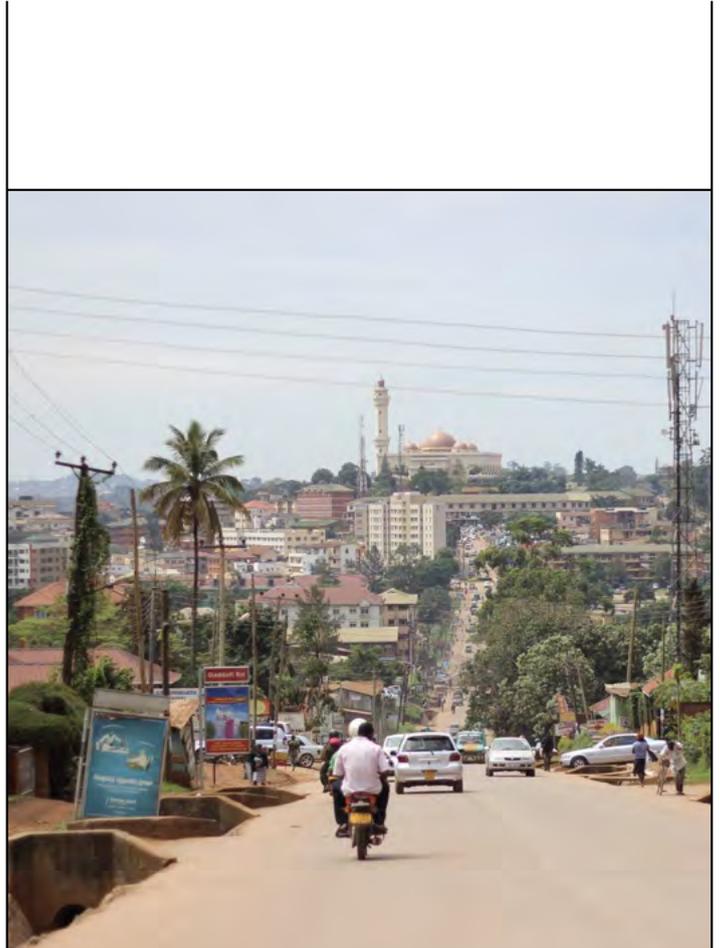


WATER OPERATORS' PARTNERSHIP

CASE STUDY



VEI, Utrecht, The Netherlands **MENTOR**

National Water and Sewerage Corporation (NWSC),
Kampala, Uganda **MENTEE**

November 2022



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Compiled by Winifred Nabakiibi

Abbreviations

AM	Asset Management
BH	Borehole
BOD	Board of Directors
CADESWAS	Capacity Development for Sustainable Water Services Within Uganda
CMMS	Computerised Maintenance Management Systems
DMA	District Metering Area
GIS	Geographic Information Systems
GIZ	Gesellschaft für Internationale Zusammenarbeit
GOU	Government of Uganda
GPS	Geographical Positioning System
HR	Human Resource
IHE	Institute of Hydraulic Engineering
IREC	International Resource Centre
KW	Kampala Water
MD	Managing Director
MIS	Management Information Systems
MWE	Ministry of Water and Environment
NRW	Non-Revenue Water
NWSC	National Water and Sewerage Corporation
P&IDs	Process and Instrumentation Diagrams
PPM	Planned Preventive Maintenance
STEs	Short Term Experts
VEI	VEI B.V. (formerly Vitens Evides International)
WOP	Water Operator Partnership
WWX	WaterWorX

Key Facts

WaterWorX (WWX) is a partnership of water operators aimed at improvement in utility performance and access to (improved) services. The overall goal of the programme is “well-performing utilities that provide sustainable, inclusive and climate resilient water services (basic or safely managed) to their current customers and to an additional 10 million people by 2030.” The WaterWorX Programme is co-funded and jointly implemented by the Dutch Ministry of Foreign Affairs (DGIS), the 10 Dutch water operators and local water operators throughout Africa, Asia and South America. By working together in Water Operator Partnerships (WOPs), water utilities can improve operational, maintenance, financial and administrative processes. In doing so, the continued strength of WaterWorX stands out in building and strengthening the capacity of local counterparts to make lasting improvements that increase access to sustainable water services and generate viable investment propositions in low-income areas. <https://gwopa.org/what-we-do/projects/waterworx/>

Partners

Mentee: National Water and Sewerage Corporation

NWSC was formed by Decree No. 34 in 1972 to serve the urban areas of Kampala, Entebbe, and Jinja. In 1995, NWSC was re-organized under the NWSC Statute. The company was given more authority and autonomy and the mandate to operate and provide water and sewerage services in areas entrusted to it, on a sound commercial and viable basis. As of December 2021, NWSC has 258 service areas spread across 97 Districts in Uganda¹. The company headquarters are located at 3 Nakasero Road, on Nakasero Hill, opposite Rwenzori House.

Mentor: VEI – Dutch Water Operators

VEI B.V. is a Dutch not for profit public limited company established in 2005 by Dutch water utilities. VEI is a full subsidiary of Vitens N.V. and Evides N.V. and implements their international Corporate Social Responsibility policy on behalf of seven Dutch drinking water partners: Vitens N.V., Evides Waterbedrijf N.V., WML, Waterbedrijf Groningen, Brabant Water, WLN and PWN.

VEI implements Water Operator Partnerships (WOPs) with dozens of water operators, aiming at sharing knowledge and skills to make the partner water operators stronger, financially sustainable and more (climate) resilient. VEI creates improved access to water and sanitation services, for approximately 350,000 people every year, mostly in low-income areas in Africa, Asia and Latin-America.

Standing side by side as water operators, VEI strives to continuously increase her impact for people living in poverty, by systemically improving the maturity of working processes of her WOP partners, supported by peer-to-peer collaboration, training, technical assistance and smart investments.



Duration of the WOP

May 2018 – December 2021



Cost (based on actual expenditure 2021)

Overall Costs: Euros 4,123,941

- Euro 2,268,167 Dutch Ministry of Foreign Affairs
- Euro 953,043 VEI
- Euro 902,730 NWSC

¹ NWSC Corporate Plan 2021 - 2024



Objectives

The overall objective of this WaterWorX project between VEI and NWSC was to strengthen the National Water and Sewerage Corporation (NWSC) in the sustainable delivery of cost-effective water services to a rapidly growing urban population. The project aimed at assisting NWSC with the implementation of the Asset Management Strategy and addressing the challenges to establish and implement a comprehensive asset management system that enhances business continuity and supply reliability while optimizing the cost of acquisition and management of infrastructure. The methods tools and practices developed and tested in Kampala were later to be replicated in the other regions.

According to a 2019 addendum to the project plan of 2018, the project implementation area was shifted from Central region, specifically Jinja which is a small area where piloting would be easier, to Kampala the capital city. The shift was guided by the thinking that if the pilot was successful in Kampala which is a larger supply area with complex supply dynamics, then replication would be done successfully in any other area of NWSC.



Motivations

Mentor VEI

VEI has a twofold mission objective. MISSION 1 VEI wants to contribute to Sustainable Development Goal number 6: achieving universal and sustainable access to water and sanitation by 2030. VEI wants to help a total number of 11.5 million people directly or indirectly to benefit from sustainable water services over the period 2015-2030. MISSION 2 VEI wants to strengthen the internal and external reputation of the partner water operators: leading in the drinking water sector.

Mentee NWSC

NWSC aspired to address the

corporation's Asset Management gaps and build the capacity of its staff, to deliver training courses in selected thematic areas to other utilities in the region. Evidence of how Dutch Water Companies run guided by asset management principles interested NWSC in this peer-to-peer support model to tap the technical expertise of the Dutch companies.



Facilitators

The WOP between VEI and NWSC was facilitated by the Dutch Ministry of Foreign Affairs through the WaterWorX programme. The main incentive for the Dutch Government is to support the achievement of SDG 6.



Approach

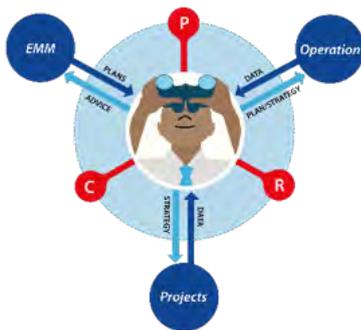
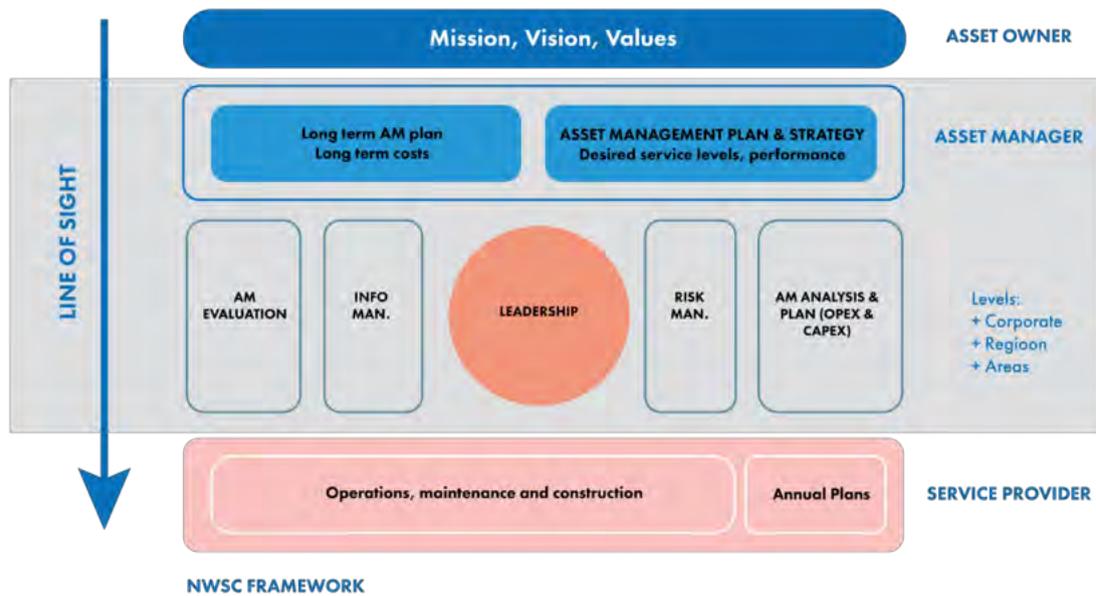
The first phase of this VEI-NWSC WOP was carried out from 2018 until the end of 2021. Initial assessments were carried out by various VEI experts who visited Uganda in 2018. Originally, VEI and NWSC were to use their complementary skills and shared knowledge and capacity to address selected areas of the NWSC Corporate plan 2018-2021. The strategic objectives of NWSC for 2018-2021 were: SP1: Service Reliability and Expansion, SP 2: Financial Growth and Sustainability. SP 3: Customer and Stakeholder Delight. SP 4: Learning and Growth. Following several discussions with different teams and eventually with guidance from the Managing Director, the focus of the WOP was directed to Asset Management. The WOP eventually focused on assisting NWSC to implement their Asset Management Strategy and addressing the challenges to establishing and implementing a comprehensive asset management system that enhances business continuity and supply reliability while optimising the cost of acquisition and management of infrastructure.

Partners signed a Letter of Intent to continue cooperation until 2030. This documented phase of the partnership was

from May 2018 – Dec 2021. However, WaterWorX Phase II has also been granted and it will be implemented over the period 2022 – 2026. The second phase of the WaterWorX programme will see NWSC and VEI support smaller utilities in Uganda, specifically the Southwestern Umbrella of Water and Sanitation (SWUWS) to adopt the practices supported

by WaterWorX Phase I in NWSC. Additionally, an EU-WOP will run for a similar purpose also supported by NWSC and VEI in the same region for the period 2022 – 2025.

The partners agreed to implement Asset Management in line with the framework below:



In this framework, the role of the asset manager was defined as the one that operates between EMM, Operations and Projects, who is tasked to find balance in performance costs and risks and can translate the data into advice to EMM and plans for Operation and Projects.

Source: Addendum to Project Plan Utility Support to Capacity Development for Sustainable Water Services within Uganda [VEI – WWX-UG-17-5001-WOP Kampala]

With this focus, the activities implemented were the finalization of the Asset Management Policy, the development of AM plans and strategies and AM systems putting in place. The systems put in place included i) a system for real-time mapping of new connections, network changes, network extensions and condition of fixtures using Mapkit software. Mapkit eliminated the need for the manual drawing of sketches and printing out of survey sheets which was a tedious and inaccurate process. ii) a Computerized Maintenance Management System (CMMS) for work orders. The system replaces the manual process of getting work orders and spares. iii) Process and Implementation Diagrams (P&IDs) for presenting process flow information and asset information. It promotes clear registration of the functionality for production assets. Other support covered capacity building in

the sustainable management of groundwater abstraction and borehole systems to ensure a reliable and adequate supply of quality water while preserving biodiversity. This required capacity building along the full cycle of GW management covering procurement, borehole siting, drilling and development, installation, Operation and Maintenance of the BHs through to decommissioning. Reviving the hydraulic modelling unit to support investment planning, design and monitoring of NRW reduction interventions and finally, support the preparation of investment proposals for improving Faecal Sludge Management and for rehabilitation, restructuring and extension of the KW supply and distribution network with a focus on investments required to improve control of the KW supply with DMAs.



Results

- 286,000 people got access to improved water services.
- Asset Management Policy was finalized
- Asset Management Plans and Strategies were developed
- Asset Management Information Systems have been established for both distribution and production
- Non-Revenue Water control measures have been put in place in selected areas of Kampala
- Ground Water Abstraction and Borehole Management work methods have been established and teams trained
- Investment Proposals for additional funding have been prepared and approved

The major achievements are highlighted below

Work Packages	Achievements
<p>Work Package 1: People and Organization Capacity development enhancement for improved Asset Management and implementation</p>	<ul style="list-style-type: none"> i. Support to institutionalization of Asset Management Policy and Strategy and rolled out in Kampala Water thorough strengthening of Kampala Water Asset Management Department. ii. Enhanced capacity for development and implementation of comprehensive Asset Information Management Systems (AIMS). <ul style="list-style-type: none"> ✓ Procured and rolled out MapKit application (Plate 1) as a tool for facilitating technical jobs execution in location and recording underground assets; All branch surveyors and Engineers trained and using the tool. ✓ MapKit data effectively used to validate and update assets in GIS thereby; reducing backlog of un-updated accounts, facilitating better and real time asset condition assessment, up-to-date maps and ensuring availability of data on assets for decision making ✓ Integration of MapKit and Customer Relationship Module (CRM) and documented requirements for integration with iSCALA and E-inventory systems. ✓ Procured the updated ESRI GIS server license and trained KW and Block Mapping staff on its use which has resulted in improved GIS implementation across board. ✓ Strengthened the in-house Computerized Maintenance Management System (CMMS) for efficient management of Static Plant assets by

Work Packages	Achievements
	<p>incorporating attributes of an internationally accepted CMMS application called Upkeep.</p> <p>iii. Establishment and capacity enhancement of the Borehole unit; The Unit has been facilitated to collect useful data regarding status of ground water abstraction and systems (see plate 2); A database and a mobile android data collection App has been developed to collect and update all boreholes. Acquired equipment and tools including Borehole camera. NWSC currently has over 374 boreholes for which O&M has greatly improved.</p> <p>iv. Energy Audits: The static plant Energy team was equipped and trained in performing Energy Audits. The team did audits in Entebbe, Jinja Kitgum and Masaka and prepared a proposal for investment in energy saving measures that can be earned back within less than two years.</p> <p>v. Support provided to IT team on development of Water Quality Information Management System (WaQIMS) which has been rolled out to all laboratories</p> <p>vi. 41 training sessions for NWSC staff amounting to 1610 person days with 26% participation of women.</p> <p>vii. Exposure visits for NWSC staff to utilities in Netherlands to enhance their skills and peer to peer exchange in Asset Management, Groundwater and Borehole Management.</p> <p>viii. Participation of one staff in the Young Engineer Professional Programme in the Netherlands</p>
<p>Work Package 2: Water and Sanitation Extension and improvement of access to water and/or sanitation services</p>	<p>i. Over 384km extensions done in Central Region and Kampala Water as part of SCAP 100 project translating into 48,900² additional customers</p> <p>ii. Completed mapping and update of extensions and customers in (i) above</p>
<p>Work Package 3: Finance Attracting finance for external investment in water and/or sanitation services</p>	<p>i. Faecal sludge treatment Kampala: Supported development of proposal for faecal sludge management in Kampala attracting funding to the tune of Euros 700,000 for Design to Build (D2B) project from Invest International, the Netherlands. Project agreement to be signed by end of June 2022.</p> <p>ii. Network Planning and investment in Kampala Water: Draft proposal for grant financing up to 30 million Euro towards Network Extension in Kampala through the DRIVE initiative funded by the Dutch Government.</p> <p>iii. Solar Energy Pilot: Contribution to funding towards the pilot project for use of Solar PV in NWSC installations</p>



Success Factors

- Realization by the utility that there is an AM problem in the utility and willingness to address the problem

² The additional number of people served is the number of additional customers/connections multiplied by approx. 6 people per connection.

- Evidence of 'what could be' which was acquired through the benchmarking visits
- Access to funds that allowed the mentor to purchase equipment, software, and licences when needed
- The ability of the mentor and the utility to financially facilitate employees' time which kept them motivated and actively involved in executing project activities
- Flexibility on the side of the WaterWorX Programme as a whole and of the Project Manager
- Contribution of the mentee to the WOP through investing in network extension
- The duration of the partnership 3 years was found helpful as opposed to short term interventions.



Challenges

- The main challenge faced in this WOP was the pressure to show that the proposals work (pressure to show proof of concept), yet showing such results takes time.
- The covid pandemic did slow things down a bit but the team managed to work around this.

Introduction

This report analyses the potential for sustainability of improvements from the Water Operator Partnership between National Water and Sewerage Corporation (NWSC) and VEI from 2018 – 2021. The Boosting Effectiveness in Water Operators' Partnerships (BEWOP) analytical framework has been applied to understand the approach to the WOP. The BEWOP programme exists under the auspices of the Global Water Operators' Partnerships Alliance (GWOPA).³ A total of 9 interviews⁴ with key informants involved in the VEI-NWSC WOP helped inform the documentation of this WOP.

This WOP is part of the WaterWorX programme. WaterWorX as a programme is a long-term partnership running from 2017 to 2030. Phase I of the partnership runned from 2017 to 2021 with a total of Euro 54 million. 55% of this co-financing is from the Dutch Ministry of Foreign Affairs and 45% of co-financing is by Dutch and Local Water Companies. Funds are to cover; salaries for Dutch Long-term and Short-term experts as well as a local project leaders and local young experts, flights, operational investments such as NRW reduction and in services provision in low-income areas, development of investment proposals, training courses and exposure visits for benchmarking, operational and administrative costs including M&E and audits.

The following sections summarize the different phases of the WOP from partnership scoping, partnership creation, partnership formalization, and implementation of the improvement tracks to analyzing evidence of progress towards the impact and effectiveness of the WOP. An evaluation of the WOP's impact is done by looking into the replicability, relational capital, the satisfaction of partners in the WOP, and effectiveness and efficiency of measures implemented. The main objective of this report is to understand the success factors of the VEI-NWSC WOP and to assess the sustainability of progress made beyond the partnership.

Partnership Scoping

Contextual Factors

Uganda's Water Sector

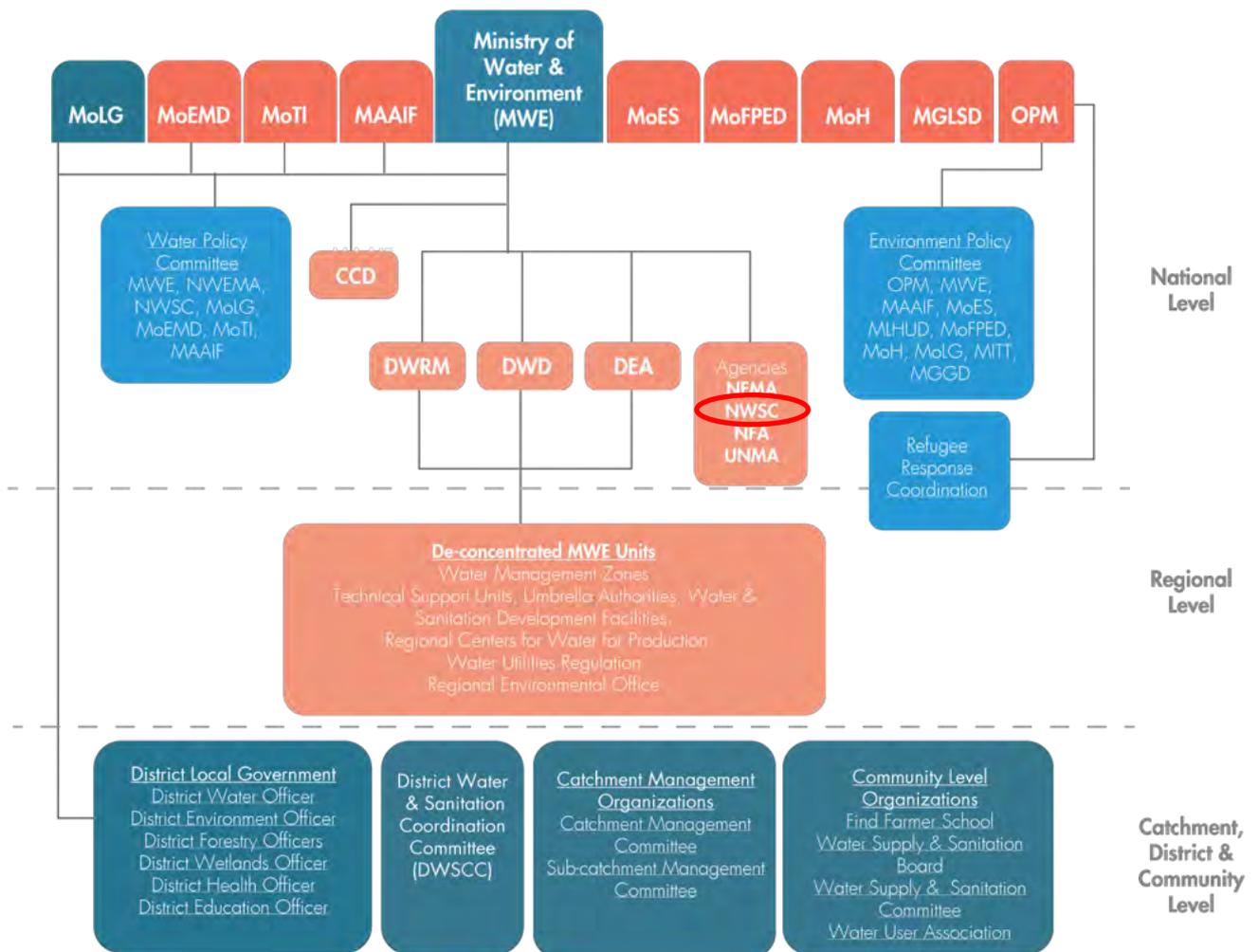
Institutional framework

The Ministry of Water and Environment is the main ministry for the water sector. The Ministry has three Directorates that include: 1) Directorate of Water Development (DWD) 2) Directorate of Water Resources Management (DWRM) and 3) Directorate of Environmental Affairs (DEA). The water sector also has four (4) semi-autonomous agencies namely, National Environment Management Authority (NEMA), National Forestry Authority (NFA), Uganda National Meteorological Authority (UNMA) and National Water and Sewerage Corporation (NWSC). Several deconcentrated support structures exist at the regional level including Water Management Zones (WMZs) who oversee the management of water resources, Water Supply Development Facilities (WSDFs) who manage investments in water supply in small towns, Umbrella Organisations (UO) which manage piped water schemes and sanitation facilities in Small Towns and Rural Growth Centres, and technical Support Units (TSUs) which provide technical support to district water and sanitation teams.

³ GWOPA is a network of partners committed to helping water and sanitation operators improve their collective capacity to provide access to water and sanitation services for all. Led by UN-Habitat, GWOPA supports operators through Water Operator's Partnerships (WOPs) – not-for-profit peer support partnerships between water and sanitation operators aimed at enhancing their capacity and performance to provide a better service to more people in support of the SDGs.

⁴ Interviews included:

Several other ministries have important roles in the water sector i.e., the Ministry of Local Government (MoLG), Ministry of Energy and Mineral Development (MoEMD), Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), Ministry of Education and Sports (MoES), Ministry of Finance, Planning and Economic Development (MOFPED), Ministry of Health (MoH), Ministry of Gender, Labour and Social Development (MGLSD), Ministry of Lands, Housing and Urban Development (MLHUD) and the Office of the Prime Minister (OPM).



Source: MWE (2019) Water and Environment Sector Performance Report 2019

National Water and Sewerage Corporation (NWSC)

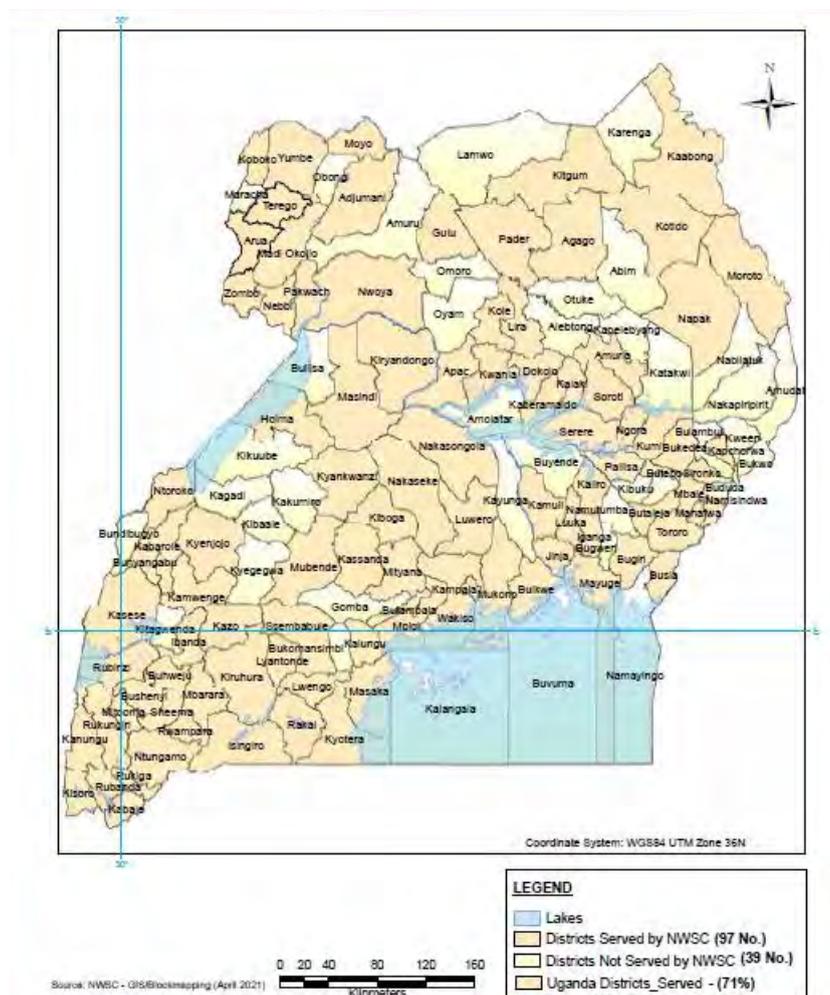
The National Water and Sewerage Corporation (NWSC) is one of the 4 four semi-autonomous agencies active in the water sector. The Corporation was formed by Decree No. 34 in 1972 to serve the urban areas of Kampala (city), Entebbe and Jinja. Sector reform has forced NWSC to take on a massive programme of taking over urban water supply schemes throughout the country. This is in response to a government decision in 2014. As a result of this decision, NWSC's geographic coverage has increased to 258 towns up from 17 in 2016. One major outcome of this expansion has been the significant increase in the number of water connections being serviced. NWSC's customer base now stands at 750,000 water connections and 24,000 sewer connections⁵. The challenge is to connect new users, thereby increasing access to safe water services, and at the same time improving the overall sustainability of water services in all these towns.

⁵ NWSC Corporate plan 2021-24

NWSC is a mature national water utility with a mainly linear top-down corporate management culture. NWSC’s vision is “To be a leading customer service-oriented utility in the world”. A combination of discipline and professionalization directed at fulfilling this vision is what drives both the management and employees of the corporation to create solid customer trust in their water services delivery. Asset management cuts across the power lines at several layers in the organization. Professional interest and a common keen interest to continuously improve and expand the public service make it possible to introduce more information-driven decision-making processes.

As the scope/span of command for the Corporation is increasing rapidly, top-down management can no longer be supported with trust alone. Timely sustainable investments are needed to technically maintain the utility’s service. Better asset management and asset management information allows for building a bridge between understanding the operational performance and better planning of investments. The rapid growth of NWSC has also in a way been experienced by VEI, although in a different way. The Dutch mentor companies have all gone through a period of merging smaller municipal water companies into larger ones that cover half the country. Although this is different from the rapid growth scenario of NWSC, the organizational and managerial challenges in merging companies are very similar to a fast-growing company. As such, sharing technical expertise based on asset management principles and backed by evidence of how far the Dutch Companies have come, helped the peer-to-peer support model of this WOP.

NWSC’s Nationwide Coverage



Source: NWSC Corporate Plan 2021 - 2024

A Rapidly Growing Urban Population

Uganda's urban population is estimated to be more than 10 million (24% of the Ugandan population) and it is likely to double by 2040. The provision of water supply infrastructure is vital if the population is to enjoy its institutional right of access to reliable, safe, and affordable water supply. Uganda's urban population growth is at a higher rate and has outstripped the rate of infrastructure development. This is attributed to rural-urban migration and the creation of new districts, cities, municipalities, and town councils which has led to gazetting former rural areas as urban areas. As of June 2021, the population with access to safe water in Uganda in the urban areas was 78%.

Environmental Challenges in Uganda

Uganda is a small country located on the East African plateau. It faces several environmental problems with the main ones being deforestation, land degradation, and water pollution. Other challenges are overgrazing, and primitive agricultural methods, all of which lead to soil erosion. Uganda's climate is naturally variable and susceptible to flood and drought events which have had negative socio-economic impacts in the past. Uganda's atmospheric resources of temperature, rainfall, sunshine, and wind show trends which suggest the possible influence of climate change. In 2005, Uganda experienced a severe drought that led to a decline in the water levels of Lake Victoria. In 2007, Uganda experienced its heaviest rains since the el Niño of 1997/98. Uganda's forest cover declined from about 5 million hectares in 1990 to 3.7 million hectares in 2005. This was a result of encroachment on agricultural production, deforestation to produce wood fuel, urbanization, industrial growth, migration, and problems of internally displaced people. Uganda's water resources cover about 16 per cent of the country's total area. The biggest pressure on the water resource is from the growing population and poor waste management practices of industries located near the water system.

Threatened Water Resources

Uganda is endowed with significant surface and groundwater resources. However, water resources are under increasing threat of degradation as exhibited in reduced quality and quantities in major freshwater bodies. Soil erosion and industrial pollution have reduced surface water quality. Watershed degradation and climate change also reduce surface and groundwater quantities.

Uganda's growing population and poor industrial practices, inefficient use and pollution of rivers, lakes and wetlands pose a threat to water systems. Urban growths that destroy wetlands also reduce the potential for water purification before wastewater reaches the main water systems. Therefore, increased efforts will be needed in the short-term and medium-term to strengthen regulations and enforcement of water quality monitoring and effluent management by firms located close to water systems.

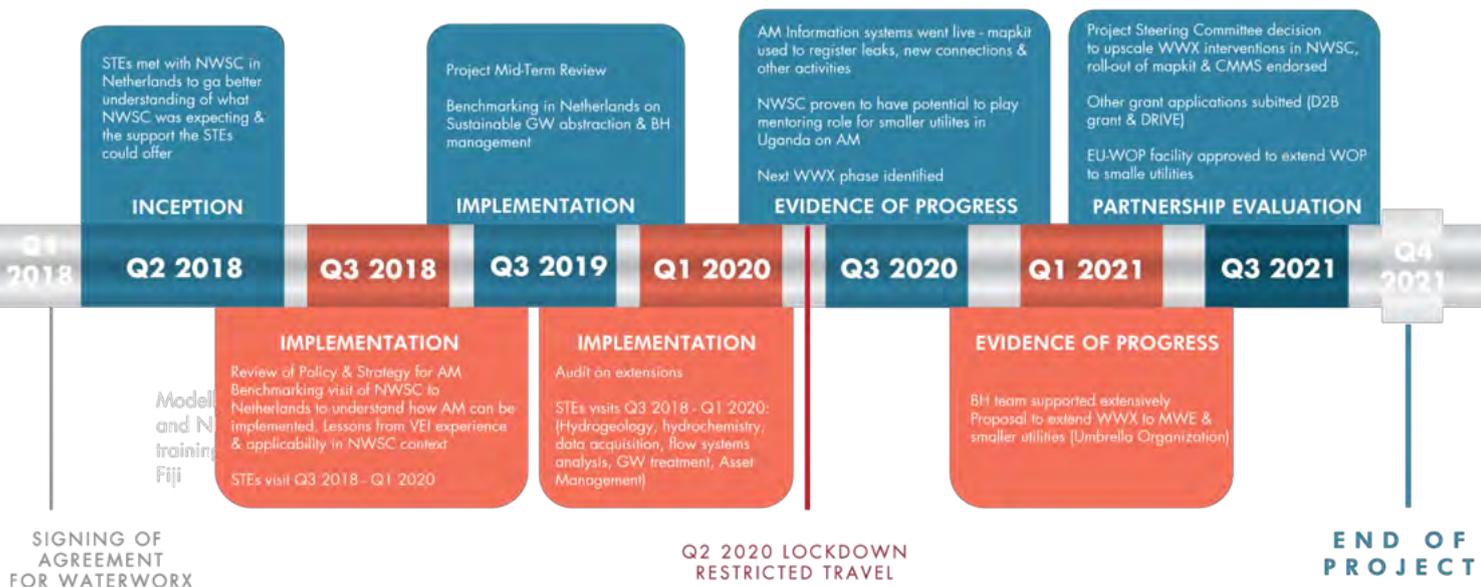
Partnership creation

A partnership with a long history of collaboration

In 2011 NWSC and VEI collaborated through the EU Capacity Development Project in Northern Uganda. In this project, VEI supported asset management of small water utilities through the creation of asset registers, energy reduction and strengthening of the regional capacity of water operations. The linkage was facilitated by GIZ, who supported putting together the project proposal and the project design. After this, VEI, IHE and NWSC agreed to collaborate for future

opportunities within the region. In 2014 the Alternative Approaches and Tools for Improved Water Supply and Sanitation for Towns in Northern Uganda AtWatSan) project started (although with a limited role for VEI). Early in 2017, an MoU was signed between NWSC, IHE and VEI to intensify cooperation. The trio agreed to further capacitate employees and use the NWSC International Resource Centre (NWSC-IREC) as a vehicle to excel in national as well as regional training of water operators. National Water and Sewerage Corporation, IHE Delft foundation and VEI, represented by MD. Dr Eng. Silver Mugisha, Dr Fritz Holsworthy and Dr Marco Schouten respectfully signed a tri-party cooperation agreement aimed at developing the capacity of NWSC staff through the delivery of training courses in selected thematic areas⁶. The signing of the agreement marked the beginning of a new capacity-building era in NWSC. The capacity building would later be developed into a customized programme to address the corporation’s training gaps and those of other utilities in the East African region. The agreement for this WOP which is a part of the WaterWorX programme was signed in January 2018 between NWSC and VEI.

Timeline for the Partnership



Note: End of Project phase I and start of Phase II

Enabling factors

GIZ had already established a good working relationship with NWSC and was confident of its capabilities. When the Northern Uganda proposal was prepared, GIZ incorporated NWSC with a support function to the smaller utilities in the North. VEI worked with NWSC for the first time under this project. At the time, the terminology of mentor-mentee was not in use but in the context of WOPs NWSC and VEI were mentors to the small utilities in Northern Uganda. This was the initial contact between the partners. Receptivity to new ideas and approaches played a key role in the successful formation of the initial partnership. NWSC was open to the idea of collaboration, which has led to a series of other successful collaborations with VEI.

⁶ Source NWSC website

Partnership Formalization

About VEI

VEI B.V. is a Dutch not for profit public limited company established in 2005 by Dutch water utilities. VEI is a full subsidiary of Vitens N.V. and Evides N.V. and implements their international Corporate Social Responsibility policy on behalf of seven Dutch drinking water partners: Vitens N.V., Evides Waterbedrijf N.V., WML, Waterbedrijf Groningen, Brabant Water, WLN and PWN.

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Standing side by side as water operators, VEI strives to continuously increase her impact for people living in poverty, by systemically improving the maturity of working processes of her WOP partners, supported by peer-to-peer collaboration, training, technical assistance and smart investments.

Motivation for mentor engagement in WOP

VEI has a twofold mission objective. When VEI was founded in 2005 these two mission objectives were already set in the statutes of VEI.

- **MISSION 1** VEI wants to contribute to Sustainable Development Goal number 6: achieving universal and sustainable access to water and sanitation by 2030. VEI wants to help a total number of 11.5 million people directly or indirectly to benefit from sustainable water services over the period 2015-2030.
- **MISSION 2** VEI wants to strengthen the internal and external reputation of our partner water operators: leading in the drinking water sector.

VISION In the vision of VEI, the 2 mission objectives come together in organizing peer support between water operators. Sharing experiences between water companies brings tangible benefits for all parties. In that respect, VEI is a real win-win approach where peer support are the way in which both water operators in a Water Operator Partnership (WOP) benefit from the collaboration. VEI organizes the solidarity between water operators to enable them to serve their customers better.

KPIs VEI partner utilities 2020 (Vitens, Evides, Brabant Water, PWN, Waterbedrijf Groningen, WML)

Number of customers (in millions)	13,89
Number of households (in millions)	6,7
Water produced (millions of m ³)	970
Number of employees	3683
Number of water treatment plants	n/a
Length of network (in kilometers)	103,410 km
Unaccounted for water (percent of total)	n/a
Staff per 1000 connections (water supply)	0.55
Staff per 1000 population served (water supply)	0.26
Turnover (in millions EUR)	1,063
Average drinking water price per m ³ (EUR)	1,04 (Vitens)

About NWSC

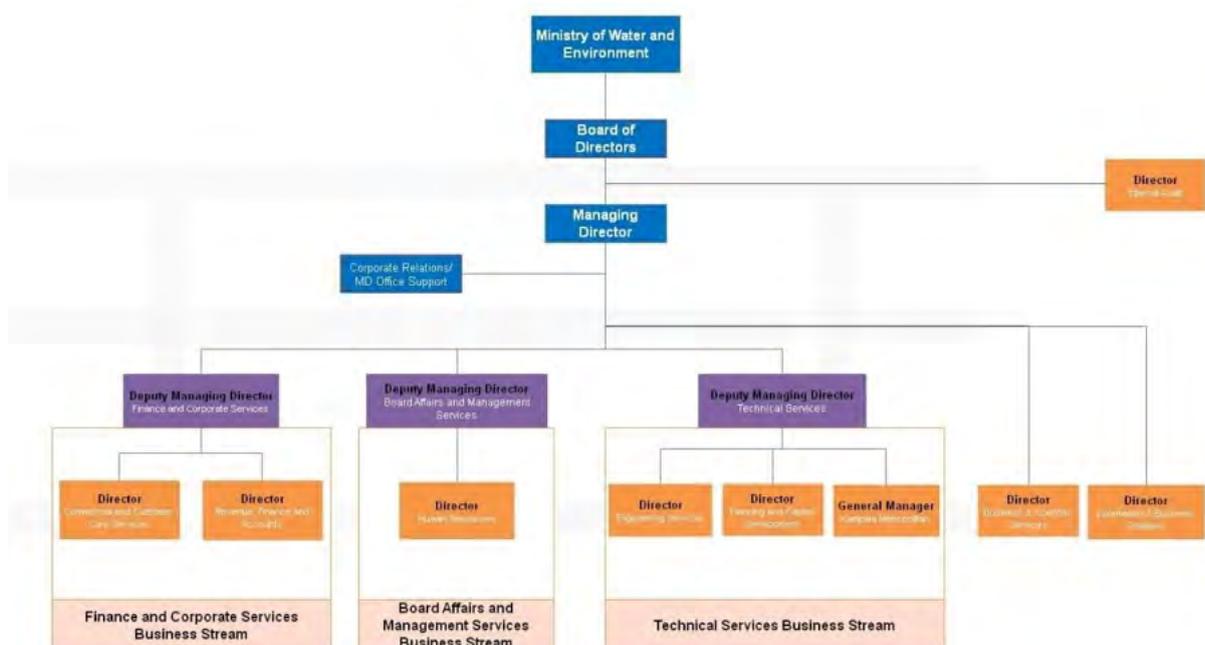
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Governance Structure

NWSC is governed by a Board of Directors (BoD) consisting of Nine (9) members from a broad professional spectrum including finance, engineering, accounting, and local governance; The Board of Directors is appointed by the Minister of Water and Environment in accordance with the NWSC Act, except the Managing Director who is appointed by the Board. The Managing Director (MD) is the Chief Executive Officer (CEO) of the Corporation and the only executive member of the Board. He/she is responsible for planning, organizing, managing and controlling the activities of the Corporation in line with the NWSC Act. The MD is responsible for supporting the Management team to carry out day-to-day operations and management.

The Corporate Structure comprises three Business Streams (Finance and Corporate Strategy, Technical Services, and Board Affairs & Management Services), eight (8) Directorates, sixteen (16) Departments and Forty-four (44) Units/Functional Roles. New job titles of Deputy Managing Directors and Directors were also adopted to head the Business Streams and Directorates respectively. The total number of staff at the time of the MTR was 3,200 giving staff productivity of 6 staff per 1000 connections.

In addition, NWSC currently operates in 258 towns and RGCs across the country organized under four Regions namely: Kampala Metropolitan, Central, Northern and Eastern, and Western and South-Western. The demarcation of regional clusters took due recognition of the need to ensure that the regions and constituent areas adhere to the minimum economies of scale, revenues, and break-even status. The towns and RGCs are further clustered in 51 Operational Areas.



Key Performance Indicators (KPIs) of the mentee utility

Population served (in millions)	18.1 million customers
Number of towns	258
Number of villages	11,143
Number of connections (water supply)	750,000
Water supply (millions of m ³)	137
Number of employees	4058
Number of water treatment plants	65
Length of network (in kilometers)	20,513
Unaccounted for water (percent of total)	36%
Staff per 1000 connections (water supply)	5.4
Staff per 1000 population served (water supply)	0.22
NWSC turnover (in millions EUR)	110
Average drinking water price per m ³ (EUR)	0.9

Financing of NWSC

NWSC's resource envelope comprises inputs from water and sewerage billings, Government of Uganda support and from Development Partners. They also generate resources from non-core services for example External Services (support to other utilities) as a way of income diversification. Over the five-year period 2016 – 2021, NWSC realized a total of UGX.3.402 trillion, of which internally generated resources account for 60%.⁷ The internally generated resources are mainly used to finance operating expenditure, minor capital investments and meeting co-financing obligations for major water and sanitation investments financed by Development Partners and the Government. DPs supporting NWSC include: Agence Française de Développement (AFD), German Government via KfW Entwicklungsbank, European Union Africa Infrastructure Trust Fund (EU-ITF), European Investment Bank (EIB), African Development Bank, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), and World Bank Group.

Summary of the financial resources from the various sources over the last 5 years in UGX

Source	FY 2015/16 Baseline	FY 2016/17	FY 2017/18	FY 2018/19	FY2019/20	FY 2020/21	Total
External Resources							
Development Partners	272,089,607	205,832,568	89,685,226	170,783,183	344,130,286	234,351,400	1,044,782,663
GoU	48,970,814	14,292,827	22,231,108	94,874,436	70,329,575	84,898,077	286,626,023
Total Ext. Resources	321,060,421	220,125,395	111,916,333	265,657,620	414,459,861	319,249,476	1,331,408,686
Internal Resources							
Water & Sewerage	284,127,998	332,724,890	384,656,993	436,971,646	390,998,077	445,809,941	1,991,161,546
External Services	2,313,083	2,078,424	7,175,292	10,463,165	7,425,708	2,500,000	29,642,588
Total Int. Resources	286,441,081	334,803,314	391,832,284	447,434,811	398,423,784	448,309,941	2,020,804,134
Market Finance	-	-	-	-	36,700,000	13,300,000	50,000,000
Total	607,501,502	554,928,709	503,748,618	713,092,431	849,583,645	780,859,417	3,402,212,820

Source Corporate Plan 2021 - 2024

For many years NWSC has been supported through external financing of its investment programs. In concerted action with the Government of Uganda (MWE and MoFPED), NWSC develops investment plans that are submitted for financing to international donors or financing institutions. WaterWorX builds on the objectives of the signed agreement and raises the collective responsibility

⁷ NWSC Corporate Plan 2021 - 2024

of all three parties to commit themselves to the overarching goal of SDG6: 'clean water and sanitation for all'. NWSC committed € 902,730 towards the WOP from GoU funding.

NWSC Involvement in WOPs

NWSC has been involved in several WOPs and is increasingly working as a mentor to many utilities in Africa and Asia. They shared some of the lessons they have learnt from these WOPs on factors that determine the success of a WOP.

NWSC experiences and lessons from other WOPs.

Length of WOP

The utility has experience with implementing short-term WOPs where they used more of a consultancy approach with the team staying with the mentee for a while then leaving and returning to check on progress and in between working with them remotely. This approach they felt did not deliver results effectively. Also, according to Mr. Allan Kafford of NWSC, supporting WOPs remotely creates varying levels of interest from the mentee where once the mentor is in the country there is excitement and interest in the WOP but once the mentor leaves, the interest slowly deteriorates. From his perspective, longer mentee engagement hence long-term WOPs and contact give bigger chances of success. Remote engagement can be successful only if the utility is more mature. Otherwise, the WOP will not be successful. 'Short-term WOPs are a waste of time. These will not work' Dr. Rose Kagwa Director BSS, NWSC.

Maturity of the Mentee Utility

Another aspect pointed out was the maturity of a utility which supports problem identification. According to NWSC, a more mature utility knows where its problems are and simply needs to be pointed in the right direction. Mature utilities are good at problem identification while with less mature ones, focusing on actions identified becomes a problem. In that sense, differences in the maturity of utilities will affect success.

Support not only activities but processes to sustain success

NWSC has learned that funding is not a guarantee for outputs or for the transformation of a utility. Supporting processes need to be addressed to be able to realize outputs. For example, installing meters without paying attention to who will read the meters will not deliver results. Interventions need to be followed up with building capacity for those interventions to yield results. Capacity building needs to be looked at beyond training; it is also processes and equipment.

'A computer (equipment) is needed to store data however how to get the data to the computer (processes) is equally important and so is the analysis of the data (training). It is therefore important to pay attention to training, equipment as well as processes' Zainab Mpakiraba quoting one of the NWSC Managers' Jude Mwoga, Director Information and Business Solutions (IBS) (insert position).

Leadership Commitment is key for the success

NWSC share their experience with Sierra Leone Water Company (SALWACO) where the Managing Director was changed 4 times in a span of a few years during the WOP. This slowed down the progress of the WOP and NWSC learned that stability in leadership is key to the success of any WOP.

Facilitator

The Dutch Ministry offered financial support for the WaterWorX programme to support progress towards the SDGs and to promote Dutch Utilities' Know-How and this WOP wouldn't have been possible without this support which was 55% of the total budget.

In the WWX WOP relationship between Dutch VEI and NWSC Uganda, 55% of the budget is funded by the Dutch Ministry of Foreign Affairs as a global facilitator for this partnership. This is not just financial support, but due to the structure of the programme and long-term commitment over 12 years, the WOP allows the parties to build a relationship, continue to exchange knowledge, jointly develop professionally and facilitate trade in the water and sanitation services sector. Many NWSC managers have for example studied at IHE in Delft, Dutch software developers have now internationalized their application, and Dutch developers have an opportunity to showcase their unique approach to faecal sludge treatment in Uganda. Dutch engineers also gained more experience in groundwater research and had an opportunity to become better chemistry teachers at a local Dutch school because of the experience gained in Uganda. Because of this relationship, the partners can now jointly approach Dutch and international financiers and present infrastructure investment plans with confidence in the numbers as well as in their organization. In addition, the WWX programme provides an even broader platform for cooperation, which for example is resulting in using the combined Ugandan/Dutch knowledge of Customer Relations and Distribution Management to support water utilities in Zimbabwe and Kenya.

Financing of the VEI – NWSC WOP

The budget of the VEI-NWSC WOP more than doubled from the originally planned €1.46million to €4.12million. Originally, VEI was to contribute 35% of the budget with NWSC contributing 10% of the budget and the rest 55% from the Dutch Ministry of foreign affairs. In the end, VEI contributed 23% of the increased budget while NWSC contributed 22%.

The SCAP100 Programme which is the Government of Uganda's funding channeled through the Ministry of Water and Environment to NWSC specifically for investments in the expansion of water services made a major contribution to the project thus reaching many more people than the planned 17,000. In the end, the partners jointly reached 256,825 people.

Agreement characteristics

This WaterWorX WOP built on the objectives of the 2017 MoU between NWSC, IHE and VEI where the three parties committed to using their collective skills to achieve SDG 6: clean access to water and sanitation services for all (Source MTR report). NWSC and VEI had also earlier signed a Letter of Intent expressing that they intend to engage in a Water Operator Partnership (WOP). For this WaterWorX partnership, they signed an agreement to consolidate the partnership⁸.

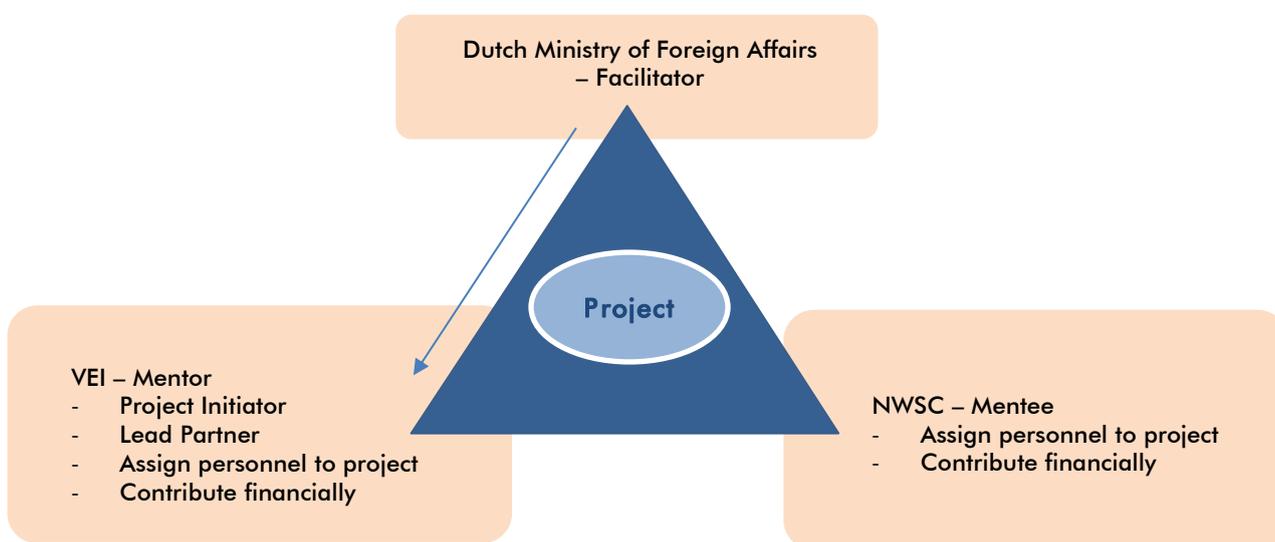
According to the agreement, the overall objective of the project Capacity Development for Sustainable Water Services Within Uganda (CADESWAS) was to strengthen the National Water and Sewerage Corporation (NWSC) in the delivery of cost-effective water services to a rapidly growing urban population. The expectation was that the newly formed regions of NWSC will have by 2021

⁸ This documented phase of the partnership was from May 2018 – Dec 2021. However, WaterWorX Phase II has also been granted and it will be implemented over the period 2022 – 2026. The second phase of the WaterWorX programme will see NWSC and VEI support smaller utilities in Uganda, specifically the Southwestern Umbrella of Water and Sanitation (SWUWS) to adopt the practices supported by WaterWorX Phase I in NWSC. Additionally, an EU-WOP will run for a similar purpose also supported by NWSC and VEI in the same region for the period 2022 – 2025.

increased their capacity to operate, maintain, replace, and extend their infrastructure in a way to ensure reliable and sustainable water services for all.

The partnership was built on a not-for-profit basis. So, only direct costs were to be covered without profit of any sort to any of the participating parties. According to the agreement, VEI was the project initiator and the party through which the funds from the Dutch Ministry of Foreign Affairs were to be channeled. Hence, VEI was the lead partner with overall responsibility for project implementation and fulfilment of all obligations under the project. It was also said that each party would assign enough of its personnel to the project so that provisions of the agreement are complied with, and the services are carried out in accordance with the project plan. The agreement stated that the project plan would be reviewed by both parties on an annual basis and updated as needed.

All changes to the programme and budget in the project plan would be valid only if agreed in writing by both parties. The agreement did not incorporate other stakeholders beyond the parties to the contract. The reporting mechanisms under the partnership were well articulated in the agreement.



Roles of the different parties as per the signed agreement

The resources that each partner was to bring to the partnership were specified in the agreement. See below:

Contributor	Original budget 2018	Actual Expenditure
DGIS	€ 806,581	€ 2,268,168
VEI	€ 509,446	€ 953,043
NWSC	€ 150,451	€ 902,730
Overall Budget	€ 1,466,438	€ 4,123,941

Source: Agreement between VEI and NWSC regarding WaterWorX Project CaDeSWaS and Final budget and expenditure WaterWorX report

Note that in real terms, the budget for the phase more than doubled to Euros 3.4mln. The Dutch Foreign Affairs Ministry 55%, VEI 35% and NWSC 10%. The local utility NWSC also more than doubled their contribution. The extra funds were a Government of Uganda contribution that was invested in network extensions in several areas served by the utility.

Diagnosis of needs

The diagnosis of needs was done in a participatory manner by the mentor and mentee. The diagnosis was not a very formal process and VEI and NWSC agreed to use their complementary skills, shared knowledge, and capacity to address specific areas of the NWSC Corporate Plan 2018-2021. The project plan outputs were conceived in line with the strategic objectives of the Corporate Plan which were SP1: Service Reliability and Expansion, SP2: Financial Growth and Sustainability, SP3: Customer and Stakeholder Delight, and SP4: Learning and Growth. Using a needs assessment template executed by the mentee, the mentor and mentee jointly agreed on what they needed to do together. 3 work packages were agreed upon in relation to Asset Management the agreed focus of the project and that at the same time aligned with the WWX Standard work packages.

1 People & Organization

- Management Information Systems improved
- Capacity Development Programme prepared and implemented (Asset Management)
- NRW Reduction Plan enhanced, and people trained in NRW reduction approach
- Maintenance Management Programme improved, and people were trained in maintenance management (at Ggaba, pump stations and wastewater treatment works of Kampala Water)
- Proposals developed for providing people with direct access to improved water and/or sanitation facilities, coordination of the implementation of the proposals and climate-resistant water supply. Programme 2050 developed
- Energy-saving programme
- Gender analysis and approach confirmed and incorporated in all project activities

2 Water (extension of services from Package 1 in Kampala to Central region)

- Reduction of NRW
- Maintenance Management
- Water distribution Program
- Energy Saving Program

3 Investment proposals

- Climate robust investment proposals were developed for providing new people (network expansion) with direct access to improved water and/or sanitation facilities in the period 2022-2030.

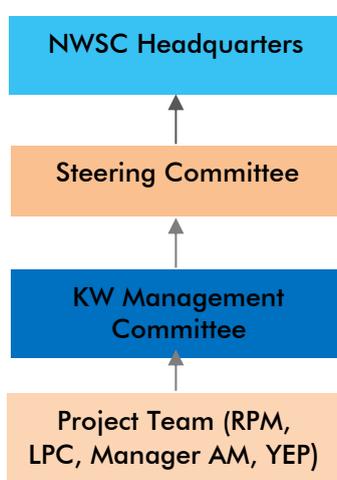
See Addendum to Project Plan - 2019.

It is important to note that this project had a slight change in focus from the original plan hence the need for an addendum to the project plan. The project priorities were revised and how this happened is explained under the section on re-orientation of project priorities.

Project Implementation

Management of the Partnership and Inter Organisational Dynamics

The WaterWorX programme uses a model where a Resident Project Manager (RPM) is assigned as the focus person to manage the relationship between VEI and the mentee utility. For the management of this project, a Resident Project Manager (RPM) was appointed by VEI. NWSC allocated the RPM an office in the Asset Management department of Kampala Water (KW). With this arrangement, the RPM was able to interface very often with the mentee as well as be approached whenever he was needed. NWSC provided a Local Project Coordinator (LPC) to assist the RPM in the execution of project activities and to follow up on expert inputs. On project implementation, the VEI RPM and NWSC LPC reported to the General Manager (KW) who spearheaded the implementation of the pilot project activities for the Kampala Area.



Reporting mechanism under the project.

From NWSC HQ, the project was supported by a Young Expert from the M&E Corporate Planning and Risk department. The RPM, LPC, Manager AM and YEP worked as the project team and met regularly.

Roles and Responsibilities

Role	Responsibilities
Resident Project Manager	<ul style="list-style-type: none"> - Overall project implementation and relation with the donor - Guidance of experts from the Netherlands
Manager Asset Management	<ul style="list-style-type: none"> - Implementation of project activities in Kampala and alignment of these with the AM policy and strategy
Local Project Coordinator	<ul style="list-style-type: none"> - Local project administration and implementation of project activities outside Kampala.
Young Expert Professional (YEP)	<ul style="list-style-type: none"> - Monitoring and Evaluation of the project progress - Support mainstreaming of the Asset Management function at the corporate level

Role	Responsibilities
Kampala Water Management Committee	- Support implementation of the project activities
NWSC Steering Committee: <ul style="list-style-type: none"> • General Manager (KW) • Director Business and Scientific Services • Director Information and Business Solutions • Manager Operations (Central Region) 	<ul style="list-style-type: none"> - Approve annual project plans and progress reports - Give strategic guidance regarding the impact of the project at concern level. - Meet at least 4 times per year

The project team (RPC, LPC, Manager AM, YEP) was tasked with regularly informing the management committee regarding progress made and agree on the deployment of human and financial resources for the project with this committee.

Management of Kampala Water and VEI had joint responsibility for achieving the outcomes of the project and operational issues were handled by the GM-Kampala Water. Meetings were mostly sporadic based on the assignment. Over and above the Kampala Water management committee, the project team made a quarterly report to the steering committee that also helped with steering regional issues. Quarterly reports, however, were not very formal and there was a lot of flexibility. The Steering Committee would meet occasionally as the project tended towards what was practical. Reporting quarterly and annual progress was done based on templates provided by the WaterWorX programme. During the project period a mid-term review (appointed by WaterWorX) and end-term (appointed by DGIS) evaluation by an external evaluator by took place.

Choice of experts

There were mixed views about the experts provided during this WOP. Some people from the mentee operator felt that the mentor had the tendency to bring in juniors thus using the mentee utility as a training ground for them. It was mentioned however that the mentee did call out the behaviour of bringing in junior experts which resulted in a change. This shift might explain why on the other hand, others felt that the short-term experts were good, and the needs assessments carried out led to the creation of context-relevant training. Some members on the mentee side really appreciated the short-term experts. For this WOP, the VEI experts included:

- Project Coordinator
- Project Director
- Project Management Expert
- Asset Management Expert
- Distribution Hydraulics Expert
- Distribution Management Expert
- Geo-Hydrologist
- Water Production AM Expert
- Water Production O&M Expert
- Water Quality Expert
- Energy Management Expert
- Wastewater AM Expert

Areas of Conflict

There were issues regarding transparency in accounting for funds used and questions on how much actually benefits the utility vis a vis what goes back to the mentor utility through the Dutch junior experts who came as trainers. Interaction of management and the operational level was planned however, management was not so interested in interaction but in results. The mentee's management made it explicit that what was needed was to show results. According to the project manager, based on this, attention was shifted to the operational level. The project was under intense pressure to show proof of concept. The mentee needed to show that the ideas suggested work. An effort was invested in supporting the staff to get real value out of the proposed interventions and thus appreciate what the WOP was delivering. These teams were then later to be the ambassadors who

share with management the progress of the programme.

The WOP faced a unique 'risk' in that the capacity of the NWSC professionals, the scale of the utility and the potential for progress were quite outstanding relative to other WWX WOPs⁹ that the mentee had been involved in. This raised a question regarding the relevance of the WWX programme for NWSC. However, acknowledgement of NWSC as a joint mentoring partner that was in every right a co-partner for the effective dissemination of the knowledge gained by the WWX programme addressed this concern. The level of trust between the partners improved along the partnership time as the project continued to deliver results. The evidence or proof of changes reported by the utility staff helped to increase trust in the partnership.

Reorientation of the project priorities

Initially, the WOP's main objective was to strengthen the operational performance of NWSC servicing the urban and peri-urban populations of Uganda. The initial idea was for the project objectives to be implemented in the Central region, particularly in Jinja which is a smaller area. The thinking was that piloting and creating impact would be easier in a smaller water supply area. The methods tools and practices developed and tested in Jinja would later be replicated in the other regions. Alongside this, NWSC and VEI would develop relations and models of cooperation to provide continued support for developing the capacity in these regions and even on the African continent at large. At the time, the proposed areas of intervention were: Comprehensive Asset Management System, Non-Revenue Water Reduction, Water Service Reliability (water sources, water quality and quantity), Water Service Coverage, Timely and Efficient Delivery of Capital Investments, Environmental Sustainability, I.T Business Solutions (Integrated ICT Solutions), Investment Financing, Pro-poor service delivery, Staff Motivation, Staff Capacity Development, Research & Development (R&D), Organisational Capacity Development. Following this, it was critical to have a shared understanding of what the actual priorities were, and this took several meetings with the operational teams at the beginning of the project.

In a meeting with the top management of NWSC, the Managing Director suggested/stated that the project should focus keenly on Asset Management. Dr. Eng. Silver Mugisha, the managing Director of NWSC, expressed that what the utility needed was to demystify the concept of AM. *"We want to change from management by storytelling to management by facts."*¹⁰ He said that what the utility needed was to ensure that they can get the information they need for Asset Management. He guided that Asset Management is the lens through which all efforts of the WOP be directed. He also suggested the shift in focus from Central region to Kampala. The initial focus on Central region was that the services are more needed here and if successful will be expanded to other NWSC areas. However, the MD guided that any intervention's legitimacy should be tested in Kampala where implementation is the toughest, and which is the heart of the business. Kampala is also a more complex area given the volume of business and the population served. 'Any intervention that succeeds here will certainly succeed in any other NWSC area' he said. Hence the shift in focus to the more complex Kampala area, also with a keen focus on Asset Management.

The WOP was now to assist NWSC to develop a comprehensive asset management system that enhances business continuity and supply reliability while optimizing the cost of acquisition and management of infrastructure. The new plan became to implement NWSC's Asset Management

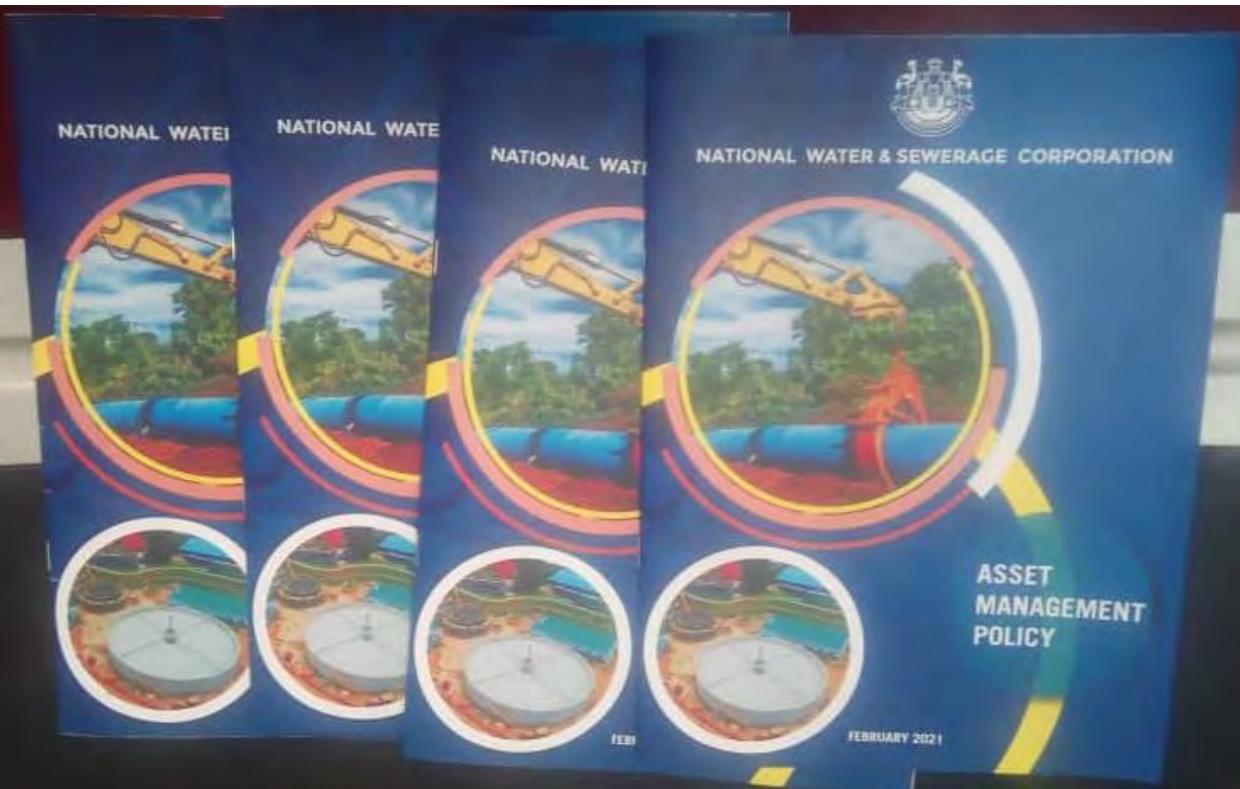
⁹ Q2-2020 WWX Progress Report

¹⁰ Interview with VEI Project Manager Martin Nijse on 8th/12/2021

Strategy in Kampala Water, working on asset information and improving capacity to carry out maintenance and later replicate this in other regions during a potential subsequent second phase.

Several expert missions were carried out related to asset management focusing on:

- Review of the Asset Management policy and strategy
- Update of the Asset Register
- Benchmarking of Asset Management practices in VEI and development of Asset Management plans for NWSC
- Development and implementation of in-house Computerized Maintenance Management System (CMMS) for production assets
- Piloting of Upkeep CMMS software for production assets
- Development and implementation of Process and Instrumentation Diagrams (P&IDs)
- Integration of the Supervisory Control and Data Acquisition (SCADA) system and remote monitoring systems with the Asset Management System
- Piloting Mapkit Asset Management Information System for distribution assets and linkage of this with the GIS system.
- Development of standards for sustainable development and maintenance of groundwater abstraction systems
- Trainings in: Basic Hydraulic Engineering (Hydraulic modelling), meter management, leakage control AM etc. to build capacity within NWSC.
- Assessment of the potential to develop an investment proposal for faecal sludge management facilities
- Developing investment proposals



Asset Management Policy

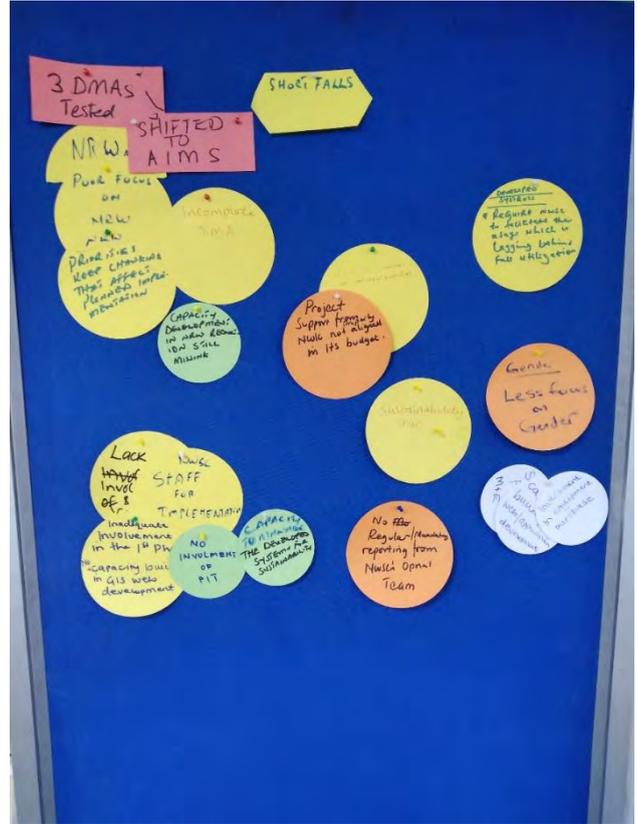
Improvement tracks implementation under the project

Benchmarking Visits

A team of the utility staff visited the Netherlands to see firsthand from Vitens and Evides how they handle different aspects of their operations. During this visit, the team was exposed to how AM was done in the Dutch utilities; digitalization of processes was fundamental to asset management and the team was amazed by the way the systems there operated. The team observed the importance of documentation, asset registers and tracking asset conditions. During this visit, it was evident to NWSC that Vitens and Evides were quite mature in the subject of Asset Management and that this was one area where they had an advantage over NWSC. At the time, NWSC's assets were updated manually about once every 10 years for purposes of financial Asset Management but there was not much happening on the technical side. The NWSC team was convinced that this was one area in which they could tap into the knowledge of their mentor. They needed a more dynamic asset register that would support more responsive operation and maintenance, production, distribution, and sewerage service delivery. It became clear that having asset registers in digital form would make work a lot easier than it was with a manual system. The benchmarking visit served to convince the team about the value that would accrue to their utility if they were supported in AM.

From the benchmarking, they learned that the risks and problems that the two utilities faced were different, with the Netherlands being a very flat country and Uganda on the other hand and more specifically Kampala having many hills hence high pressures and flows being a big issue. Also, the households in the Netherlands are getting smaller hence the number of people per connection reducing while consumption and population per connection are rapidly growing for NWSC. The contexts of the 2 utilities are thus rather different and pose completely different challenges with those of the mentee utility being more complex. Nevertheless, there was a lot still to be learned from Vitens and Evides as asset information was a big gap for NWSC.

It was also during this visit that borehole management was included as part of the WOP programme. NWSC had recently taken over several towns/service areas that were supplied by groundwater and yet the competence to manage groundwater supply was not available in the utility. The NWSC team was not very knowledgeable in Geohydrology and had minimal experience in borehole management with the static plant maintenance team dedicated to fixing pumps which were breaking down very often. The team agreed that the gap in the static plant maintenance department was borehole management, and they could address this gap through this WOP.



Getting insight in Distribution and NRW; Evaluation of results

Improvement Track: Asset Management Information Systems

The objective of this improvement track was to operationalize a Comprehensive Asset Management System, streamline the functionality of Mapkit (a software that supports the new connection process, leaks, and bursts handling) to allow for effective use of the software by the field teams, rolling out the use of Mapkit in all 25 Branches in Kampala and implementing Process and Instrumentation Diagrams as the standard guide for modifications and process control.

Process of Implementation

NWSC had been discussing AM for years but had not made headway on its implementation within the Corporation. The utility needed to break down the subject into what they would do, what would be relevant and above all, what would be implementable. The team started by breaking down the NWSC business and where it was going. They zeroed in on three core areas: 1) Production 2) Distribution and 3) Sewerage. For Production, the focus was on Ggaba Water Treatment Works and the Static Plant Maintenance Department. On the distribution side, the focus was on NRW management and for Sewerage Services the focus was on the collection/distribution process to document the assets. The production side already had a solution which was installed by the contractor and which is working well.

Areas of Improvement

- Asset Registration (Asset registers)
- Development and Implementation of Process and Instrumentation Diagrams (P&IDs)

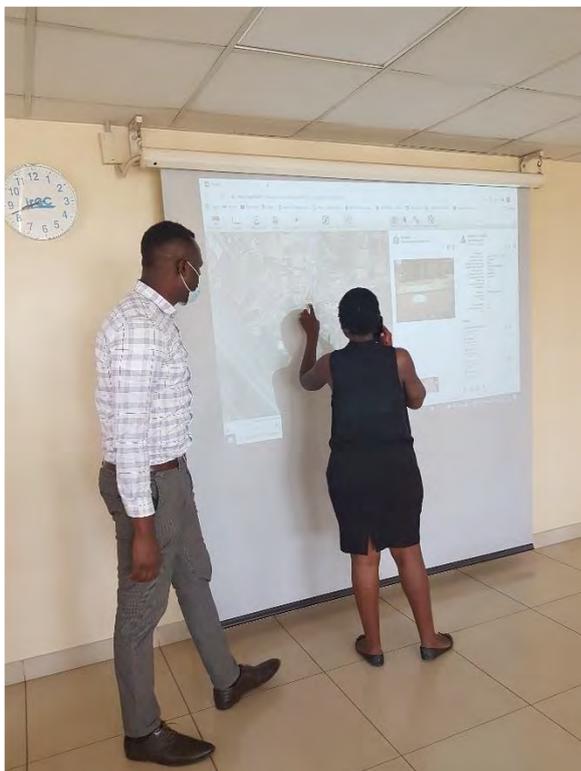
- Integration of use of Mapkit in all network maintenance and new connections activities across all branches
- Piloting of Upkeep Computerised Maintenance and Management Systems (CMMS) software
- Development and implementation of in-house CMMS
- Establishing a SCADA connection to AM system using Microsoft Open Database Connectivity (ODBC) Interface for interoperability thus integrating SCADA and remote monitoring systems (automation) with AM System

Activities carried out

1) Policy Review of Asset Management and Development of Asset Management Strategy and Plans

A draft AM Policy was in place and a technical team had been formed to support this. The Finance department also had an asset management policy from the financial point of view. It was agreed that support is given to fine-tuning and finishing the policy as well as finalizing the AM strategy. What was needed with the strategy was breaking it down into implementable steps. According to the mentor, the work to be done involved almost starting from scratch with finalizing the AM policy and getting buy-in for the policy through various departments and management teams. The team was pushed by the managing director who instructed that they shift from 'walking corridors' seeking buy-in to proving the concepts suggested through real work in the field. His view was that the managers whose approval was being sought through meetings would quickly appreciate it once they saw real solutions provided for problems they are facing. The challenge posed to the mentor was to shift from telling the story of what AM can do to showing what it can do in practice. For the WaterWorX project, this meant focusing on the operational level and doing whatever was needed to demonstrate results including purchasing the necessary equipment to demonstrate that things work.

2) Enhancement of the GIS Mapping System



Mapkit Training

The utility faced a challenge of a lengthy network update process following repairs and maintenance in the field. A surveyor needed to go out with a sketch, locate the fixture, plot it and maybe on a weekly basis scan all that he had worked on and collected in the field and then digitize this for upload. This was a very lengthy process so was sometimes ignored which resulted in a lot of data gaps in the databases. The GIS mapping system has been enhanced with the application of a tool called Mapkit. Mapkit is a tool that supports capturing information and details of incidences in the field in real-time with pictures and coordinates. In addition, it disseminates data that can be used by field teams. As incidences are being handled in the field, the information is immediately captured and uploaded. Any user that has credentials in Mapkit can report an incident from anywhere they are, and this is immediately logged to be addressed. Previously, the GIS unit was generating base maps by procuring satellite images which were not only costly, but the images had to be digitized thereafter to

create a base map. It was time-consuming to generate a base map that the maintenance teams or

new connection team would then use to map new customers, especially in the areas within the service area which was growing rapidly. It was also not possible to keep the base map up to date with the speed of growth because of the processes involved in procuring and subsequently generating an up-to-date base map. Mapkit has helped close that gap. Mapkit uses maps as the base; google maps and ESRI imagery are updated by their own vendors. With Mapkit, it is possible to add information i.e., pipes, fixtures, and customer information in areas where there was previously no information/infrastructure. The benefit of the software is that the process of users adding information that eventually ends up with the GIS office is greatly supported hence reducing the amount of missing data. The project also supported the upgrade of the ArcGIS license and as a result of the upgrade, the team can do a lot more and apply the high-end functionality of the GIS.

3) Enhancement of the Customer Relationship Management (CRM) System

The utility faced the challenge of tracking when customer complaints were addressed. Once a customer called the Call Centre, their complaint was logged, allocated a job card and the job card passed to a plumber. However, there was no way of tracking if the plumber had addressed a customer's concern until the plumber returned to the office to close the complaint in the CRM system. The CRM was only available via the office intranet. With Mapkit, such information can now be uploaded in real-time. A Mapkit team came to Uganda and engaged with the Customer Relationship Management (CRM) team to understand the requirements of the utility. They then customized Mapkit to the utility's needs. The team was able to integrate Mapkit with the CRM. Through the CRM system (call centre), once a customer logs a complaint it can now be tracked to completion because of the Mapkit app. The app is accessible via desktop computer as well as on phones so closing complaints can now be done in real-time.

4) Asset Condition Assessment

A condition assessment of all fixtures was done which informed the utility of the condition of all these fixtures as well as helped identify those that needed critical intervention. The Planned Preventive Maintenance (PPM) team did a comprehensive survey of all critical fixtures (fire hydrants, valves, washouts, air valves). This required combing through the whole network. Now, all fixtures are known, documented, and their condition is tracked. A picture of the fixture is collected in Mapkit and uploaded into the GIS database. 3 display screens were procured to allow for better network monitoring and management. Besides this, Mapkit can keep a record of all assessment reports or PPM works done on each fixture. What that means is that you can go back in history and understand the story of a certain fixture including who did the assessment or subsequent PPM works. Across the board, any user can now see what is happening in the different branches in terms of leaks/burst management, the new connection process i.e., how many customers have expressed interest in a water connection but are still pending connection and how many customers have been mapped at say a given branch.

5) Asset Register

Integration of iScala with AM Systems

NWSC's asset register is available through their financial system iScala¹¹ and was last updated during an asset re-evaluation exercise in 2018. Discussions were underway to link iScala with the other asset management information systems through Mapkit. Linking these would allow the asset register to continuously be kept up to date with information validated from the other information systems. This linkage would also foster timely investment planning for infrastructure replacement or expansion which is informed by the technical status of the utility's assets.

¹¹ System for capturing financial asset information

Process and Instrumentation Diagrams (P&IDs)

The teams were trained by a consultant on P&IDs. P&IDs are used for presenting process flow information and asset information. The NWSC water supply systems did not have P&IDs, now the teams have embarked on creating these for each of their systems.

Activities carried out

The teams developed a functional specification document detailing P&ID aspects and a symbol library. They then embarked on sketching process flow diagrams (PFDs) and P&IDs and assigning tag numbers based on agreed convention with the financial systems. They also developed a tag numbering convention for equipment in OSBL (Outside the Battery Limit), did markup of existing tags and collection of attributes on assets and fixtures in Gaba 1, 2, 3 and booster stations.

NWSC has now initiated the production of P&ID network drawings for Kampala Water Network, and Jinja. Teams were trained on how to use Auto-Card P&ID software to convert/draw PFDs & P&IDs sketches into final drawings using auto-cad P&ID software. Other trainings done were source training for the core team using auto-cad P&ID, training of engineers on the purpose and proper use of P&IDs in engineering works, training, and technical assistance for system users. The project developed a spare parts specification database in excel to be imported into the in-house Computerized Maintenance Management System (CMMS).

Other activities carried out to improve asset registration were physical tagging of equipment and fixtures using engraving equipment which was purchased under the WOP. Coding was developed for engraving. Engraving will address the challenge of rampant vandalism to fixtures. A precast concrete laboratory was also supported by the WaterWorX project with tools and equipment.

The asset register was updated to include specifications for newly installed assets and instrumentation, design, building and installation of infrastructure i.e., PLC panels, COM Methods, and servers. Programming of PLC input/output modules and servers. All the drawn Process and Instrumentation Diagrams (P&IDs) for all the areas captured were uploaded into the CMMS.

6) Inventory

An Electronic Document Management System was piloted in the Business and Scientific Services Department for the External Services (ES) Division, Archives, Central Stores, and the Water Quality Department. After a review of the pilot, the plan was to expand to more departments starting with those that are most critical and have a lot of paperwork. Digitizing helped eliminate paperwork and created an agile document management system. Information managed includes contracts, mains extensions etc.

Orientation on the use of Mapkit was done initially using tablets. This was mainly the engineers and surveyors. Later, it was realized that different user types require different solutions and that some users were better placed to use a smartphone, others a tablet depending on the work they do on a day-to-day basis. With this realization, 46 additional handheld devices were procured for field teams in the branches. VPN cards and data were procured for the devices. With this, supervision of fieldwork was made a lot easier. One can easily see how many leaks are being worked on and which leaks are not yet addressed. In this sense, the utility has acquired a good management and accountability tool which has also increased the productivity of plumbers.

Improvement Track: Water Production (Static Plant Maintenance Gaba)

The objectives of this improvement track were to establish a system for storing production asset information and to obtain a dynamic system for asset registration and for Operation and

Maintenance.

NWSC already had a Computerised Maintenance Management System (CMMS) where they stored asset information (asset register). They needed one to support storing asset information and at the same time serve as their maintenance system. After review by the WaterWorX experts, it was agreed that the NWSC system was good enough to be retained for AM. The project then supported improving the available CMMS by exposing the NWSC development team to a variety of options on the international market. There were several of these. They looked into the modules in each and explored the advantages of one over the other. After comparing the software on the market, they selected UpKeep as the best solution on the market. The mentor VEI purchased a 1-year Upkeep licence for NWSC. The idea was to use it to improve their own CMMS.

Sustainability given the annual licence fees was also a challenge, so an in-house option was best for NWSC. They have now embarked on improving their own Maintenance System which mimics the functionality of Upkeep. This is a solution customized to the specific needs of NWSC for water production assets including boreholes.

Activities carried out

The Static Plant team presented the CMMS option in use by then. The team agreed that a CMMS software on the market be identified, have it used by the team to check applicability and modules and then explore improvements to the CMMS in-house option. They did compare all the modules and capabilities of various CMMS software on market and selected Upkeep. Upkeep had several advantages in that it had all modules plus it had both a web and mobile version. Licenses for Upkeep were acquired, and an advanced laptop was procured for storing the Upkeep software. Tablets were procured for installing and running upkeep. Users studied web and mobile programming to aid the development of the in-house CMMS. Special features of upkeep CMMS were identified for implementation in the in-house developed CMMS.



Inspection and regeneration of boreholes by the static plant team

Teams were trained on various CMMS modules such as work order management, work request handling, asset registration, planned preventive maintenance, and staff and spare management among other modules. A P&ID module was also incorporated as part of the CMMS. The population of asset data in the CMMS system was done by the KW team in Gaba. In-house development of CMMS was done by the Static Plant team. They created asset and facilities list tree-structured data for importation in upkeep. They then migrated the database from Upkeep to populate the in-house CMMS. The in-house CMMS solution has modules such as asset register, work requests management, work order management and planned preventive maintenance. Customising the in-house solution involved creating /designing electronic PPM and Work order templates, customization of electronic PPM forms and work orders in upkeep to suit user requirements, testing the app and

configuring rugged tablets for Upkeep-specific use. This was followed by a pilot roll-out of the CMMS system (web version & mobile app).

The CMMS has been operationalized in Central and other regions through regional workshops in Gulu (Northern Uganda), Mbale (Eastern Uganda), and Mbarara (West and South-Western Uganda).

Improvement Track: Water Distribution

The objectives were to support the reduction of commercial and physical losses. The areas of Improvement tackled were the creation of DMAs in Bukasa, Kanaaba, Kirinya and Busabala, testing the effectiveness and financial sustainability of Asset Management Resources (AMR), testing the effectiveness and conditions for a meter exchange programme, and testing the effectiveness of active pressure management.

Activities carried out

Meter Management

Meters that had registered over 5000 units of water or are above 7 years since installation within the DMAs Bukasa, Kanaaba, Kirinya and Busabala were replaced. Also, defective bulk meters were replaced and in other cases, new bulk meters were installed to complete the isolation of the DMAs. An AMR meter in the Kiwafu DMA was installed and tested. The capacity to test water meters at the time of delivery to stores and during the servicing of already installed meters was increased.

Pressure Management

2 Pressure Reducing Valves (PRVs) were installed for the Kanaaba and Busabala DMAs as well as 2 pressure loggers for each of the DMAs to enable monitoring of pressures. The pressure management zone of Namanve where there were persistent bursts was designed. 2 Pressure Reducing Valves (PRVs) to reduce pressures within the DMA and thereby reduce physical losses through leakages and bursts were proposed. Procurement of the required PRVs will be supported by WaterWorX project Phase II.

Energy Management

An Energy Analysis model was done for the Gaba 2 pumping station. The plant's performance was assessed in terms of energy consumption and recommendations on what can be done to improve were made.

Hydraulic modeling

The hydraulic modeling unit was re-established. The hydraulic team is now able to produce meaningful and helpful models for users in the utility. They are more involved in modeling activities required to formulate the scope for rehabilitation, restructuring and extension of the Kampala water supply and distribution network. Their work also includes continuous distribution network data clean-up to correct for over or undershot pipelines in the GIS database where inconsistencies are identified. The team continue to interface with Dutch experts who offer online support where needed.

The team were in the process of preparing the hydraulic model for the Kampala water primary system to ascertain the water supply status for 2040. This would collaborate with ongoing efforts by consultants who are modeling the new water treatment plant's distribution system (Katosi) in the Greater Kampala Metropolitan Area (GKMA). Staff were also trained on the basics of Water GEMs and EPANET software.

Improvement Track: Groundwater Abstraction and Boreholes Management



Borehole drilling supervision training

The objectives of this improvement track were to develop a robust organization that ensures sound and sustainable design, construction, operation, maintenance and management of groundwater abstraction and borehole systems. The areas of improvement were building in-house capacity regarding sustainable groundwater abstraction and boreholes systems development and management, cost optimization in development, construction, operation and maintenance of groundwater and borehole systems, effective borehole lifecycle management, and improving service reliability of boreholes systems by mitigating borehole systems failures and promoting technology and innovation in groundwater abstraction and boreholes systems construction, operation, maintenance and management.

Justification

Even though over 70% of NWSC operational towns rely on groundwater and borehole systems for their water needs, prior to the WaterWorX project, the aspects of sustainable groundwater and boreholes management within NWSC were weak. The

Corporation did not have a groundwater and borehole assets database and there was no dedicated function within the utility's structure responsible for groundwater and boreholes assets. Therefore, there was limited capacity and fragmented efforts in boreholes development, maintenance, and management, and above all, there were no clear guidelines for groundwater abstraction and boreholes systems design, construction, development, operations, maintenance and management.

Such limited capacity resulted in inappropriate borehole location and design, exploitation by contractors and consultants, low yielding wells, well clogging, rampant breakdown of electromechanical equipment henceforth high operation and maintenance costs, a high number of abandoned boreholes, reduced lifespan of boreholes, among others.

A dedicated NWSC team tagged "Groundwater and Boreholes Management Team" was set up. The team had a benchmarking visit to Vitens and Evides Water Utilities in the Netherlands aimed at exposing them to modern practices of groundwater and boreholes management that would later form a basis for change within NWSC. During the visit, it was noted that if any significant progress was to be realized towards sustainable boreholes maintenance and management what was urgently needed was a database for all groundwater and borehole systems. The team on their return embarked on mapping and making an inventory of all NWSC boreholes assets using a mobile digital app (borehole data management app) that was developed in-house.

Over 400 BH pumping stations have been mapped. Going forward, the whole process of adding an inventory of the newly drilled and acquired boreholes to the database and continuously upgrading and updating it in a professional and centrally coordinated manner will be the norm. All the information in this app is linked and consolidated in the Computerised Maintenance Management

System (CMMS) of the Static Plant Maintenance Department (static plant). This system can generate maintenance history about these assets.

The project also helped develop clear and comprehensive guidelines for groundwater abstraction and boreholes construction, development, and management by facilitating and enabling the NWSC team in liaison with an external consultant to revise the old guidelines that were obsolete and narrow. The process involved getting on board different stakeholders in the groundwater sector in a facilitated workshop that involved NWSC, the Ministry of Water and Environment, the Uganda Drilling Contractors Association and sitting consultants to discuss the roadmap to the sustainability of groundwater resources. Testing of the new guidelines is underway, in hand with continuous improvement and upgrading.

In a bid to spread awareness and improve the technical capacity regarding the operation, maintenance and management, the project facilitated the training of various NWSC staff including Borehole Operators, Area Technical Supervisors and Area Engineers through various workshops and field trainings. This was coupled with convincing NWSC top management to embrace and support efforts toward improved groundwater abstraction and boreholes development, operations, and management. Support from VEI experts was both online and through short missions to Uganda.

Siting, drilling, and pumping test works were entirely left in the hands of the private contractors and consultants with NWSC staff only being spectators on their own sites due to limited technical know-how. The project has helped NWSC to develop in-house capacity for supervision of these works. The Utility Head Office is continuously seeing the value of the BH unit and is giving them more work. Seasonal monitoring of BHs is now linked to operations and the cost of monitoring and maintenance.

Activities carried out

Benchmarking with the Dutch water operators (Vitens & Evides) on groundwater abstraction and borehole management, and for automation and remote monitoring of borehole systems. As a result of this benchmarking several developments took place in NWSC. NWSC management and other stakeholders in the groundwater sector were engaged in the need for better approaches to groundwater abstraction and boreholes development and management. Training needs and training content scope was identified, and various categories of staff (core team) were trained on groundwater abstraction and borehole management.

Guidelines for groundwater exploration, abstraction, and management were revised (ToRs for siting and drilling). A groundwater module was developed as part of the CMMS and the groundwater level (static and dynamic) water level monitoring module was introduced. Baseline surveys for siting production boreholes were done and drilling and test pumping supervision was carried out. Asset Management Plans for boreholes, condition assessment (camera inspection) was done on boreholes in certain areas e.g., Rushere, Mubende, Bugiri, Kitgum, Iganga, Kyotera, and this continues for other boreholes. Borehole regeneration (air flushing and HTH treatment) was done for selected boreholes. Various borehole data management templates were developed. A mobile borehole management app. was developed, upgraded, and updated. NWSC boreholes were visited, and borehole data was collected to establish an asset register and gather siting and drilling reports. The boreholes were mapped based on their GPS coordinates using open street maps. A standard wellhead was designed and existing well heads were modified for groundwater monitoring. With the new wellhead design access to boreholes for water level monitoring has been eased. The new design also ensures the safety of electrical cables and the support rope as well as safeguarding the borehole from contamination.

We went for a benchmarking visit to Netherlands and came back with open minds to improve things. We saw that the Dutch control BHs from the production side not from the abstraction side. The visit gave us many ideas. Back home we did not even have information about the BHs depth, year of installation or yield. We also lacked operational guidelines for GW abstraction. After identifying the gap, we constituted a BH section.

To develop our guidelines, we compared with the South African standards and other agencies and then developed new standards/guidelines. We had a consultant review these as they were tested for improvement. We had VEI experts look at the guidelines and the systems we had created, and they advised on improvements. The VEI expert identified gaps which we couldn't realise because this is what we were used to. The biggest challenge we had was that BHs were not being given enough time to regenerate due to the high demand in the areas. The main interest of the areas is revenue, but this was at the expense of sustainability of the systems. We are now looking for a way to harmonise.

We also created an app and had a team move to each NWSC area and each water station collecting data on the boreholes. This gave us a full record on each BH.

With VEI support we were able to draft a proposal on what we need to improve our processes which included 1) water level monitoring - equipment 2) maintenance and 3) regeneration. VEI bought the equipment we needed. We have never had a system for managing of BHs, now we have a structure. We had to present to top management to justify why we need a structure; Head Office now recognizes our unit. Having a structure is a big deliverable to our work.

WaterWorX has done its part, now NWSC needs to replicate these efforts to other regions.

Hillary Atuhairwe, Senior Engineer Boreholes Development – NWSC

Improvement Track: Investment Proposals

The objective was to attract finance for investment. Several operational investment proposals were prepared by NWSC with support from VEI. A plan for energy saving measures was approved and is being implemented. Approval was secured for a 50million Euro DRIVE Grant. Under this, the grant fund for investments is matched with loan.

Also, a proposal for WaterWorX Phase II to finance distribution of Katosi Water Treatment Plant (Euro 50 million, 50% Grant and 50% loan) was prepared and was awarded. NWSC was seeking approval from the Finance Ministry in Uganda for this loan.

Additionally, a prefeasibility study for faecal sludge management (FSM) was done. A grant agreement for the FSM project was signed by the Uganda Ministry of Finance and the Dutch Ambassador.

Progress towards impact and effectiveness of the project

There is clear evidence of progress towards impact by this WOP. The attitude and reflections from the mentee (NWSC) are generally positive and top management has given instructions for the activities under the WOP to go to scale.

Achievements in capacity and performance of the mentee water operator (KPIs)

WaterWorX had a specific objective of access to water for 17,000 people, the project was able to reach many more people as there was an extra contribution through the Government of Uganda programme SCAP100. The GoU funds were invested in network expansion to reach more people. In the end, the partners jointly reached 286,000 people. 16 times more than the planned 17,000 people.

The utility has improved its Asset Information Systems. Real-time data collection and incident management have improved staff productivity and the areas that are prone to leakages and bursts can more easily be identified.

Capacity for sustainable groundwater abstraction and borehole management has also been built. Monitoring of water levels in the wells, which is regarded as the heart of sustainable groundwater abstraction and boreholes operations and maintenance evolved from scratch (no monitoring) to manual monitoring (lowering the water level meter into the annular space between the permanent casing and rising main and then installing of a monitoring tube alongside the rising main) to semi-automation (installing retrievable pressure loggers), with a fully automated remote monitoring system. In-house capacity in borehole regeneration and test pumping functions greatly benefitted NWSC as these services were initially being contracted very expensively to private firms. Currently, chemical treatment, air flushing of boreholes as well as pump testing of regenerated boreholes can be done internally with very credible results. NWSC can now supervise drilling which used to be sub-contracted. Initially, anyone could develop BOQs on siting; this is now being centralized so there will be more clear supervision of BH siting. The utility has built the capacity to review and interpret BH siting reports. BH maintenance has also been professionalized. 'I am also very enthusiastic about the BH activities outside Kampala' Charles Kiyimba. According to the utility, however, there's still room for improvement in these aspects in terms of experience, equipment, and technology which the team is optimistic about in a second phase of the project.

WaterWorX project supported the re-establishment of the hydraulic modelling unit to support the learning and design of water supply systems. The unit now supports production of hydraulic models that help the team to manage the network.

Project Outputs

The project did deliver on the planned outputs. It is important to note that an addendum to the initial plan exists as the focus shifted to Asset Management following guidance from the Managing Director. However, even after the AM focus was agreed upon, the specific approach to addressing the mentees AM challenges remained unclear as AM was very broad. The WOP approach was concretely shaped after the utility visited the Netherlands to benchmark with Vitens and Evides. The team's exposure to the VEI approach to Asset Management helped them to see what functioning AM systems and processes look like.

The benchmarking helped to clearly define and shape how AM under this WOP will be addressed and the aspects that will be targeted.

The WaterWorX project has equipped the utility with several tools and equipment worth over €240,000 that were identified as necessary for modern-day AM (GIS and groundwater monitoring and boreholes systems data collection, maintenance, and management). Although these tools and equipment were mainly for piloting the different aspects of sustainable groundwater and boreholes management, the immediate results, outcomes, and impact have been tremendous.

Outcome

A reasonable part of the NWSC Asset Management Strategy was implemented through this WOP. The AM myth was also demystified. The teams have been able to see what is possible with a good asset information management system and have participated in its development. The journey to achieving NWSC's desire for a comprehensive asset management system that enhances business continuity and supply reliability while optimizing the cost of acquisition and management of infrastructure has been started and is off on a good trajectory with most initiatives going to scale after approval from top management. The methods, tools and practices developed have been tested in Kampala and will be replicated in the other regions. Funding for investment has been secured as well as a new phase of the WaterWorX project for NWSC to upscale initiatives under phase I of the WOP as well as share what they have learnt with other smaller utilities.

The Impact

Asset information management is changing the business landscape in NWSC. A dedicated in-house team has been trained which has had an immediate contribution in reducing the costs of drilling and development per borehole as well as improving the quality of the boreholes being constructed. Boreholes that would in the past have been overhauled/abandoned are flushed and reinstated. The unit is also saving the Corporation money.

Desired next steps

Currently, there is a technology gap and the utility needs state-of-the-art equipment to increase efficiency in operations, specifically borehole siting. All regional heads and technicians (2 technicians per region) need to build capacity in troubleshooting and assessment. During the NWSC and VEI reflection session of March 2022 some other gaps that still need to be addressed were highlighted; Gaps in implemented system hardware/equipment gaps, process information and reporting systems in CMMS still missing, lack of integration between systems Mapkit, CMMS etc. On Asset management, Asset Lifecycle planning and fleet management.

Sustainability of change trend

The WaterWorX project was hinged on the element of 'proof of concept'. Not one aspect of it has been scaled up without endorsement by the utility that 'this works for us'. So, every intervention that has been scaled up has been approved and endorsed for upscale in other areas of the utility. This is endorsing the sustainability of the changing trend.

Another key aspect of the project was building of in-house capacity. For example, the project invested Euro 45,000 in purchasing the UpKeep software licence. The utility was not ready to invest this amount just-in-case the approach did not deliver the expected results. What happened instead is the team studied this software, picking up all the positive elements and created an in-house system that mimics the UpKeep potential. It means that for the utility, they have the software with its capability, built internally so no need for future license purchases and with their own capacity built

they can work on fine-tuning as well as upgrades. In the end, they can also sell the product to other utilities an opportunity for future income for the utility.

Nevertheless, there are still some sustainability challenges for example involvement of relevant NWSC staff during implementation and roll out was inadequate. Capacity building to maintain the developed systems e.g., capacity in GIS web development was inadequate. Overall, the developed systems require NWSC to facilitate their usage and according to the reflection session this is lagging full utilization. There is also no budgetary allocation within the utility for upscaling/mainstreaming of project pilot activities.

Unexpected results derived from the project targeted improvement tracks

The Corporate Management Strategy of the utility had earlier proposed integration of existing units: Network Information Systems, GIS and Hydraulic modelling. As a result of this project, the planned preventive maintenance unit was pulled out of the water supply department and integrated with the other units under the AM department. This was an unexpected result derived from activities of condition assessment of fixtures under this WOP. During the exercise, it was realized that updating information on the status of the fixtures was not enough; what was needed was re-establishing the full functionality of the fixtures where needed. The planned preventive maintenance unit was responsible for the task of rehabilitating /repairing network fixtures and so it made sense that this unit is integrated with Asset Management. The scope of integration proposed under the Corporate Strategy was therefore expanded to include the planned preventive maintenance unit also being incorporated within the AM department.

MapKit was able to integrate systems. It linked field teams working in distribution and those working in production, CRM and GIS.

NWSC management approved and added to its structure a Groundwater and Boreholes Section under the Static Plant maintenance Department. This was unplanned and it went to confirm that there was a gap in sustainable groundwater abstraction and management that this WOP helped to close. The current growth and expansion of NWSC into new areas will greatly benefit from this unit.

NWSC emerged as the best in the innovative use of the ESRI GIS software that is used by over 100,000 companies across the globe. ESRI stands for Environmental Systems Research Institute. They are a global market leader in GIS and have helped organizations improve their service offering using advanced technology since 1969. NWSC uses the GIS software for analytics, insights into data, visualisation, and linking customer data to other databases e.g. billing systems, and customer relationship management systems which helps the utility in decision making. They were recognized as one of the best users of the ESRI Global GIS system and were awarded the prestigious Global Special Achievement in GIS (SAG Award) from ESRI. NWSC attributes this achievement to the WOP with VEI and believes that the achievement would not have been possible without the support they received from VEI.

Project Evaluation

Impact in terms of sector targets

The partnership has contributed to the overall development objectives of NWSC and the sector targets. Improvement of Management Information Systems directly supports monitoring of the utility performance. While in the past, it was difficult to monitor timely response to failures and to track the behavioral history of the network, all this is now possible.

For the sector, the lessons from this WOP have been approved for upscale and replication in other areas of NWSC as well as to the other utilities (Umbrella Water Authorities). The capacity enhancement to the NWSC staff will also benefit utilities outside NWSC as these will be mentors for the smaller utilities. Overall, AM has been demystified which is a key deliverable of this WOP. The next step is to upscale the programme to improve working processes for all utilities in the country.

A total of 286,000 people gained direct access to safe drinking water, so investments have been made in the WASH sector. A major gap in the sector is the lack of accurate information to guide decision-making. Now a system has been defined that if implemented across the board will allow access to more accurate asset information.

The investment proposals prepared under this WOP have secured funding and will provide even more people with direct access to safe water and improved sanitation facilities over the next couple of years.

Effectiveness

AM information systems are slowly being embedded and they need time to have them fully embedded. For example, integration of the financial assets into the AM system is critical to enjoying the full functionality of an asset management system however this is not yet done and there is also some hesitation towards this. The utility hesitates to go so far with systems integration even though it would support planning. *'Overall, AM is a journey and what is critical is to catch the different users where they are most interested or where their urgent and critical needs are'*. Martin Nijssse, Project Manager VEI.

The activities under this project were guided by an addendum to the initial project plan. The full scope of a fully functional AM system could not be fully realized in the 3-year period. The utility must continue with the proposed solutions. NWSC knows the problem and now they have been shown the way. As the utility is mature, with a good understanding of the problem and how best to address the problem, continuity of the proposed actions is possible and could easily be done. The created in-house CMMS was a great move for the utility as license fees will not be an inhibiting factor. What is needed urgently is not necessarily finances, budgets, or donor financing but rather the continued commitment of the utility to consolidate the capacity built. The targeted objectives have in this sense been achieved.

Efficiency

The partnership was executed efficiently. The highlight of all utility partners was the flexibility of the project manager. *'The coordinator was very open to accepting what the utility wanted and maybe in some respects, he could have been more adamant on what he sees as the utility needs based on his own experience rather than going with the utility directing the WOP'*. Dr. Rose Kaggwa.

Success factors and challenges

Access to funds

A key strength of WaterWorX is its uniqueness and the mentor also has funds. In this case, the mentor was tasked to show proof of concept through implementing the initiatives, this required some investments in equipment, tools, software, and software licenses. The mentor was able to invest in this. In another case, the requirement that the mentor use their funds/budget to prove the concept may not be possible leading to the failure of the WOP.

Motivation for Employees

To ensure their participation, the employees needed motivation in the form of facilitation. The mentor had to bear this cost. According to the mentor, this needed to be done. Showing proof of concept was more important than anything as if this was not achieved, all the other efforts would have been in vain. The mentor was therefore willing to do whatever it takes to get full participation from the teams. For example, the improvement track groundwater abstraction and borehole management were starting from zero. Any activities that needed to be done e.g., field visits and flushing of boreholes had to be funded by the WaterWorX project as there was no budget for such in the utility budget. The downside of this was that there were no incentives for non-field activities.

Flexibility

The mentees emphasized the value that was got from having a flexible programme. Under the WaterWorX programme, the project manager was open-minded and very responsive to addressing needs as they arose. This according to the mentees was a major strength of this partnership.

Contribution by the Utility

NWSC also invested in the WOP, which was a sign of commitment.

Weaknesses of the Partnership

The request for the mentor to show proof of concept before the mentee gets fully on board posed the risk of the mentee getting lazy and laid back. When the burden for proof of concept lies with the mentor, the mentee has the tendency to wait on the mentor to do what he needs to do while they look on waiting to see if things work out. It takes a while for an initiative to work, (showing proof of concept). Training teams to the extent that they adopt something and implement the concept takes time. It also did take time for this WOP and the mentor embarked on finding ways to incentivize his teams.

The organizational/governance structure for project implementation was not very clear and because of this, NWSC management team involvement in the implementation and monitoring was minimal. There was no mandatory or regular monitoring and evaluation of NWSC's implementation team.

The network planning and optimization (Hydraulic modelling) function has not yet been embraced in the utility and staff trained in hydraulic modelling by the project left the utility hence the gap in this area remains despite the trainings that were done.

Factors critical for the success of the partnership

- **Flexibility** of the WaterWorX programme and hence flexibility on the side of the Project Manager was critical to the success of this partnership. It was critical because when the project started, the focus shifted to focus intensively on showing proof of concept through

the prism of Asset Management. The 3 District Metering Areas that were anticipated were not done as the focus then shifted to Asset Management Information Systems. Unforeseen and unanticipated needs came up. Both software and hardware assets were needed, Mapkit and Water Gems software, equipment and devices like Hi-tech computers, smartphones, borehole, and energy audit equipment etc. The WaterWorX programme with access to funding and the ability to shift budgets was able to meet these needs to the pleasure of the mentee and continue the successful collaboration. Flexibility of the mentor is thus a critical factor for success of the WOPs.

- **Realization by the utility that there is a problem** and that they need help from someone who has done it and has the expertise to handle the problem. With this level of readiness, it is easier to realize success. If a problem exists but the mentee does not feel it is a priority, then they will not nurture the new process or adopt best practices and may not continue with the new process beyond the WOP. This also explains the varying levels of success in the improvement tracks that were picked for support under this WOP. Hydraulic modeling did not register as much success as the other tracks.
- **Motivation of staff** is key. NWSC preferred to get some of their in-house experts for certain improvement tracks however securing the commitment of these frontline staff could take a while for NWSC (about 2 weeks) while VEI on the other hand could more easily mobilize their experts. Because VEI was so intent on showing proof of concept, they deemed it fit to find a way to remunerate the NWSC teams on the assignment which worked. The lack of capacity to motivate staff could have hindered the success of the project.



Conducting an Energy audit

Main lessons learned from the partnership

Commitment from all levels of the Organisation is key for success

Achieving project objectives requires substantial commitment from both the utility top management as well as the implementers on the ground. During the NWSC-VEI Partnership, all stakeholders in NWSC that have an influence on the performance of specific capacity-building activities were integrated. The initiatives were discussed both at management and at lower levels of the organisation to guarantee that the benefits of the initiatives were well understood and supporting policies developed and adopted by NWSC. There were concerns about the limited involvement of the strategic level of the utility however the onus could be on the implementing team to ensure the strategic level is continuously kept abreast on development.

Planning together is key

Integrating staff in planning supports understanding of the local context which ensures the success of proposed initiatives. Right from the onset of the NWSC-VEI Partnership, the staff of NWSC in all the relevant departments were fully involved in the planning sessions. The participatory approach during the planning and implementation of the WOP ensured full commitment on the side of the beneficiary staff.

Integrate WOP initiatives into ongoing utility programmes

To ensure faster project implementation, integration of the project activities into the running utility plans is vital in terms of creating ownership. Although most of the activities adopted during the NWSC-VEI Partnership were started on a pilot basis, they were later approved and fully integrated into the departmental plans, and this has helped the staff to continue implementing the agreed initiatives for upscaling. However better alignment of the NWSC and WWX strategic planning and governance would help further smoothen implementation of activities.

Invest in operational tools and equipment

For capacity-building projects to be successful, there is a need for some investments in operational tools and equipment to ensure proof of new concepts. During the NWSC-VEI Partnership, the WaterWorX project provided funds to implement new concepts in form of licenses of new software such as Mapkit, upkeep, Water Gems including tools and equipment for regeneration of boreholes and energy audits, smartphones, hi-tech computers etc. The availability of these tools and equipment enabled the staff of NWSC to physically test all new concepts that they had trained on which enhanced their understanding of the new methodologies. The corporation would not invest in these before appreciating the value that this investment would return. The WOP funded the testing and learning offering proof to the rest of the NWSC staff and management of the full value of these new technologies.

Changing personnel during the project affects progress

Changing personnel during project implementation affects project progress and its adverse effects need to be countered through an effective risk management plan. For this partnership, the project involved as many key persons as possible for each of the focus areas to mitigate the risks associated with staff turnover. Although some staff that had been trained in some of the focus areas such as hydraulic modelling left the corporation. This gap was because network planning in general is not yet embraced by the utility.

Invest in more than capacity building, some level of hardware investment is needed

Where the WOPs have some funds to invest in hardware, the utility does better than they

normally would have. Budget matters. Part of the reason WOP interventions are not realized is a lack of hardware. Based on the proof of concepts by the WOP the mentee utility should be able to prioritize funding for rolling out and mainstreaming WOP interventions in their budget. Without a budget, a few outcomes may be realized by default. However, it's best if there is a budget attached to the WOP interventions. In this case, the utility also contributed to network expansion which supported the planned outputs however, there is need for aligning project support in the utility's budget.

Presence of a resident manager adds value

The WaterWorX project presented a different approach with a Resident Project Manager to support follow-up of actions and who was present to support the WOP 'full-time'. According to the mentee utility, this was a key factor in the success of the WOP.

Start with the low-hanging fruits

'Low hanging fruits', i.e., subjects from which you can quickly show the value of the partnership help with building partner confidence and trust. In this case, the BH restoration activities served the purpose. The BH unit was new, and the staff did not have much knowledge of what needed to be done. Evidence that the BHs could quickly be restored was an easy sell that attracted interest in the activities under the WOP. To be able to show proof of concept, go where relevance can be optimized.

The Uniqueness of Asset Management as a focus area for a WOP

AM is a journey. A journey that requires fine-tuning as you go along. For this WOP whose focus was AM, there was a considerable level of fine-tuning and flexibility as the project advanced. In some cases, what was needed was an investment in equipment, software etc. where these opportunities for investment were identified, which were critical elements, the necessary investment was done. The lesson is that where critical investments are identified, be ready to do it.

Most challenges of the utility can be tackled if looked at through the lens of Asset Management because through this lens, for example, when you look at AM you will need to manage NRW and pressure management through hydraulic modelling. So, *'A utility may not necessarily go out to do NRW reduction, but AM activities will help curb NRW'*.

Other factors that positively or negatively affected the project

The AM policy of the utility had previously been supported by a consulting company GFA under GIZ support. This support had been on for a while so considerable effort had been invested in defining the AM policy direction in terms of where the utility should be going. This background work paved the way for the interventions under the WaterWorX project. It created a good starting point where discussions had already been going on and the teams were already familiar with the concept and with increased interest in exploring what AM could offer for their utility operations. The utility was ripe to explore and demystify AM.

The upkeep license purchased by the project cost USD 40,000 per year. The utility would not afford to maintain such a license. For this WOP, a team in NWSC was very keen on understanding the upkeep software and created an in-house solution with equal potential. With this, NWSC has an in-house solution that is customized to their context. When the project started, this was not part of the plan but courtesy of the WOP, the team with high programming skills developed an interest in CMMS and was able to design this solution. Assets can now be tracked as well as their maintenance activities. They will continuously improve their system.

The staff expressed satisfaction with the approach and working processes of VEI. They were

impressed by the flexibility of the Project Manager who was open to prioritizing needs the mentee identified as the project went along. 'Because of this intervention, the corporation is better placed to manage its assets and to maintain them better'. Ms. Zainab Mpakiraba, Manager External Services.

The Mapkit tool for capturing asset information was seen by the mentee as the most valuable and the biggest success of the WOP. The tool instantly made work easier for the General Manager that it was immediately upscaled from a pilot in 2 branches to all branches in Kampala. Hydraulic modeling, on the other hand, was perceived to be the least successful area of intervention. The hydraulic team was reconstituted (team of 3) by the project and yet they still ended up disbanding with one member leaving the organization, and another being transferred to the Kabale area under NWSC thus leaving only 1 member to work under this unit. Later the 3rd member also left the organisation. The unit is therefore almost back to where it started. So, hydraulic modeling did not progress that much. One respondent attributed the failure of this module to the topographic challenge and infrastructure that cannot be relayed. Others also felt there is not yet demand for it, although with the Drive Project for Katosi water supply system, the scope involved which includes NRW components such as SCADA systems, monitoring pressures and flows, and hydraulic modeling will be important in developing and maintaining these systems, hence they gain more relevance in Kampala. It will also be tested outside Kampala.

People Management

A steering committee is critical as it helps to bring on board departments that would otherwise be hesitant. The utility should utilize the teams whose capacity has been built as mentors during scaling up to maintain their interest in utility activities and thus avoid staff turnover. Also incentivizing teams (through financial facilitation) helps to motivate staff. Strong leadership is also key for success. In general, the decisions of the CEO/MD were a dominant governing mechanism that directed the course of the partnership.

Replicability

This partnership is replicable, and plans are already underway to replicate it in other areas outside of Kampala. "This needs to be expanded to the whole of NWSC. It needs to be replicated in other towns. I would love to see upscaling/roll out of Mapkit in smaller areas and check how effective it will be as these areas are less facilitated and their infrastructure is not as good as in Kampala. Also getting people to adapt to quick updates and documentation of extensions; it will be interesting to see how it works out". Ms. Zainab Mpakiraba, Manager External Services.

Replication elsewhere will easily be done as this phase has provided lessons on what is needed, how to approach the delivery of what is needed as well as on the expected achievements/outcomes. The mentee is already working on replication/scaling up to other areas. AM has been demystified and now the direction is clear. There is now a clear structure through which to make decisions on Annual plans. In another 3 years, the utility will be at a mature level.

Contribution to SDG6

By providing services to over 286,000 people the WOP directly contributes to SDG 6.1. The WOP has developed a proposal for Euros 50 million to support FSM and thus will contribute to SDG 6.2 and 6.3. through the hydraulic modeling activities e.g., pressure management the utility will increase water efficiency and ensure sustainable withdrawal and supply through demand management thus contributing to SDG 6.4. The new cooperation with MWE will allow for integrated water resources management through cooperation with water catchment stakeholders thus contributing to SDG6.5.

Cross-cutting issues

The WOP activities had men mostly in the lead. The Young Professional is female, but most interventions were led by men. During the trainings, some effort was made to have women participate. Overall, the WOP trainings were attended by 758 members, 199 of whom were women and the 559 men. This shows a 26% attendance by women against 74% attendance by their male counterparts.

The BH interventions greatly contribute to Climate Change adaptation and resilience. Many boreholes in the past were dying because of poor management. They were not allowed enough recuperation time. Through the WOP, the team has attained training in groundwater management thus increasing the lifespan of boreholes. Well-functioning BHs directly contribute to climate resilience of the water supply systems.

Interviewees

- 1) Mr. Allan Kaford – Principal Engineer External Services/ Local Project Coordinator WWX Project
- 2) Ms. Zainab Mpakiraba – Manager External Services
- 3) Dr. Rose Kaggwa - Director Business & Scientific Services
- 4) Dr. Kizito Frank – Senior Manager Asset Management, KW
- 5) Mr. Charles Kiyimba - Senior Manager Static Plant
- 6) Mr. Daniel Besigye – Senior Engineer Static Plant
- 7) Mr. Hillary Atuhairwe - Senior Engineer, Boreholes Development
- 8) Mr. Amir Lubega – Principal Engineer Electronics
- 9) Mr. Martin Nijse – Resident Project Manager WWX Project
- 10) Mr. Samuel Kiwanuka - Engineer Asset Management

Other Contributors

Mr. Bernard Mwaka – Senior GIS Kampala Water
Ms. Muggaga Nsaali – Principal Engineer – Projects & Performance Management

CASE STUDY



Water Operators' Partnerships (WOPs) are peer support relationships between two or more water or sanitation operators, carried out on a not-for-profit basis in the objective of capacity development. This is one of a series of four impact-oriented case studies conducted on WOPs in Africa. It is intended for water and sanitation service providers, governments, development banks, donors, WOPs facilitators and all who are interested in gaining a better understanding of this solidarity-based approach to helping public operators improve their capacity to sustainably deliver water and sanitation services for all.

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