Applicability of the Dosatron Technology on the Water Supply Systems in Kamwenge District

The Technology Applicability Framework (TAF) developed in the WaSHTec project by a consortium; is a decision tool on the applicability, scalability and sustainability of a particular WaSH technology. It is used [illegible]
technology can provide the envisaged service sustainably, meeting the needs of the users and also helps to capture the valuable learning with insights for technology scale up.

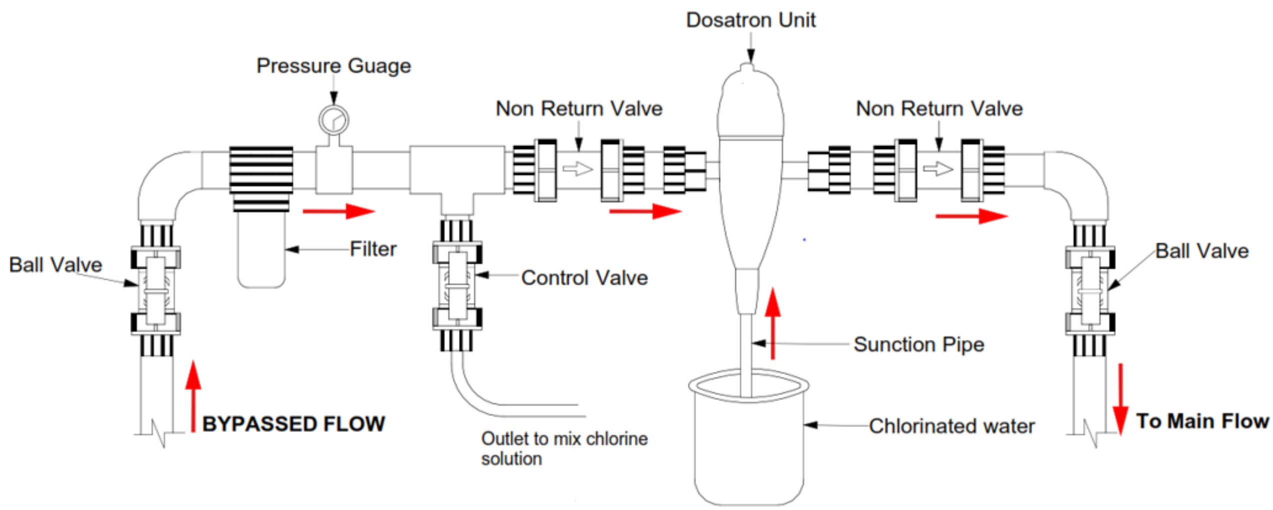
[illegible]
evaluation conducted.

Dosatron Technology

The Dosatron is a non-electric online chlorine dosing technology that utilizes in-built pressure energy within the transmission line to pump chlorine into the reservoir tank. The water supply system is designed with a bypass that leads water into the Dosatron and the chlorine mixing tank, the piston strokes create the suction effect which can suck the chlorine and pump it back to the transmission main which then leads the chlorine to the reservoir tank where mixing of the chlorine occurs.

[illegible]
valve on the bypass. The model of Dosatron installed on the transmission line depends on the system design, par-[illegible]
chlorine dosage requirements. One unit is installed on a Water Supply Systems (WSS) and these range from D8 to D20S with a designed capacity of 1m3/hr to 20m3/hr. Thirteen (13) Piped WSS were constructed by Water for People [illegible]
systems i.e., Kampala B, Malere, Kabingo, Bihanga-Kaberebere, and Nkarakara, were installed with Dosatron technology with varying models i.e., D8, D9 and D20S. The Dosatron was adopted to strengthen the water safety along the supply chain.

At the time of assessment, four (04) WSS were evaluated and these are managed by National Water and Sewerage Corporation (NWSC) and Mid-Western Umbrella of Water and Sanitation (MWUWS) i.e., Bihanga-Kaberebere, Nkarakara and Kabingo, Malere respectively.



The TAF process

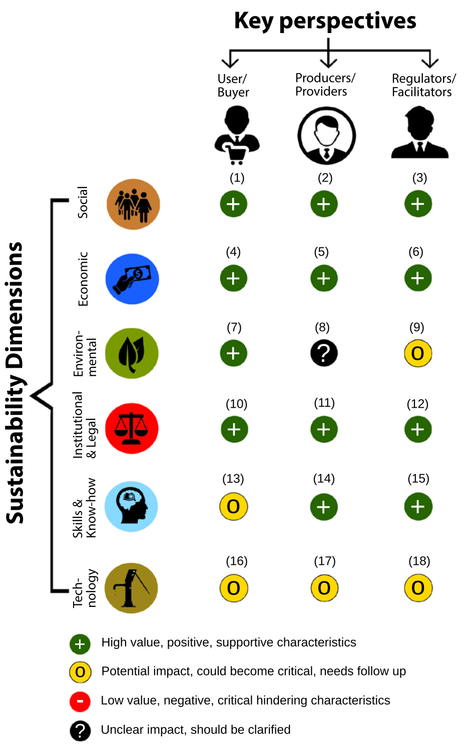
The assessment was based on perspectives of three stakeholders' groups; user/buyer, provider/producer and regulator/facilitator. The exercise was guided by six (06) sustainability dimensions; i.e., social, economic, skills and know-how, technological, environmental, and legal & institutional. Each dimension had three (03) indicators, bringing the total to 18 accessed indicators. The indicators were scored through a transparent process using information collected and validated by the stakeholders.

[illegible] guidance for developing a roadmap for scaling up the technology as it offers a comprehensive interpre- [illegible] technology.

Sustainability dimensions	Key perspectives	User Group/Operators **NWSC & UWS**	Producer/promoter **Water For People and Davis & Shirtliff**	Facilitator/regulator **DLG & MWE-Fort portal**	18 indicators for Dosatron
	Social	(1) Demand for Dosatron	(2) Need for Dosatron promotion	(3) Need for Dosatron	
	Economic	(4) Affordability	(5) Profitability	(6) Support financial mechanism	
	Environmental	(7) Potential negative impacts on the environment and end user	(8) Potential negative impacts in the production of the Dosatron	(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 Dosatron users	(14) Levels of technical skills and business skills	(15) Sector capacity for introduction of Dosatron	
	Technology	(16) Reliability of Dosatron and user satisfaction	(17) Viable supply chains for Dosatron spares and services	(18) Support mechanisms for Dosatron development	

Results of TAF assessment of the Dosatron

The assessment highlighted areas of both strong and moderate performance, as well as critical gaps that need to be addressed. A total of 12 green scores were recorded, indicating strong performance; 5 yellow [illegible] issue raised by providers concerning environmental safety and plastic waste management.



Social Dimension

On the systems where the Dosatron technology has been installed, it has received positive feedback from communities, about the quality of water however, negative feedback is received whenever the technology is non-functional. The systems serve approximately 4,416 households in the district. Community members were aware of chlorine dosing and its contribution to improved water quality. Initially, there were fears that excessive chlorine could negatively affect their health, particularly their internal organs. These concerns were addressed through sensitization efforts led by the technology promoters, district and system operators, which helped build community trust and increase acceptance of chlorinated water. Despite the growing acceptance, some communities experience intermittent water supply, prompting households to resort to using untreated sources such as pond water. This [illegible] attribute waterborne illnesses to a spe- [illegible] moters periodically conduct residual chlorine testing to monitor treatment effectiveness, and communities con- [illegible]

However, several challenges persist, some community members reported issues of trapped air in the pipeline, which causes water meters to register usage even when no water is dispensed, result- [illegible] the billing system.

Economic Dimension

Respondents reported that the systems were fully funded by Water For People, with communities paying UGX 100,000 for private connections and UGX 100–200 per 20-litre jerrycan. The promoters and operators considered a dosatron as a cost-effective technology due to its non-electric operation. Monthly O&M costs ranged between UGX 70,000 and UGX 100,000. At Nkarakara, the only fully functional site, operators reported monthly revenue reaching UGX 7 million. Initial investment costs ranged from UGX 9 to 20 million depending on the model, with estimated cost recovery periods of 2 to 7 years. While the technology supports long-term cost reduction, revenue losses due to breakdowns and delayed spare part delivery were reported as key challenges.

Environmental Dimension

Given that the technology is just imported, there is no known environmental threat in the country at the moment. The local distributors/ promoters import the spare parts with delivery times of 2 to 3 weeks when ordered, further compounding operational downtime. The maintenance practices such as timely repair of leaks and bursts minimize risks. Apparently, the technology operates without electricity, relying solely on water pressure which makes it a low carbon solution compared to electrically powered dosing pumps. Operators reported that chlorine dosing is monitored regularly to ensure safe levels. Since dosatrons are made of plastic, the district and promoters have not put in place structured recycling mechanism for the outdated or malfunctioning units, leading to accumulation of plastic waste. It was also highlighted that, there is a potential risk of microplastics leaching into water due to wear and tear of plastic and rubber parts.

Legal/Institutional Dimension

The Dosatron units are produced in South Africa, distributed by Davis & Shirtliff, and are ISO and [illegible] and Umbrella Authority under guidance with the National policy framework. Davis & Shirtliff possess the required technical knowledge but are not legally obliged to provide structured, long-term training for system operators. There is absence of a policy mandating continuous skill development of the operators.

Skills and Know-How Dimension

All system operators demonstrated basic operational and maintenance knowledge of the Dosatron units [illegible] [illegible] in troubleshooting more complex issues, particularly those related to the piston system. Respondents noted that the initial training provided by Water For People was limited in scope, and no follow-up or refresher training has since been offered. As a result, operators often rely on suppliers, such as Davis & Shirtliff, to perform even minor repairs, leading to frequent delays in system restoration. In some cases, due to lack of capacity and delays, operators resorted to improvised dosing methods such as directly pouring chlorine into storage tanks or using chlorine tablets, which compromises dosing accuracy and consistency.

Furthermore, staff turnover has negatively impacted skill retention, the personnel trained during system installation and handover were no longer present. No formal orientation or adequate knowledge transfer was done to new operators. Davis & Shirtliff continues to offer basic training but only for systems they directly install.

Technological Dimension

The Dosatron technology is suitable for off-grid systems due to its non-electric design and ease of installation. While its design life is estimated at 10 years, reliability has been a concern, primarily because units are imported on order, resulting in delays in replacements. Operators reported issues like [illegible]-quent breakdowns due to worn components such as pistons, seals, and rubber parts. Although chlorine levels in the distribution network remained within Uganda's acceptable range of 0.2–0.5 mg/L, consis-[illegible] pressure balancing. Concerns were also raised about potential microplastic contamination from aging rubber components, suggesting a need for further investigation into long-term safety implications.

	Observation	Recommendations
Technical components and design	▪ Most of the systems failed due to variations in pressure and flow rate from inconsistent solar energy	▪ Place the Dosatron after the reservoir (dose into distribution or at tank inlet with stable head) ▪ Consider a backup option like a generator
	▪ Some systems failed due to poor design choices like incorrectly sized dosatrons, lack of flow meters, pressure gauges and non-return valves	▪ Improve the system design and ensure all critical components are installed before and after the dosatron unit ▪ Dosatron sizing for Bypass installation $Qbp = \frac{\mathbf{D}\ \mathbf{Q}\text{main}\ \mathbf{R}}{\mathbf{C}\text{stock}}$
Knowledge transfer	▪ Lack of structured knowledge transfer and technician handover	▪ Provider/ promoter should commit to long-term capacity building beyond installation training
Skill gaps	▪ Lack of adequate technical skills among system operators and none of the systems had operating procedures	▪ Provide regular refresher training to enhance troubleshooting and maintenance skills ▪ Develop a step by step operational manual
Non-functionality of the units	▪ Non-functional units were linked to mechanical failures and lack of preventive maintenance.	▪ Establish a routine maintenance schedule, ensuring mechanical parts are inspected and replaced as needed
	▪ Delays in repairs due to spare part shortages.	▪ Create a local inventory of essential Dosatron spare parts to minimize interruptions
Microplastic contamination	▪ Potential microplastic contamination from worn rubber/plastic parts.	▪ Additional water filtration technologies should be added to the system like activated carbon to effectively remove microplastics
Conduct further research on microplastic contamination to assess environmental risks and explore alternative durable materials for internal components		

Qbp: Bypass flow (L/h or m^3/h)
Qmain: Mainline flow (L/h or m^3/h)
D: Target chlorine dose (mg/L)
Cstock: Stock solution concentration (mg/L)
R: Desired ratio setting

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 [illegible] 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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