DRAFT POLICY PAPER:

ADOPTING ASSET MANAGEMENT TOOLS TO MODEL COST RECOVERY OF RURAL PIPED WATER SERVICES

The WaterTime case study: Agago district, Uganda

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EXECUTIVE SUMMARY

This policy paper is the result of a piped water project in Northern Uganda implemented under the Dutch WASH SDG Programme and partners of the WASH Alliance International. The policy paper responds to the ambition of the Government of Uganda to supply all households with piped water by 2040. To realise a sustainable acceleration of piped water services, it is essential that recurrent costs are recovered. Cost recovery through water pricing remains, however, a controversial and politically challenging topic.

By using an **Asset Management framework**, the paper analyses the implications of the Ugandan pro-poor tariff of 50 UGX on the financial sustainability of a rural piped water scheme in northern Uganda.

The paper shows that an Asset Management approach provides valuable insights into system sustainability. It demonstrates the significance of design, tariff setting and management arrangements on the long-term sustainability of piped water services. The case study demonstrates that the pro-poor tariff, without additional funding or a sizeable amount of paying users from individual, or, yard connections, will unlikely result in cost-recovery of piped water schemes in rural areas. The paper advocates the need to enhance transparency about the costs of post-construction piped water supply and argues that continued use of hand pumps, which usually do not require users to pay per volume of water collected, will impede the transition to piped water in rural areas.

INTRODUCTION

Across sub-Sahara Africa, rural populations are struggling with non-functional and financially unviable water systems. For decennia, authors have pointed at the daunting 'rural water crisis' as a result of the 'graveyard of failed water infrastructure across Africa'. The fact that 2.1 billion people worldwide have no access to safe water (WHO/UNICEF, 2017), fuels the international ambition to realise sustainable and safely managed water services, providing both reliable and affordable access to water.

> The WASH SDG Programme in Uganda is a 6-year multi-country programme (2017-2023) funded by the Dutch Ministry of Foreign Affairs. The programme aims to improve the delivery of sustainable access to water and sanitation services.

The Government of Uganda formulated the goal to realise 100% piped water coverage by 2040. It recognises the need of user payment to realising a sustainable water service. Because 25% of the rural population is living below the poverty line and about half of the rural population is a subsistence farmer (UBOS 016[1]), the government of

[1] https://www.ubos.org/publications/statistical/23/

Uganda promotes a pro-poor tariff of 50 UGX per jerry can.

The pro-poor tariff is the public tap stand tariff used by National Water and Sewage Corporation (a parastatal company) . However, this tariff is heavily subsidised through user cross-subsidisation and government support. In reality, users pay more than 50 UGX, as tap operators include a surcharge[2]. Actors that do not live up to the pro-poor tariff of 50 UGX per jerry can, may experience resistance – from both government authorities and water users.

Rural areas face considerable obstacles for realising a financially viable water service. Users in rural areas often have a low-purchasing power due to their seasonal income and live more dispersed (making water infrastructure costlier) compared to urban citizens. To move away from water scheme management at the local level, the Government of Uganda established the Umbrella of water and sanitation (W&S) in 2017; a public water utility for the management of piped water schemes in small towns and rural areas at regional level. To enable cost recovery, it is important for the Umbrella Organisation to (also) take over those water schemes that are financially viable. **By using an asset management tool, this policy paper explores the implications of the pro-poor tariff on the financial viability of a piped water systems in northern Uganda.**

While financial sustainability is a key condition to make sure that piped water systems have the funds to be repaired and maintained, there is often a general lack of understanding about the financial post-construction implications of a water system and what actions can be undertaken to realise financial sustainability. In fact, there is often no insight of what it involves to keep a system alive. Moreover, the term financial sustainability is not used consistently. Whether or not capital maintenance costs (so the replacement of hardware – like towers, pumps and pipelines) need to be covered by water sales is not clearly defined.

When implementers such as governments and NGOs are not fully aware of the financial implications of a piped water project, systems will continue to run the risk of breakdown - creating bigger graveyards of non-functional water systems.

This policy paper is the result of a piped water project in northern Uganda under the WASH Alliance programme. The paper shows the significance of design, tariff setting and management arrangements on post-construction financial sustainability and argues that these three elements need to be put central in the planning stage of rural water supply programmes. It demonstrates the value of treating water systems as a business where the key question of 'who pays for what' is provided with an answer .

THE CASE STUDY

In Northern Uganda, the WASH SDG Programme is piloting the WaterTime approach that aims to realise cost recovery of post-construction piped water service delivery. The WaterTime project emphasises the role of **design, payment and reliable management for sustainable water access.**

Design: Uses a modular building approach whereby the scale of the infrastructure corresponds with the ratio of users to reduce the investment costs and avoid a water system is too large and too costly to maintain for a relatively small consumer base. By minimising the investment costs, recurrent

[2] For example, in Ibanda District, water from a NWSC public tap stand is 100 UGX a jerry can, where as it is 200 UGX in Bweyale town, Kiryandongo District.

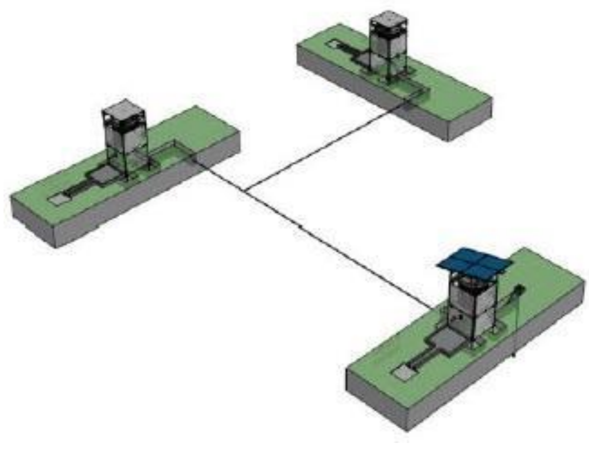
maintenance costs are reduced. When demand increases, the network can be expanded from water revenues.

Payment: Integration of pre-payment and monitoring technology to ensure user payment and monitoring whether sufficient income is generated for cost recovery.

Management arrangement: because the pilot aimed to test the financial viability of the system it was initially decided to let the system be managed by a local NGO. As of the publication of this paper, the Northern Umbrella of S&W has taken over management with the support of a Water User Committee.

Characteristics of modular building:

- Niche solution between 300 and 2000 water users;
- Solar powered;
- Demand based building;
- Scalable;
- Standardised towers (enables standardised maintenance plans);



CONTEXT IN NORTHERN UGANDA

Northern Uganda is a challenging environment for charging water payments. The area has seen the presence of humanitarian relief efforts during the civil war (1986-2007) with Internally Displaced Person (IDP) camps. Due to their humanitarian remit, these NGOs did not engage with the need for users to pay for water. As a result, the NGOs were associated with the construction of water systems and free provision of water, but once UNHCR closed its office and the majority of NGOs also left, the water systems struggled and now many are defunct: indeed the IDP camps of Northern Uganda represent a classic infrastructure graveyard[3]. Northern Uganda

Rationale Modular Water System

Piped water schemes are prone to premature breakdown as they are often over-dimensioned and involve high construction, operation, maintenance and repair costs. Governments and donors tend to: 1) employ a design horizon of 20 years with an annual projected population growth rate and, 2) use the standard WHO norm of 20 litres per day per capita. In the event piped water systems are oversized they may struggle to recover the minimal running costs, let alone the replacement and expansion expenditures. Such systems start and often remain non-viable because customers are few in comparison to the size of the infrastructure and often consume significantly less drinking water than the official WHO standard of 20L per capita per day. As a result, water tariffs are often too low to cover the recurrent costs of the service in the long-term leading to degraded and ultimately non-functioning water systems.

[3] It is important to stress at this juncture the importance **of NGO and donor accountability to their beneficiaries**. If NGOs and donors do not appreciate the long-term implications over their system designs, and the importance of tariff setting and post-construction management, then they are not representing the true complexity and long-term implications of schemes to their beneficiaries. There is risk of reputational harm: the IDP camps in northern Uganda represent a stark warning over infrastructure graveyards.

is also characterised with a high prevalence of poverty. The average monthly income in northern Uganda is 186,000 UGX (45 USD) compared to the average 300,000 UGX (80 USD) in rural Uganda. The WaterTime project is piloted in Agago District. Community members and government actors have been actively engaged by the implementing NGO Agriculture for Sustainable Rural Transformation (AFSRT). The local government of Agago proposed the rural villages Omot and Wol as the pilot locations. Omot has 553 households and a population of 2773 collecting water from nine hand pumps near the trading centre. In July 2019, one hand pump was upgraded into a modular solar-powered water system with 2 public water towers. One was at the location of the handpump and another was strategically constructed in the centre. In 2021 another modular solar-powered system was created with also 2 public water towers in the rural village of Wol. In 2022, the systems of Omot and Wol were both upgraded with an additional 10 yard connections each.

Figure 2 Satellite tower/ water kiosk that replaced handpump

RESEARCH METHOD

PRACTICA Foundation developed an Asset Management tool to calculate the income and costs of O&M and provide guidance for the upkeep of the system. Asset Management Planning (AMP), widely used by the water industry in the EU, but to-date hardly in the WASH development sector, may have potential for supporting and modelling the financial sustainability of piped water schemes in rural settings. AMP recognises that in reality maintenance and Capital Maintenance Expenditure (replacement of parts) are often difficult to disaggregate. AMP asks users to define their preferred service level, which can be used to calculate the tariff level needed to maintain that level of service. AMP helps service providers to operationalise the maintenance tasks and may also provide a tool for engaging with users over O&M and CapManEx requirements, but in an interactive way, which may result in a deeper level of community buy-in.

An AMP can thus be used to plan, evaluate and optimize the financial sustainability of a system. In this case study an AMP is used as research method to evaluate and optimize the financial sustainability of an existing system.

COSTS OF THE MODULAR WATER SYSTEM - CASE OF OMOT

The hardware investment cost of the Omot water system totals about EUR 19.000[4]. (The investment costs for the Wol system were similar.) The relative costs per hardware component are presented in the figure below[5].

[4] This does not include well drilling, pump tests, water quality test, consultancy and installation costs

[5] It can be observed that the monitoring/prepayment systems presents a substantial part of the overall hardware costs

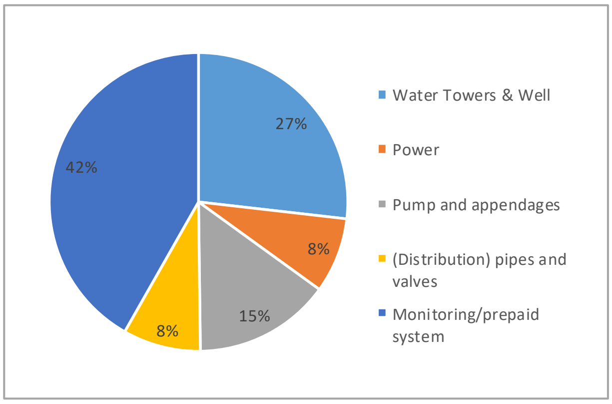


Figure 3: Capital investment costs Omot

Figure 4 shows the expected combined capital maintenance and operational expenditure costs over a duration of 15 years. For this purpose, data were collected in the field on the repair and replacement of various assets of the water system. It can be observed that the expected costs are just above UGX 4.586.000 (~EUR 1000) per year and that there is a peak in year 8 which is due to the expected replacement of the solar pump. Costs have been corrected for an inflation rate of 4%.

INCOME & WATER CONSUMPTION IN OMOT

The real-time monitoring data collected via the prepayment technology showed in an initial phase in 2020 in Omot **an average monthly consumption of 1733 Jerry Cans per month and a daily consumption of 58 Jerry Cans per day**[6]. There are 54 tokens sold, representing the consumption of around 1 Jerry Can per household.

If there are 5 people per household, then 1 Jerry Can represents the consumption of 23/5=4,9 litres/capita per day. This shows, similar to other studies[7], a lower consumption level than the WHO standard of 20 litres per capita per day. The current number of 54 households using the system is also much lower than the total number of 553 households in the study area. The first reason for the lower consumption is that people are not used to pay for water . Another reason for the lower consumption rate, appears to be the presence of nine handpumps in the area. Some users argued to favour a free

Figure 4: Combined expected operational and maintenance costs over 15 years (in EUR)

[6] Data retrieved during 8 months from August 2019 until May 2020

[7] A host of studies show that actual consumption levels from piped water services in rural contexts are often much lower. A study by WSP (2010) in Benin, Burkina Faso, Mali, Mauritania, Rwanda and Senegal shows that actual consumption levels from piped water systems are about 3 litres per capita per day. In another WSP study (2002) in Ethiopia, people were found to consume 9 litres per day per person and in six small towns in Burkina Faso, Pezon et al (2013) demonstrate consumption levels of 10 litres per day per person.

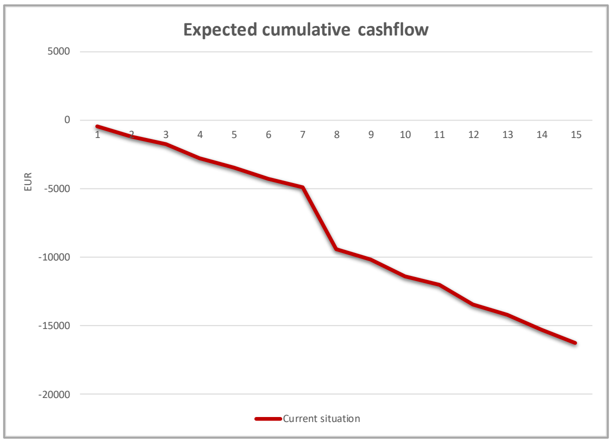
hand pump above a (pre-)paid water service. The people that did collect water from the pre-paid WaterTime system, linked their choice with the increased service level: chlorinated and safer water, closer to the home (for these particular users) and the fact that no human effort is needed to get the water flowing.

SCENARIO'S FOR COST RECOVERY

This section presents the initial situation and four scenarios for cost recovery based on different costs (capital maintenance and operational costs) and income. Income is generated through payments from the public water towers and yard connections. A yard connection provides water from the public tower to a group of neighbouring households.

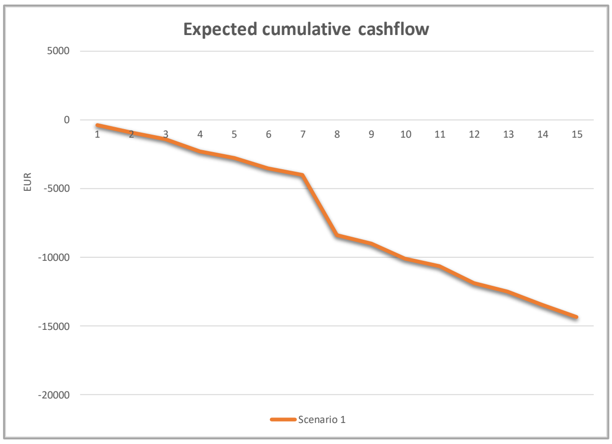
The modelled situation, based on figures from 2020, represents an average consumption of 58 jerry cans/day, a water tariff of 75 UGX/ Jerry can and 0 yard connections. Below, 4 scenarios are presented to show the options for realising cost recovery from user tariffs.

Scenario 1: 100 UGX per jerry can with current water consumption of 58 jerry cans per day



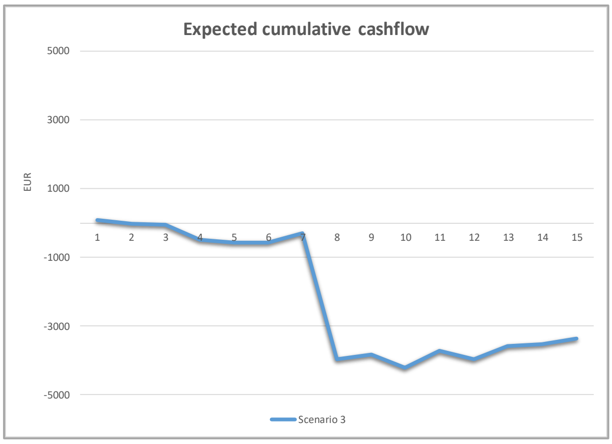
The graph of scenario 1 shows a plummeting line. Increasing the tariff from the 75 UGX to 100 UGX per jerry can will not be sufficient to enable cost recovery.

Scenario 2: a lower water tariff of 50 UGX/ Jerry can and an increased consumption of 122 Jerry Cans/day



After discussions about the water tariff with the community the belief is that by lowering the tariff to 50 UGX/Jerry can, the consumption would double.

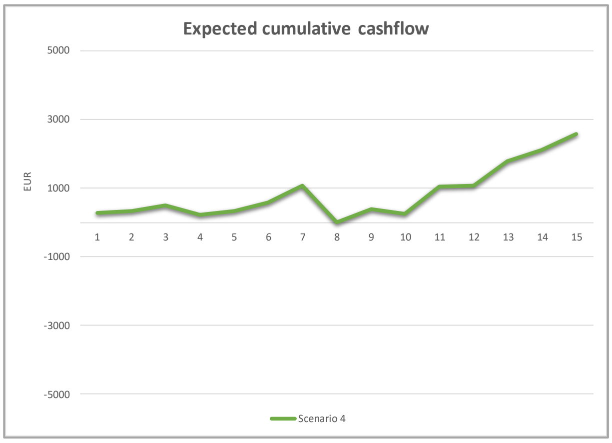
Scenario 3: an expansion of the existing system with 10 yard connections, the lower tower water tariff of 50 UGX and an increased consumption of 122 Jerry Cans/day.



A yard connection is expected to provide 150 liters per day which equals a number of 7 Jerry Cans. Still, with just 10 yard connections and a tariff of 50 UGX the system is only viable for 3 years, but not in the long run.

Scenario 4: Because of the increased service level, the water tariff is set at 75 UGX/ Jerry can for the yard connections.

With a number of 20 yard connections the system becomes financially viable.



Scenario 4 shows the number of yard connections needed if the pump replacement costs are taken out of the capital maintenance costs[8]. This shows a significant reduction in costs and thus also less yard connections needed (14) to make the system financially sustainable.

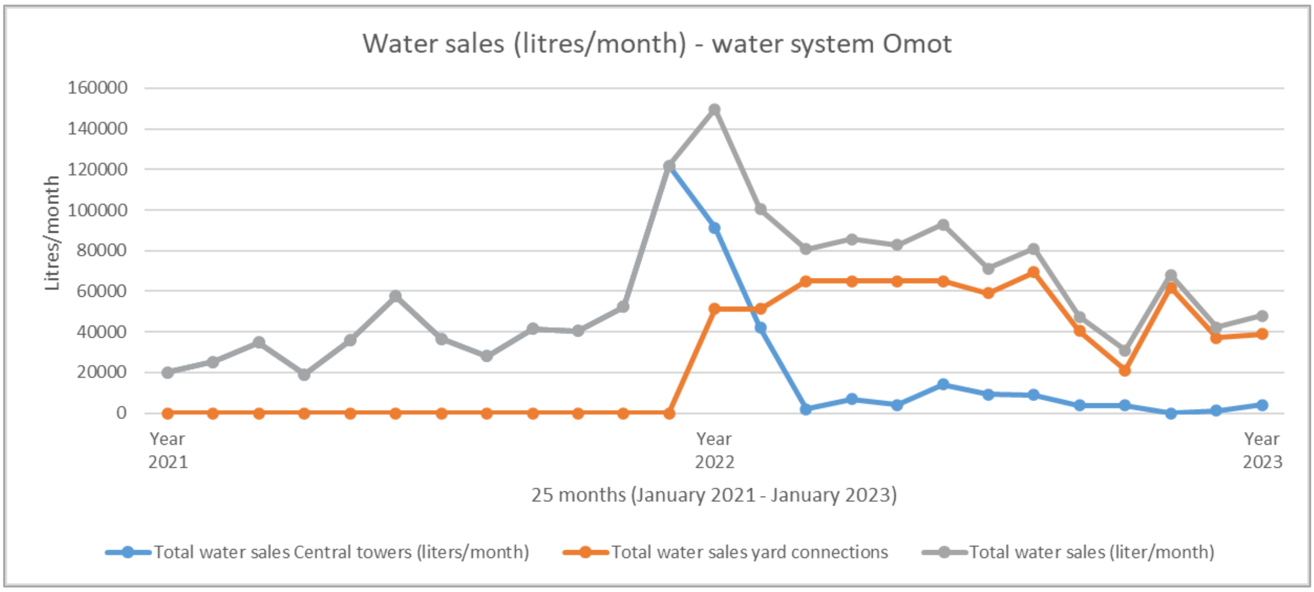
Scenario 4, which includes more than 14 yard connections and a higher water tariff, thus provides a sustainable base for cost recovery. In the later phase of the pilot project (2022), it was decided to add 10 household connections at each location. However, the water tariff of 50 UGX was kept the same for all locations. The chosen set-up thus represents scenario 3.

PRELIMINARY RESULTS

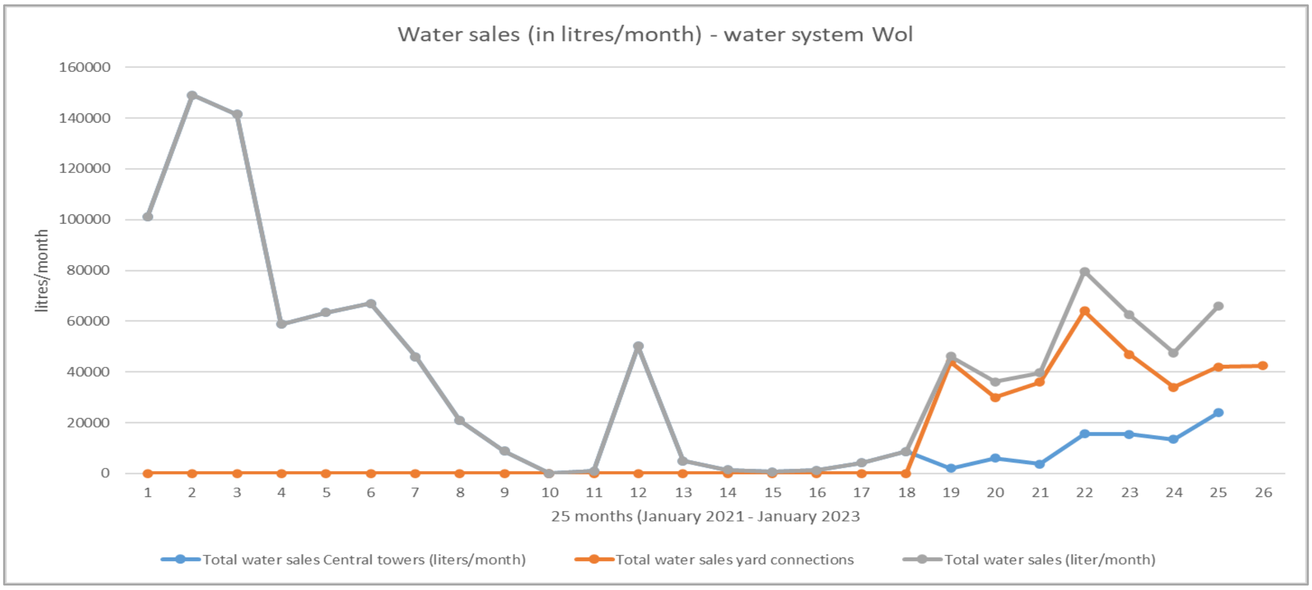
Below are the preliminary monitoring results of the two sites with data from 1 January 2021 till 31 January 2023. For the yard connections only data of 2022 is presented, since these were installed in January (Omot) and July (Wol) 2022 respectively. ***It should be noted that these data have not yet been cross-checked and validated.***

From this preliminary data, we can observe tentatively:

1. Total water consumption and sales in the two respective rural centres increases after installing yard connections from an average of 1733 jerrycans/month in 2020 to an average of 3430 jerrycans/month in 2022 in Omot and 2454 jerrycans/month in Wol (see graphs below).
2. The water consumption in the central tower's water kiosk however drops at cost of the yard connections. End-users thus seem to move to water sources close to their home. Why this

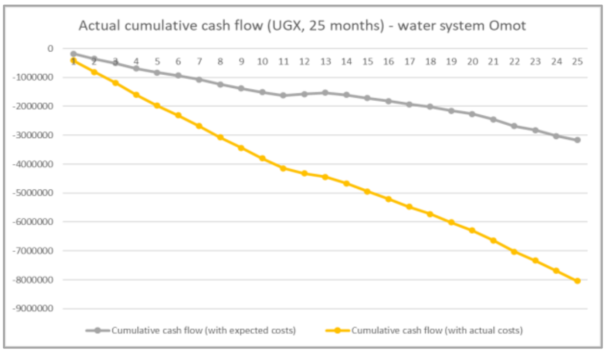


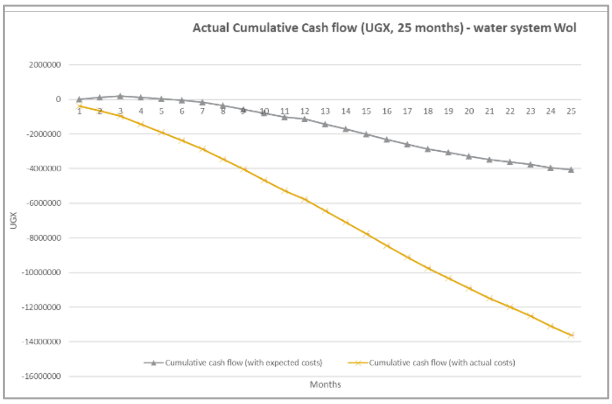
[8] In the AMP the pump is expected to be replaced in the 8th year with an estimated cost of EUR 1800



is the case needs further investigation but could be explained by the fact that the water tariff everywhere is the same.

3. Overall, the cash flow (including just operational and maintenance costs) is not (yet) positive after installing yard connections (see graphs below). This can be explained by the fact that:
    a. Actual operational and maintenance costs were more than expected. Further checking and verification is required whether the data on actuals are correct and if yes, why this is the case. It is striking that especially the digital pre-paid system had quite some more expenditures than expected.
    b. Water tariff for yard connections was not increased to 75 UGX/jerrycan as advised, so insufficient income was generated.
    c. The number of yard connections advised was not possible within the project budget and thus remained to be 10 per system instead of at least 14 per system.
    d. The competition with other safe or cheaper water sources remains high. In the case of Wol, another medium-sized piped water system has recently been installed by an international donor-funded project. One can see that the Omot system was in early 2021 still a popular point to fetch water, however the interest dropped after the donor-funded piped water system came into place.





In Omot, there are numerous handpumps where water can be pumped for free or at a minimum cost.

CONCLUSION

This policy brief argues that **financial sustainability must be at the heart of the planning, design and post-construction management of water systems.** The case study from Uganda provides useful insights and potential lessons.

1. The case study shows that the government's pro-poor tariff of 50 Ugandan Shillings (UGX) per 20 litre jerry can is not sufficient to sustain small-scale solar-powered piped water systems in rural areas with similar conditions as Omot and Wol; the systems are effectively bankrupt before the water flows through the pipes. Even with a 100 UGX tariff and a modular system design, we can see the systems are still over-designed and tariffs too low to provide long-term financial security to ensure the water keeps flowing.

2. The case study shows that cost recovery is *only* realistically possible when water public water points are complemented with yard connections. In the Omot water system example, a minimum of 21 yard connections are needed - with a consumption of 116 Jerry Cans/day of the tower and a water tariff of 50 UGX/Jerry can - to keep the entire system running for at least 15 years. This is under the assumption that the calculated expected operational and maintenance costs are accurate, which is not certain based on the preliminary findings.

3. The topic of tariff setting and engendering the need to pay for water is often very challenging, particularly in contexts such as Uganda where the National Water tariff is widely known, and where there is pressure from local politicians around election time, promoting 'water should be free'. Implementing actors may not wish to disturb community relations when their programming in the area is time-limited. In the case of Omot and Wol is has appeared to be challenging too, since the water tariff remained at 50 UGX/jerrycan at all locations, though the advice from the start has been different to realise full cost recovery.

4. In some areas, paying for system restoration may be accepted; whereas paying in perpetuity i.e. just in case of system-breakdown, is not[9]. Thus, even getting communities to initially accept the need for regular on-going payment for system upkeep, as well as for a tariff that needs to be in excess of e.g. the Uganda NWSC pro-poor tariff, will be difficult. A case in point is Northern Uganda where the pilot takes place and where people have not been used to paying for water. In conjunction with a low Human Development Index, the legacy of free water services is challenging to overcome, so programmes may need longer lead-in times for behaviour change initiatives.

5. In the case study area, many users preferred other water resources, for example, the use of free water from a hand pump or another piped water system with post-billing over the use of communal water towers with the pre-paid system, introduced in this pilot. While government regulation allows hand pumps to be decommissioned in a town council if

[9] With regards to Malawi refer to Chowns 2015, and Uganda, see Brown and van den Broek (under review) and van den Broek and Brown 2015.

piped water is installed, this is not common practice. Competition of other water resources thus remains a huge challenge for the introduction of the WaterTime concept. Site selection and cooperation from local government is thus key for success.

6. One of the scenarios for cost recovery showed that the financial viability of the system can be improved if part of the fixed capital maintenance costs is included in the investment costs (e.g. the pump). This lowers the cost for operation and maintenance and thus increases the financial viability.

7. To date the cost of pre-payment and monitoring technology is relatively expensive. In the presented case study, the pre-payment technology consumed 40% of the total hardware budget. In addition, local (trained) NGO staff had difficulties to understand how to work with the settings of the technology. A simpler to maintain and less expensive pre-payment and monitoring technology would be useful to enhance and ease the uptake of this technology in the rural water sector. Practica has field-tested prototype for mechanical pre-payment technology suited for rural areas, called the TokenTap, which is less expensive and easier to operate and maintain.

RECOMMENDATIONS

1. The use of hand pumps impedes the transition to piped water in rural areas. If boreholes are not decommissioned, the continued use of hand pumps must be factored in the calculations of the expected water consumption/income.

2. Asset Management Planning is a helpful method to gain insight into the (likely) funding gap at different tariff levels. Using AMP also shows two important implications:

A) **System design does have an impact on the scale of funding gaps**. More research and innovation activity is needed to consider how designs can be better matched to current needs. In order to maximise donor funding for systems, Asset Management Planning must inform the design and operations of water schemes.

B) Applying an asset management lens also starkly presents the true costs of systems: capital, operational **and** capital maintenance expenditure (CapManEx)– the latter is often not fully appreciated.

3. The use of AMP may increase **transparency** across the sector, encompassing beneficiaries, system managers[10], NGOs, government and donors, over the **true cost of sustainably supplying water**, and fundamentally a discussion is needed over **who should pay for what component** of the system. If users are expected to be fully responsible for O&M and CapManEx, then the design of systems is key, to ensure they are not financially compromised from the outset. In the case of Uganda, users of NWSC public tap stands (pro-poor tariff) are not responsible for both O&M and CapManEx. Applying the same conditions to rural water systems, where at present there is no potential for system-to-system cross-subsidisation is, therefore, unrealistic.

4. AMP can also help to improve insight on the required liquidity of water schemes. The risk profile for systems can be assessed and a **recommendation over a minimum amount of readily available funds** for an emergency is recommended.

[10] Who may be private operators or communities.

5. Having **transparent AMP systems for demonstrating accountability** over the management of funds is really important and is a concern at present. A **standardised book keeping approach will** help with accountability to users and will also allow for auditing and oversight by NGOs or local government so they can compare different systems more readily.

6. In Uganda, standardised accounting and AMP may also help with system turn over to Umbrella Organisations. By managing rural water schemes at regional level, the Umbrella of S&W has the advantage to cross subsidise loss making schemes with profitable systems. With organisational support, the Umbrella of S&W has the capacity to integrate financial sustainability at the heart of the planning, design and post-construction phase of rural water piped systems.

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