38th WEDC International Conference, Loughborough University, UK, 2015

WATER, SANITATION AND HYGIENE SERVICES BEYOND 2015:
IMPROVING ACCESS AND SUSTAINABILITY

Multi-faceted approach to introducing household water treatment technology in South Africa

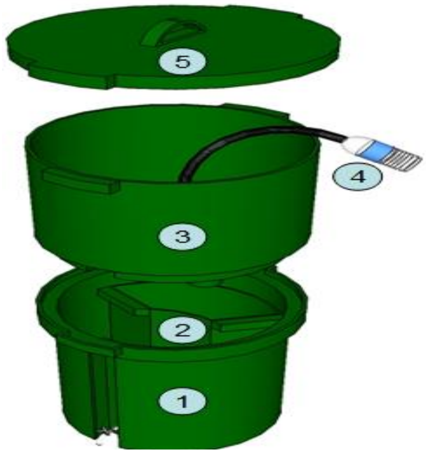
S'bonelo Zulu, Ester Ngorima & Gertrude Matsebe

BRIEFING PAPER 2238

This paper explores the approaches that were applicable during the introduction of a new technology to a community and highlights a multi-faceted approach that was used in Tsambokhulu, Mpumalanga, South Africa. It takes into consideration the importance of using different stakeholders within the community to achieve the goal of potable water for the community. The sustainability of a water supply technology rests on the approach that is used when implementing a project. The study further demonstrates the importance of putting the technology user in charge of the technology determines whether the outcome is success or failure. This paper draws its conclusions from the power of unity that the stakeholders possess and the approach that the implementer uses when introducing a project dictates its sustainability.

Introduction

Treating water at the household level has shown to be one of the most effective in terms of improving water quality and cost-effective means of preventing waterborne disease particularly for communities located in remote villages that cannot be served by convectional water supply systems. A variety of Household Water Treatment and Safe Storage (HWTS) technologies have been developed by various organisations. This approach of water services delivery has helped vulnerable populations to take charge of their own water security by providing them with the knowledge and tools to treat their own drinking water. However, even though HWTS technologies have been known to effectively control the proliferation of water-borne diseases (UNICEF, 2008).. Most of the deployment has been through either donor-funded programs or projects without any long-term support mechanisms to enhance their sustainability. This paper highlights a multi-faceted approach that was used in a rural community to deploy the AmaDrum technology that was developed by the Council for Scientific and Industrial Research (CSIR). The AmaDrum is a HWTS technology that combines flocculation and chlorine disinfection with filtration and safe storage to ensure the availability of clean drinking water to households that would otherwise not have such access to potable water. The operation process of the AmaDrum technology involves mixing a specifically formulated chlorine based coagulant with 50 litres of raw water and stirring until flocculants form on the base of the top AmaDrum compartment. A suction mechanism is then introduced to slowly draw treated water into a filter sand column, which eventually produces potable water that is safe for human consumption. Water is stored in a 50 litre capacity bottom compartment of the AmaDrum. The AmaDrum technology is most applicable in situations where unprotected surface water is readily available because of its ability to treat microbial contaminants.



AmaDrum components

1. Water storage compartment
2. Sand filter column that fits snuggly in a fixed position
3. Water treatment compartment
4. Float
5. A covering lid with grooves on the handle for ease of handling

Figure 1. AmaDrum components

Background

In South Africa, an estimated 1 million households still lack access to clean potable water and 50% of them are located in deep rural areas,(Stats SA, 2011). This situation is prevailing in a background where billons of Rands have been invested in water infrastructure with the objective of improving access to safe water through centralised water treatment. It thus clearly demonstrates that the widespread expansion of centralised water treatment has been ineffective, particularly in informal settlements and poor rural areas due to the high cost and technical complexities of the required infrastructure. Furthermore, even when safe water is available through a communal source, which is a common form of water provision in many poor communities, a high risk of contamination remains between the time of collection and consumption in the home (Clasen and Bastable, 2003). Household water treatment and safe storage (HWTS) interventions have therefore been considered low-cost and effective alternatives for reduction of the incidences of diarrhoeal disease that can be implemented at the point of use (Clasen et al, 2006 and WHO, 2002).

Aims and objectives

The aim of a multi-faceted approach is to ensure the sustainability of a technology and to increase a sense of ownership amongst its users.

The following objectives were adhered to in order to achieve the aims of the project:

- Higher levels of sustainability of technologies were obtained by getting the buy-in from the relevant stakeholders through ensuring that they validate the importance of the AmaDrum technologies in their daily lives.
- Field testing of AmaDrum to determine its fitness for purpose
  Involving the end users in decision making processes regarding the performance of the AmaDrum technology to increas their sense of technology ownership, therefore increasing the levels of adoption and hence sustainability.

Approach and methodology

Most studies introduce new technologies to needy communities but sustainability remains a challenge. Most challenges are addressed when the stakeholders are properly engaged in any project (Griffiths et al, 2007). Focus Group Discussions (FGD) have been highlighted as ideal strategies to earn trust within the participants (Putri and Wadiha, 2012). Such approaches have a great potential in increasing the level of technology adoptability.

The approach used in the study is a major contributing factor towards the success of the AmaDrum technology. This approach started with the establishment of effective communication channels at a higher level of which was the engagement of different relevant stakeholders, as well as the potential technology users. Constant communication throughout the deployment process of the AmaDrum technology and the training of beneficiaries was maintained during the course of the project, this assisted in keeping track of practices around the AmaDrum technology. Water quality analysis was done prior and after water has been treated by the AmaDrum under field conditions. The study focused on putting the technology users as the leaders of the project in order to sustain the adoption and use of the technology.

The multi-faceted approach followed both top down and bottom up approaches when introducing the technology to the participants. This included the following:

Stakeholder engagement

Extensive in-depth consultations were conducted with the active role players ranging from community leadership (traditional and political), community representatives, water service providers, local NGOs, researchers and water regulatory bodies. With the understanding that these stakeholders have different saliency, power, as well as conflicting interests, consultations were also conducted individually with different stakeholder groups until there was a common understanding of the technology and its benefits. The municipality served as an entry point to the community due to its role of a Water Service Provider (WSP) and the project site falls within its jurisdiction. The municipality's role was to market the technology to all leadership structures within the community. The CSIR team presented two HWTS technologies namely the Tulip filter and AmaDrum to the municipality, and the potential technology users. The potential technology users selected the AmaDrum as their technology of choice and this was supported by the municipality. In addition, the municipality's buy-in indicated to the project implementers that the technology will be maintained long after it had been handed over to them. The presentation also indicated that the project implementers (CSIR) will cover the cost of the AmaDrum units from the piloting of 30 units to the full rollout of 350 units and further costs of provision of consumables (coagulant sachets) will be covered by the municipality.

Introducing the technology to the participants

A mass meeting was held in the village during which the AmaDrum technology was introduced and demonstrated to the community. Thirty households were identified by the local leadership to participate in the pilot study. The household selection process prioritised vulnerable groups, which included the frail elderly, people with threatening diseases such as HIV/AIDS, and people living with disabilities. This was done mainly to assess the technology's fitness for purpose in real life conditions. The selected users of AmaDrum were reserved a right to not participate in the study and for those that participated also had a right to opt out during the course of the project without any penalties being imposed on them. This was addressed through consent to participate form that had to be signed before the training and distribution process could proceed.

Training

The selected users of the AmaDrum technology received extensive training on the operation and maintenance of the AmaDrum. The demonstration and training was participatory in nature with users actively involved in the step by step process regarding the importance of each component and the process involved in the treatment. The process was facilitated in the local language. These sessions were followed by distribution and delivery of the AmaDrum units to 30 households along with an operator's manual in the form of an adhesive sticker placed on the exterior side of the drum. The sticker was designed to be easily understood, even by those with basic literacy skills and it was translated into the local language.

The CSIR project team also selected and trained a local task team that could liaise with the participants in the absence of the project implementer (CSIR). Such people were tasked with addressing challenges that could arise regarding the AmaDrum during and after the project has been completed. This further allowed for the AmaDrum users to provide feedback with regards to operational challenges experienced while operating the technology.

Follow up surveys, corrective training and interviews

The technology was supported by an ongoing monitoring program to provide back up support to users in the form of retraining them should there be a need. Further assessments were conducted a day after the training and distribution session of the AmaDrum took place. This was done to ensure that the AmaDrum units were properly assembled and used according to the instruction provided during training. Amadrum users that could not follow proper operation processes of the AmaDrum had to undergo a corrective training at a household level.

Follow up interviews were conducted 6 weeks after introducing the technology to the participants and 2 more interviews were conducted at 4 week intervals to determine the level of user's satisfaction and to obtain feedback with regards to the operation of the AmaDrum. The interviews were accompanied by water quality assessments in order to determine whether the responses were aligned with the results or not. The results from the follow-up interviews were needed to determine if there was a need for further retraining on the operation and maintenance of the AmaDrum.

Water quality analysis

As part of the fitness for purpose assessment, the water quality was assessed to determine the AmaDrum's ability to treat water under everyday household conditions. The technology performed perfectly under laboratory conditions and it was ideal to test it under the conditions that it is designed for. Fifty percent of participants had their water sampled for analysis per survey. The 15 collected samples were subjected to chemical and microbiological quality analysis to assess if the treated water met the national drinking water quality standards as per South African National Accreditation Standards (SANAS) 241 guidelines. In addition, water samples were analysed for all parameters listed under the SANAS 241 guidelines. . The water quality tests were conducted for samples obtained from prior and after the water treatment process using the AmaDrum technology.

The follow up assessments were to validate the consistency in the results obtained in the first fit-for-purpose-purpose assessment.

Results and discussions

Stakeholder influence on project success

Various stakeholders played different roles that contributed to the success of the project. Although the CSIR project team was responsible for the study, other stakeholders were allowed to lead in different sections of the study, which increased the level of involvement in the project, thus indirectly enhancing its success. The municipality successfully identified the project site and ensured that the project was introduced to the community through appropriate structures, such as the tribal authority, the councillor and the community committees.

The presence of local community structures during the introduction of the project resulted in immediate buy-in from the community. The identified participants were responsible for the use of the AmaDrum in order to determine its fitness for its intended purpose under field conditions. The participants were also offered a platform to voice their concerns regarding potential developments and other factors relating to the AmaDrums' performance, this further increased sense of ownership for the AmaDrums amongst the users. The rationale for this was to develop a sense of responsibility from all stakeholders. All involved parties shared the common goal of providing potable water to the community.

Adoption, acceptability of the technology and potential breakthroughs

High rates of acceptability and adaptability of the AmaDrum technology by of the participants resulted from the rigorous training and constant interaction between the researchers and the participants. Participants gained more confidence in their ability to operate the AmaDrum technology as more training was conducted. Whilst the AmaDrum was well accepted with trial participants being happy that it produced clean water, there were a few challenges highlighted with regarding to the operation of AmaDrum. The participants highlighted design as well as operational challenges and they suggested an increase of the AmaDrum size and the reduction of filter sand quantity. Such suggestions could not be addressed because the AmaDrum came at a standard size and reducing the quantity of filter sand in the AmaDrum would compromise the treatment process. However, only factory faults could be addressed if and when a need arises. The participants further devised strategies on how to address such challenges by themselves since they viewed the AmaDrum as theirs .This highlighted the value of sense of ownership they have towards the AmaDrum technology. The technology users indicated that they devised a new method that catered for participants with limited literacy levels which focused only on observations instead of time. The treatment instruction required them to use watches to monitor the flocculation process but they used the visual appearance of "white stuff" (flocculants) to indicate the completion of the mixing stage. Most of the households (85%), including those with limited literacy, could narrate and recall all the treatment procedures as per the training provided by the project team. Proper training encouraged better practice which automatically reduced mistakes and corrected improper practices. Such practices indicate that the community has adopted and accepted the technology as theirs.

Water quality

The results from the initial water quality assessment that was conducted by the CSIR under normal field conditions showed unexpected inconsistencies when compared to the AmaDrum performance under laboratory conditions. The results were therefore regarded as inconclusive as the performance of the AmaDrum could not be ascertained in terms of treatment efficiency under field conditions. This resulted in corrective training sessions for the users of AmaDrum and sampling processes that were conducted under stricter conditions than the initial assessments. The final water quality results produced were in accordance with the SANAS 241 in terms of microbial and physical parameters. Furthermore, water quality results indicated that the AmaDrum technology is fit for its intended purpose.

Conclusion and remarks

The technology was adopted by the stakeholders as an immediate solution to medium-term water challenges in water scarce communities, such as Thambonkulu village. The first batch of water quality results indicated that the level of training provided was insufficient and therefore retraining had to be conducted. Addressing such issues through adoption of lessons learnt from users supported by ongoing corrective retraining resulted in the AmaDrum's improved performance as noted in the outstanding water quality results from the laboratory. However, AmaDrum technology is not designed to remove chemicals such as nitrates from water but future work that focuses on improving the technology to cater for chemical removal is underway. The initial sample of 30 units remained with the participants from the pilot phase, while 350 more AmaDrum units were rolled out to the whole community and are all in use up until this day. The technology now belongs to the participants and will be serviced by the responsible municipality by means of provision of consumables.

The study validated that introducing a technology using multifaceted approach where all the stakeholder's value and contribution to the project is clearly understood and defined for the lifespan of the project help increase the levels of sustainability. This is because stakeholders such as the municipalities, political and tribal leadership are more knowledgeable about the core needs of the community. The involvement of AmaDrum users in decision making and potential improvements regarding the performance of the technology increases the sense of ownership of the introduced technology. Stakeholders become more willing to take part in the study if the project implementer indicates that everyone is working together to make the project a success. Informal communication between different role players in the project allowed easy access to information and assistance from all involved parties regarding the AmaDrum technology. The participants from the pilot study will assist the CSIR team in further training of the rest of the community on how to operate the AmaDrum technology. The approaches used in the implementation of this project have created a community that is willing to serve as champions of the technology because they can testify performance of the AmaDrum technology as well as the power of working together.

Acknowledgements

The authors would like to extend gratitude to the participants of Tsambokhulu and relevant stakeholders for their willingness to participate in the study. The authors express gratitude to the CSIR for funding the project for the past three years.

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Contact details

S'bonelo Zulu
PO Box 395, Pretoria, 0001
Tel: +27 (012) 841 4021
Fax:+24 (012) 841 4847
Email: szulu@csir.co.za
www.csir.co.za

Esther Ngorima
Address: PO Box 395, Pretoria, 0001
Tel: +27(012) 84102077
Fax:+27(012) 841 4847
Email: engorima@csir.co.za
www.csir.za
