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THE FUTURE OF WATER, SANITATION AND HYGIENE:
INNOVATION, ADAPTATION AND ENGAGEMENT IN A CHANGING WORLD

Affordable water technologies as a key to reach the base of the pyramid

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Innovations have drastically reduced cost and increased sustainability of many water and sanitation technologies. New Smart Water Solutions are simple, affordable and available. They can be produced and/or sold by the local private sector so income is generated and spare parts are available resulting in a "**profit-based sustainability**". Water quality can be improved with new household water treatment options at costs of 0.1 -0.5 US$/person/year. Water quantity can increase with new rainwater harvesting, well drilling technologies and 100 US$ hand pumps. In East Africa these hand pumps are providing water for 20 families irrigating crops that feed 80 people all year round. With large scale capacity building on new affordable technologies the local private sector will be stimulated and more families at the Base of the Pyramid could increase health, produce food production and increase income.*

Smart Water Solutions

Smart Water Solutions, also called Smart techs, are innovative water and sanitation technologies. An example of a Smart Tech is the **rope pump**, an ancient technology that, with new materials and designs, now is a very effective and low cost pump option*. After developments in Nicaragua there now are 100,000 rope pumps worldwide used by 4 million people of whom 1.5 million in Africa. The result of the shift from imported piston pumps to locally produced rope pumps is that the rural water supply in Nicaragua increased three times faster than countries using conventional piston pumps. The number of people in Zimbabwe, Malawi, Zambia, Tanzania and Mozambique that have water with locally produced rope pumps is now 2 million and may increase to 20 million by the year 2015. Rope pumps can be used in wells and boreholes to 35 m deep, are produced with local materials by local blacksmiths and much cheaper than piston pumps. The main asset however is that they are easier to repair because of their simplicity (no black box). If properly produced and installed, over 90% stay working even many years after installation.* Other new Smart techs are:

1. **Well recharge and Tube recharge:** Options that can store 10 to 100 m3 of rainwater in groundwater layers. Families themselves can install them Cost; 2 – 5 US$
2. **Underlining.** A masonry technology to avoid collapsing of wells in sandy soils.
3. **Well fan**; A manual well fan that supplies fresh air to well diggers at the bottom of the well.
4. **Rota sludge, Emas drilling** and **Baptist drilling.** Manual drilling options for compact clay and semi-hard ground layers to 50 and 80 meters deep.. Cost 3–10US$/meter (incl. casing)
5. **Rope pumps** 6 Models. Hand and pedal powered for drinking water and domestic use. Motor, wind or animal powered models for irrigation.
6. **Blue pump;** An new piston pump that can pump from 100 m deep and can supply up to 2000 people per day. It is reliable, sturdy extreme low maintenance cost.
7. **Wire cement tanks, Belanta tanks.** to collect rooftop or ground runoff water. They use wire instead of round bar and materials like bricks, bamboo, cloth or adobe blocks. The cost is 30% less than Ferro cement tanks. Volumes 0.5 to 60 m3. Material 1 bag of cement / m3
8. **Easy drip;** Drip systems using lay flat hoses with micro tubes or prepunched holes for laterals and local polypipe for the main. Cost 10US$ per 100 m2

9. **Filtron filter** A pot-shaped ceramic filter promoted by Potters for Peace. It eliminates turbidity and bacteria and now is produced in 20 countries. Cost;10 -25 US$*****
10. **Siphon filters**. A small very effective water filter that produce 60-80 liters of safe drinking water per day, with a life time of 7000 liters. Cost per filter; 10 - 14 US$.
11. **Silver bars.** Silver impregnated ceramic bars that avoid recontamination of water in storage tanks and eliminates bacteria. Cost 1- 2 US$/year. (in test phase)
12. **Watasol.** Local chlorine production. Cost 0.5 – 2 US4 / yr / family. Other low cost disinfection options for households are **Aguatabs**, **Twin oxide** and **Silverdyne**
13. **Petrifilm, Colilert, Hach** Simple options for testing of harmful bacteria
14. **UD latrine slabs.** Latrine with a Urine Diversion to be used as fertilizer (Phosphate). The urine of a family can supply phosphate for production of their own food. Cost 10 US$

Effects of Smart Techs

In Tanzania small communities and schools have water supply with hand drilled boreholes with a rope pump. The shift from machine drilling to hand drilling and from imported piston pumps to locally produced rope pumps reduced the cost of water points in south Tanzania from 3000 US$ to 600 US$. Pumps are installed since 2004 and some 90% are working. Users do the maintenance.* In Bolivia over 20.000 family wells are drilled with the Emas or Baptist method. Total cost of the well + a PVC pump (average 30m deep) is 100 to 400 US$. In Zambia small farmers get a loan for a drilled or dug well and a rope pump. Some produce tomatoes for the local market and 10 neighbouring families get water for domestic use. Loans of 400 US$ are paid back in 6 months. Over 900 systems installed in the last 3 years. In Zimbabwe 8800 Siphon filters were disseminated during the 2009 Cholera outbreak. None of the families that used the filter did have cholera. In Malawi the so called Elephant toilets with urine diversion are introduced. The urine is used as fertiliser for the production of vegetables. In Mozambique the **Tippy Tap** is disseminated via schools and children learn about hygiene and hand washing. Children inform their parents about the importance of hygiene and the existence of new technologies. Evaluations of EU funded projects indicate that a **rope pump** provides water for 20 families and **produce food** for 80 people all year round.

Water quality can be improved with conventional Household Water Treatment (HWT) options like boiling and chlorination but also with new disinfection and filter options. Options as Waterguard, Aguatabs or Silver bars eliminate harmful bacteria. Options as Life straw family, pot filters or Siphon filters eliminate both turbidity and harmful bacteria A one time investment in a 10 US$ water filter is often earned back in 3 - 6 months because of savings in medicines and time. If water is contaminated with chemicals like arsenic, HWTs can be combined with rainwater harvesting.

Water quantity can be increased with storing rainwater in the ground (3R) that cost less than 0.1 US$ per m3 or storage tanks that cost 1 bag of cement per m3. Hand dug wells or manual drilled boreholes can be combined with locally produced hand pumps with cost starting from 50 US$ / system.

Business development

Options like Piston pumps, Plations and Siphon water filters need to be imported in most countries. Options like pot filters, hand drilling, Emas en rope pumps can be produced and sold by the local private sector generating incomes and creating business development. Options like SODIS, underlining, Tube recharge, UD latrine slabs etc, can (after training) be made by communities and families themselves.

If Smart Techs are so good, why aren't they used widely ?

Some mayor reasons are:

- **Lack of awareness.** Organizations and local and national governments are not informed about new options or think they are not proven so do not include them in development plans. It takes publicity and demonstration in real situations to make stakeholders aware of what is available and adequate in their situation. There are also wrong assumptions about "Appropriate Technologies" being "stone age" solutions. For example people remember the rope pump from 35 years ago when it was introduced in Africa, as a low lift pump fit for family wells. Sometimes the rope pump does not count as an improved water source since it is an "open" pump and the well can be contaminated. Experiences indicate that both assumptions are not correct.
- **Simple is not easy.** One lesson learned is that to make WASH facilities sustainable, a very important condition is **repairability**. Whatever technology is installed, the users should be able to manage the maintenance. Options such as rope pumps seem simple but many errors are being made in the construction and installation. In technology "the devil is in the detail". For instance a small error in a bushing can cause

the pump handle to break within two months. If it is made and maintained right, a rope pump bushing can last for 20 years as proven in Nicaragua.

- **Lack of training facilities and financial structures.** For successful dissemination of Smart Techs, training is needed in technology but also in marketing and financial aspects. Training is needed in production, installation, quality control, maintenance management, monitoring and the creation of sustainable supply chains for spare parts. Regarding financial aspects, clients need to have access to small loans of 100 to 500 US$ to purchase Smart Techs.

Conclusions

- Safe drinking water and water for irrigation is essential to reach at least Millennium Developments Goals. Publications indicate benefits of $5-28 per $1 invested. (SIWI/ WHO 2007) A publication of the UN University (2008) indicates "*No other single intervention is more likely to have a significant impact on global poverty than the provision of safe water."*
- Decentralized and affordable solutions are essential to reach the poorest
- With new HWTs options, people can at least have water that is safe to drink would reduce cost at family level but also reduce health budgets of governments. 50% of hospital beds are occupied by patients with water borne diseases!!
- There is no silver bullet to solve all water problems; but a wide-scale dissemination of new affordable technologies has the enormous potential to increase health, reduce rural poverty and increase food security for the BOP.

Suggestions

- Increase awareness on all levels on the huge positive economic impact of water and sanitation.
- Increase awareness on new options through the dissemination of publications for instance the booklets of the Smart Series, AKVO the Wikipedia for water and sanitation, Water channel. RWSN network publications on self supply, the MUS network and others.
- Before installing new WASH facilities, investigate low cost options. For instance before starting a machine drilled borehole, investigate if hand drilling is an option.
- Improve existing or create new Smart centers that demonstrate conventional and new low cost options that are adequate for that area and have capacity to train local NGOs and private sector in production, maintenance and marketing, via hands on and practical training.

Photograph 1. Tanzania. Manual drilling of a 40 m deep borehole with the Baptist drilling technique

Photograph 2. Tube recharge system made by this family. Installed near a hand dug well

Photograph 3. Mozambique. Taking Water from an open shallow well

Photograph 4. A new well is made covered with cement and a rope pump. Total cost ca 600 US$

Photograph 5. Mazambuka. Zambia. A Rope pump for domestic use and irrigation. Cost of well, lining, cement cover& rope pump 250 US$

Photograph 6. Construction of a latrine slab with urine diversion

Photograph 7. A Tulip siphon filter. Filter capacity 80 l/ day Life time of element 3000- 7000 litres
Retail price 10-14 US$

Photograph 8. Smart center in Tanzania. African trainers are trained in production and maintenance of 15 different technologies

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Information on projects, evaluations etc www.connectinternational.nl

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