

The power of knowledge in executing household water treatment programmes globally

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This paper presents a case study of five organizations from five countries: Haiti, El Salvador, India, the Philippines and Pakistan, demonstrating that knowledge transfer can be a catalyst for locally driven water programmes for the poor. Each organization received training and technical consulting from the Centre for Affordable Water and Sanitation Technology on Project Implementation for the biosand filter. Each then established an independent project resulting in cleaner water for 156,000 people in six years, and widespread biosand filter acceptance among users.

Lessons learned are that knowledge transfer can result in effective, sustainable and scaleable technology implementation; transfer takes place one person at a time, making education at all levels crucial; pilots/demonstrations are essential motivators to technology adoption; involvement of mainstream government can result in faster implementation and widespread acceptance; and technology training is not enough. Organizations need to learn how to plan, implement and monitor programmes.

Keywords: technology transfer, household water treatment, training.

THE FOLLOWING CASE STUDY is an illustration of successful household water treatment (HWT) programmes, initiated by five different organizations in five countries – Haiti, El Salvador, India, the Philippines and Pakistan – through the use of education and training and the open source distribution of training programmes.

Players

The process of knowledge transfer was initiated by CAWST, the Centre for Affordable Water and Sanitation Technology, a Canadian NGO. Over the last six years, from 2001 to 2007, CAWST has trained over 2,400 individuals in HWT and, in particular, on a specific technology called the biosand filter. Although CAWST teaches many HWT options,

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The biosand filter can be manufactured anywhere in the world using materials that are locally available

this particular technology has been the one selected by most of the trainees for implementation.

The biosand filter works in the same way as conventional slow sand filters. The difference is that the biosand filter is smaller, and water does not need to flow through it all the time, making it suitable for household use. The biosand filter can be manufactured anywhere in the world using materials that are locally available. It can also treat contaminated water from various surface and ground water sources, such as a river, stream, spring or well.

The filter itself is simply a concrete or plastic container, with layers of sand and gravel inside. As with all slow sand filters, a biological layer (often called a biolayer) of sediment and micro-organisms develops at the sand surface. Pathogens and suspended material are removed from contaminated water through a combination of biological and physical processes in the biolayer and sand bed. Contaminated water is poured into the top of the filter whenever clean water is needed. The water slowly passes through the biolayer, sand and gravel. Filtered water flows out through the tube and is collected by the user in a storage container.

Households are encouraged to contribute at least part of the filter's cost

A biosand filter costs between \$12 and 30, depending on the local context. Although this cost is relatively low, it is often beyond the reach of the poorest of the poor in developing countries. Biosand filters are usually subsidized by the implementing organization to support those who are unable to purchase the filter at full cost. Regardless of the amount of the subsidy, households are encouraged to invest a nominal amount into the filter to give them personal ownership.

While the training is specifically designed with several critical steps and design parameters, people can learn how to build, install, operate and maintain the filter in a relatively short period of time. Under normal circumstances, the knowledge required for this can be transferred in a four- or five-day workshop using various learning techniques.

The 'technology transfer' model has been successfully used to promote appropriate technologies in developing countries, such as the treadle water pump, ceramic pot filters and improved stoves. CAWST has built on other's experience in technology transfer to develop the 'knowledge transfer' model. In addition to technology transfer, the goal of this model is to pass knowledge and skills to organizations and individuals through education, training and consulting services. They, in turn, have the capacity to motivate households to take action and meet their own needs for safe water and sanitation. Most people that CAWST reaches are not water and sanitation professionals. Training programmes and educational materials are designed for a wide variety of non-technical audiences to make water knowledge, common knowledge.

CAWST uses participatory learning and action as a way to help people to participate together in learning, and then act on that learning. While participatory activities take more time to conduct, they are much more likely to be successful than conventional teaching approaches. CAWST experience shows that when everyone is actively engaged and contributes to the learning process, people feel more ownership and become empowered to take action.

The content of a four-day Project Implementation for the Biosand Filter Workshop includes the following topics: global and local water, hygiene and sanitation issues; water quality and disease transmission; improved hygiene and sanitation; community versus household water treatment; household water treatment process; design parameters of the biosand filter; construction and installation of the biosand filter; operation and maintenance of the biosand filter; project planning and implementation.

A typical workshop includes a variety of learning techniques such as facilitator-led presentations, demonstrations, role playing, small group work, open discussion, case studies and hands-on construction. Active participant engagement in all learning activities is encouraged.

A combination of the workshop content and participatory learning activities helps to build participants' capacity in the following areas:

- productive skills (e.g. construction, operation and maintenance of the biosand filter);
- technical knowledge (e.g. understanding of water quality, disease transmission, filter design);
- project planning skills (e.g. setting objectives, stakeholder analysis, budgeting, scheduling, fundraising, monitoring);
- social awareness (e.g. connection between poverty and human development, importance of community participation and education).

Regardless of the content being delivered, CAWST uses the following training format:

- *Opening and introductions.* To welcome people and enable participants and facilitators to get to know each other.
- *Learning expectations.* To clarify participants' hopes about the training session.
- *Ground rules.* Participants develop ground rules so that everyone has a shared understanding of how people will work together. They are sometimes called a 'group agreement' to emphasize the fact that the rules are not imposed by the facilitators.

Active participant engagement in all learning activities is encouraged

- *Objectives and schedule.* To outline the objectives, content, methods and timings of the training session. Although presented at the beginning of the workshop for the participants to see, schedules are flexible to allow the planned activities to be reviewed and changed to meet the needs and interests of the participants.
- *Energizers.* To help participants relax and get to know each other, and give them more energy and enthusiasm.
- *Field work.* To provide an opportunity for participants to put new skills into practice.
- *Small and large group work.* To do participatory activities and have focused discussions.
- *Recaps.* To provide a summary (usually by participants at the beginning of each day) of what has been covered so far.
- *Follow-up action plan.* For participants to clarify what concrete steps they will take after the workshop in order to use the new skills and knowledge they have gained.
- *Evaluation.* To enable participants to assess the strengths and weaknesses of the training session, including facilitation, techniques used, materials, venue, accommodation, food, relevance of topics covered.
- *Closing.* The end of the training session is official or unofficial depending on what is appropriate in the local context.

To further support knowledge transfer, each participant is provided with a manual and a CD with electronic copies of all educational materials and activities used in the training. All of CAWST's materials are open source and permission is given to reproduce materials with the intention of increasing the availability to those who need it.

Among the organizations trained by CAWST over the last few years were:

- Koshish Welfare Society – a Pakistani NGO which sought a water treatment solution for the villages it served.
- Clean Water for Haiti (CWH) – an NGO created to promote and advance HWT in Haiti.
- South Asia Pure Water Initiative, Inc. (SAPWI), formed to bring biosand filters to poor communities in Kolar, Karnataka, India.
- A Single Drop (ASD) – an NGO focused on water advocacy and education to inspire unified action for water stewardship in the Philippines. ASD expanded the scope of its vision after learning of the biosand filter.

- Asociación Agua Viva de El Salvador is connected to the US-based NGO, Living Water International (LWI). Agua Viva was trained in biosand filter production prior to CAWST's formation in 2001; since then it has participated in CAWST trainings to advance its programme.

Activities

The five client organizations have participated in or co-facilitated a total of eight CAWST workshops since 2005. In addition approximately five follow-up visits were conducted by CAWST. Since 2004, CAWST has delivered more than 100 workshops in 33 countries, including those in Canada.

Subsequent to the initial training, Agua Viva and SAPWI focused primarily on project implementation in specific communities, while ASD, CWH and Koshish focused additional effort on training other organizations as a means to promote HWT more broadly in their countries of operation. Implementation by each organization generally started with a small pilot (e.g. five biosand filters in the case of Koshish). It was the success of these pilots (such as Agua Viva's observation of less turbidity in the water after filtration) that convinced the organizations to move ahead with their projects.

Both CWH and SAPWI reported that filters were initially placed in schools, health centres, churches and in the homes of community leaders. SAPWI used its connections with local Rotary members to facilitate this implementation. Koshish, on the other hand, used a network of village health workers at the Pakistani Union Council level to introduce filters to the community. According to Koshish:

Each Union Council usually comprises 20–25 villages and each village has one to three female health workers. Training is provided for the female health workers in each village, and an agreement is made that the health workers will receive a BSF [biosand filter] free of charge in exchange for promoting the technology, facilitating the installation of at least 20 filters, training the users and following up on the operation and maintenance of installed filters in the village. Users receive a guide to assist them in the maintenance and troubleshooting. Health workers and a technical person (usually a mason) also assist if problems arise. As a last resort, there is a telephone 'hotline' where users can call Koshish to ask for advice and assistance. If necessary, a Koshish staff member visits to fix the problem, but this is difficult due to distances and cost of transportation.

Implementation by each organization generally started with a small pilot

Health workers receive a free filter in exchange for helping install at least 20 filters and training the users

All the HWT projects include an educational programme, utilizing training materials developed by CAWST to train a 'Community Health Promoter' to help the local communities use the filters properly. In addition, SAPWI provides children with a bar of soap to encourage handwashing.

In addition to training, CWH supports other Haitian organizations by sharing experiences, and selling materials to construct filters at cost. In India, SAPWI has developed an Adopt-A-Village Partnership programme which generates funding in the US to provide filters for the most impoverished people in the Kolar District. ASD started its introduction of the biosand filter in the Philippines by organizing four workshops which were delivered by CAWST and assisted by ASD staff. More than 50 per cent of the 91 participants were from large international aid organizations or health workers from local government agencies. Because of the demand, ASD decided to become a full-service Water Education Training Center that introduces affordable water technologies to other organizations. In less than a year, ASD conducted 13 biosand filter workshops, training over 250 community facilitators and eight ASD staff members as biosand filter trainers. ASD focuses its training on existing implementing organizations, or alternatively, receives a grant from a funding agency to help develop community-based water organizations called Water PODS (People Offering Deliverable Services).

ASD now trains other organizations in the use of affordable water technologies

Outcomes

Together these five organizations have improved the drinking water of 156,000 people in less than six years. One biosand filter installed in a household serves six people on average (see Table 1). This average was verified by a 2007 CAWST survey of 186 HWT implementers worldwide.

Furthermore, all organizations reported widespread user acceptance and good filter performance. Koshish states that users were satisfied with the water quality and no one got sick. CWH adds, 'We are able to

Table 1. Families using household water treatment

<i>Implementing organization</i>	<i>Number of biosand filters installed in households¹</i>
Koshish Welfare Society	14,000
Clean Water for Haiti	6,600
Asociación Agua Viva	3,600
South Asia Pure Water Initiative	1,500
A Single Drop	300

¹ On average, one filter can provide clean water to a family of six people

Box 1. 'Bionic' Joshua and the biosand filter

In August 2004, the village of Barangay Birawan on the island of Daram, Philippines, experienced a diarrhoea outbreak causing the hospitalization of 10 children and the eventual death of five of them. Almost every year, especially during the rainy season, Birawan is troubled with an outbreak of diarrhoea due to drinking water contamination.

A partnership between Plan Philippines, A Single Drop and CAWST resulted in the first training in the Philippines on the biosand filter as an alternative for household water treatment. Barangay Birawan was selected as the first pilot area to implement the biosand filter. In September 2006, 10 filters were built and installed to serve about 30 families, and another three filters were installed in the elementary school.

Naiding Raya, a community volunteer and Barangay Health Worker, together with her family, was chosen as one of the beneficiaries. Mana Naiding's family uses the treated water from the biosand filter, especially for their cooking and drinking. The following December, Mana Naiding's daughter Shiela gave birth to an eight-pound, healthy baby boy named Joshua. Since his birth, Joshua is being pampered with filtered water. The water that is being used for his drinking, food and even bathing comes from the biosand filter. Joshua's mother declares, 'I am very proud of Joshua because he is very healthy. He has not been ill of any water-related diseases such as diarrhoea or rashes since his birth, unlike other children in the community. I will continue taking care of Joshua with water from the biosand filter.'

The biosand filter has since been introduced in other partner barangays and it is becoming a popular technology for ensuring safe and potable water in communities.

Fed with water
from the filter,
Baby Joshua is very
healthy

see visible improvements in the health of community members over time, especially in communities where a saturated [biosand filter] installation has occurred within six months'. Demand for HWT now outstrips the organizations' abilities to supply.

Lessons learned

The most significant learnings reported by the organizations involved are that:

- Knowledge transfer through a system of international, national and community-based organizations can result in effective, sustainable and scaleable technology implementation as evidenced by the fact that people can use the filters to remove pathogens from the water consistently, people continue to use the filters for many years without outside intervention, and, systems and networks for knowledge transfer, which can reach millions of people, are in place. These systems and networks allow messages to be adapted to fit the local context at each step of the programme, encourage each organization to act independently using its own support networks, engender community ownership,

and establish a feedback loop to enable continuous programme improvement.

- Providing ongoing consulting services and progressive training workshops over time is essential to programme improvement and expansion.
- Technology transfer takes place one person at a time. Person-to-person communication is the key. Education at all levels is crucial in raising awareness ... awareness of the need for water treatment, hygiene and sanitation; and in the correct production, operation and maintenance of HWT.
- Pilots and demonstrations where people can see the results are essential motivators to technology adoption. The ease with which the biosand filter can be piloted in various communities is one of the reasons for its widespread global distribution – over 180,000 biosand filters in 49 countries – in a short period of time.
- Involving local, regional and national governments and other organizations resulted in much faster implementation and widespread acceptance. The Koshish programme now has the support of the political leadership of the Province of Punjab, the federal government and the local leaders.
- Training organizations have discovered that technology training is not enough. Organizations need to learn how to plan, implement and monitor programmes. CAWST now offers training programmes in all these areas, and in water quality testing. CWH raised the implementation success rate of students after training from 10–20 per cent to over 80 per cent by adding a ‘project implementation’ component to its programme.

Demonstrations where people can see the results are essential motivators to adoption

Involving local, regional and national governments resulted in much faster implementation and acceptance

Challenges

The major challenges now being faced by these organizations are: (1) financially sustaining what has been started; (2) ensuring good quality control; (3) following up and monitoring existing installations and programmes; and (4) overcoming resistance by external organizations.

Koshish states ‘At present there is a huge demand, but we need to limit response to what can be managed effectively, in order not to become over stretched’. The Koshish programme needs to become financially sustainable so the organization has temporarily suspended subsidizing filters and will restart by ‘selling’ at full cost, which may include operating and administration costs.

Good quality control requires well-trained work teams and often additional costs

Good quality control requires well-trained work teams and often additional costs. Agua Viva states, 'Our biggest challenge is to train the work teams'. And Koshish currently transports sand 400 kilometres for use in its filters, adding to overall costs. The expense is worthwhile, however, for good quality sand.

Both CWH and ASD believe that one of their greatest challenges at this point is to follow up on all of the biosand filter projects that have been initiated. CWH suggests, 'We need to visit the filters again and ensure that users have proper user education'. ASD concurs, stating that, as a training organization, 'We have many people trained, a growing number of projects and a small staff to train, monitor and evaluate. Travelling around the many [Philippine] islands is time consuming and cost-prohibitive.'

Koshish also faces objections to the biosand filter from water treatment experts in Pakistan. These objections are based on a limited number of tests showing low bacterial removal. Koshish reports that:

Interaction with high-level experts from different organizations can be difficult as we feel we are lacking in knowledge and expertise to be able to talk at the same level, despite the fact that we have constructed and installed many filters which are operating properly and supplying people with safe water. We will need additional professional training and support.

Household water treatment programmes are sometimes opposed by people in authority

Introduction of household water treatment (HWT) programmes are sometimes opposed by people in authority. These people include those who believe that HWT solutions are second class, and not to the same standard as community-scale treatment or global standards, those concerned about the government regulator's ability to monitor individual treatment in numerous households, and those not willing to devolve the power involved in supplying clean water.

This scepticism is generally overcome by the programme implementer through:

Scepticism is often overcome by openly sharing results, information and plans with the authorities

- demonstrating the overwhelming acceptance and support for the HWT programmes by the poor;
- honest and open sharing of results, information and plans with the authorities and soliciting the authorities' advice and involvement in programme implementation and expansion;
- showing support for the technologies and approaches by knowledgeable and respected national and international institutions.

Plans forward

All of the organizations are confident that they can meet these challenges, and each has significant plans for the future. Agua Viva's plans are to triple its current output and install 60,000 filters in total.

SAPWI's programmes include a joint effort with Rotary District 7980 in southern Connecticut to collect money at weekly Rotary meetings to finance over 1,000 filters for 411 schools and 120,000 children in the Kolar District. The organization is also expanding the programme into Bangalore, India. It obtained financing for the Rotary District Governor in Bangalore to create a similar programme for schools in the area involving 500 filters. SAPWI makes itself available for groups interested in clean water and gives many presentations, promoting the biosand filter and the Adopt-A-Village Partnership programme.

CWH states:

We have become a leader in Haiti and have made it a goal to pass our knowledge on to others that are starting projects so that they might have a faster start up time and eliminate some of the problems that we encountered. We set a goal of 100 filters installed every month and are close to reaching that target consistently.

Koshish's long-term objective is to cover the whole population of Punjab with HWT. Koshish states,

Forty districts out of the 110 districts of Pakistan suffer acute problems with water supply and/or quality. We need to reach all of them. We will concentrate on the villages in our area. At the same time, we will train civil society organizations working in other areas to disseminate the technology and reach the other districts. We also plan to investigate how to start dissemination through entrepreneurs constructing and installing filters.

ASD's ultimate goal is to be a model of financial independence to the Water PODS it mentors by being financially sustainable itself. ASD also plans to provide additional training and mentoring in rainwater harvesting, integrated watershed management, spring development, pump repair, and emergency preparedness for natural disasters so that communities can continue to develop sustainable water and sanitation solutions, after their programme is completed.

CAWST will support all of these organizations in their plans. CAWST currently provides 371 organizations in 49 countries with services in technical consulting and training and acts as a global centre of expertise in water and sanitation for the poor. In 2008, 40 per cent of CAWST's International Services resources will be directed to the development of Centres of Expertise such as ASD in five countries: India, Nepal, Zambia, the Philippines and Haiti.

Koshish aims to encourage entrepreneurs to construct and install filters

Conclusions

These activities, results and plans all started with a simple four-day course on biosand filter implementation by CAWST, followed by the open source distribution of training programmes and materials that enabled good-quality project implementation at the community level. This provided the catalyst for the organizations involved to get started, seek out required funding, and to overcome initial challenges on many levels. The knowledge acted as the foundation for innovation (e.g. CWH developed a lighter biosand filter which is now the standard worldwide), and continuous technical and training support has enabled them to scale up. Not only are these organizations involved in implementing biosand filter projects and offering training programmes, they are also actively involved in supporting other civil society and government organizations that wish to do the same.

These activities and plans all started with a simple four-day course on the biosand filter
