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According to the United Nations (2006), 1.1 billion people still lack access to improved water sources, and an estimated 2.2 million people die each year from water-borne diseases. This water crisis disproportionately impacts women and girls in developing countries; they must sacrifice educational pursuits to spend their days collecting water for their families. Whether it is hiking miles before sunrise or waiting in long lines at a community water kiosk, women spend countless hours acquiring water to meet the daily needs of the family. Estimates from the UN Water and Sanitation Task Force indicate "over 40 billion mostly woman-hours per year are spent fetching water in Sub-Saharan Africa" (Ray 2007). Effective solutions to address the current water crisis must address the fundamental role of gender in global water issues.

When investments are made to improve access to clean water, women spend less time collecting water and more time participating in income generating activities (IFAD 2011). Exciting advancements in water gathering and data technology have led to new innovations. This paper highlights selected innovative water solutions in the field today and the continued need for innovation, investment and action. Addressing the global water crisis requires a variety of efforts ranging from basic, low-tech, community based solutions to large capital-intensive infrastructure investments.

Designed in 2011, the backpacks were distributed in urban, pre-urban and rural communities throughout Haiti to test their effectiveness, durability and comfort. *Photo Credit: Greif Company*

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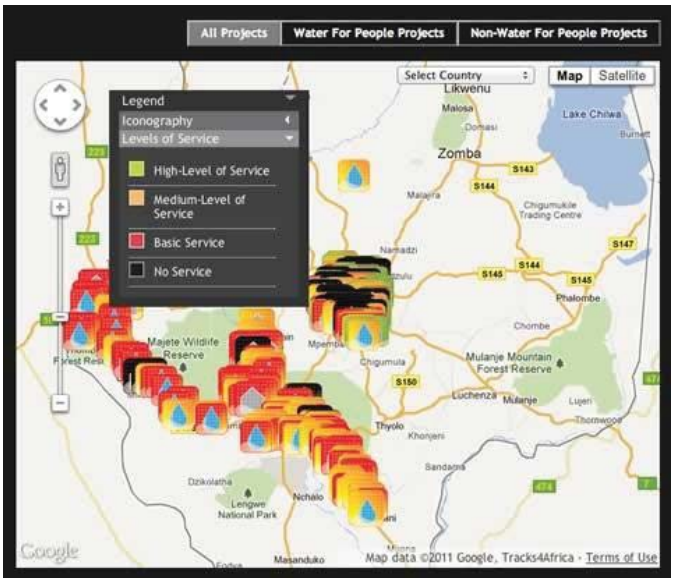
Throughout many countries, the main method of collecting water involves the use of jerry cans. A standard five-gallon jerry-can weighs about 40 pounds when full (Charity Water 2011). Often jerry cans are carried by women on their head which yields painful physical side effects and leads to long-term damage of the spine, neck and back (Ray 2007.) As the largest producer of jerry cans, Greif Company identified an opportunity to help alleviate the burden faced by women and girls in their day-to-day water gathering responsibilities. Greif has adopted a simple but innovative approach to water collection efforts with its "Buckets to Backpacks" initiative that has yielded an unexpected public health benefit (Greif 2012). This new water collection device, known as "WaterWear," is essentially a backpack for water, replacing the need for jerry-cans. According to Grief, while WaterWear enables the user to carry the same amount of water as an average jerry can, it is both seven times lighter and smaller. This substantial reduction in weight alleviates the physical side effects arising from carrying heavy loads of water balanced on the head. Through the use of Water Wear, physical effects including long-term chronic pain in the neck and knees can be alleviated due to the redistribution of weight (Greif 2012).
This innovation has implications for gender roles as well. Initial observations by behavioral psychologists in those communities where the innovation has been introduced indicate that men find the WaterWear backpack style more fashionable, making them more likely to participate in the water collection process (Greif 2012). According to Scott Griffin, WaterWear project manager, "the most meaningful measure of their success was the enthusiasm with which testers embraced and used those backpacks" (Greif 2012).

A more complex technological innovation developed by students at University of California-Berkeley and the Stanford School of Business, "NextDrop," utilizes mobile phone technology to capture and disseminate water availability data to communities across India. NextDrop was inspired by NextBus, which is a mobile application used in California that notifies users when the next bus is expected to arrive (NextDrop 2012). In many urban areas throughout India, women wait for hours at water pumps and kiosks to collect water from an unreliable system plagued with daily maintenance problems. The goal of this project is to use crowd-sourcing and social applications to create a network that allows users to know when water will be delivered, thus eliminating time wasted waiting. The application relies on local utility employees to contact an interactive voice response system via mobile phone to let communities know when they open feeder valves which require manual opening to enable local water delivery (NextDrop 2012). In an effort to ensure accuracy, the interactive voice response system will contact users randomly to verify the information they received from utility employees was accurate (NextDrop 2012). This innovation includes

a feedback loop and user ownership that is essential to the success of water projects. By contacting residents to verify the success of the NextDrop system, transparency and efficiency reinforces the success of this innovation. Given the explosive growth of mobile phone ownership across the globe, Next Drop's technology could prove to be transformative in promoting access to water throughout developing countries with the communication of real time water distribution information. This innovation allows women to use their time formerly spent waiting for water collection for other pursuits.



The power of linking mobile phone technology to water data is also recognized by the organization Water for People (WFP). They created a new application that combines mobile phone technology and Google Earth GIS mapping -- Field Level Operations Watch (FLOW). FLOW enables the organization to constantly track the progress of all of its water projects throughout the world. Using smart phone technology and Google Earth software, field workers, volunteers and WFP partners collect data from thousands of water points. This information is broadcasted on WFP's online global map which is publically available. This system not only provides up-to-date information to Water for People, but also relays this data to field personnel and WFP's local partners. The photo above is a screen shot of the FLOW technology from Water for People.

Keri Kugler, WFP's Senior Manager for Programmatic Data, notes that this development will significantly impact the success of their projects. She says:

> *"This isn't just useful for involving the whole community in monitoring and contributing to Water for People's work. When you have information, you can challenge what you're being told. Records on the state of water and sanitation access provide proof that cannot be ignored to governments and agencies who otherwise might be unaccountable for their people's wellbeing. It's an instant feedback tool, for people who need it most."* (Banks 2012)

This technology has the ability to transform the water industry, but also empower local communities by providing real-time data on the status of water projects and subsequent availability. It also helps counterbalance the phenomenon of broken-down water systems that are not fixed due to lack of follow-up, monitoring and capacity-building.

Grundfos, a water engineering company based in Denmark, also utilizes mobile phone technology in its "LifeLink" initiative (Kvistgaard 2009). This program combines mobile phone technology, mobile banking and solar powered water pumps to deliver water to some of the most remote areas throughout Africa and Southeast Asia. The design of the water system is tailored to individual community needs based on geography, access to a water source, and community layout. LifeLink allows rural villagers to access and pay for water using "water credits," which combines mobile banking and local financial institutions (Kvistgaard 2009). These minimal payments are then used for pump maintenance and operational costs. LifeLink not only installs and maintains the solar pumps, it assists the benefitted community in the formation of a water authority to manage and oversee payment. The success of this project requires the formation of close partnerships between LifeLink and the local community, as well as local government and local banks.

While the aforementioned initiatives represent creative and successful approaches to the global water crisis, there are equally valuable lessons to be learned by assessing failed strategies as well. "Play Pump" is a failed water project that provides just such an example. This failure envisioned the integration of a hand pump with a merry-go-round. As originally conceived, water would be pumped to the surface by the spinning merry-go-round propelled by children at play. However, one Play Pump cost $14,000 and required specialized skills to maintain (UNICEF 2007). Despite the high price, the idea quickly gained support from the World Bank, USAID and other NGOs garnering millions in financial support. AidWatch called the PlayPump "a donor-pleasing top-down solution that simply didn't fit many target communities" (Freschi 2010). Play Pump also garnered criticism due to concerns about child labor. An aid worker in Malawi summed it up best, "Each time I've visited a Play Pump, I've always found the same scene: a group of women and children struggling to spin it by hand so they can draw

Children trying to spin the PlayPump as women wait to collect the water.
Photo credit: UNICEF 2007

water" (Freschi 2010).

As evidenced in the case of Play Pump, water design solutions should be tailored to the particular needs of each community. This is best accomplished through bottom-up approaches both in the design and execution of a water project. This sentiment is expressed in the United Nations 2006 World Water Report, "Local organizations and communities that are direct water users have strong local hydrological and socio-economic knowledge and also have most at stake in water decisions" (United Nations 2006). Women hold much of this local knowledge from their roles as caretakers, water fetchers and/or farmers throughout much of the developing world. Therefore it is critical to include women in innovation discussions as well as every step of water project planning and implementation.

These innovation processes and technological advances, such as the WaterWear backpack can contribute to gender equality in the collection of water. NextDrop and Water For People's FLOW technologies highlight the fact that mobile phone technology has been and will continue to be a force for innovation. These solutions not only yielded health benefits for communities by providing access to clean water, but also served as a vehicle for economic empowerment by providing women with greater opportunities for upward mobility. By spending less time collecting water, women can pursue an education, income-generating activities and play a larger role in the innovation process.

It is important to emphasize that technological innovations alone will not ensure universal access to potable water in the absence of political will, creative financing mechanisms, and community involvement. Successful water innovations will target specific communities while promoting the active engagement of local stakeholders, including women, in every step of the process -- from the inception of the idea to its final execution. We must continue to invest and promote innovation and advancement in the water industry, as it will not only help to alleviate the world's water crisis, but also serve as a catalyst for further global economic development and gender equality.

Photo credit McKay Savage

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