Applicability of the Poldaw uPVC Riser System as a Technology for enhancing Boreholes' performance in Uganda

The Technology Applicability Framework (TAF) was developed under a three year action research WaSHTec project by a consortium of organisations. It is a decision making tool used to assess the applicability, scalability and sustainability of a particular WaSH technology. TAF evaluates the potential of a given technology in a specific setting, helping us to understand if a given technology can provide the envisaged service sustainably, meeting the needs of the users. The tool also helps to capture the valuable learning with insights for technology scale up.

The Poldaw uPVC riser system was subjected to rigorous assessment using the TAF tool and this briefing note presents findings of the evaluation conducted.

Poldaw Riser System

The Poldaw riser system consists of pipes made of uPVC with pressure rating of 20 bars. The pipes are joined using threaded PVC collars and GI sockets. The system is designed for installations on boreholes of upto 60m deep. Its joints are fully dismantlable, facilitating maintenance. It also has a head pump that is customized with a galaxy chain mechanism and a 10.8mm diameter plain rod with lock nut, reducing overall weight during operation. Centralizers of 40mm external diameter are fitted on the rods only, ensuring alignment and stability within the rising main.

Pump Components

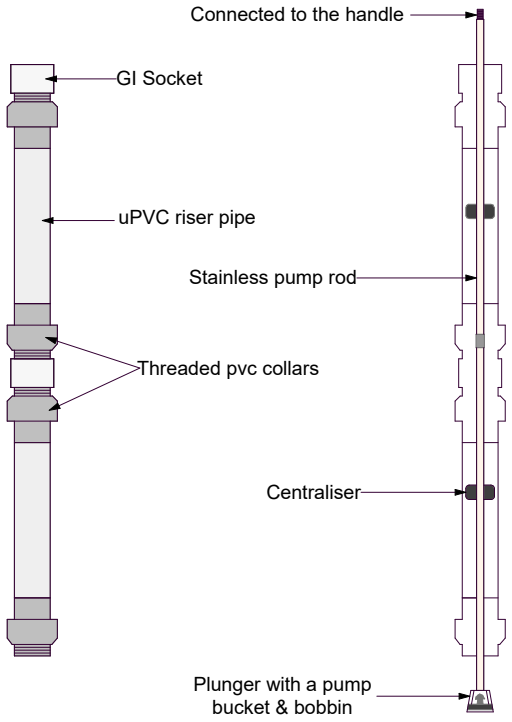
The system operates with a set of standard handpump components, including: Plunger, O-ring, Foot valve, Rods, Galaxy chain, Threaded PVC collars, sockets and centralisers designed to integrate seamlessly with the Poldaw riser system.

The Poldaw riser system is currently being piloted by WaterAid in Masindi and Kabalore districts where 84 and 16 boreholes were upgraded respectively and have been operational for two years. TAF assessment was carried out in Masindi district by a multidisciplinary team with representatives from nine District Local Governments (DLGs), Ministry of Water and Environment (MWE), WaterAid Uganda, Hand Pump Mechanics (HPMs), Local Authorities, Water Users and the Appropriate Technology Centre (ATC). The TAF assessment was complemented with a technical assessment of 40 upgraded boreholes that were dismantled and system components analysed.

The TAF process

The assessment was based on perspectives of three stakeholders' groups; user/buyer, provider/producer and regulator/facilitator. In this case, the users/buy was Masindi DLG and the HPMs,

Visualization of Poldaw components



Promoter was WaterAid Uganda and Regulator was MWE. The exercise was guided by six (06) sustainability dimensions; i.e., social, economic, skills and know-how, technological, environmental, and legal & institutional. Each dimension had three (03) indicators, bringing the total to 18 accessed indicators. The indicators were scored through a transparent workshop session using information collected and validated by the stakeholders.

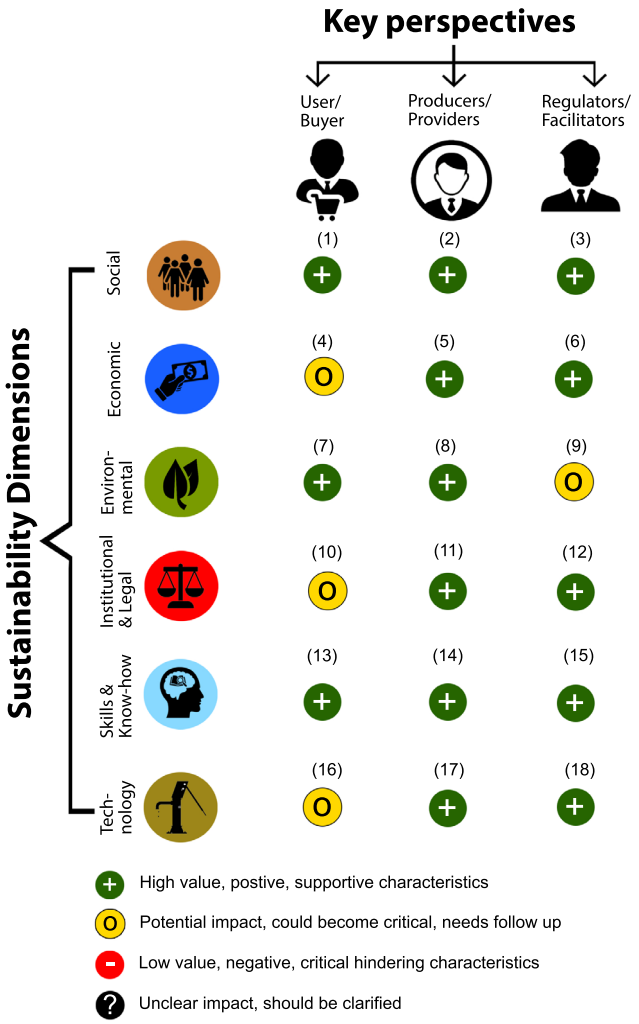
	Key perspectives			
Sustainability dimensions		User/Buyer	Producer/ Promoter	Facilitator/ Regulator
	Social	(1) Demand for Poldaw riser system	(2) Need for Poldaw riser system promotion	(3) Need for Poldaw riser system
	Economic	(4) Affordability of Poldaw riser system	(5) Profitability of Poldaw riser system	(6) Financial Support mechanism
	Environmental	(7) Potential negative impacts on the environment and end user	(8) Potential negative impacts in the production of the Poldaw riser system	(9) Potential negative impact of scaling-up
	Institutional/ Legal	(10) Structures for management and accountability	(11) Legal regulation and requirements for registration of promoter	(12) Alignment with national strategies and compliance to national standards
	Skill & Know How	(13) Skills set of users for management of Poldaw riser system	(14) Levels of technical skills and business skills	(15) Sector capacity for introduction of Poldaw riser system
	Technology	(16) Reliability of Poldaw riser system and user satisfaction	(17) Viable supply chains for Poldaw riser system spares and services	(18) Support mechanisms for Poldaw riser components development
18 indicators for Poldaw uPVC Riser System				

Scoring

Scores generated were used to develop the graphical TAF profile for Poldaw uPVC riser system. The graphical profile provides guidance for developing a roadmap for scaling up the technology as it offers a comprehensive interpretation and provides for identification of strength, bottlenecks, risks and uncertainties with regard to the technology.

Results of TAF assessment of the Poldaw uPVC riser system

The assessment highlighted strong performance of the Poldaw riser pipe system across most dimensions, while also identifying moderate gaps that require further attention. A total of 14 green scores were recorded, indicating areas of strong performance such as social acceptance, skills and know-how, and institutional alignment. Four (04) yellow scores were noted, reflecting moderate challenges particularly under the user perspective on the economic, legal and technological dimensions, and under the regulator perspective in the environmental dimension. The technology gaps were linked to reductions in flow rate for upgraded boreholes' corrosion of GI sockets. No black scores were recorded, underscoring that no critical or high-risk failure was identified at this stage.



Social Dimension

The Poldaw technology has been widely embraced by communities because it responds directly to the demand for more efficient and reliable water supply. Households expressed high satisfaction, noting that their boreholes no longer breakdown as they used to prior and the pumps requires less effort to operate than conventional handpumps while also providing cleaner water. Promoters built on the value addition brought about by the technology in form of improved water quality, reliable and sustainable service with reduced down time. For the regulators, the poldaw innovation is needed to address the challenge of corrosive iron that happens to be undermining the hard-won service delivery gains in expanding access to safe water in rural areas.

Economic Dimension

Users never invested in the technology and they do not know how much Poldaw pipes and fittings cost, they also lack information on maintenance costs. Upgrading of the 100 boreholes with Poldaw riser system was funded by WaterAid, providing all the necessary materials and equipment and HPMs were facilitated to undertake the installation works. From the promoter's perspective, the Poldaw uPVC pipes and fittings are quite affordable (table below), supplied by Reliefline and Victoria Engineering. Both these companies operate in Uganda with potential to supply country-wide. Government promotes the borehole technology through DLGs. This implies that the resources for promoting the poldaw technology can be availed i.e., by replacing GI component with Poldaw in the allocated budget for boreholes.

Table presenting market prices for poldaw system components

Sn	System component	Specifications	Unit cost (UGX)
1	Poldaw uPVC pipes	3m long, 50mm diameter, 63mm thick	90,000
2	Threaded collar	50mm diameter	50,000
3	Set of fittings (bobbins, plunger, foot valve, O-ring, pump bucket)		300,000
4	Stainless Rods with locknuts and centralizers	10.8mm thick, 3m long	145,000

Environmental Dimension

Users consider the Poldaw technology as environmentally sound since they were told that the pipes can take over 15 years without wearing out. In addition, they do not see any poldaw pipes and fittings littered in their environment. Unlike with the GI riser system with which they used to find rust and sediments in the water, users have not experienced any water quality issues attributed to wear and tear of poldaw pipes. The HPMs credited the poldaw rising system for being environmentally suitable given that they are pre-assembled away from the installation site, minimizing litter of plastic waste. The regulators observed that there is no holistic Lifecyle management plan for poldaw technology and cautioned that scaling it up without safeguards could increase the risk of plastic and metal waste accumulation.

Legal/Institutional Dimension

There are existing structures i.e., District Water Office, Hand Pump Mechanics Associations (HPMAs) in charge of Operation and Maintenance (O&M), and Water User Committees (WUCs) operating at community level. However, these have not been effectively empowered to takeover implementation and promotion of the poldaw riser system innovation without the support of the promoter. This undermines long-term ownership. Apparently, even mere collection of water user fees is not done partly because the boreholes do not breakdown and in cases of minor bobbin and pump bucket failures, the promoter provides the replacements for free. According to the Promoter, the already existing structures provide advantage of integrating the technology. Uganda has national guidelines for rural water supply, however, there are no specific legal or policy frameworks for scaling up the Poldaw riser system thus the need to address this gap to enhance long-term institutional support.

Skills and Know-How Dimension

The district has skilled HPMs capable of installing the Poldaw riser system, attend to both minor and major repairs. The HPMs have all the necessary tools required for undertaking the assignment. Also, the District Water Officer has the necessary technical skills to support and supervise installation and repairs of the poldaw riser-based boreholes. The promoter & technology provider have the experience, technical and business skills to meet the market demand. The government has promoted borehole technology for time immemorial and apparently an estimated 67% of the country's rural population relies on hand pumps for safe water supply. Important to note that the Poldaw riser system innovation uses the same pumping mechanism as the traditional U2 and U3 hand pumps. The difference comes in on the aspects of riser pipe materials and assembly, cylinder depth, joints and seals. Thus, government through MWE and DLG Water Offices have the necessary skills for introduction and wide adoption of the poldaw riser system.

Technology Dimension

The reliability of Poldaw uPVC rising main was compared to U2 and U3 boreholes constructed using GI pipes. The Poldaw was seen to be more re-

liable and durable. Users reported that for the two years of use, all poldaw components are still intact with no sign of future corrosion or decay. Technical assessment revealed that, in Masindi district the poldaw components were installed in aquifers with aggressive ground water chemistry but they were still intact and serving the intended purpose. At present, poldaw spare parts are limited within the country. The poldaw components are produced by Ajay Industrial Corporation Ltd based in India, a parent company to Reliefline that imports and distributes the technology components in Uganda on prior order. It takes a minimum of two months for the components to be shipped from India.

The Poldaw technology can be installed on a well of upto 60m deep compared to U2 that requires a maximum depth of 50m. The HPMs pointed out the ease of handling the poldaw system indicating that it is designed with light weight components that allows easy extraction of the plunger and foot valve during borehole maintenance.

It was observed that the Poldaw uPVC pipes were joined using GI sockets and these presented with rusting and scaling. Most affected were the sockets submerged in water some of which presented with black and white coating. In the long run, as the sockets rust and scale they will end up weakening and may compromise the strength and functionality of the whole borehole system.

Field Observations and Recomendations

Issue	Observation	Recommendation
Flow rate variations	Measured flow rates in most boreholes fell below the designed 0.343 L/stroke.	The manufacturer should redesign the orifice at the cylinder base where the foot valve rests.
		Adjust only the lower bobbin length from 42 mm to 40 mm to allow more water inflow.
Corrosion and scaling of GI sockets	Corrosion and scaling of GI Sockets submerged in water was observed for all boreholes assessed.	Improve the GI grade of the coating or replace it with non-corrosive alternatives to extend service life.
Installation errors	Some boreholes had leakages attributed to lose joints leading to water loss during pumping	The district together with project implementers should provide stronger supervision for HPMs to ensure correct installation
	In some boreholes, the plunger failed to release water during dismantling due to improperly seated bobbin, which made dismantling hard	
Use of Non-standardization of pipes	Some boreholes were installed with a combination of pipes having varying internal diameters i.e., 48mm and 50mm	Technology promoter should develop, disseminate and ensure adherence to design and technical guidelines for installation and maintenance
Other Recommendation	Conduct an economic cost–benefit analysis comparing technologies i.e; Poldaw, GI, Ordinary PVC and Stainless Steel riser system	

About Water, Sanitation and Hygiene Technologies (WASHTech)

WASHTech was an action research initiative in Burkina Faso, Ghana and Uganda that aimed to facilitate cost-effective investments in technologies for sustainable water, sanitation and hygiene services. http://washtechafrica.wordpress.com or www.washtechnologies.net

Technology Applicability Framework (TAF)

The TAF is a participatory evaluation tool that identifies blockages, scalibility and performance of a technology. With blockages identified, a clear picture is formed of areas where collective action towards improving the success of a WASH service in a given context may be taken.

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