



Utility Platform

For strengthening partnerships
of municipal utilities worldwide



Outcome Report 7 – Water Operator Partnership

Tanzanian Water Operators Kahama-Shinyanga
Water Supply and Sanitation Authority (KASHWASA)
and Kahama Water Supply and Sanitation Authority
(KUWASA) and German Operators HAMBURG
WASSER and Netze BW Wasser

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Fact-Finding Mission of water supply system, GIS and Water Loss Reduction at KUWASA | 02/2022 |
Photo: Ezat Hanif Kaserkandi's

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About “Utility Platform for Strengthening Partnerships of Municipal Utilities Worldwide”

Context

In many German partner countries, municipal utilities providing public goods and services such as water and waste disposal are in poor economic shape. As a result, their service provision is only unreliable or does not reach the entire population. Due to the war, utilities in Ukraine are finding it particularly difficult to maintain operations, restore destroyed technology and bring new plants up to European Union standards. In the face of climate change, growing cities and digitalisation, utility companies in Germany and its partner countries are facing similar challenges in order to continue providing their services.

Objective

Municipal utilities in cooperating countries have better access to up-to-date, tried-and-tested knowledge and the technical and institutional expertise of German municipal utilities.

Approach

The Utility Platform promotes and supports 28 partnerships between German municipal utilities and operators in Zambia, Tanzania, South Africa, Jordan, Moldova, Ukraine and Albania in the water and waste sector. The platform promotes close exchange on corporate management and on operating and maintaining plants. Technical advice, mutual visits, job shadowing, virtual meetings and the procurement of technology, particularly for Ukraine, form the core of the cooperation between the companies.

The project has also established a logistics hub that dispatches donations and procurements from German utility companies to their Ukrainian counterparts. Appeals for donations by the Association of Local Utilities (VKU) make it possible to deliver needed technical equipment to Ukraine. In addition to the donations, the logistics partner Go Local also transports the goods that are procured for Ukrainian utilities as part of the 16 solidarity operator partnerships.

About the author: Maria Pascual-Sanz



Maria Pascual-Sanz is a development professional with over 20 years of experience in the fields of water services and urban sustainability. The last 16 years of her career have been dedicated to Water Operators' Partnerships (WOPs), through diverse roles in several organisations. From direct implementation of WOPs as part of VEI (The Netherlands), to research and lecturing as part of Rotterdam School of Management and UNESCO-IHE (in Delft), to global WOPs programme design, coordination and implementation as part of UN-HABITAT GWOPA. She is currently an independent consultant based in Barcelona engaged in organisational support on areas such as monitoring, evaluation and learning; research, knowledge management and product development; partnership facilitation; strategic planning; WOP programme design and resources mobilisation and advocacy.

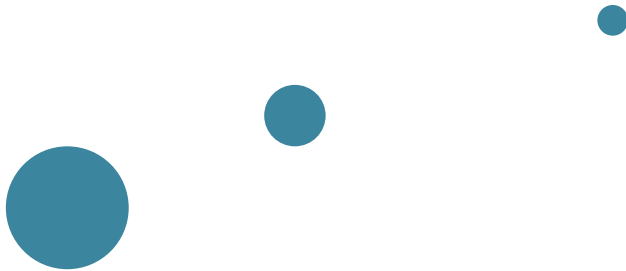


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ACRONYMS

AfWASA	African Water and Sanitation Association
BMZ	Federal Ministry for Economic Cooperation and Development of Germany
EWURA	Energy and Water Utilities Regulatory Authority, Tanzania
FFM	Fact-finding mission
GIS	Geographical Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
HW	Hamburg Wasser
GWOPA	Global Water Operators' Partnerships Alliance
IWA	International Water Association
KASHWASA	Kahama-Shinyanga Water Supply and Sanitation Authority
KUWASA	Kahama Water Supply and Sanitation Authority
MoU	Memorandum of Understanding
PaT	Pumps as Turbines
WP	Work Package

EXECUTIVE SUMMARY

The Water Operator Partnership (WOP) between Kahama-Shinyanga Water Supply and Sanitation Authority (KASHWASA), Kahama Water Supply and Sanitation Authority (KUWASA), HAMBURG WASSER (HW) and Netze BW Wasser is part of the pilot phase of the 'Utility Platform for strengthening partnerships of municipal utilities worldwide', funded by the German Ministry for Economic Cooperation and Development (BMZ).

The contract between HW and GIZ was formalised in February 2022 and the MoU between all the partners in the project was signed in March 2022. The project termination date was initially set to be May 2023, but two extensions took

place until June 2024. The main work packages (WP) addressed by the partners were 1) Improvement of Water Supply Network Performance incl. reduction of Non-Revenue Water (NRW), 2) Water Production (only in KASHWASA), 3) Geographical Information System and 4) Management Support and Strategic Planning.

The project timeline shows a total of seven missions, three job shadowing visits to Hamburg and Stuttgart, two networking meetings plus visits in Hamburg and one International Water Association (IWA) conference had taken place by December 2023 in Kigali, Rwanda.

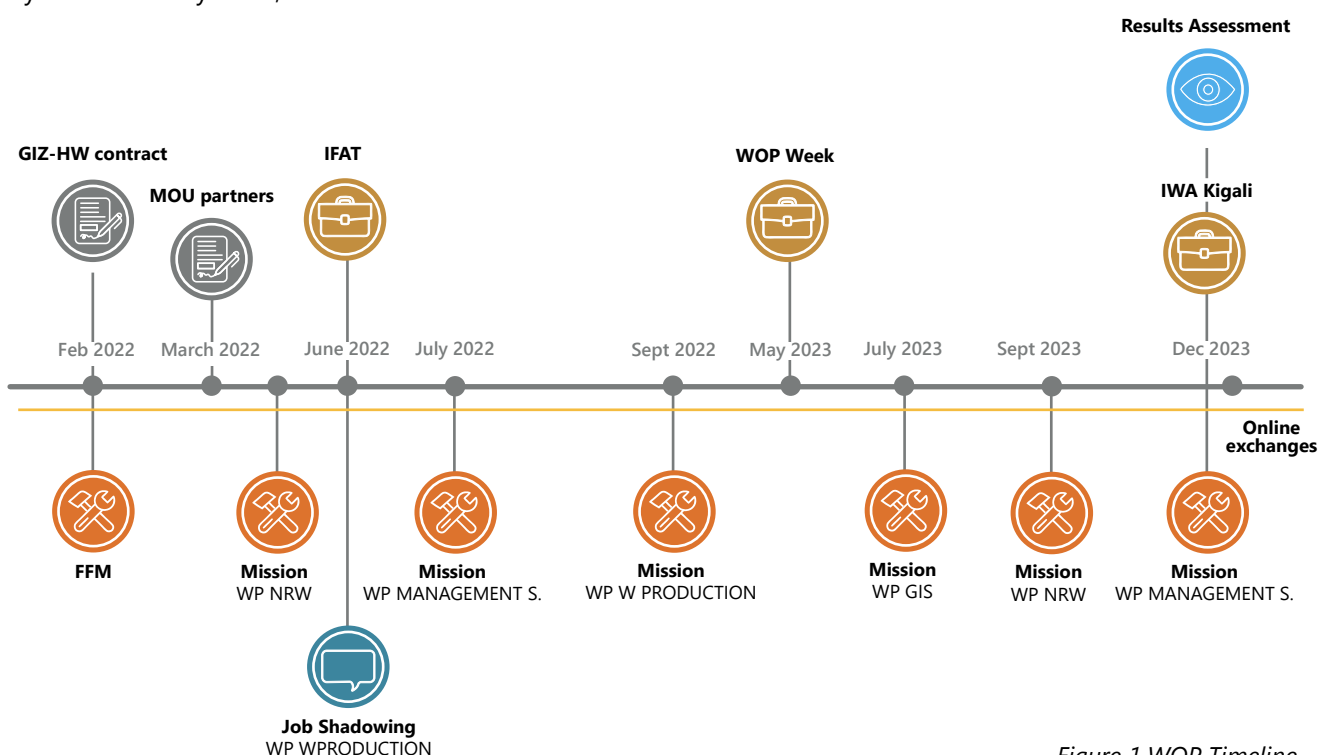


Figure 1 WOP Timeline

WOP Outcomes (Chapter 3)

The WOP resulted in capacity outcomes at individual, operational and strategic level. The table below provides a visual summary of the key outcomes achieved throughout the WOP for each of the work

packages (WP). Details on the achieved capacity outcomes can be found in Chapter 3 “Progress towards results by work area”.

Orga- nisa- tional level		Capacity outcome	KASH- WASA – Water Supply	KASH- WASA – Water Production	KASH- WASA - GIS	KASH- WASA – Man- agement Support	KUWASA – Water Supply	KUWASA - GIS	KUWASA – Man- agement Support
INDIVIDUAL		Enhanced know- ledge and skills	3 people See p. 19	10 people See p. 27	6 people See p. 31.	4-8 people See p. 33	5 people See p. 22	6 people See p. 32	2 people See p. 34
		Increased motivation	See p. 19	See p. 27	See p. 31	See p. 33	See p. 22	See p. 32	See p. 34
		Applied new knowledge and skills	3 people See p. 19	5 people See p. 27	3 people See p. 31		3 people See p. 22	3 people See p. 32	2 people See p. 34
OPERATIONAL		Improved data and information	See p. 19	See p. 27	See p. 31		See p. 22	See p. 32	
		Better systems	See p. 19	See p. 28	See p. 31		See p. 22	See p. 32	See p. 35
		Improved organisa- tional structure					See p. 23	See p. 32	
		Better equipment/ infrastructure	See p. 19	See p. 28	See p. 31		See p. 23	See p. 32	
		Improved management practices		See p. 28					See p. 35
		Improved working routines		See p. 28	See p. 32			See p. 32	
STRATEGIC		Improved vision, mission, strategy					See p. 23		
		Additional resources		See p. 28	See p. 32	See p. 33		See p. 32	See p. 35
		Improved external relations				See p. 33		See p. 32	See p. 35
		More supportive organisational culture							
		Better leadership							
OTHER		Any other Outcomes							

Figure 2: Capacity Outcomes on organisational level of the four Work Packages

Key Outcomes Achieved



- **Enhanced knowledge and skills (WP 1):** Staff members from KASHWASA and KUWASA gained knowledge and skills on managing pressure in their water network, using the IWA water balance sheet, also for NRW calculation, and on installing and using ultrasonic water flow meters.



- **Applied new knowledge and skills (WP 2):** Staff members from KASHWASA are actively applying newly acquired skills in optimizing water treatment processes, including in the stages of flocculation, sedimentation, filtration, and disinfection (WP 2).



- **Improved data and information (WP 3):** Through the gained skills, the GIS teams of KASHWASA and KUWASA have been able to improve the quality and completeness of geodata. In the case of KUWASA, the improvement of the water supply network and the customer location data was especially visible.



- **Additional resources (WP 2):** Savings amounting up to 330,000 € per year were achieved by optimised disinfection (reduced costs by adjusted and reduced amount of chlorine) during the water treatment process at KASHWASA.



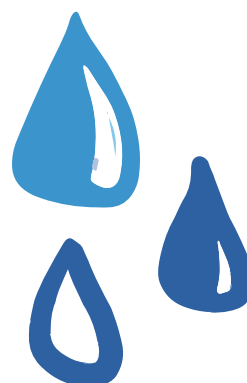
- **Better equipment/infrastructure (WP 3):** New equipment for the GIS teams at KASHWASA and KUWASA has been procured. This includes suitable workstations (notebooks and monitors), a powerful GIS software and tablets for applying the implemented web-GIS onsite.



- **Improved external relations (WP 4):** KUWASA was invited to prepare a proposal to the Urban Water Catalyst Initiative (UWCI). HW has supported KUWASA in the proposal preparation and submission.

Partnership strength (Chapter 4)

When asked for the quality of their collaboration, the partners agreed that the WOP has matured. The partnership design was considered good overall with an emphasis on the project's flexibility. Partners agreed that in-person interaction during mission was crucial to understand roles and responsibilities in the WPs, especially for the Tanzanian colleagues who did not understand the peer-to-peer nature of the project in the beginning. Additionally, the on-site missions were considered important for developing a technical understanding and personal relationships. According to the partners, the work processes of this partnership functioned well, with plans being jointly set up, reviewed and updated during regular online meetings for each WP. The communication between partners seemed to be effective and the used platforms adapted as needed. Public procurement processes were evaluated to be too long, which delayed targeted operational improvements related to the equipment to be procured. The German partners praised the strong engagement of their Tanzanian partners and highlighted the collaboration between KUWASA and KASHWASA. Partners reported to have achieved a state of great trust, transparency and openness that helped them to work efficiently as partners. KASHWASA and KUWASA were eager to engage in this project from the beginning as an early perception of benefits helped to develop trust and interest. In terms of resources, partners claimed that a longer duration of the project and more available funding for equipment is instrumental to consolidate further operational improvements.



1. INTRODUCTION

The Federal Ministry for Economic Cooperation and Development of Germany has set up the 'Utility Platform for strengthening partnerships of municipal utilities worldwide', as a pilot project running from 2019 until 2024. Another project phase will be starting in July 2024, running until June 2027. The initiative supports partnerships between municipal utilities in Germany and its partner countries to support the implementation of the Sustainable Development Goals (SDGs) and the New Urban Agenda. The partnerships of the pilot project follow principles of peer-support with the aim to build capacity on a not-for-profit basis to enable better service delivery. These principles were derived from the Global Water Operators' Partnerships Alliance (GWOPA), which was founded in 2009.

This WOP project is one of nine international WOPs, three solid waste operator partnerships and 16 solidarity operator partnerships with Ukraine supported under the pilot project until June 2024. This report summarises the design and implementation of the project and identifies the main outcomes derived from the partnership in each work package. It should be noted that the WOPs described in this paper have only been in place since 2021 and are still in their early stages.

The current report describes key project characteristics, progress made, outcomes in each of the work packages (WP) and evolution of the partnership strength. Multiple methods were used to collect the relevant data. These are:

- documentary review, including project proposal and annual reports, budgets, mission reports and operational plans,
- semi-structured interviews with key informants from the projects mainly co-ordinators,
- online surveys directed to both partners requesting their perception about outcomes achieved, and
- online dedicated focus group discussions (workshops) per work package with participants from all partners engaged in each work package.

The methodology applied to assess the capacity outcomes (Chapter 3), and partnership strength (Chapter 4) was inspired by the WOP-tailored methodology design by GWOPA and embedded in the web-based Partnership Management Platform (PMP).

The PMP methodology for capacity outcome assessment is an adapted version of the 'Performance and Change Model' by Burke and Litwin (1992). **Capacity is unpacked into individual, operational and strategic capacity outcomes:**

Organisa- tional level		Capacity outcome	Description
INDIVIDUAL		Enhanced knowledge and skills	Availability of human resources and the extent to which they have the required skills and knowledge to accomplish the work they have been assigned to.
		Increased motivation	Proactive tendencies to move towards goals, take needed action and persist until satisfaction is attained.
		Applied new knowledge and skills	Active use of the newly acquired knowledge and skills in daily practices.
OPERATIONAL		Improved data and information	Updated information on the conditions of any part of the water utility system, be it related to physical infrastructure (e. g. pipes), management processes, (e. g. customer database) or otherwise.
		Better systems	Standardised policies, procedures, management and operational information systems and mechanisms that facilitate work.
		Improved organisational structure	Arrangement of functions and people into specific areas and levels of responsibility, decision making authority, communication and relationships to assure effective implementation of the organisation's mission and strategy.
		Better equipment/infrastructure	Tools and equipment necessary for utility operations and basic infrastructure for the business processes (e. g. water production and distribution).
		Improved management practices	Practices that managers use to mobilise the human and material resources at their disposal and advance the strategy, including managerial behaviour, work etiquette, professionalism, planning, communication and control.
		Improved working routines	The way the tasks are executed daily in consolidated routines.
STRATEGIC		Improved vision, mission, strategy	The vision outlines the company's goal for the future and the values that define it. A mission states how the company will achieve its vision. Strategies are the ways in which the mission and vision will be reached.
		Additional resources	Additional (financial) resources via new acquisition or operational costs savings.
		Improved external relations	Improved communications with external stakeholders and customers. This includes stakeholder relations that the operator has forged and how such networks support the achievement of its strategy.
		More supportive organisational culture	Collection of rules, values and principles that are enduring and guide organisational behaviour.
		Better leadership	Managerial staff providing overall organisational direction and serving as behavioural role models for all employees.
OTHER		Any other Outcomes	

Figure 3: Overview of methodology assessing the Capacity outcome of WOPs

The **Partnership Strength** of the project is analysed in Chapter 4 by looking into several aspects such as partnership design, clarity of roles and responsibilities, meeting processes and representation, working processes, resources, trust, transparency

and teamwork and flexibility/adaptability of the project. The partnership strength methodology follows 'Partnership Health Check' tool categories developed by Prescott and Stibbe (2017).

Fact-Finding Mission at Ihelele Water Treatment Plant, KASHWASA | 03/2022

Photo: Ezat Hanif Kaserkandi's



2. THE WATER OPERATOR PARTNERSHIP (WOP)

Four partners are collaborating in this WOP project. HAMBURG WASSER undertakes the overall technical, administrative and financial coordination of the project. Each work package (WP) has a focal point from a German water operator and a focal point in the Tanzanian partner. As the coordinating partner, HW meets every two to three weeks with Netze BW Wasser, once every three weeks with the other German water operators engaged in WOPs, and once every three months with all the partners of the project, including GIZ Germany. More details on how the project coordination takes place are included in the chapter 4. Partnership Strength.

2.1 WOP Partners

Kahama-Shinyanga Water Supply and Sanitation Authority (KASHWASA) and Kahama Urban Water Supply and Sanitation Authority (KUWASA) were established in and operate under the Water Supply and Sanitation Act No. 5 of 2019 after repelling the Water Supply and Sanitation Act No. 12 of 2009. The Water Supply and Sanitation Authorities are the Government Institutions under the Ministry of Water and are guided by the Water Policy of 2002 and regulated by the Energy and Water Utilities Regulatory Authority (EURA). Both KASHWASA and KUWASA are regular members of the Association of Tanzanian Water Suppliers (ATAWAS). Since their establishment in 2009, both entities have worked hand in hand to improve water supply and sanitation services through the provision of water with good quality, long hours of bulk water supply, settling of water bills on time (KUWASA), etc. These have resulted in improved water delivery across the region and beyond. Despite achievements that have been attained, KASHWASA and KUWASA still experience various challenges and are looking at best ways to minimise them to be able to provide their services smoothly.



KASHWASA produces and treats water from Lake Victoria in Northern Tanzania, conveys it through the transmission main of over 600 km and supplies water in bulk to eight water supply and sanitation authorities and 170 community-based water supply organisations. The service areas include several districts with a population of one million people. The installed capacity of the KASHWASA transmission pipes is to convey water up to 120,000 m³/day and the current capacity of the water treatment plant is 80,000 m³/day, but there is a provision to expand to 120,000 m³/day.



KUWASA is supplied with bulk treated water from KASHWASA. KUWASA is located in Kahama Municipality in Shinyanga Region. Currently, the Kahama Municipality has an estimated population of 308,296 people. The water service coverage for Kahama is 82%. It is one of the top three water utilities in Tanzania with high performance resulting from the EWURA performance review report of 2019. The average daily water supplied to consumers is 14,000 m³/day. The pipe distribution network in Kahama is 416 km and all the water users are metered.

HAMBURG WASSER is the largest utility in the north of Germany providing water and sanitation services to more than two million consumers in the metropolitan region of Hamburg. There are two separate legal entities in the company – Hamburg Waterworks Ltd. (Hamburger Wasserwerke GmbH) and Hamburg Public Sewage Company (Hamburger Stadtentwässerung AöR). They were combined in 2006 with a common aim, structure and procedures, as well as identical management for the first three hierarchical levels. Both companies are owned by the Federal State of Hamburg. In 2004, citizens petitioned for a referendum against their potential privatisation. They were successful, resulting in legislation in 2006 guaranteeing the public supply of water.



Netze BW Wasser provides and assures the quality of drinking water for the Municipality of Stuttgart, Germany, including storing and distributing drinking water for more than 600,000 inhabitants in Stuttgart and the surrounding region. This task includes all the technical operational aspects of the water supply system including water loss monitoring and reduction, customer metering, repair of leaks, installation of house connection etc. For the annual supply of 40 million cubic metres of drinking water about 1.8 GWh of energy is required.



2.2 Timeline of the partnership

A first contact between the water operators HW, KUWASA and KASHWASA as part of an African Water and Sanitation Association (AfWASA) Congress triggered the creation of this WOP. Partners started working together to prepare a proposal to apply to the EU-WOP Programme managed by the Global Water Operators' Partnerships Alliance (GWOPA) in 2021. While they did not make it to the final selection round, the work for the development of the proposal was crucial for them to access GIZ funds to start the project under the Utility Platform pilot programme. In late 2021, Netze BW Wasser joined the consortium of partners given their

expertise in the NRW field. The contract between HW and GIZ was formalised in February 2022 through an ex-tension to the existing contract with GIZ. The MoU between all the partners in the project was signed in March 2022. The total resource envelope for the WOP is € 511,097.

Up to December 2023, the project had been implemented for 22 months, with a total of seven missions, two job shadowing visits to Hamburg, two networking meetings plus visits in Hamburg and one IWA conference in which both partners presented the project. The timeline in figure 1 below specifies when they took place and which work packages they were mostly addressing.

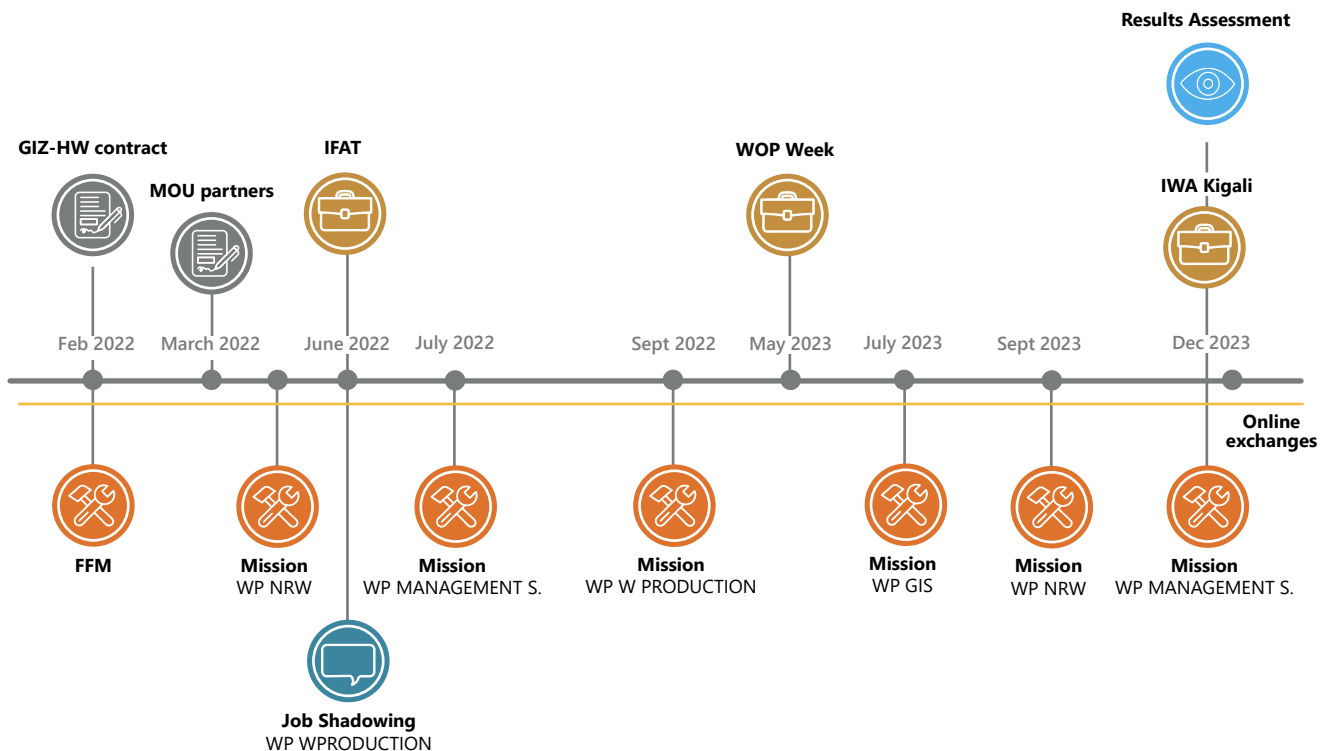


Figure 1 WOP Timeline

More details on the duration of each event are included in this list:

- ▶ Fact-finding mission (FFM):
26 February - 7 March 2022
- ▶ Mission NRW: 14 - 21 May 2022
- ▶ Networking meeting and IFAT:
30 May - 3 June 2022
- ▶ Job shadowing Water Production and Networks:
06 - 10 June 2022
- ▶ Mission Management Support: 23 - 31 July 2022
- ▶ Mission Water Production:
24 September - 3 October 2022
- ▶ GWOPA Congress and Utility Networking
Meeting: 22 - 27 May 2023
- ▶ Mission GIS training: 24 June - 4 August 2023
- ▶ Mission NRW: 24 September - 4 October 2023
- ▶ Mission Management Support and IWA
Congress Kigali: 10 - 14 December 2023
- ▶ Initially anticipated end date of the project
(as per MoU): 31 May 2023
- ▶ Extension of pilot project: June 2024
- ▶ Joint Visit of IFAT Munich: May 2024



Exchange of experience and joint exploration of applicable solutions at IFAT 24 | 05/2024



3. PROGRESS TOWARDS RESULTS BY WORK AREA

The overall project goals of the WOP were to improve operation and maintenance of the drinking water infrastructure, supported by HAMBURG WASSER and Netze BW Wasser and to establish a sound, long-lasting cooperation in partnership between KASHWASA, KUWASA, HAMBURG WASSER, and Netze BW Wasser. The main objectives and related work packages (WP) were defined as

- **Work Package 1:** Improvement of Water Supply Network Performance incl. energy efficiency, supported by Netze BW Wasser
- **Work Package 2:** Optimisation of treatment processes in drinking water production, supported by HW. This WP was only selected for KASHWASA,
- **Work Package 3:** Development and implementation of a GIS unit, supported by HW,
- **Work Package 4:** Management support and strategic planning via self-assessment of utility performance incl. agreement of roles and responsibilities, initial guidance on self-assessments of Water Supply Network Performance and assistance with Strategic Planning and Benchmarking, supported by HW.

In this chapter, the four work packages are being examined regarding the implementation of activities and the outcomes achieved in both KASHWASA and KUWASA.

3.1 Work Package 1: Water Supply Network Performance

Implementation of activities at KASHWASA

The **challenges** faced by KASHAWASA have been investigated during a fact-finding mission (FFM) in February 2022. During this mission at KASHWASA, their headquarters, main storage, several transfer reservoirs and bulk water metres, the Ihelele intake and pumping station, the Ihelele water treatment plant, and the main storage reservoir "Mabale Hill" were visited.

At the Ihelele water treatment plant, several challenges have been noted during the initial investigation. Firstly, the SCADA system was out of oper-

ation, pressure gauges were partly not working, and hydraulic analyses of pumping stations were not possible. Additionally, high wear and tear was reported in the Ihelele high lift pumps (cavitation), potentially caused by unfavourable pipe routing in the suction pipes. Pumps run out of their optimal operating range, leading to high energy consumption

At the transmission system, the expected inaccuracy of customer water metres has been noted. Also, a high failure rate of (electromagnetic) bulk water metres with unknown reasons (possibly unstable power network) has been reported.

The **goal** of KASHWASA in this WP focused on the water transmission mains (approx. 657 km), in particular on

- conducting a joint baseline survey to investigate water leakages and develop and review Standard Operating Procedures (SOPs) for leak detection and repair works,
- jointly assessing current NRW to develop a NRW reduction plan including a water balance based on the IWA approach,
- exploring the feasibility of introducing and operating energy generating measures (turbine operation) for energy recovery from the water supply network.

To achieve these goals, the following activities are to be implemented at KASHWASA:

- Procurement (and training) of ultrasonic portable water metres to check customer bulk water metres. This should also be made available to KUWASA.
- Procurement of pressure sensors and loggers to check for high pressures and pressure reduction options in the transport network.
- If enough data is available, a hydraulic model should be developed to define pressure management options.
- Establishment of contact to providers of water meters to discuss possible reasons for regular failures of electromagnetic metres.

- Procurement of working tools. HW and Netze BW Wasser will provide calibrated water metres
- Verifying water meters to ensure accurate customer meters at Igunga Junction.
- Placing pressure loggers at the transmission line extremes for pressure management exploration.
- Updating the NRW table.

The **progress to date** covers several areas of KASHWASA's goals. Firstly, the segmentation of the entire system was started. An initial segment at "Igunga Junction" was identified and a monthly reading was carried out for customers in this section between August 2022 and February 2023. Through further analysis of the pilot segment of the network, it was determined that water losses at this node were reduced. KASHWASA had replaced one of the main water metres in this branch. However, it is not certain whether this is the reason for the observed improvement. After analysing the meter readings, a deficit of approximately 48% was found between the start of the branch and the 11 customers in this branch. Further investigations into this are underway. Also, a hydraulic model was created from the obtained data to better understand the system and help decide on the energy management measures (e. g. pressure surges). The next step is to support KASHWASA in creating the water balance table according to the IWA guidelines. KASHWASA would particularly like support in calculating the ILI (Infrastructure Leakage Index). In addition, the hydraulic model is being further improved.





During the mission in September 2023, Netze BW Wasser delivered essential tools for improved water management. The delivery included one ultrasonic water meter and four pressure loggers, with all necessary accessories to facilitate its operations. This package encompassed charges, clamp-on sensors, fittings, and software designed for efficient data retrieval. During this mission, Netze BW Wasser provided digital installation guidelines for the equipment deployment, dedicated time explaining the details of these systems and how to work with them and provided onsite support for the installation and measurements. Once installed at KASHWASA, it was determined that water losses in Igunga Junction fluctuated significantly, ranging from 15% to 50%. The implementation of ultrasonic water meters was crucial for validating the accuracy of the customer meters. Additionally, pressure loggers offer an initial insight into the pressure dynamics along KASHWASA's transmission lines. This preliminary data forms the cornerstone of a rough feasibility study for energy recovery and energy management within

the system. This focused analysis aims to enhance system efficiency.

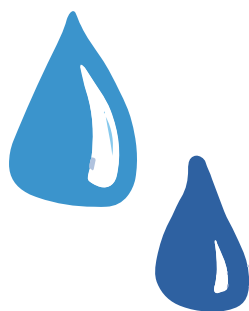
Furthermore, German and Tanzanian staff members worked on the IDALA tank during their mission in September 2023, which is another point within the Igunga Junction section, to inspect and validate the functionality of the water meter. It became evident during the assessment that the water meter failed to provide accurate flow readings, signalling a malfunction. This discrepancy underscores the need for further investigation and potential maintenance or replacement of the faulty water meter. Identifying and addressing such issues are essential steps in ensuring the reliability and precision of non-revenue water (NRW) within the Igunga Junction section, aligning with their commitment to enhancing the efficiency and accuracy of KASHWASA systems.

During the visit to Solwa, where the pressure logger was installed, primarily to monitor the system pressure but also to assess the occurrence of water

hammers during system working hours, it was observed that water hammer events can significantly impact the system's integrity and detecting them requires observations at a very small interval. To achieve this, the pressure loggers were meticulously programmed, with a half-second interval set for precise and detailed monitoring.

Additionally, a specific discussion session on the water balance table previously conducted by KASHWASA took place. The session involved a comprehensive review of the components, sparking fruitful discussions regarding the estimation and determination of various components. This collaborative effort is essential in refining the accuracy and completeness of the water balance table, ensuring a comprehensive understanding of water distribution dynamics.

Lastly, the potential of energy recovering through Pumps as Turbines (PaT) was explored. The recorded data revealed a substantial average pressure fluctuation of approximately 15 bar. This significant pressure variation, characterized by its magnitude and frequency, poses challenges for the efficiency of energy recovery mechanisms like PaT. The observed variability suggests that alternative approaches may need to be explored to maximize the effectiveness of energy recovery within the operational context of KASHWASA.



Outcomes achieved at KASHWASA

Individual level

- 
Enhanced knowledge and skills: Three staff members have directly gained knowledge and skills on managing pressure in the water network (network zoning, pressure measurement), the IWA water balance sheet and using it for NRW calculation, identifying NRW contributing factors, and installing and using ultrasonic water flow meters to check customers' water meters.
- 
Increased motivation: The staff at KASHWASA is reported to be highly motivated due to their full involvement in carrying out activities to reduce NRW.
- 
Applied new knowledge and skills: New knowledge is being applied, i.e. pressure zoning, pressure measurements, developing and updating the water balance table, installation of ultrasonic water flow meters.

Operational level

- 
Improved data and information: Most of the tasks undertaken in this WP have focussed on developing a more accurate information base about the system in terms of its network, flows, pressure, leakages, etc. All the investigations have resulted in a complete water balance of the system and ideas on how to best approach NRW and energy reduction measures.
- 
Better systems: The IWA water balance methodology is currently being used and partners are using the Excel-based programme WB-EasyCalc to fill in information. The associated documentation to this system is intended to cover all components and specifications of the water balance table and to facilitate further procedures for future work.
- 
Better equipment/infrastructure: Four pressure loggers and one ultrasonic water flow meter have been acquired through the project.

Implementation of activities at KUWASA

The **challenges** faced by KUWASA have been investigated during a fact-finding mission (FFM) in February 2022. During this mission at KUWASA, the headquarters, main storage, main transfer reservoir, including bulk water meter and pumping station, water tower and pressure break tank were visited. The investigation showed that the NRW has been reported with monthly figures varying a lot from 0 to 32% NRW. Additionally, flow and pressure are not known in the distribution network (no bulk water metres or pressure sensors) and no water balance has been established. Also, there is a high number of old domestic metres (with high inaccuracies) and no functional metre testing method in place.

The **goal** of KUWASA in this WP lay on establishing a pilot zone (District Metered Area "DMA") for water loss reduction, including a definition of the pilot zone boundary, the installation of a bulk flow metre (DN 150) at the zone inlet, the provision of

at least two pressure loggers to be installed in the pilot zone and other relevant locations, taking flow and pressure measurement in the pilot zone, the evaluation of the flow and pressure measurements and consumption data, the establishment of water balance, and the development of an action plan for NRW reduction in the pilot zone. Additionally, a mobile water meter test kit for on-site testing of domestic metres was planned to be constructed, i.e. Netze BW Wasser brought two calibrated water meters from their stock and KUWASA constructs a mobile water meter test kit.

The **progress to date** covers several areas of the WP's goal. Firstly, it was determined that a more detailed analysis of the pilot zone's water meters was required. From August to October 2022, the meter readings of all customers in the pilot zone and the main water meter were read daily by KUWASA. By doing this, a good estimate of the meter error rate (apparent losses) for the water balance can be achieved.

Fact-Finding Mission - Optimisation of the water supply and reduction of Non-Revenue Water at KUWASA | 05/2022



Photo: Netze BW Wasser



Additionally, a specific workshop was held to explain the water balance followed by weekly online sessions to explain the various components of the water balance according to the IWA and to guide the data collection process. The assessment of the measurements taken from October 2021 to October 2022 was analysed and the water balance table was created and filled out during regular online meetings with the partners using the Excel-based programme WB-EasyCalc. A documentation was set up intended to cover all components and specifications of the water balance table and to facilitate further procedures for future work. This report de-

scribes the methods and procedures used to create the water balance table, including data collection, analysis and interpretation as well as collaboration with the partners during online meetings. Each component of the table and its importance for water balance analysis is explained. KUWASA is currently developing a report explaining the specific data collection measures and calculations behind each value used to create the water balance. Both the technical losses and the economic losses in KUWASA were estimated and communicated to the management team.

During the mission in September 2023, Netze BW Wasser delivered the equipment of essential tools for improved water management. The delivery included one ultrasonic water meter and four pressure loggers, completed with all necessary accessories to facilitate its operations. This package encompasses charges, clamp-on sensors, fittings, and software designed for efficient data retrieval. During this mission in September 2023, Netze BW Wasser provided digital installation guidelines for the equipment deployment, dedicated time to explaining the details of these systems and how they work and provided onsite support to the installation, measurements and installation. Furthermore, in-depth discussions took place between partners on the relevance of refining the zoning system at KUWASA. The significance of accurately segmenting the entire system into district meter areas was emphasized.

Moreover, a significant issue had emerged with the occurrence of backflow from the KUWASA intake tank back to the KASHWASA system, attributed to a substantial reduction in inlet pressure. The measures taken with the ultrasonic water meters and pressure loggers helped to develop a good understanding with partners on this phenomenon.

The potential to feed electricity back into the network in Kahama is currently being explored. One feasible option under consideration involves generating and recovering energy, particularly electricity, at the inlet of the breaking pressure tank. To advance this initiative, a comprehensive flow and pressure investigation at the inlet of the tank will be essential. This investigation aims to provide crucial insights into the dynamics of water flow and pressure conditions at this specific point in the distribution network.

Lastly, a NRW reduction strategy and a water meter policy were developed by KUWASA and are currently under review. KUWASA shared that both documents have benefited from the knowledge gained from the peer-to-peer interaction through the WOP.

Outcomes achieved at KUWASA

Individual level

- 
Enhanced knowledge and skills: Five staff members have directly gained knowledge and skills on the IWA water balance sheet and using it for NRW calculation, identifying NRW contributing factors, and installing and using ultrasonic water flow meters to check customers' water meters.
- 
Increased motivation: The staff at KUWASA is reported to be highly motivated due to full involvement in carrying out activities to reduce NRW.
- 
Applied new knowledge and skills: Three people are currently applying the new knowledge and skills.

Operational level

- 
Improved data and information: The information about the system has been consistently improved through the WOP. Most of the tasks undertaken by the WOP in this WP have focussed on developing a more accurate information base about the system in terms of its network, flows, pressure, leakages, etc. All the investigations have resulted in a complete water balance of the system and ideas on how to best approach NRW and energy reduction measures.
- 
Better systems: The IWA water balance methodology is currently being used and partners are using the Excel-based programme WB-EasyCalc to fill in information. The associated documentation to this system is intended to cover all components and specifications of the water balance table and to facilitate further procedures for future work. Also, the development of a water meter policy by KUWASA is currently under review.



- **Improved organisational structure:** The creation of a specific unit dedicated to NRW reduction has been proposed as part of the NRW reduction strategy currently under review, but was not materialised yet. As part of the strategy, the network zoning is proposed, which will likely entail organisational structural changes.



- **Better equipment/infrastructure:** Four pressure loggers and one ultrasonic water flow meter have been acquired through the project.

Strategic level



- **Improved vision, mission, strategy:** A NRW reduction strategy has also been developed and it is currently under review. The strategy has been fed from the lessons learned through the WOP.

3.2 Work Package 2: Water Production

Implementation of activities at KASHWASA

The **challenges** faced by KASHWASA have been investigated during a fact-finding mission (FFM) in February 2022. Possible optimisation methods of the water treatment process were discussed by different staff members of the water treatment plant. The step-by-step process was inspected, where possible optimisation was discussed for each step and, if possible, tested during the visit of Ihelele Water Treatment Plant of KASHWASA. The technical manager, engineers as well as staff of the laboratory were involved in these discussions. Afterwards, first tests were executed in the laboratory (application of flocculation chemicals) and in full scale (filter backwash), and promising optimization measures were directly implemented wherever possible.

Therefore, the flocculation and chemical use was discussed during the FFM. Firstly, the Ihelele Water Treatment Plant receives its raw water from Smith Sound, a southern extension of Lake Victoria. Light brownish colour indicated a predominantly mineral turbidity. The participants of the FFM discussed the current strategy of chemical use regarding pre-chlorination normally applied when high numbers of algae, colour or faecal input affect the raw water quality. Here, these factors could not be seen.

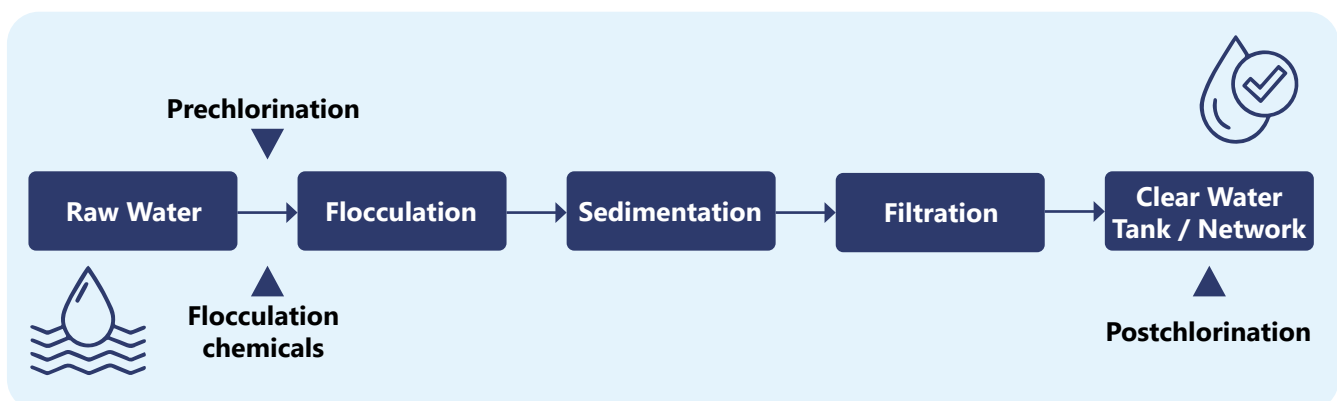


Figure 4 Water Production Treatment process (Copyright: HAMBURG WASSER)



Moreover, the chemical costs present a main cost factor in the operation of the water treatment plant. They account for up to 50% of the total costs. The team evaluated the suitability of different products and dosing strategies for the given raw water quality to elaborate options to reduce the chemical use and production costs. So far, a blend product of polyaluminum chloride (PAC) and cationic polymer (PolyDADMAC) was used as coagulant. The dosage quantity is adjusted from regularly performed jar tests in the water treatment plant laboratory. The blend product was chosen as it performed better than the PAC product applied before. Well-formed flocs of bright colour are obtained during the flocculation process.

It was determined by jar tests that the blend product used so far, which is designed for water containing algae, did not perform well given the raw water quality. It gives clear water, but the dosage is high, and the flocs are not very dense and stable, therefore not sedimenting rapidly. Different alternative blend products as well as different pure PAC in combination with pure polymers (flocculation

aid) products were tested in the water treatment plant laboratory to identify the best performing products and dosing strategy. A split dosing of PAC and anionic polymer gave the best results regarding floc quality (big, dense, stable and rapidly sedimenting, low residual turbidity) and economic efficiency by reduced dosing quantity.

The dosing system is to be modified so that PAC shall be dosed into the raw water pipe and anionic polymer shortly later at the inlet of the flocculators. To prepare the dosing solution of anionic polymer, a new preparation unit is to be installed. Based on the tests a cost saving potential of up to 50% (approx. 300,000 €/year) is calculated for an adjustment of the flocculation chemicals and dosing strategy.

Furthermore, the following treatment steps, sedimentation and filtration will perform better due to lower residual turbidity from optimized flocculation. This can even lead to an increase of the plant capacity of water produced and plant efficiency. Additionally, a significant reduction of residual

turbidity at the sedimentation outlet is expected from the new chemical dosing because sedimentation takes place in shallow basins after flocculation.

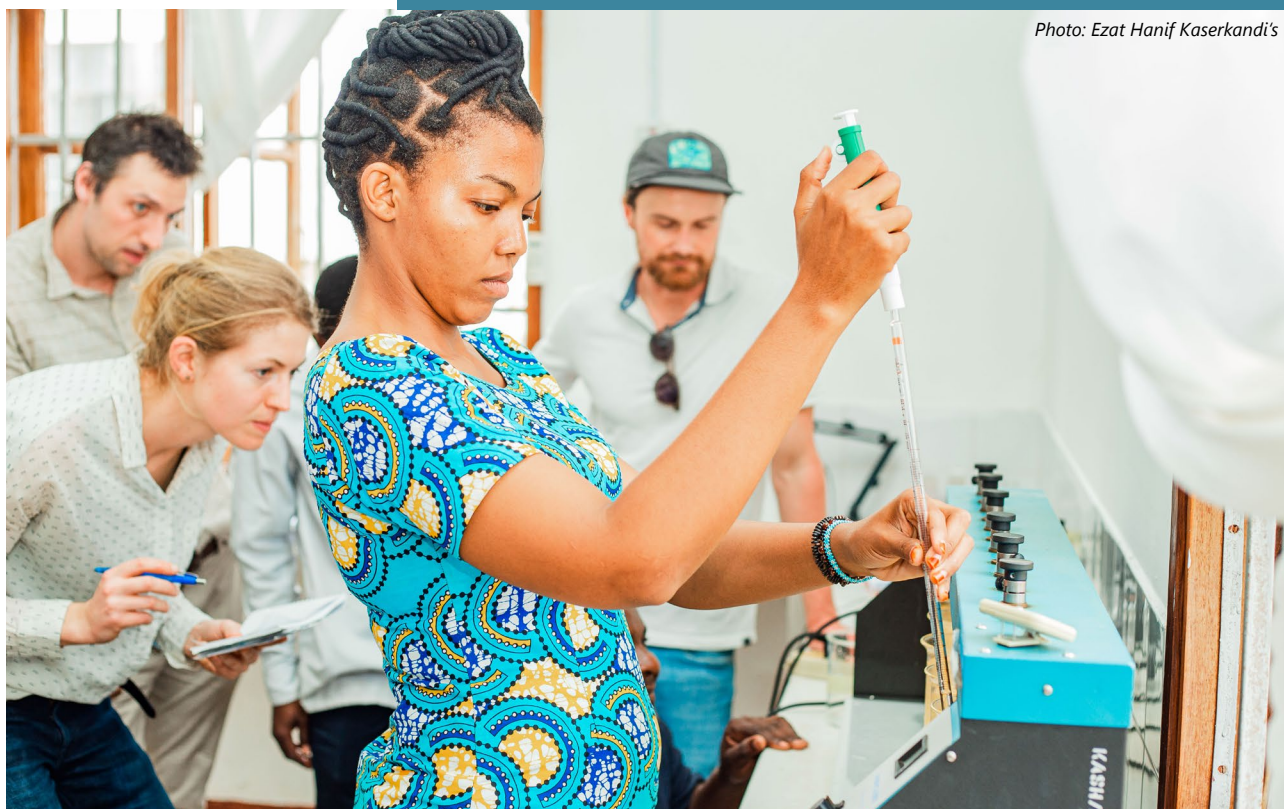
Moreover, the filtration process at the Ihelele water treatment plant was investigated including filter material and the backwashing process. It was found that the filters had lost filter material, very likely due to the filter backwashing procedure applied. In addition, the supporting layer and the sand material are mixed because of the current backwashing. Filter runs are short due to the elevated turbidity coming from the sedimentation. The partners discussed the need to replace lost filter sand and agreed on implementing a pilot filter with correct filling of a supporting layer and a sand layer. The so far used backwashing process led to the loss of the filter material, because combined backwash by air and water is continued after water level reaches the outgoing channel. The air scour is longer than necessary, resulting in a high water consumption for the subsequent water backwash. An alternative backwash procedure was discussed, tested, and

implemented during the FFM. It consists of a short air scour of one minute, intermediate combined backwash (water – one pump - and air at the same time until water level reaches the channel) and a final water backwash step (two pumps) until water is getting clear. With the alternative backwash configuration, the amount of backwash water is reduced. Water savings will increase the water production and therefore the plant efficiency. The loss of filter material is prevented for all filters by the optimized filter backwash process.

Lastly, the disinfection was looked at. The dosage quantity of pre-chlorination was a recommendation given during the commissioning of the treatment plant. For pre-chlorination, chlorine gas is dosed into the raw water at the intake and the dose is even higher than for post-chlorination after filtration. The pre-chlorination was seen as questionable considering the raw water analysis. No challenges from algae, colour or faecal contaminations could be identified. Therefore, the discontinuation of the pre-chlorination was discussed and

*Determination of the most suitable flocculation medium and dosage via Jar tests –
Drinking water lab, KASHWASA | 03/2022*

Photo: Ezat Hanif Kaserkandi's



stopped during the FFM. By the discontinuation of pre-chlorination, cost savings of about 50% (regarding the chlorine gas costs) were realized immediately due to the high dosing quantity used for pre-chlorination. In addition, the drinking water quality is expected to be improved regarding taste and disinfection by-products. It was determined that post-chlorination using chlorine gas is applied according to demand. The chlorine is dosed into the filtered water for disinfection and to ensure necessary residual chlorine for a safe drinking water quality.

The **goal** of KASHWASA in this WP lays on different steps of the water treatment process, which were defined jointly by the WOP partners as priorities. Firstly, the flocculation should be optimised, including jar tests with alternative blend products, pure PAC and pure (anionic) polymer, evaluation of the jar tests and selection of coagulant/flocculation aid, implementation of split dosage of coagulant and flocculation aid, adjustment of the dosing point, design and specification of a polymer preparation/dosing station, adjustment of the dos-

ing quantity regarding seasonal differences, and implementation of direct filtration and therefore reduced or no dosage of coagulant during the dry season (further reduction of chemical dosing).

Moreover, the disinfection is to be optimised by evaluating the discontinuation of the pre-chlorination, and the method used to determine the chlorine dosing quantity (post chlorination). Furthermore, the filtration should be optimised by replacing the lost filter bed material and establishing a pilot filter, which compares the correct refilling of the filter bed with separate supporting and sand layers with present filters having mixed layers. Additionally, optimization of filter backwash should be optimised due to an evaluation of the implemented alternative operation mode, evaluation of the expected water savings, and investigation of the influence of the mixing of the filter bed material. Lastly, the savings are to be presented, including the data collection and compilation of key figures, and graphical presentation of water and cost savings.

Joint lab session at Central drinking water lab of HAMBURG WASSER | 06/2022



The **progress to date** in the water treatment working group, entailed regular monthly online meetings with the participating peer colleagues in which current events, progress and further steps were discussed. These included observations of the implemented pilot filters, the availability of measurement technology for flow monitoring, the evaluation of beaker tests and the consideration of the inlet and outlet qualities of the plant. In addition, the way the waterworks operates when there is high turbidity during the rainy season was discussed and adapted to the current flocculant.

Furthermore, tender documents were prepared for the procurement of a new chemical dosing station and new flocculation chemicals. The delivery of the new flocculant chemicals is pending and expected in the first quarter of 2024. The first offers for the chemical dosing station were examined jointly so that the new dosing station could be contracted.

For the optimisation of disinfection, it is planned to switch from chlorine gas (costly and often not available) to the production of a disinfection solution by electrolysis from table salt at the water treatment plant. The procurement of the electrolyser station was jointly prepared and is ongoing. KASHWASA plans to make more technical investments in the next financial year (starting July 2023). Other topics were addressed, including a planned expansion taking the ongoing optimisation of the waterworks into account, as well as focus topics in workshops on water treatment for KASHWASA's operating staff.

Outcomes achieved at KASHWASA

Individual level

- **Enhanced knowledge and skills:** Around 10 staff members were reported to have gained new knowledge. The staff learned advanced techniques for optimising water treatment processes such as reducing chemical consumption, hands-on skills in conducting joint experiments like jar tests for flocculant and polymer usage and optimizing filter backwash processes. Peer-to-peer discussions and joint problem-solving sessions helped the staff to develop innovative solutions to technical challenges. The WOP emphasised the importance of transparent communication and trust-building among peers.



- **Increased motivation:** The staff was reported to be highly motivated since the beginning of the WOP.



- **Applied new knowledge and skills:** At least five people are applying new knowledge and skills. Laboratory tests are continued and conducted, optimisation of dosing points is planned, optimisation of further filters is continued, exchange regarding different disinfection systems is organised by KASHWASA staff.



Operational level

- **Improved data and information:** The WOP has strongly contributed to better, updated, and complete information through i.e. enhanced data collection and analysis via Key Performance Indicators (KPIs) for continuous monitoring of various parameters, including water quality, chemical dosages, and costs. In addition, detailed information about the water treatment processes, including the stages of flocculation, sedimentation, filtration, and disinfection, was gathered and analysed and improved documentation and reporting practices were implemented, which led to more organised and complete information about the water production systems.



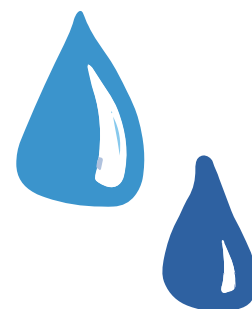


- **Better systems:** Standard Operating Procedures (SOPs) were created for the refilling of filters. Plans were created for new dosing points. Data sheets and reports were created for tests and visits of other water treatment plants.
- **Better equipment/infrastructure:** KASHWASA is in the process of procuring specific new equipment such as an Anionic polymer preparation station and an electrolyser for onsite chlorine preparation. As these items are currently in the procurement process, they have not yet been installed or become operational. New filter material is partly implemented. An ultrasonic meter for optimised filtration has been installed.
- **Improved management practices:** Various management-related practices improved, i.e. open, transparent, and effective communication between different levels of staff and between the partner utilities fostering a culture of clear and constructive dialogue. Furthermore, monitoring and evaluation improved with Key Performance Indicators (KPIs) and regular reporting mechanisms to conduct better tracking of progress and more informed decision-making. Also, a culture of adaptation and innovation in management practices developed, challenging managers to think creatively and be open to new ideas and methods.
- **Improved working routines:** New working routines have been consolidated in flocculation and filtration processes incl. filter backwash and chemical testing.



Strategic level

- **Additional resources:** Savings were achieved by optimised disinfection (reduced costs by adjusted/reduced amount of chlorine). An increased plant capacity is achieved by optimised filtration and filter backwash leading to more treated water available for distribution (less treated water is used for filter backwashing with new filter backwash and new filter layering with partly new filter material). Also, savings are expected with new flocculation chemicals (optimised flocculation and sedimentation, reduced costs for flocculation chemicals by improved flocculation). Additionally, further increased plant capacity is expected with new flocculation chemicals (optimised flocculation and sedimentation, longer filter runs, more treated water for distribution). These savings amount up to 330,000 €/year.



3.3 Work Package 3: Development and implementation of a Geographical information system (GIS) Unit

Implementation of activities at KASHWASA AND KUWASA

The **challenges** faced by KASHWA and KUWASA have been investigated during a fact-finding mission (FFM) in February 2022. Firstly, HW met with the GIS team of KASHWASA. The team consists of four people, including three engineers and one information and communication technology expert. They assessed the current situation regarding hardware, software, experience, data, and methods and defined goals to be achieved during the project. In an initial workshop, each person of the GIS team at KASHWASA explained their work and pointed out aspects which could benefit from GIS. The general outcome of this meeting was that firstly a basic GIS

introduction should be given providing a clearer understanding of the potentials and limitations of GIS. From the team, two persons were selected to act as GIS administrators with the responsibility of maintaining and updating the data. Generally, the GIS unit at KASHWASA is already well equipped with notebooks suitable for GIS work. Suitable software solutions are also already in use. However, two more workstations and two GPS devices were deemed as necessary. HW provided the hardware specifications for these workstations and identified suitable GPS devices. During a later assessment of the accuracy, functionalities and costs of different GPS devices, it was concluded that GPS equipped tablets would suit the needs of the GIS team best. The procurement was carried out by KASHWASA. Next, the available GIS data was assessed. This data was created by an external person and afterwards organised and structured. In general, the data at KASHWASA is of good quality and only small improvements for the data management were identified (e.g. merging pipes of different diameter into one file). Finally, HW gave a short training in GIS. A few workflows relevant for the daily work at KASHWASA were shown and documented.

Fact-Finding Mission of water supply system, GIS, Water Loss Reduction at KUWASA | 03/2022



Photo: Ezat Hanif Kaserkandi's

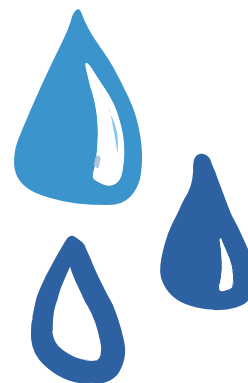
HW also met the GIS team at KUWASA. The team consists of three people with different levels of experience in working with GIS. Overall, 1.5 days of GIS specific workshops were carried out at KUWASA with the aim of assessing the current situation and identifying requirements as well as defining goals. This was achieved as HW was able to gain a clear picture of the available GIS infrastructure (hardware and software), the experience of the GIS team, the methods used and the available data. Furthermore, a good mutual understanding of the goals of the partnership was achieved. This provides a good foundation for the rest of the project. After getting to know each other, the GIS expert of HW started the workshop by presenting the general ideas for the project. Then GIS users of KUWASA explained their usual GIS activities and pointed out challenges they are facing, and aspects where they see potential for improvement.

Based on the jointly defined challenges, several **goals** were collaboratively defined. Firstly, to complete network and customer data, basic and specific GIS trainings and continuous technical assistance for GIS related tasks throughout regular online meetings are to be provided to the GIS teams at KASHWASA and KUWASA, i.e. on improving methods for data acquisition, digitisation and measurement, and establishing more efficient workflows and SOPs for GIS related tasks. Furthermore, workflows for importing AutoCAD and Excel files, geo-referencing of files and filtering and analysing network data should be provided. HW plans to define topics for further GIS trainings and provide additional software specific training materials.

Additionally, after assessing the existing hardware and software for GIS, it was decided that new equipment should be procured. At KUWASA, GIS software solutions are already available. However, it was concluded that the costs and benefits of other software solutions should be investigated. For the GIS team consisting of three people, only one notebook is currently available. This notebook however does not fulfil the requirements of the used GIS software. Thus, it was concluded that each member of the GIS team should be provided with a GIS workstation consisting of a notebook with specifications according to the used software, a monitor and an external

mouse and keyboard. The required hardware specifications will be provided by HW. The procurement will be done by KUWASA. HW wants to take care of the identification of suitable GPS devices.

Following this, the already existing GIS project of the available data at KUWASA was analysed. A need for centralising and structuring the data was identified. Currently 80% of the network data is digitally available. The goal is to complete the data within the WOP specified period. This will be assisted by HW by jointly finding more efficient methods for data acquisition and digitisation and by the procurement of GPS devices. Furthermore, the customer data of KUWASA was analysed. A comparison between two different databases revealed inconsistencies. The reason for this could not be identified during the FFM due to the limited time available and was solved during a later workshop. Next customer data available within an Excel document was imported into GIS. This functionality was not known by the GIS team at KUWASA and was thus documented in a little instruction. The network data together with the customer data was then prepared for presentation for another workshop, which had the aim of identifying a suitable pilot area for carrying out a district meter area project. For this area, it was detected that relevant data is missing and hence, it was decided that this data should be completed soon.



The **progress to date** in the development of the GIS units of KASHWASA and KUWASA continues. First, suitable hardware and GIS software were purchased. For KUWASA, the procurement of suitable notebooks was an important step in making the GIS unit operational. A licence of the ArcGIS Pro software was purchased for both partners. The decision to use this software was based on a comparison with other software packages, primarily due to the possibilities of implementing a mobile GIS. With a mobile GIS, maps can be created online and geodata can be edited directly on site using mobile devices. Training materials were put together for the GIS teams to familiarise themselves with the new software. The induction is supported by regular biweekly online meetings. Instructions for carrying out special work steps in GIS are currently being created. The introduction of the mobile GIS was implemented in July 2023 during the mission.

The GIS activities of both partners were expanded and significantly improved, particularly regarding data management. Online meetings take place regularly for short training units and to provide support with any arising GIS tasks. This enabled both partners to learn important work steps in GIS. During the latest mission in 2023, further training on the use of ArcGIS Pro and ArcGIS Online was carried out using the partners' respective data. A key goal was to improve existing workflows and publish the first web maps, which can be viewed and edited using mobile devices outdoors. It is expected that this will result in a significant improvement in carrying out survey work, collecting customer data and updating water supply infrastructure. Tailored training materials in the form of written materials and presentations were created and supplied to the partners. Furthermore, the GIS projects were prepared to be used optimally in web GIS. The progress in developing the GIS units is encouraging. The expanded projects, improved data management and implementation of web GIS help increase the efficiency and accuracy of the GIS work. The regular online trainings offer employees the opportunity to expand their knowledge and skills in using GIS tools. The on-site training in July 2023 improved the GIS knowledge of both partners allowing independent problem solving and autonomous implementation of work processes.

Outcomes achieved at KASHWASA

Individual level



- **Enhanced knowledge and skills:** Six individuals have gained knowledge to fully exploit the capabilities of GIS, i.e. field data collection, preparation of a database, cleaning collected data, creating maps, publishing maps online, capturing pictures at site using a GIS related app.



- **Increased motivation:** WOP activities have significantly heightened the motivation of the GIS team at KASHWASA. The introduction of new software, the enhanced workstations, and the intensive GIS training, are among the key activities that have empowered the team to make substantial contributions to the utility's success in providing customers with high-quality water at reasonable costs.



- **Applied new knowledge and skills:** Three people regularly apply the new skills. The acquired knowledge supports infrastructure management, the documentation of leakages, and onsite activities through online maps.

Operational level



- **Improved data and information:** KASHWASA enhanced the quality and completeness of geodata of the system.



- **Better systems:** Documented processes on how to use the new software (ArcGIS Pro and ArcGIS Online) were provided and how to carry out the most important tasks on GIS. These materials are being internalised and led to a more efficient workflow that has significantly improved the processes of data collection, analysis, and modification, which in turn led to notable time savings for the staff.



- **Better equipment/infrastructure:** A suitable workstation, a powerful GIS software and tablets for applying the implemented web-GIS on site have been provided.



- **Improved working routines:** Improved workflows and routines have been established for collecting data in the field, preparing databases, cleaning collected data, creating maps, publishing maps online, capturing pictures at site using GIS related apps among others.

Strategic level



- **Additional resources:** The new systems and applied knowledge is leading to staff, vehicle, fuel, and time savings in carrying out data management and analysis activities.

Outcomes achieved at KUWASA

Individual level



- **Enhanced knowledge and skills:** Six individuals have gained new knowledge and skills to conduct data analysis and to enhance the management of the water supply infrastructure, i.e. on ensuring effective data analysis, informed decision making, and significant optimising of the water supply operations.



- **Increased motivation:** The activities have significantly boosted the motivation of the GIS team and the customer service team of KUWASA.



- **Applied new knowledge and skills:** Three people of the GIS team extensively apply their new skills for completing the data of the water supply network, the management of customer data, and the delineation of pressure zones.

Operational level



- **Improved data and information:** Through the gained skills and knowledge, the GIS team of KUWASA has been able to improve the quality and completeness of geodata especially of the water supply network and the customer location data.



- **Better systems:** A documentation on using the new software (ArcGIS Pro and ArcGIS Online) and on how to carry out the most important activities was provided to the GIS team. The process of data collection has been significantly improved by a more efficient workflow, which also results in time savings for the staff.



- **Improved organisational structure:** The introduction of GIS has brought together the technical team and commercial team when attending their daily activities even if explicit changes have not yet materialised in the organigram.



- **Better equipment/infrastructure:** New equipment for the GIS team has been procured. This includes suitable workstations (notebooks and monitors), a powerful GIS software and tablets for applying the implemented web-GIS onsite.



- **Improved working routines:** New working routines for data collection, customer identification, and analysing customer data have been implemented. The team has also integrated the essential functionalities of ArcGIS Pro so that they are able to develop their own solutions for upcoming challenges.

Strategic level



- **Additional resources:** The new working procedures implemented with GIS have been reported to save time and resources although they have not yet been quantified.



- **Improved external relations:** The updated information on the system network has been reported as a valuable asset towards the municipality.

3.4 Work Package 4: Management support and strategic planning

Implementation of activities at KASHWASA

The **challenges** faced by KASHWASA in this WP is on how to lower operating costs, generate energy, optimize the water treatment process and reduce NRW. Additionally, their revenue collection efficiency could be increased, i.e. by prepaid water metering, developing a public relation strategy and brand management. Lastly, the staff needs capacity building, training needs must be identified and a human resource strategy to be developed.

Therefore, the **goals** are to concretise the previous activities on the topics of leadership and minimising costs. Also, the existing KPI system should be revised by analysing the corporate and unital KPIs more closely to be able to better manage the company in line with its corporate vision. Additionally, the dependencies between the unital KPIs shall be analysed. Therefore, KASHWASA will send their Strategic Plan 2026 and the existing KPI system to HW by the beginning of January 2024. HW will then make a proposal for the next steps towards a strong leadership and invite to an initial coordination meeting at the beginning of 2024.

The **progress to date** includes several online workshops, which took place with KUWASA and KASHWASA on topics of management support and strategic planning. HW customer service topics such as complaint management processes and customer satisfaction surveys were presented and discussed with KUWASA. In addition, other strategic issues related to the use of prepaid water meters were discussed with KASHWASA. Representatives from both Tanzanian companies visited Germany at the end of May 2023. They first attended the GWOPA congress in Bonn, where a meeting took place with a division manager from HW and the managing directors of both companies. Afterwards, the colleagues from KUWASA and KASHWASA (six colleagues in total) were in Hamburg and visited the HAMBURG WASSER facilities, including the drinking water laboratory

at the headquarters in Rothenburgsort, the largest waterworks in Hamburg in Curslack and the central sewage treatment plant. In addition, an exchange on strategic topics took place on site with two managers from HW, particularly on organisational issues. It was also agreed that the topics of IT security, funding and staff performance indicators should be looked at further in-depth.

Outcomes achieved at KASHWASA

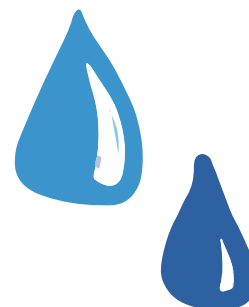
Individual level

- **Enhanced knowledge and skills:** There is a regular dialogue with four to eight colleagues. The main areas of exchange have been on strengthening revenue collection efficiency, reducing operating costs and staff capacity building.
- **Increased motivation:** The motivation of the colleagues is enhanced by the regular exchange and sharing ideas of alternative solutions and their feasibility.



Strategic level

- **Additional resources:** The work on revenue collection is expected to directly lead to an increase of resource availability in the future (it is still at an early stage of implementation).
- **Improved external relations:** The ongoing investigation into the feasibility of installing prepaid water meters will require engagement and discussions with key stakeholders such as regulator and possibly end users.



Implementation of activities at KUWASA

The **challenge** faced by KUWASA in this WP is the need to measure the performance of their staff and the utility. Additionally, the task description of their staff members was noted to not match their responsibilities.

The jointly defined **goal** was to work on these challenges. Therefore, in addition to the already taken steps, KUWASA will provide the status of the organisational structure (which has recently changed) and task descriptions by the beginning of January 2024. Additionally, the Personal Performance Management Information System (PEPMIS) introduced nationwide by the regulator, is now to be supported in the input of relevant data, i.e. task descriptions (for functions and teams), and an exchange of experience is to be organised. Based on the priorities named by KUWASA, a reflection will take place, and HW will then make a proposal for the next steps and invite to an initial coordination online meeting at the beginning of 2024.

The **progress to date** includes several online workshops, which took place with KUWASA and KASHWASA on topics of management support and strategic planning. HW customer service topics such as complaint management processes and customer satisfaction surveys were presented and discussed with KUWASA. Representatives from both Tanzanian companies visited Germany at the end of May 2023. They first attended the GWOPA congress in Bonn, where a meeting took place with a division manager from HW and the managing directors of both companies. Afterwards, the colleagues from KUWASA and KASHWASA (six colleagues in total) were in Hamburg and visited the HAMBURG WASSER facilities, including the drinking water laboratory at the headquarters in Rothenburgsort, the largest waterworks in Hamburg in Curslack and the central sewage treatment plant. In addition, an exchange on strategic topics took place on site with two managers from HW, particularly on organisational issues. It was also agreed that the topics of IT security, funding and staff performance indicators should be looked at further in-depth.

To improve corporate management, the WP has so far worked on making staff and utility performance measurable with the help of specific task descriptions and the allocation of responsibilities. They are also working on increasing performance through the introduction or adaptation of incentive systems.

The topic of rainwater harvesting for KUWASA was brought up in a management discussion with HW. KUWASA has decided to seriously analyse this alternative source of water given that funding to set up the treatment plant would be provided by the Mining Authority. The subject has now moved from WP management to the WP Water Production. The HW colleagues are currently advising KUWASA on the technical way forward.

Outcomes achieved at KUWASA

Individual level

- **Enhanced knowledge and skills:** At least two colleagues gained knowledge on management issues, particularly on staff job descriptions, staff performance and customer relations.
- **Increased motivation:** The discussion of experiences illustrates best practices and repeatedly generates innovative approaches. The exchanges and trainings motivated KUWASA staff. Travelling to Germany is also considered a motivation booster.
- **Applied new knowledge and skills:** The staff members are applying the acquired knowledge on setting up KPI's and including them in individual performance contracts, both regarded as human resource management tools.



Operational level



- **Better systems:** Job descriptions and performance measurement systems have been improved. The WOP has contributed to align job descriptions with their intended performance more strongly.



- **Improved management practices:** Openness towards strategic topics, discussion and decision making has improved.

Strategic level



- **Additional resources:** The improved job descriptions and individual performance measurements are expected to result in performance improvements at individual level, which in turn will potentially lead to resource optimisation.



- **Improved external relations:** KUWASA was invited to prepare a proposal to the Urban Water Catalyst Initiative (UWCI). HW has supported KUWASA in the proposal preparation and submission. The network and contacts from the German partner, together with the improvements and efficiencies gained through the WOPs, have positioned KUWASA in a more favourable position for future resource acquisition.

3.5 Other outcomes achieved

Outcomes achieved

Individual level

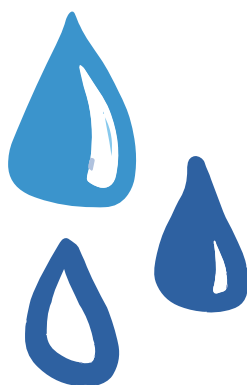


- **Enhanced motivation:** The German partners reported to have gained very rich knowledge and motivation to learn more and provide better peer-to-peer support.

Strategic level



- **Improved external relations:** The partners reported that the engagement in the WOP and the specific efforts on external communication activities have helped them to interact with other WOP actors and extend their network, to create visibility of the type of activities in a WOP and to raise interest to collaborate in WOPs.



4. PARTNERSHIP STRENGTH AND LESSONS LEARNED

This section documents the WOP participants' perceptions on the evolution and partnership strength based on an assessment of several partnership aspects. Participants of all WPs were consulted. All partners agreed that the partnership has matured over the last 22 months reaching a very efficient collaboration. Some quotes from partners are included to illustrate the perception of the partnership strength.



Quotes

It took very short time for us to click as partners, even despite the different working culture.

We are now like brothers; it has gone beyond the official partnership.

Partnership design

Overall, the partnership design was considered good by the project partners except for the short duration of the projects and the heavy administration and financial processes required. Partners praised the flexibility built into the project design, given that it allowed partners to jointly identify priorities along the way, which avoided having to rush into defining expected results when there was only a superficial understanding of the situation on the ground. Also, a point was raised on the value of jointly agreeing on activities and expected tangible results on an annual basis, once partners have had the chance to get to know the situation on the ground. Additionally, there is a good balance between the built-in flexibility to adapt and additional activities or shifts needed. This is coupled with adequate activities and results, planning and monitoring jointly conducted by all partners. A management staff member from KUWASA argued, that in their context and given the poor equipment conditions, more available funding for equipment would support their development.

Roles and responsibilities

Roles and responsibilities were not clear at the beginning. Sufficient time for in-person interactions during the missions were reported as crucial for the KUWASA and KASHWASA colleagues to understand the peer support nature of this project.

Meeting processes and representation

Generally, for every WP in the project, partners targeted having in-person interactions at least twice a year through missions, job shadowing or network events in Germany and one online meeting at least once per month. Working groups were formed to address each of the work packages integrating all relevant partners. The composition of the teams from the German partner often involves pairing individuals with different experience allowing them to mutually learn from each other's distinct perspectives. When it comes to the Tanzanian partner, the aim is usually to involve staff at operational and management level. This approach is considered useful in ensuring commitment and knowledge transfer.

Work processes

Work processes seem to be quite smooth in general, both during in-person exchange and online exchanges. For each WP, plans are made and jointly reviewed and updated during the online meetings. Each working group has agreed on their preferred ways of online communication (including MS Teams, emails and instant messaging). One aspect stressed was the public procurement processes that tend to be quite long. This means that the operational improvements, that are dependent on equipment procurement, tend to take longer than initially anticipated. It is important to take this into consideration when planning activities that require public procurement in terms of expectations management from partners.

German partners praised the strong engagement of Tanzanian partners. They also expressed how grateful they were about the support received making logistics in terms of travelling as effective and convenient as possible. An aspect reported to contrib-

ute to more efficient work processes was the great collaboration between KUWASA and KASHWASA. Both are eager to help each. A recent example is the support provided from KASHWASA to KUWASA in the activities related to the initial exploration of the project on rainwater harvesting. They offered support not only with the use of their installations and equipment for early tests but also with knowledge transfer activities.

Trust and transparency

Partners reported to have achieved a state of great trust, transparency and openness that helps them to work efficiently as partners. KASHWASA and KUWASA were eager to engage in this project from the beginning on. The time on-site during missions is considered crucial for the German partners, not only to gain a detailed understanding of the technical installations and processes, but to share thoughts and ideas, to get a sense of the intentions of the peers, understanding the roles of each person in each WP, and their initial level of interest and eagerness to engage. Missions on-site are essential to develop a technical understanding and a personal relationship, and both are instrumental for the work ahead in the project. This sets a good foundation to be able to effectively collaborate online.

Partners argued that engaging together in experiments and on-the-job exchanges was extremely useful to get to know each other and identify individuals for each WP that were eager to learn and to improve. An early perception of benefits from the Tanzanian partners helps with the development of trust and interest to engage. The work done in the WP Water Production in KASHWASA is an example of on-the-job training through shared experiments that lead to quick wins directly, which triggers immediate engagement and trust from partners. The GIS work, particularly in KUWASA, also illustrates how improved operational practices leading to simplification of working routines and more efficient use of resources triggers an immediate interest and engagement from the Tanzanian partner.

Partners shared how there is a great transparency in terms of information exchange for each of the WPs

about coordination and technical information. HW suggested more transparency of funding available towards the Tanzanian partner. Having a clear understanding for both partners early on during the project would help them to jointly agree on what to prioritise each year.

The network meetings (i.e. in Stuttgart, Bonn) and joint participation in Water Events (i.e. IWA Development Congress in Kigali) were also reported to create trust, extend a network and develop motivations and led to a shared sense of belonging at a programme level.

Resources

Partners claimed that a longer duration and larger budget is crucial for the projects to consolidate results.

Adaptation and flexibility

All partners agree on the value of the great flexibility built into the projects to adapt to emerging needs. An example of such flexibility is how HW has recently started to support KUWASA in exploring and setting up the feasibility of a Rainwater Harvesting Treatment Plant. The WOP in KUWASA did not initially focus on the WP Water Production. However, the topic of Rainwater Harvesting was discussed by the team in the WP Management Support as a measure to reduce costs of purchasing bulk water, as well as to have a second water source, hence, to increase the operational efficiency of the utility. Once the decision was made at high level to proceed with it, the operational work was assigned to the corresponding technical WP, which in this case was the WP Water Production. This same example also illustrates the openness of the WP Management support, which also aims to stir open reflection and awareness raising on topics that are relevant for KUWASA and KASHWASA from a strategic and managerial perspective. When decisions are made at a strategic level through the WP Management support, the topic is then delegated to the technical level through the corresponding WP.

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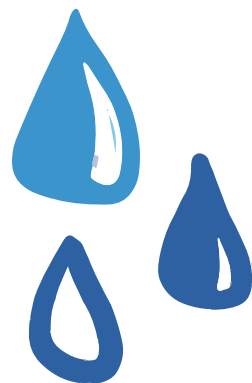
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Interviews with all partners

ANNEXES



Links to external communications initiatives

HAMBURG WASSER LinkedIn:

LinkedIn Channel HAMBURG WASSER International

WOP Update Tanzania by Karam Koudary

<https://www.linkedin.com/feed/update/urn:li:activity:7023235393932165121>

Antje Werkmeister: What happens inside WOPs?

<https://www.linkedin.com/feed/update/urn:li:activity:7021064830853767168>

WOP in three words

<https://www.linkedin.com/feed/update/urn:li:activity:7019611250925961216>

Enabling WOPs workshop Bonn

<https://www.linkedin.com/feed/update/urn:li:activity:7009104078592950272>

Aftermovie Jobshadowing Hamburg by Tanzanian Colleagues

<https://www.linkedin.com/feed/update/urn:li:activity:7006197280210829314>

June 2022 Job shadowing of Tanzanian colleagues of KASHWASA and KUWASA at Hamburg Wasser (version with German subtitles: Job-Shadowing tansanischer Kolleg*innen bei Hamburg Wasser (Deutsche Untertitel) - YouTube)

WOP meeting Berlin German Operators

<https://www.linkedin.com/feed/update/urn:li:activity:7003353939278483457>

HAMBURG WASSER won the SDG challenge post 2

<https://www.linkedin.com/feed/update/urn:li:activity:6995333430833987585>

HAMBURG WASSER in Tanzania

https://www.linkedin.com/posts/hamburgwasser-international_kashwasa-ihelele-water-activity-7181899253089263616-Dmpe?utm_source=share&utm_medium=member_desktop

December 2023: IWA Kigali

https://www.linkedin.com/posts/hamburgwasser-international_iwa-waterdevelopmentcongress-kigali-activity-7139716189462634497-8CDe?utm_source=share&utm_medium=member_desktop

Netze BW Wasser LinkedIn:

<https://www.linkedin.com/company/netze-bw-gmbh/posts/>

Summer 2022: Netze BW Wasser travels to KUWASA

https://www.linkedin.com/posts/osama-madwar-bb8547142_tansania-wasserversorgung-wassernetz-activity-6947179520235864064-WYIG?utm_source=share&utm_medium=member_desktop

Summer 2022: Netze BW Wasser travels to KUWASA

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April 2024: KUWASA and KASHWASA visit Netze BW Wasser in Stuttgart, Germany

https://www.linkedin.com/posts/utility-platform_netzebw-giz-utilityplatform-activity-7188461687744724993-pCo4/?utm_source=share&utm_medium=member_desktop&rcm=ACoAAED-ZVgBDU6t2nYJltroDyIYSmY6BUW6Qrk

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