purpose dams accounting for 62% of total dam supply, and 94% of flood control capacity in Korea (Yi et al. 2018). The sophistication of Korea’s water resources infrastructure and institutions is now matched by a similarly sophisticated approach to obtaining water resources data and converting it to decision-relevant information.

This example focuses on K-Water’s Hydro-Intelligent Toolkit (K-HIT), part of its wider portfolio of ‘Smart Water Management’ technology. The focus is on lessons from the wider architecture, including institutions and human resources, as much as the technology solution itself.

Korea’s WRM infrastructure has been created to increase interconnectedness (e.g. multi-regional water supply) and achieve multiple benefits (e.g. multi-purpose dams, for flood risk management, irrigation, and drinking water supply). In this context, the significant economic benefits from effective water use as well as the costs of water-related disasters have made rapid acquisition and translation of data into decision-relevant information essential to optimise benefits, reduce risks and manage trade-offs.
Response

There are five key components to K-HIT, which was evolved in phases from 2001–2011 (Yi et al. 2018):

i. Real-time hydrological data acquisition and processing system (RHDAPS) – sources real-time hydrological data from dams including rainfall, water level, inflow and outflow.

ii. Precipitation forecast system (PFS) – providing high resolution (3x3km) forecasts of average precipitation in dam and weir basins.

iii. Flood analysis system (FAS) – draws on PFS and RHDAPS to derive an optimal release plan given estimated flood risk.

iv. Reservoir water supply system (RWSS) – models optimal dry-season release, considering demand, water balance (including risk of drought) and quality (especially minimising algal blooms).

v. Generation integrated operation system (GIOS) – used by K-Water to monitor and operate the 25 hydropower plants, a small proportion of total electricity generation but a contribution to stable electricity supply by ensuring hydroelectricity can be used to meet peak demand.

However, K-HIT can be seen as an overall architecture for linking data to decisions, comprising much more than software solutions, including:

• **Substantial ICT infrastructure with an emphasis on reliability.** Flow and rain gauges have been replaced with telemetric sensors, and there are numerous inbuilt systems for verification and backup. For example, the real-time hydrological data acquisition and processing system transfers data in parallel by both satellite and code division multiple access (CDMA, used in many mobile phone standards) and allows users to verify readouts in the graphical user interface with real-time video from the dam sites.

• **Dedicated human resource.** Alongside the K-HIT system, K-Water has progressively strengthened technical staffing to make the most of the information available. A Water Management Center was established in 2002 with 38 experts in water, weather, ICT and power. This has been progressively increased and stood at 67 personnel in 2016, with provision to increase staffing at times of water extremes, when rapid, evidence-informed decisions become even more critical.

• **Clear decision rules.** Staff in the Water Management Centre and the wider water management ecosystem have defined rules and protocols to further aid the translation of data into effective decisions. Flood early warning triggered by FAS, for example, involves a discharge schedule disseminated to local-governments, broadcast companies and downstream communities at least three hours in advance of a release. The Drought Response Guideline issued to dam operators specifies procedures for reducing discharge in stages and by use, as required. Additionally, under the RWSS, final decisions on water release are made by Joint Operating Council following consultation with interagency organisations.

Impacts and current challenges

K-Water asserts that numerous floods, droughts and pollution incidences have been effectively mitigated by management of discharges from multi-purpose dams from 2011 onwards, as a result of K-HIT. They also suggest that digitalisation has effectively increased profits by reducing staff required to run the system (Yi et al. 2018). Looking forward, the OECD (2017) points out that the system is thus far geared towards those directly involved in water systems management rather than users of different kinds. There is a need to move beyond pushing data and information out to others, for example, different categories of users, to more of a two-way engagement. Despite K-Water’s control of much of Korea’s water management system, there is also potential to expand the system to monitor and manage other built and natural infrastructure, for example, small agricultural dams and agricultural land management.
CHAPTER 05

Key Lessons to Consider for the Kenyan Water Sector

This section provides a summary of the key lessons and insights from the various examples set out in the preceding three chapters as a resource for Kenyan water sector stakeholders as well as other parties interested in water sector strengthening. For convenience these are numbered in alignment with the original section headings and sub-headings.

2. Governance and decentralisation

2.1 Coordination and division of responsibilities for WRM (Netherlands, Switzerland)

- Material incentives and quantitative targets, for example cost savings through efficiency, can significantly sharpen the motivation for coordination, as they have for decentralised authorities responsible for various aspects of WRM in the Netherlands. Other countries looking to incentivise coordination through financial efficiency targets will need to consider the financial autonomy of the concerned authorities. The incentive will be more powerful if the public bodies involved can retain any savings for their own activities. It is also important to recognise and work around the political economy barriers for coordination and cooperation when setting these incentives, for example, where Ministries have different political and policy objectives.

- In a multidimensional sector such as WRM, roles and responsibilities need to be specified clearly not just in high-level documents but in policy and regulatory instruments governing particular areas. For example, surface water management, water quality management, and flood risk management, amongst others. In the Netherlands, this is done through a wide range of legal and administrative instruments. It may not be possible to have a single overarching law or policy that addresses all aspects of coordination, but new instruments in different areas should be carefully reviewed to ensure they reinforce an agreed delineation of responsibilities, rather than creating duplication or institutional competition.

- Where WRM requires the cooperation of subnational entities, for example basin organisations or subnational governments (such as Counties in Kenya), it can be politically important to respect their autonomy. In such cases – not
just in the relatively ‘extreme’ example of Switzerland – national authorities will need to work through a range of approaches to incentivise coordination at lower levels. Relevant types of levers include voluntary (e.g. policy guidance); financial (e.g. targeted or conditional transfers); and mandatory (e.g. legally mandated steps on specific areas such as emergency planning).

2.2 Improving implementation of WRM policy and regulation through capacity building, enforcement and incentives for compliance (Israel)

- Israel’s experience suggests that a sanctions ‘ladder’ can be helpful to encourage compliance, with the threat of more severe penalties providing an effective deterrent, especially where individuals such as local government and business leaders are liable. Other, less severe penalties can provide an important complement, especially where these play on the wider motives of key groups, for example, restricting development permits for mayors until pollution issues are addressed. The lesson for other countries is not to rely on a single type of incentive but provide a range of carrots and sticks.

- Compliance can be costly. Wherever possible, financial support should be made available alongside sanctions to help stakeholders enhance infrastructure and governance systems for compliance, as in the case of Israel which supported municipalities to invest in progressively better wastewater treatment. However, in other countries such support can be tapered or made (progressively) repayable, reflecting the financial situation.

2.3 Climate adaptation (South Africa)

- The experience of Cape Town in developing its Water Strategy in the wake of the 2015–2017 drought shows other countries that pragmatic options are possible to incorporate and address the uncertainty caused by climate change. Simplified scenario planning that situates climate change alongside other key uncertainties can support participatory discussion, including tolerance for risk and redundancy. A risk-based, staggered approach to prioritising implementation measures will maintain adaptability as far as possible.

- A further lesson for countries grappling with climate change impacts on water resources is that climate-sensitive plans for WRM are not just technical documents. They need to set an inclusive and inspiring vision that can secure buy-in for both potential demand-side restrictions, and expensive supply-side investments.
3. Financing and investment planning

3.1 Financing WRM plans and frameworks for private investment (Netherlands, Uganda)

- Uganda’s efforts suggest that a bottom-up approach may provide a credible basis for resource mobilisation. For other countries, this could include basing financing plans and strategies on a pragmatic assessment of trends in historically available finance, and the existing legal or policy mechanisms by which ‘innovative’ finance can actually be raised, rather than starting with a practically unfeasible (even if technically accurate) funding gap.

- Despite the appeal to private finance to fill significant funding gaps, the fundamentals of water resource management finance will often fall to public expenditure to cover. The lesson from the Netherlands for other countries is that this does not remove a need to treat tax- and tariff-payers as intelligent customers, with explicit incentives to keep costs down, and transparent information on rate-setting, costs and performance.

- The Netherlands’ WRM financing architecture also shows that a strong foundation of public finance from the ‘3Ts’ (taxes, tariffs and transfers) provides predictable revenue and can allow public entities to raise private finance to smooth lumpy investments. Other countries have developed their own public/ non-profit funding bodies for water and sanitation services. For dedicated WRM funds or banks to become viable, revenue streams will likely need to be strengthened through taxes or other levies on water use, pollution, land use/ development, or other activities impacting water resources.

3.2 Incentives for water conservation, re-use and circular economy (Peru)

- Peru’s experience suggests that dedicated laws and regulations may be needed in order to scale-up financial mechanisms that internalise or shift the distribution of costs to incentivise better water management (e.g. Payment for Ecosystem Services – PES). Other countries at an earlier stage of learning on PES should consider how flexibility can be built into these legal instruments, in order to foster experimentation, at least in initial years.

- PES schemes can increase the financial burden on those downstream. For the system to work and have legitimacy, environmental, social and economic objectives must be balanced, and any increased cost matched by tangible outcomes (the ecosystem service provided). In Peru, this is assured through approval of the increased costs (primarily levied on downstream water service user tariffs) by an independent regulator. Other countries can consider an equivalent form of oversight of PES schemes, while being mindful of creating unnecessary bureaucracy.

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16 For example, Kenya has the Water Sector Trust Fund and Kenya Pooled Water Fund.
4. Technological innovation, research and use of data

4.1 Use of monitoring and data flows to identify illegal abstraction (England)

The UK’s approach to monitoring and enforcing abstraction licensing has evolved over time and provides a number of lessons for other countries:

- Strong water resources monitoring networks are a pre-requisite for allocation decisions, license or permit determination, and targeting inspections for enforcement.

- Obligatory metering and self-reporting for permit holders can provide a first line of enforcement – although there is no guarantee of honesty, this offers a baseline against which inspection findings can be checked.

- Complete digitisation of the permit system can allow easier targeting of inspection and reconciliation of findings with permit conditions, as well as making it easier for users to obtain permits and check water conditions themselves.

- Collaboration with other departments can allow new deterrents to be introduced, for example withholding subsidy payments from illegal abstractors.

- Technologies such as drones can be deployed in at-risk areas to speed up identification of illegal abstractors.

4.2 Improved data sharing and coordination for WRM (South Korea)

- Korea’s sophisticated WRM management information systems show that data sharing and coordination requires not just software solutions but also data acquisition and computation hardware, trained and remunerated staff, and defined rules and procedures to help guide decision making, all of which will come at a cost both in financing and in terms of human resource capacity.

- Other countries looking to attract financial resources to such initiatives can emphasise the high public good dimension of water resources data when properly used. This includes reducing the risk of floods and droughts and their economic impacts. To manage costs and reduce risks of obsolescence, countries can also follow Korea’s example in assembling the WRM management information system in phases.
1. **Country context:** decentralisation and macro-level governance; economic growth; population distribution and urbanization; market reforms; geographic and hydrogeological conditions; aid dependency

2. **Water System**

   - **Centralised Water Supplies (Urban)**
   - **Decentralised Water Supplies (Rural)**

3. **Triggers and drivers of reform (both inside and outside water system)**
   - Sector evolution, status and maturity: Coverage, separation of functions
   - Reform triggers: Efficiency? Response to failures? External conditionalities?
   - Main objectives of transformation: Political? Technocratic?
   - Comprehensiveness of transformation: One sub-sector or multiple? Stand alone or integrated?

**ANNEX 1: CONCEPTUAL FRAMEWORK FOR ANALYSING WATER SECTOR**
ANNEX 2: REFERENCES

General


### Country examples

**Section 2.1**

Personal communication with Herman Havekes, Strategic advisor to the board and management, Dutch Water Authorities.

Personal communication with André Olschewski, Head of the Water Supply Division, Holinger AG.


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Section 2.2


Section 2.3

Personal communication with Dr Kevin Winter, Lecturer, University of Cape Town.


Section 3.1

Personal communication with Dr Callist Tindimugaya, Commissioner Water Resource Planning and Management, Ministry of Water and Environment, Uganda


Section 3.2


Section 4.1

Personal communication with Mr James Dodds, Chairperson, Envireau Ltd.


Section 4.2


