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Technology Applicability Framework: Cases from Uganda for WASH Technology validation and uptake

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Abstract/Summary

This briefing paper reflects on the Technology Applicability Framework which was developed by the WASHTech project in Uganda as a tool to help validate the appropriateness of WASH technologies is specific local contexts. Three years after the end of the project, the tool is playing a crucial role in identifying blockages to sustainability and scalability of WASH technologies in Uganda. Through continued application of the tool, stakeholders are gaining a better understanding of the technology introduction process and learning is documented and shared within the sector. The TAF has provided valuable lessons on the context into which WASH technologies may do well. Particularly, this paper considers lessons learned from its application on the Urine Diversion Dry Toilet (UDDT) and the metered hand pump. Results of using TAF on the UDDT have shaped ecological sanitation research and promotion of the technology country-wide. Through application on the metered hand pump, the TAF reveals how technology innovations may introduce new operation and maintenance management models that promise to deliver more sustainable rural water supply services. The TAF, together with the Technology Introduction Process (TIP) a commitment to improved documentation of learning about WASH technologies, represent an organized technology introduction process and validation procedure available to the WASH sector in Uganda.

Introduction

The WASHTech project was a 3-year project funded by European Union's Research and Innovation funding programme for 2007 – 2013 (EU-FP7) and implemented by a consortium that included IRC, TREND, NETWAS (U), Cranfield University, Skat Foundation, WaterAid and KNUST. WASHTech was listed among the 13 most remarkable projects out of 85 projects evaluated under the EU-FP7-Environment Programme (European Commission, 2014). The project ran from 2011-2013.

The Technology Applicability Framework (TAF) was one of the outputs of WASHTech. The TAF was developed through action research in Burkina Faso, Ghana and Uganda as a tool to validate new or existing WASH technologies on their appropriateness within a specific context to contribute to water or sanitation service delivery. It held the promise of enabling decision makers to make informed decisions on WASH technologies (Skat, 2013, p.5). The TAF is a participatory tool that brings together the perspectives of diverse sector actors through field data collection and a validation and scoring workshop. This paper particularly looks at how the TAF is being applied in Uganda to contribute to improved water and sanitation service delivery.

During WASHTech, efforts were made to find a host for the TAF in each of the 3 countries. In Uganda the host is the Appropriate Technology Centre for Water & Sanitation (ATC), the research arm of the Ministry of Water & Environment (MWE). The MWE has traditionally been seen as the entry point for those who wish to introduce or promote WASH technologies in the country and they have delegated the role of validating such technologies to the ATC. A researcher from the ATC was involved in testing the TAF and participated in consortium meetings during the WASHTech project.

The ATC has relied on the Technology Introduction Process (TIP) to prescribe a procedure for those who wish to have technologies introduced or validated. The TIP, also an output of WASHTech, outlines the steps for introducing a WASH technology including steps to manage uptake and take a technology to scale. With the TIP and the TAF, a technical working committee developed the 'Guidelines to WASH Technology Introduction in Uganda (GTI). The TAF is viewed as an essential tool in understanding a WASH technology and the context in which it may be applicable, but also enabling appreciation for barriers to introduction. Its participatory nature has been key in promoting understanding of the issues amongst the key stakeholders: users, regulators and producers/providers of technologies. It has also promoted understanding of the importance of six sustainability indicators to the success of a technology in a given context. These are institutional/legal, skills & knowhow, technological, environmental, social and economic.

The results obtained during the testing of the TAF have informed decisions on whether and how to scale up specific WASH technologies. Application of the TAF has continued in Uganda since the end of WASHTech, including on Solar Disinfection (SODIS), inclusive toilet facilities and the metered hand pump. The documentation of assessed technologies has improved so that lessons learned can be shared with those who wish to take these technologies to scale. As Uganda grapples with improving water and sanitation coverage the TAF remains highly relevant as a tool to understand the context (geographical, social, and economic) in which promising technologies are introduced. The TAF has influenced the perception of some technologies both positively and negatively and remains an effective tool for evaluation of WASH technologies in a transparent way, as well as for monitoring.

Context, aims and activities undertaken
Context

In 2011, Uganda's water sector framework was guided by the National Water Policy (1997) and the Water Statute (1995). These provided for the use of appropriate low cost technologies that offer community participation in decision making, implementation and operation and maintenance. These documents also required that only well-known and tested technologies should be used. However, there was no established procedure for testing and validating such technologies (Kimera & Achiro, 2011). Furthermore, there was no clear technology introduction procedure. Documentation of introduced technologies was seldom done as there was no particular organization responsible for this. Lessons learned from the introduction of technologies were often lost as a result. Even for a technology such as the U2 pump which had gone to scale in the country at that time, most stakeholders were unaware of any tests being done. The WASHTech project, which examined both the technology introduction process and a technology validation tool, has therefore added much value to the sector.

During its development and testing, the TAF was applied to five technologies in Uganda: the Urine Diversion Dry Toilet (UDDT), the ferrocement tank, the solar pump, the rope pump and the U2 pump. The different technologies were assessed on a district basis and the results were considered to be representative for the entire district. In selecting the districts, the research team relied on a Knowledge, Attitudes and Practice (KAP) study done for each of the different technologies. A TAF analysis for each technology was done in two districts; one district representing an area in which the technology was considered to be successful and the other in an area where it was considered unsuccessful. The two contexts were expected to provide an accurate national perspective into the kind of contexts and enabling environments that make a particular technology successful or not and determine what considerations are

necessary to take the technology to scale.

The WASHTech project ended in December 2013. Since then the TAF has been taken up by the ATC as a tool for validation of WASH technologies in Uganda. Together with the TAF, a National technical working committee developed the 'Guidelines to WASH technology Introduction in Uganda' (GTI). It prescribes a step-by-step process for managing the process of technology introduction and uptake with roles of the actors clearly spelt out for each stage of the process. The ATC uses both the GTI and the TAF to aid technology introduction and validation. The GTI and TAF have been used to introduce: inclusive household toilets, inclusive U2 hand pumps, metered hand pumps, and an indicator for solar disinfection of water. Typically whenever the TAF and GTI has been applied in Uganda, the research team has comprised the TAF host (ATC), a District Water Officer, a private sector actor and NGOs that may be involved in technology promotion.

Aims

The overall aims of the activities undertaken both during the WASHTech project and afterwards are espoused within the GTI and the TAF. Specifically, they are to:

- Stimulate discussion about a WASH technology
- Assess the potential of a particular WASH technology in a specific geographical and socio-economic context
- Assess the readiness of the sector to scale up a technology
- Support monitoring and evaluation systems for the technology introduction
- Document and formalize technology introduction procedures and processes
- Guide the sector on the technology introduction procedures

Activities

TAF Assessment of the Urine Diversion Dry Toilet

The evaluation on the UDDT was done in July 2012 in Pader, Agago and Kabale districts of Uganda. Kabale is located in Western Uganda while the other two are in Northern Uganda. It was thought that the two areas would provide a rich mix of experiences, particularly because the Northern districts were in a process of post conflict recovery and Kabale was believed to be a beacon of success of the technology (NETWAS & WATERAID, 2013).The cost of the assessment for the two different geographical areas was a combined total of 24, 956,000/- (USD 7,340) The ecological sanitation approach was seen as an approach that could extend sanitation services at household and institutional levels. A number of demonstration facilities were built at health centres, district and sub county offices to promote knowledge of the ecological sanitation approach and stimulate demand for the technology.

No.	Description	Cost (USD)
1.	Transport costs	2,160
2.	Stationery and Printing	100
3.	Refreshments & meals for participants	440
4.	Allowances for researchers/ partcipants	4,640
	Total	**7,340**

Table 1: Cost of carrying out assessments using the TAF on the UDDT in two regions

The design of the program provided for smaller study teams to collect user data and a larger workshop team to carry out assessment based on information gathered that took into account user, regulator and producer perspectives. Two study teams were dispersed to the two study areas of Kabale and Pader/Agago. Both teams had Team Leaders from the respective Technical Support Units (TSUs) of MWE, local contractors involved in construction of the UDDT, NGOs, a number of district officials responsible for water & sanitation, education and health sectors. In Pajule and Agago the sites visited were located at a health centre, sub county headquarters, schools, a town council, a market and a primary school. In Kabale, the sites were located at primary schools, a health centre and at individual households.

The field study took into account condition of the facilities, their usage, how well users understood the proper use of the UDDT, as well as perceptions and challenges they had. Focus group discussions were used for community toilets to obtain the perspective of the users, while key informant interviews were used to capture the perspectives of the regulators (DLG, MWE) and providers (local contractors, NGOs). All these contributed to the answers sought by the 'TAF Sanitation Assessment' tool.

TAF Assessment of the Metered Hand Pump

The assessment of the metered hand pump was taken up by the ATC after the WASHTech project. The assessment was done in October 2015 at a cost of 11,000,000/- (USD 3,000). The costs shared equally between the NGO Water for People and the ATC.

The addition of the water meter to the U2 hand pump was an innovation introduced by Water for People and the ATC. The addition of the water meter makes it more convenient to operate the pump in a business model with easy monitoring by a private operator (ATC, 2015, p.1). The U2 model is the most widely used water lifting technology in Uganda. It is one of only 2 standardized hand pumps in Uganda (Kimera & Achiro, 2010). The metered hand pump was developed to provide a business platform for management of rural water resources, a move away from the model of relying on water user committees (Keesiga and Kimera, 2014), a management model which has contributed to a low level of functionality for hand pumps (Nimanya et al, 2011). It was hoped that the metered hand pump would transform the management of hand pumps into a viable business model and reduce break-down times of boreholes.

There are now 30 boreholes fitted with the metered hand pump in Kamwenge, a district in Western Uganda, serving an estimated 9000 people. There are another 10 such boreholes in Kyegegwa district. The TAF assessment focused in Kamwenge. It sought to determine if the metered hand pump meets user's needs, is likely to be sustainable and scalable, and to capture valuable learning and experiences with regard to the technology.

Researchers were drawn from international and local NGOs, the national government, local government, hand pump mechanics and users. The 3-day exercise included visits to three sites where the metered hand pump was installed, sharing of findings by the different study teams and then scoring the technology in a workshop attended by all the researchers and other stakeholders.

The scoring was done using six sustainability dimensions (social, economic, environmental, institutional and legal, skills and knowhow, technical) and three stakeholder perspectives (user/buyer, producer/provider and regulator/investor/facilitator). During the scoring exercise, participants tried to reach consensus on a given score for each category by justifying reasons for each score. Whenever consensus was not reached, a vote was taken. Figure 1 shows a graphical profile of the results.

Main results and lessons learnt

The UDDT

From a user perspective, the UDDT was considered unaffordable. Unsurprisingly the UDDT was not adopted at a household level in Pader and Agago. The UDDT was adopted, to some extent, in Kabale, utilizing locally available materials such as logs, mud and grass thatch. The logs were generally used for the slab, while the grass thatch was for the roof. The lack of funds for operation and maintenance in all institutions meant that toilets were poorly maintained. Institutions, such as sub county and town council offices, were unable to ensure that ash, a necessary input for proper use of the UDDT, was available. As a result, the institutional facilitates where beset by many challenges including misuse, and simultaneous use of chambers. Schools had a better record with regard to the availability of ash as pupils were encouraged to bring ashes from home. Some facilities especially those used as demonstrations at district, town council and sub county offices were abandoned. Overall, community toilets in Kabale performed better than those in Agago/Pader. There was a clear information gap in Pader/Agago with regard to the

proper use of the UDDT technology. Researches attributed this to the war situation where internally displaced peoples returned to find a toilet infrastructure they knew little or nothing about. Generally, UDDT users were unable to manage the technology appropriately based on the current level of skills and capacity. In Pader and Agago, urine from the UDDT was not used.

The level of supportive structures for this technology and funding for further innovations and development to enable successful scaling up were wanting.

The TAF evaluation of the UDDT revealed that providers of the technology were not promoting the UDDT nor sensitization on its proper use. Producers/providers of the technology lacked effective mechanisms to carry out targeted market research and much needed follow up. They were also in need of marketing skills.

The lack of demand for the compost from the UDDT, even where the toilets were functioning well, was a barrier because people generally had no intention to use the compost. On a positive note, the TAF evaluation has shaped the national sanitation research agenda to focus on more options for reuse of human waste including manufacture of briquettes for cooking from faecal sludge and composting human waste using worms. In response to the high cost of the UDDT, the fossa alterna (alternating pits composting toilet) has been promoted.

From the observations above, prospects for scalability in the Northern districts of Pader and Agago were low. Prospects were better for Kabale due to difficulty in excavations for traditional or VIP toilets but further sensitization was still necessary.

The Metered Hand pump

TAF analysis result in a "traffic light" profile, seen in Figure 1 below. Green represents positive impact, yellow is neutral/potential impact, red represents negative or hindering characteristics, and black is an unclear impact that needs to be clarified (Skat, 2013).

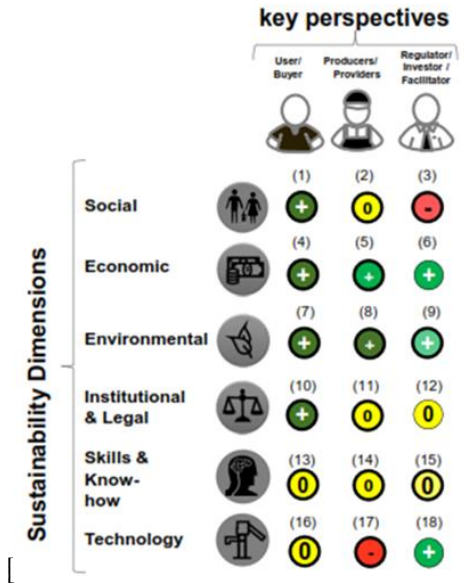

Figure 1 – Graphical Profile of TAF Results for metered hand pump
Source: ATC/Water for People

In the case of the Metered Hand Pump, the profile shows that communities expressed a high demand for the services provided by the technology. They understood that although they had to pay at the point of collection for each jerry can, they were assured of a more reliable service and were thus willing to pay.

Social
Social indicator 1 which examines demand was scored positive because users were willing to pay for a reliable service. It was also considered a more equitable system compared to flat monthly household fees that did not take into account the number of users in a household or the volume of water consumed. Social indicator 2 was scored neutral because although there is a team of extension workers in place to do follow ups and the private operators have received some training on marketing, they are yet applying those marketing skills. Social indicator 3 was scored negative because there is a need for behaviour change at the national and local level and it may require policy changes to scale up this model as a viable alternative to water user committees which are provided for nationally.

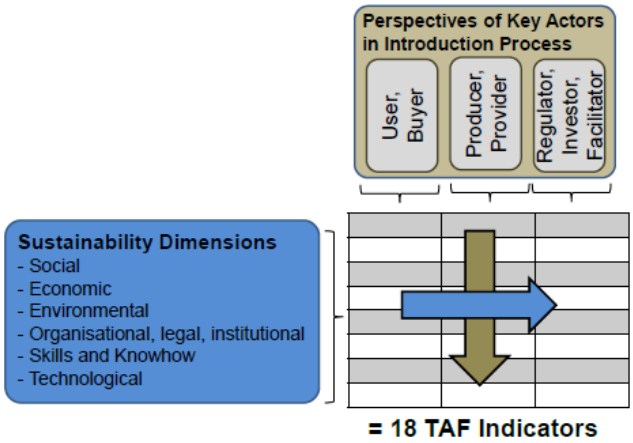

Figure 2: Combining 3 perspectives on 6 dimensions results in 18 dimensions
Source: TAF Manual, 2012

Economic
Although users were engaged in determining the tariffs, some still find them unaffordable and instead opt for unprotected sources. A small proportion of boreholes have insufficient demand to meet the costs for the caretaker. Economic indicator 4 was scored positive because, in most cases, user fees users cover capital maintenance costs, as well as operational costs thus ensuring sustainability. Economic indicator 5 which addresses whether the private operator can generate sufficient revenues to cover costs was scored positive because with the cluster of 10 boreholes the operators can cover costs and make a profit and the user numbers are growing. Economic indicator 6 was scored positive because there is supportive funding available for operators and hand pump mechanics (HPMs) to adopt this model. There are also WASH loans available from Post Bank.

Environmental
The metered hand pump does not present risks to the community or environment. The process used to make the hand pumps also does not pose risks to the environment. Environmental indicators 7 and 8 were scored positive because no negative impacts result from the use of this hand pump. Environmental indicator 9 was scored positive because the abstraction levels possible with this borehole do not constitute negative impacts on the environment. On the contrary, because it is metered, it can monitor abstraction quantities with accuracy.

Institutional and Legal
The district, through a council meeting minutes, recognized water as a business (WAB) as one of the accepted models for promoting sustainable water coverage. In this model, caretakers are paid a monthly stipend and ensure good care for the borehole surroundings and collect user fees. Legal & institutional

indicator 10 was scored positive because the current O&M structure is properly managed and good governance and accountability is practiced. In contrast with the Water User Committee management model, fund collection has greatly improved. There is transparency and records are readily available. The community is aware that the collections contribute to the caretaker's salary, the escrow account and the water boards. Indicator 11 was scored neutral because there are hindering factors at the national level with regard to regulation of the quality of spares of the U2 pump in general. This was however countered by a mechanism at the local level to specify the required standards of materials. Indicator 12 was scored neutral because although the U2 pump is a standardized hand pump for boreholes in Uganda, the water meter it is not. Notably though, the Kamwenge district government is highly supportive of the metered model.

Skills and Knowhow
Users, caretakers and local mechanics are familiar with the metered hand pump. The caretakers are trained and are able to read the meters well and keep records of the daily usage and monies collected. Indicator 13 had a neutral score because the hand pump mechanics lacked the tools and knowhow to handle the U3 modified hand pump which was used at some sources. Indicator 14 assesses the level of business and technical skills. This had a neutral score because the entrepreneurs still need to hone their marketing skills, while the HPMs also had some skills gaps. The sector capacity for validation, scale up and follow up of the metered hand pump considered under indicator 15 and was average at best. This was the case because although technical capacity in country was considered to be adequate, it is not matched by the necessary financial resources to do monitoring and market research needed to scale the technology.

Technological
Users appreciate the level of service provided by the hand pump. The design has not taken into account accessibility for elderly and disabled people. Hand pump mechanics are available to do repairs and this is manageable for the U2 pump. However, there are challenges with the U3 modified model both with regard to skills and availability of tools. Technology indicator 16 looking at user satisfaction with the performance of the technology was scored neutral due to the high pumping effort required for some pumps. An earlier field test however indicated only an 8% increase in collection time owing to the meter. Pregnant women in particular found it difficult to operate the pump. Technological indicator 17 which examines the viability of the supply chains for spares in the district was considered to have negative hindering characteristics as it was not established. Technological indicator 18 was scored on the basis of support mechanisms for upscaling the technology. This was scored positive because the technology promises sustainability and which is attractive to development partners. However it is still a little known technology outside of the district.

Conclusions and Recommendations
Recommendations for the sustainability and scaling up of the Urine Diversion Dry Toilet in Uganda:

- There is need to design a UDDT management model at institutional and community levels to ensure misuse is minimised.
- Private sector involvement in purchase, trade and use of compost must be encouraged and stimulated as there is currently very weak demand.
- Further studies on cultural barriers to use of the UDDT and compost should be carried out in different parts of the country.

Recommendations for the sustainability and scaling up of the metered hand pump in Uganda:

- Awareness raising should be done at the National level to promote the metered hand pump as a viable option for increasing the sustainability of hand pumps.
- Some users decry the high tariffs, often reflected by low user numbers for some borehole. Sustained sensitization and marketing is necessary to promote the services provided by this model. The costs for users when boreholes break down if well documented and should enhance

willingness to pay

- Behaviour change is required at all levels (including users and national level stakeholders) to face up to the reality that lax models of payment have failed to deliver sustainable WASH services. The metered hand pump business model should be considered for some rural areas, particularly where populations are high

Conclusions about the TAF

The TAF fills the gap of a tool to monitor or validate specific WASH technologies within a given context. It is highly regarded by the Ministry of Water and Environment and it is actively being applied to validate new technologies in Uganda. The TAF creates ownership about the decisions made with regard to scalability of particular technologies and identifies bottlenecks around WASH technologies.

The TAF presents a locally grounded perspective because various stakeholders are involved in the field assessments where they gain a better understanding of grassroots issues and interact with users, producers/providers and regulators, thereby embracing a wider view of the issues. More importantly, through the TAF process stakeholders understand their role in enhancing WASH service delivery as the barriers are identified and the group makes recommendations to enhance sustainability and scalability. The TAF creates a systematic process for documenting WASH technologies that are tested, allowing lessons learned to be shared amongst sector actors and archived for the future.

The Ugandan government, private sector and NGOs have demonstrated the willingness to adopt the GTI and subject their innovations to the TAF analysis. Some have also demonstrated the readiness to fund the costs of the validation, while the costs of the TAF (typically about $ 3,500 for a single technology in one district) are prohibitive to others.

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