

Exploratory assessment of challenges and issues with private water operators in rural water supply and service delivery: a case study of the Karamoja region, Uganda

Benbella Dektar^{a,*}, Scott McConnell^b and Allan Kasekende^b

^a World Bank's Somalia Urban Resilience Project, Phase II (SURP II), Department of Public Works, Reconstruction & Housing, Mogadishu, Somalia

^b MK Dev Consults Limited, Department of WASH Business Development, Nairobi, Kenya

*Corresponding author. E-mail: dektarb@gmail.com

ABSTRACT

This exploratory assessment was conducted in the Karamoja region of North Eastern Uganda. The aim was to analyse the contextual shortfalls that undermine the effectiveness and sustainability of private operators (PO) in water supply. POs had limited capacity to manage affairs of the water supply systems (WSS). Specifically, their skills were lacking to manage the electromechanical components of the systems, meter reading, and they exhibited poor customer care skills. Intermittent power supplies rendered the WSS unreliable. Solar systems were reported to have erratic frequencies and output which also ultimately resulted in inconsistent water supply. However, the POs hardly pursued corrective measures. The weak enforcement of regulatory policies propagated non-uniformity in tariff implementation approaches across districts contributing to lower willingness to pay. The POs' focus on profits presents a unique challenge as they attempt to minimise energy expenses in a bid to widen profit margins. We conclude that the limited technical and managerial capacity of POs in running water supply systems is a critical cause of unsatisfactory service delivery to water users. Finally, the weak water governance and regulatory policy enforcement and the non-adherence to water tariff plans not only affect PO economies of scale but also hamper efficient service delivery.

Key words: Capacity, Poverty, Private operators, Sustainability, Uganda, Water user

HIGHLIGHTS

- Institutional capacity weakness exists in sectoral coordination where it is least expected to manifest at policy formulation level which ultimately impedes the oversight function of the water authority.
- Inconsistent data use to strengthen data-driven iterative adaptation to service delivery is a major factor that inhibits evidence-based decision making.
- Weak regulatory policy enforcement mechanisms stymie water governance leading to inconsistent water tariffs, and intermittent water supply, and worse still system breakdown.

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GRAPHICAL ABSTRACT

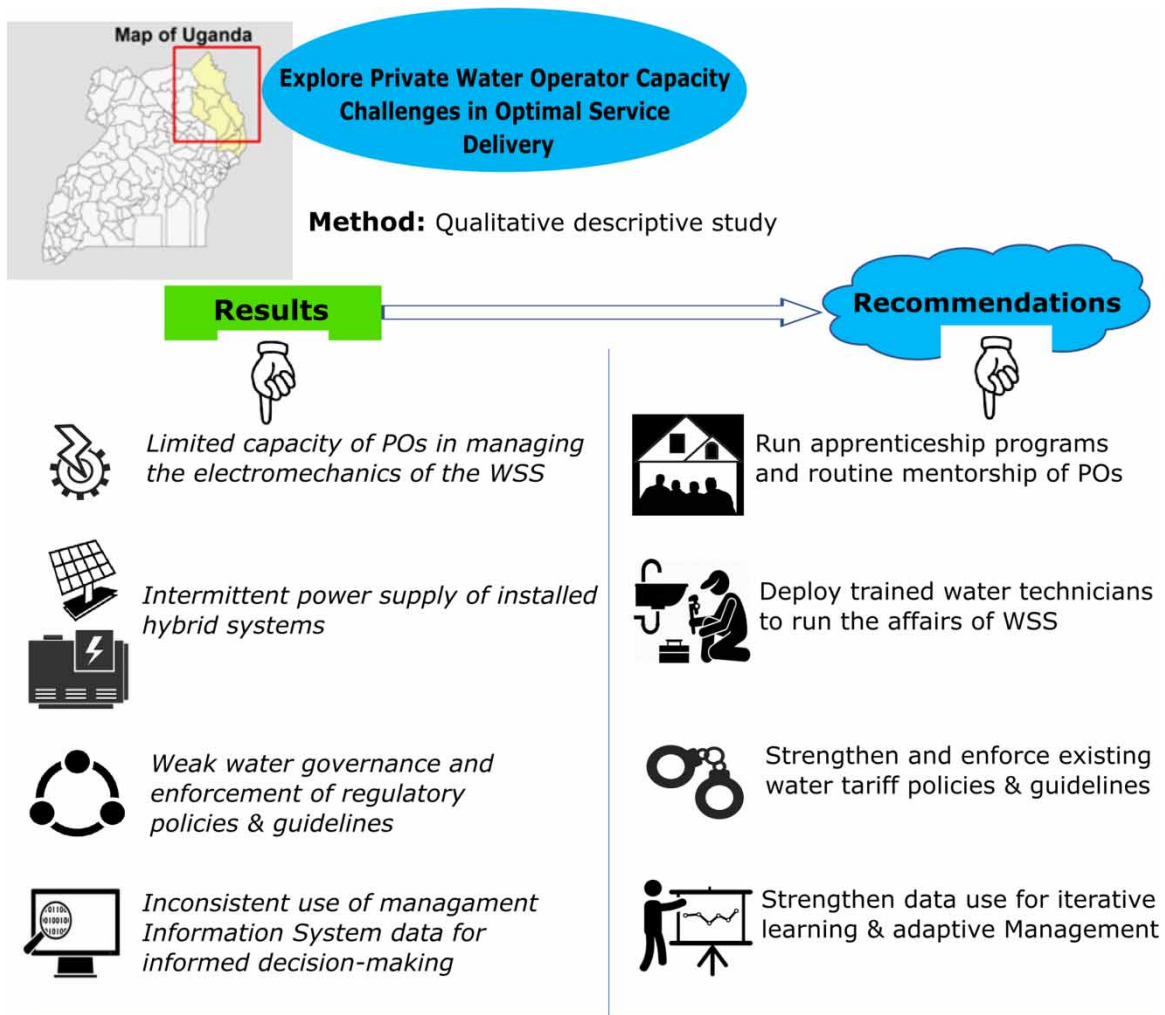


Figure 1 offers an at-a-glance visualisation of the exploratory assessment highlighting the method used, main results, and actionable recommendations. Representative symbols/icons have been used to reinforce the brief descriptions under the results and recommendations.

INTRODUCTION

Located in North Eastern Uganda, Karamoja is a semi-arid region characterized by erratic precipitation patterns and long drought spells. It is known to have the lowest groundwater potential due to low water tables. The average drilling depth and static water levels in the region are 79.3 m and 28.5 m respectively (DWRM & JICA, 2011). Karamoja is one of the underprivileged regions that has for decades been underserved in water and sanitation services by the Government of Uganda. Moreover, the region suffers from the worst poverty indicators in the country, at 74% (UBOS, 2018), a history of armed conflict and livestock rustling, poor road infrastructure,

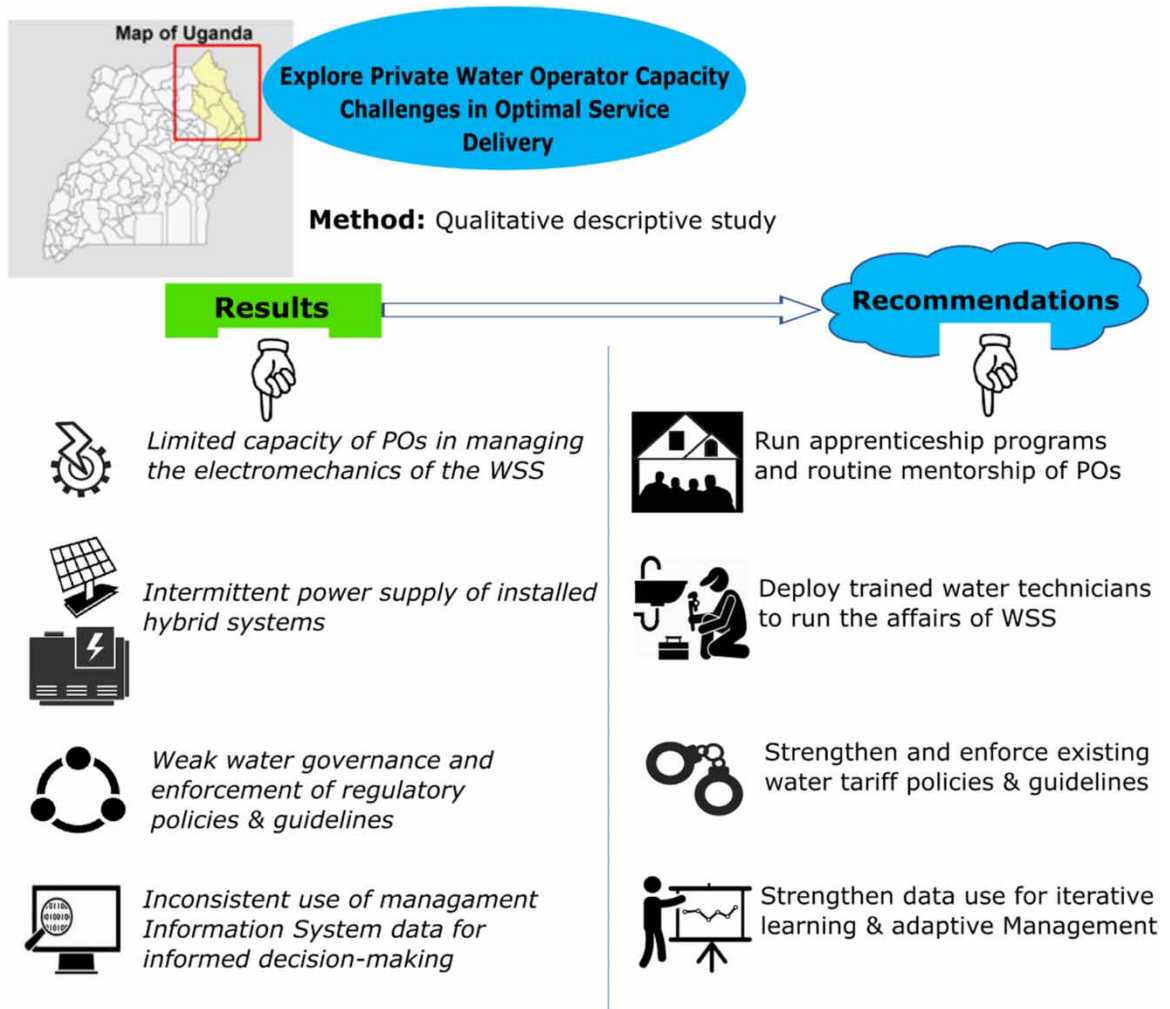


Fig. 1. | Graphical at-a-glance visualization of the method, results and recommendations.

lack of connection to the national power grid, and pastoralist lifestyles. These problems exacerbate a myriad of challenges that private water operators (POs) must address when setting water tariff plans and delivering the services in the area. Despite her wealth in mineral and natural resources, Karamoja continues to receive minimal attention from the government in terms of infrastructural development and social service delivery. According to the Ministry of Water and Environment (MWE), the region ranked lowest in sanitation and hygiene indicators albeit did comparatively well in water access. Specific water coverages for the districts of Moroto, Kotido, and Kaabong where the assessment was conducted stood at 77, 78, and 84%, respectively (Ministry of Water and Environment, 2017). These figures exceeded the national average safe water coverage in rural areas which was estimated at 70%. On the other hand, the average functionality for rural water supplies across Uganda was 85% whereas Kaabong and Moroto districts registered a functionality ranging between 76% and 84.9%, while Kotido fell below this range (Ministry of Water and Environment, 2018). We noted that the functionality of

water supply systems (WSS) is largely dependent on the commitment and performance of the POs while recognizing that the Water Boards and consumers, too, have their role to play. Water boards are special entities that take responsibility and oversight of rural water supply and sanitation services. These figures align with for instance Kleemeier (2010) who reported that the continued functioning of rural water supplies in Africa remains problematic, despite much progress over the past three decades. In addition to continuing access expansion, the high breakdown rate due to lack of maintenance is threatening the sustainability of what has already been achieved (Foster & Briceno-Garmendia, 2010).

Ndaw (2016) attributes this failure of the WSS to the inability of local governments to provide WSS services after decentralization of water service delivery from central to local governments, among other factors. Ndaw's study adds that Local Governments often lack the necessary skills and capacity to manage water supply and sanitation services, which creates the case for private sector involvement with the aim to bridge the capacity gap. However, whereas POs are, in principle, able to overcome some of the shortfalls, they, too, are faced with other contextual challenges. For example, poor follow-up is given to the District Implementation Manual of MWE which highlights that key operation and maintenance (O&M) issues should be discussed with communities from the early stages of planning the water source improvement (MWE, 2013). That way, critical issues could be identified from the outset and addressed in time. Moreover, doing so is advantageous in gaining client confidence and consistency in tariff payments.

A study on service failures of rural water supply systems in Ethiopia revealed that lack of uniformity of implementation approaches, and institutional and organizational incapability of the local government aggravate the service failures (Behailu *et al.*, 2017). In Kenya, a study by Spaling *et al.* (2014) suggested that community resistance to compliance with water sector reforms, including those intended to benefit community-managed projects, negatively affect the sustainability of water supply projects. Whereas this study identifies this challenge, it is our view that, if good follow up mechanisms by the water authority and adequate Water Safety Plans (WSPs) are put in place, community management through existing local structures and scheme operators can be effective in the long run.

In Tanzania, the low quality of water services, the lack of sustainability of constructed infrastructure, the difficulties in targeting the poor, and the inadequate internal information systems are main weaknesses that continue undermining strategies for poverty eradication (Jimenez & Perez-Foguet, 2010). Finally, Kanyesigye *et al.* (2019) stressed the need for systematic documentation of experiences to demonstrate the benefits of WSP and narrate success stories as well as challenges encountered during implementation. This is essential for initiating the relevant improvements at the policy level notably concerning institutional arrangements, legal requirements and enforcement mechanisms.

Hence, POs are faced with a wide array of challenges which range from capacity gaps, complacency from clients, and infrastructural problems presented by the contexts within which they run the WSS, while at the same time having to strike a balance between effectiveness in service delivery and profit margins that are expected to emerge from the water tariffs.

On the above account, while determining tariffs, POs often hardly consider the financial constraints consumers face. Economic Consulting Associates (2015) reported that POs propose tariffs to be charged. The MWE approves the tariffs and signs the performance contracts with Water Supply and Sanitation Boards and the National Water and Sewerage Corporation (NWSC). One of the current problems is that delays in tariff revision and setting are common because of delays in the approval process. These delays indicate potential pitfalls in service delivery even when the POs are committed to offering services to more people. Ndaw (2016) reported that POs expressed a desire to expand their business to neighbouring unserved areas with evident demand, and recommended to allow for these types of expansions or the clustering of small towns.

Finally, it is worth noting that documentation of the operations of the private and scheme operators in the Karamoja region has been minimal, leading to a paucity of information on the topic at hand in this complex region. Moreover, the activities of POs in the rural areas outside of major towns and cities have not been studied well.

Therefore, we undertook this study to examine these issues in a structured way with the aim of documenting the challenges and pathways associated with enhancing effectivity in the operations of WSS operators but also contribute to the existing body of knowledge on POs running WSS.

Specifically, we sought to qualitatively explore the capacity enhancement challenges and pathways for POs to enhance effectivity in service delivery in three districts of the Karamoja region. We aimed at identifying and addressing the shortfalls that undermine the effectiveness of POs as key actors in water supply and sustainability.

METHODS

This research is based on case studies and was conducted between February and May 2019 in four water supply schemes located in the districts of Moroto, Kaabong, and Kotido in North Eastern Uganda (Figure 2).

Purposive sampling was used to select staff or members from the POs, Water Supply and Sanitation Boards (WSSB), and the Karamoja Umbrella for Water and Sanitation (KUWS), a coordination body, for interviews. Simple random sampling was used to identify water users (beneficiaries) from the lists of household heads

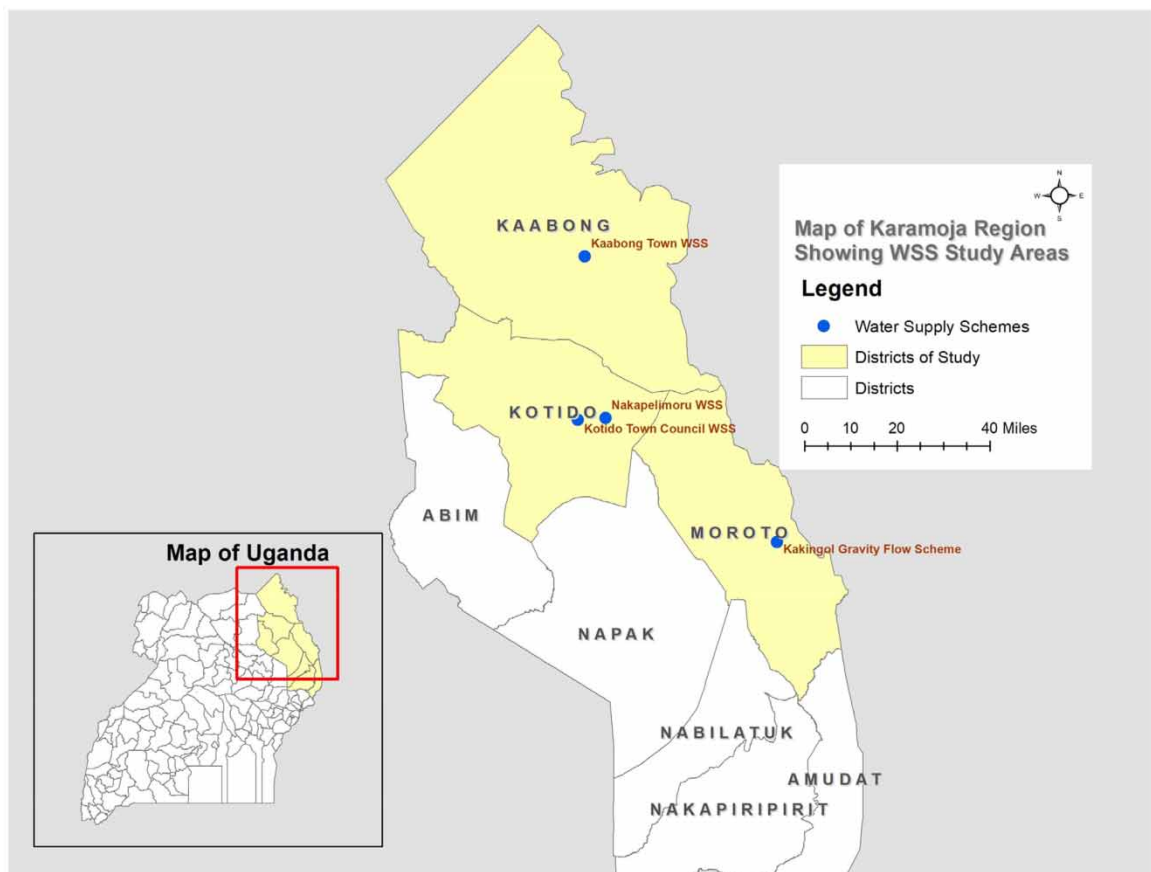


Fig. 2. | Location of the water supply schemes investigated.

maintained by local authorities for focus group discussions. We adopted a qualitative study design that mapped perceptions, experiences, and opinions of water users, WSSBs and POs.

To ensure meaningful triangulation, data was collected using a blend of qualitative data collection techniques and instruments (Table 1). Key Informant Interviews were used to obtain data from individuals with detailed knowledge of operations and processes involved in managing WSS. On the other hand, focus group discussions facilitated the extraction of detailed information from water users regarding, specifically, tariff and billing systems, customer satisfaction, and consistency in water supply. In-depth interviews ensured that the study obtained a detailed account of the experiences and practices of running WSS by private operators.

Observations were used to ascertain compliance with the general standard operational procedures (SOP) set out by the Ministry of Water and Environment which is the water authority.

The thematic analysis technique was used to manually analyse emergent latent and manifest content/data from interviews and discussions to uncover meanings in data and reveal hidden complexities. Thematic analysis is a type of qualitative analysis used to analyse classifications and present themes (patterns) that relate to the data. It illustrates the data in great detail and deals with diverse subjects via interpretations (Boyatzis, 1998).

Namey *et al.* (2008) stated that the ‘thematic moves beyond counting explicit words or phrases and focuses on identifying and describing both implicit and explicit ideas.’ In some instances, it may be better to use manual analysis rather than computer-based methods such as Nvivo (Alhojailan, 2012). Welsh (2002) argued that software might not prove as helpful as one may expect in terms of addressing issues of validity and reliability in thematic ideas that emerge during the data analysis process due to the fluid and creative way in which these themes emerge. Where speech was quoted, pseudonyms were used to protect study participants’ identities. Direct quotations provide supportive meaning to the data’s interpretation for some statements (Patton, 2002).

We obtained information on each of the water supply schemes visited (Table 2). Estimates of the population were obtained from the detailed parish files published by the Bureau of Statistics based on the 2014 National Population and Housing Census (UBOS, 2016). WSS information was obtained from unpublished technical drawings, schematics and other records availed by the District Water Offices of the Local Governments. Whereas obtaining copies of most of these records was prohibited, we were authorized to view them and take notes. Additional data was obtained from interviews and observations.

RESULTS AND DISCUSSION

Results could be categorized into three specific challenges.

Challenges related to private operators’ capacity

Limited capacity to manage the water supply systems

The results showed that POs had limited capacity to manage affairs of the WSSs. A review of the available PO records for quarters II and III which spanned Oct–Dec 2018 and Jan–Mar 2019 respectively indicated that

Table 1 | Data collection methods, instruments and respondents.

#	Method	Respondents	Target	%
1.	In-depth Interviews (IDI)	POs	8	100%
2.	Key Informant Interviews (KII)	WSSB, KUWS	20	90%
3.	Focus Group Discussion (FGD)	Water users (clients)	08	88%
4.	Observation	POs, and water users	40	100%

Table 2 | Technical details of the water supply systems.

#	Facility Name	Type	Location [Prdn. Cap (m ³)]	Est. Popn served (UBOS, 2016)	Tank Volumes		# of PSP (fxn)	Private Operator	Power Source	Water treatment syst.
					Sedimentation	Reservoir				
1.	Kakingol GFS Commissioned: Oct 2009; ~8 km transmission pipeline	GFS	Moroto district 14 m ³ day ⁻¹	3,250 (7 villages)	6.5 m ³	50 m ³ (Concrete)	13 (11)	Rotiyo Ltd 10 service connections	None (Gravitational flow)	HTH Chl. syst.
2.	Kotido Town Council WSS Commissioned: 1970s Comprises 3 production wells ~19 km trans. pipeline	WSS (M)	Kotido district 28 m ³ day ⁻¹	13,838 (14 villages)	N/A	2 tanks (72 m ³ , 100 m ³) HDPE	78 (78)	M/S Didi Ltd (NWSC) 494 service connections	Hybrid system [Solar PV arrays +45KVA Generator]	HTH Chl. syst.
3.	Nakapelimoru WSS Commissioned: 2009 Comprises 2 production wells ~10 km trans. p/line	WSS (M)	Kotido district 10.5 m ³ hr ⁻¹	3,000 (11 villages)	N/A	4 tanks (10 m ³ each) HDPE	7 (7)	Local Scheme Operator (KUWS) 10 connections	Hybrid system	HTH Chl. syst.
4.	Kaabong Town WSS Commissioned: 2012 Comprises 1 Prdn well ~4.5 km p/line	WSS (M)	Kaabong district 21.25 m ³ hr ⁻¹	11,559 (6 wards)	N/A	150 m ³ HDPE	7 (5)	M/S Trandint Ltd 263 connections	Hybrid system	Salt electrolysis (with Dosatron)

Legend: **fxn**- Functional; **GFS**, Gravity flow scheme; **HDPE**, High-density polyethylene; **HTH Chl. Syst.**, High-Test Hypochlorite chlorination system; **KUWS**, Karamoja umbrella for water and sanitation; **KVA**, Kilo-volt amperes; **M**, Motorised; **N/A**, Not Applicable; **NWSC**, National water and sewerage corporation; **Prdn. Cap**, Production capacity (yield); **PSP**, Public stand post; **PV**, Photovoltaic; **RGC**, Rural growth centre; **WSS**, Water supply system.

operations were less than desirable as low scores were achieved on all parameters assessed. Scores were particularly low on the operations and maintenance (O&M) plans, the adequate and regular financial record keeping, and the frequency of meetings with the Water Supply and Sanitation Boards and the users. A lack of routine meetings with stakeholders – including water users – contravenes the District Implementation Manual (MWE, 2013), which advises that O&M issues should be discussed with communities from the early stages of planning the water source improvement.

Deployment of unskilled and inexperienced personnel by POs

The results highlighted notable challenges as follows: Limited and inadequate capacity in managing the electro-mechanical components of the WSS, and lack of basic skills in meter readings, minor repairs and customer care skills. About 80% of the technicians deployed by the POs lacked formal education and a basic skillset necessary to effectively run the WSS on behalf of their employers.

In Kaabong, Jimmy, a technician attending to the WSS reported that *'I have not been to a technical or vocational training institute, so, I am not educated but was trained for four days on how to run the system...'* These remarks indicate that there are inadequate trainings and mentorship offered to the technicians who manage the day-to-day affairs of WSS. This affirms Ndaw (2016)'s finding that local structures often lack the skills and capacity to manage water supplies and sanitation services.

Our findings further revealed that intermittent water supply resulted in conflicts that ultimately triggered events that led to vandalism of pump houses and public stand posts in some locations, especially in Kotido.

In Kotido district, Ms Jennifer (a client) said *'...The company managing our water doesn't have qualified people. The system is always breaking down and they take long to rectify the problems...'* Intermittent supply is often associated with the functionality of the WSS in terms of O&M practices and breakdown is inevitable if O&M routines are undermined either due to lack of technical capacity or negligence.

Challenges related to power supply

Erratic power supply renders the WSS unreliable

As indicated in Table 2, power is provided by diesel generators and solar panels. The solar-panel systems were reported to have erratic frequency and output during the day which resulted in intermittent water supply. The operators also run diesel generators; thus, high diesel prices pose great concerns on the reliability of water supply, especially in rainy seasons when the diesel trucks have difficulty using the road network. The power supply-related challenges are further exacerbated by the poor road infrastructure in the Karamoja region.

The fact that POs are seemingly unable to address these challenges is in fact primarily a problem of capacity given that they are unable to devise innovative mechanisms to counter these shortfalls.

Mr Robert, a member of the Water Board of Nakapelimoru stated that *'...sometimes power supply issues are beyond the scheme operator, solar power is dependent on sunlight which is minimal during the wet spell.'* And *'Our murram roads are very bad during rainy seasons. Trucks find it difficult to deliver fuel across Karamoja region, so, you can't blame the operator for that... it's beyond his control.'* Mr Lokiru, a water technician employed by one of the companies said: *'I wouldn't have a problem running the generator for extra hours to fill the reservoir tanks to capacity, unfortunately, I cannot do so because I occasionally run out of fuel yet the trucks take days to arrive due to the bad roads they have to go through.'*

This implies that intermittent water supply is inevitably aggravated by inconsistent fuel delivery due to bad roads, high prices notwithstanding. Thus, monetary gains for the PO cannot be guaranteed. However, these findings point towards inadequate preparedness in the operation and maintenance approaches. It was observed that

POs hardly stored sufficient fuel to run their systems for at least two weeks in the event of fuel shortage or limited supply.

Challenges related to water governance, regulatory policy, and clients

Lack of consultations/engagements between POs, WSSB, and the users

The above weaknesses led to deterioration in service delivery and resulted in disagreements between the PO and the water users especially on water tariff rates and general operation of the schemes. In the event, no opportunity or regular platform was created to discuss challenges, knowledge and capacity gaps, and identify remedial measures. Moreover, weak information hampered evidence-based decision making. For example, during the assessment, it was observed to be common for POs not to know the estimated population they serve. This also shows that there was hardly any consultation, nor interaction with the existing Utility Performance Monitoring & Information System (UPMIS) for piped water supply in Uganda. This online system was developed by the Directorate of Water Development of MWE to offer operational and performance information for WSS. Whereas this was a weakness and challenge at the WSS level, we also noted that the UPMIS was not regularly updated with recent data, hence rendering it an unreliable database for accurate real-time and valid data. This gap was one of the pointers to the capacity issues at the Directorate which inadvertently affects the operations and service delivery of POs.

Limited revenues due to inconsistent adherence to tariff payments

POs are compelled to run diesel generators for only approximately three hours a day, to minimize operational expenses which result in inadequate production and dry pipes within the network.

Limited production implies less revenue for the PO making the venture less attractive and compromising viability hence risking the collapse of the venture.

From Kaabong district, Mr Lopel, a private operator, affirmed that ‘...as a private operator, I experience persistent defaults in water tariff payments by users, yet I am responsible for the technical and commercial operations of the scheme’. He adds that ‘...because of inconsistent tariff payments, I am unable to generate sufficient funds to effect expansions and run operations effectively.’

Our study revealed that the inconsistent payment culture among the users which is complicated by wide spread poverty, among other domestic challenges, and a poor fee collection management strategy of the PO, pose challenges to both users and operators alike. Our study noted that tariff decisions and approval processes are bureaucratic. Even when decisions are made on tariffs, they hardly reach the consumers on time. This finding agrees with [ECA \(2015\)](#) that reported that POs hardly take into account the financial difficulties consumers face while determining tariffs. The report adds that one of the current problems is that delays in revising tariffs are common because of delays in the approval process. Clearly, the setting and implementation of realistic and effective tariff strategies require experience and capacity with the POs and the WSSBs, which seem seriously lacking.

Weak enforcement of regulatory policies by water authorities

The study observed weak enforcement practices by the WSSB, KUWS, and the District Water Offices of the Local Governments. Even where water tariff rates had been agreed upon, in some locations, we observed altercations between the POs and users regarding amounts to be paid. We also noted inconsistencies in tariff implementation approaches in Kotido and Kaabong which involved obtaining water on loan, payment in kind with food such as flour and other small household items. The loan arrangement is risky given that consumers are bound to default thereby leading to losses and limiting the achievement of economies of scale for the scheme operators.

Therefore, as concluded by [Kanyesigye et al. \(2019\)](#), initiating the relevant moves at the policy level such as enforcement mechanisms can be instrumental in improving service delivery. Weak enforcement often leads to consumer resistance to reforms and policies which affect long-term sustainability as also found by [Spaling et al. \(2014\)](#) who concluded that community resistance to compliance with water sector reforms, including those intended to benefit community-managed projects, affect the sustainability of water supply projects.

Similarly, [Behailu et al. \(2017\)](#) found that lack of uniformity in implementation approaches, and institutional and organizational incapability of the local government, aggravate the service failures. This implies that weak and inconsistent approaches in WSS management and governance coupled with weak policy enforcement jeopardise effective and efficient water service delivery.

CONCLUSIONS

Limited technical capacity of POs in running water supply systems is a central cause of unsatisfactory service delivery and is observed in the technical management, the unreliable power supply, the setting of credible tariffs and the collection thereof, the communication with the water users, and the collection of data for the management information system. Similarly, an important role exists for national authorities such as the NWSC to strengthen capacities of POs in key thematic areas such as business planning, O&M of WSS, water safety planning, asset management, financial management, etc. The capacity of POs to manage WSSs (including the technical capacity of staff) needs to be assessed prior to contract award. Such assessment at the contract award combined with regular apprenticeship of water technicians employed by POs will enhance the sustainability of WSS and ensure better service delivery to beneficiaries.

The second set of institutional capacity weakness exists in sectoral coordination. It is logical that POs attempt to generate enough profit, and POs are particularly enticed to minimize energy expenses. Therefore, national authorities such as MWE and NWSC need to strengthen their oversight and mentorship of POs and WSSBs on commercial operations including for staff involved in daily operations. Also, key policymakers from other sectors need to be approached to help address infrastructural challenges to water service delivery, notably the connection to the national power grid and the improvement of the road networks. The better coordination of the sectors is a critical condition to ensure more profitable ventures in undertakings of WSS by private and scheme operators.

Lack of routine consultations and engagements between the WSSBs and POs partly hampered service delivery. This missing link not only leads to deterioration in service delivery but also promotes distrust and lack of transparency between stakeholders. Therefore, regular deliberations are necessary as this strengthens and maintains relations ultimately leading to satisfactory service rendered to clients. In this vein, weak regulatory policy enforcement and the non-adherence to water tariff plans affect PO cash-flows.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

REFERENCES

- Alhojailan, M. I. (2012). Thematic analysis: a critical review of its process and evaluation. *West East Journal of Social Sciences* 1(1), 39–45.
- Behailu, B. M., Jarmo, J. H. & Katko, T. S. (2017). Service failures of rural water supply systems in Ethiopia and their policy implications. *Public Works Management & Policy* 22(2), 179–196.
- Boyatzis, R. E. (1998). *Transforming Qualitative Information: Thematic Analysis and Code Development*. SAGE Publications, California.

- Directorate of Water Resources Management (DWRM), and the Japan International Cooperation Agency (JICA) (2011). *The Development Study on Water Resources Development and Management for Lake Kyoga Basin in Uganda. Report*.
- Economic Consulting Associates (ECA) (2015). *Uganda Country Report in Strengthening Public Institutions in Engaging and Regulating Domestic Private Sector for the Provision of Water and Sanitation Services in Rural Growth Areas and Small Towns: Best Practice Report*. ECA, London.
- Foster, V. & Briceno-Garmendia, C. (2010). *Africa's Infrastructure: A Time for Transformation: A Time for Transformation. Africa Development Forum*. World Bank.
- Jimenez, A. & Perez-Foguet, A. (2010). [Challenges for water governance in rural water supply: lessons learned from Tanzania](#). *International Journal of Water Resources Development* 26(2), 235–248.
- Kanyesigye, C., Marks, S., Nakanjako, J., Kansime, F. & Ferrero, G. (2019). [Status of water safety plan development and implementation in Uganda](#). *International Journal of Environmental Research and Public Health* 16(21), 4096.
- Kleemeier, E. L. (2010). *Private Operators and Rural Water Supplies: A Desk Review of Experience*. Water papers: World Bank, Washington, DC.
- Ministry of Water and Environment (MWE) (2013). *District Implementation Manual*.
- Ministry of Water and Environment (MWE) (2017). *Uganda Water and Environment Sector Performance Report 2017*.
- Ministry of Water and Environment (MWE) (2018). *Uganda Water and Environment Sector Performance Report 2018*.
- Namey, E., Guest, G., Thairu, L. & Johnson, L. (2008). Data reduction techniques for large qualitative data sets. *Handbook for Team-Based Qualitative Research*. In: (G. Guest & K. M. MacQueen, eds). Rowman Altamira Press, Maryland.
- Ndaw, M. F. (2016). *Private Sector Provision of Water Supply and Sanitation Services in Rural Areas and Small Towns: The Role of the Public Sector*. Water and Sanitation Program Guidance Note: World Bank, Washington, DC.
- Patton, M. Q. (2002). *Qualitative Research and Evaluation Methods*, 3rd edn. SAGE, California.
- Spaling, H., Brouwer, G. & Njoka, J. (2014). [Factors affecting the sustainability of a community water supply project in Kenya](#). *Development in Practice* 24(7), 797–811.
- Uganda Bureau of Statistics, (UBOS) (2016). *The National Population and Housing Census 2014. Main Report*. Available at: https://www.ubos.org/wp-content/uploads/statistics/SAP_Northern.xlsx (accessed 19 April 2020)
- Uganda Bureau of Statistics (UBOS) (2018). *Mapping the Spatial Distribution of Poor Households, Technical Report*.
- Welsh, E. (2002). Dealing with data: using NVivo in the qualitative data analysis process. *Forum: Qualitative Social Research* 3, 2.

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