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# Measuring Sustainability

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# Measuring Sustainability

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The author tests remote monitoring equipment for cookstoves in the Portland State University SWEETLab. This inexpensive technology could dramatically increase the accountability and effectiveness of development projects worldwide.

The World Health Organization estimates that 884 million people do not have access to safe sources of drinking water. Meanwhile, about half of the world's population continues to use unsustainable, biomass-based energy sources for indoor fuel, leading to extensive deforestation, harmful indoor air emissions, and in many cases upper respiratory disease and high commodity costs for impoverished families. Exacerbating these problems are the international effects of climate change, expected to significantly impact developing countries by changing water and energy quality and availability.

International development organizations work tirelessly to address these challenges. However, many efforts struggle with achieving long-term sustainability; many well-intentioned programs fail when their ambition is not matched by the financial sustainability and objective performance of data collection. Our team is studying these gaps, and we have proposed several concepts that seek to provide built-in accountability and sustainability mechanisms.

## Where Is the Accountability?

The majority of international development programs self-report project outcomes. Evaluations by outside experts are expensive and infrequent. When programs self-report, they tend to show success, even while broader surveys indicate ongoing challenges in the sector. As a result, the often rural, impoverished citizens who use these programs continue to suffer from significant public health and livelihood challenges, even as their communities are advertised to donors as success stories.[1]

Many development organizations are now recognizing the problem: a lack of objective data on program performance is contributing to a subsequent lack of accountability and misappropriation of resources. For example, in the water sector, the World Health Organization and UNICEF Joint Monitoring Program (JMP) for Water Supply and Sanitation recently reported on their Rapid Assessment of Drinking Water Quality program, and stated that "reporting use is based on household surveys," and that the global monitoring of drinking-water quality is "complex and it is expensive" at approximately US$50 per sample. The JMP stated that "data comparability is a big challenge," and there is a "need for a wider and integrated approach to link to the national monitoring systems."[2]

## Is There a Way to Help Aid Organizations Achieve Success?

Electronic sensors can help development organizations remotely monitor their own performances, similar to many engineered water and energy projects around the world. Organizations can use data to understand programmatic, social, economic, and seasonal changes that may influence the quality of a program. In addition, they can study behavioral patterns to better understand how and when the water and energy technologies are being used. It is also possible to evaluate how the sponsors of the intervention respond to the data and adjust their implementation programs.

In order to help aid organizations improve their evaluation methods, our research team has engineered a twist on data collection for international development—automated, remote monitoring. The Sustainable Water, Energy, and Environmental Technologies Laboratory (SWEETLab) at Portland State University is working with partners to demonstrate this concept across several applications and countries. This concept can provide objective, qualitative, and continuous operational data on the usage and performance of programs across a range of sectors and communities, thereby dramatically improving accountability and sustainability of water, sanitation, and energy programs around the world.

Our technology relies on a low-power, low-profile, remotely accessible instrumented monitoring system designed for developing communities around the world. The SWEETSense combines commercially available front-end sensors selected for specific applications, including water treatment, cookstove use, sanitation, infrastructure, or other applications, with a comparator circuit board that samples these sensors at a reasonably high rate. The comparator boards monitor the sensors for trigger threshold events that start and end periodic local data logging. One or more times per day, the comparator board relays logged data events either to another parent board or directly to the Internet via Wi-Fi. This second parent board can then relay the data to the Internet via Wi-Fi or GSM cellular phone technology.[3]

Data processing is enabled on an Internet-based software program, SWEETData, where the primary algorithms are stored. The Internet-based program also contains manually and automatically updated calibration files that are periodically and automatically relayed back to the local sensor boards. The innovations in this invention include the processes used to enable long-duration operation with high-resolution data logging, while operating on simple, small batteries; the use of customized and remotely updatable threshold trigger events; and the distributed data-processing load between the local sensors and the Internet.


UNICEF

Improved hygiene is a major goal of international development. The SWEETLab has partnered with Mercy Corps to measure usage trends of latrines and hand washing stations, allowing Mercy Corps to improve program implementation and share objective progress with partners, funders, and aid recipients.

Once the technology interventions are instrumented with the SWEETSense package, surveys of families and communities who have monitoring devices will be conducted to determine differences between data sets. Specifically, usage and performance data will be recorded to gain insight into the operational effectiveness of the interventions. Additionally, secondary data specific to users of the system, such as water treatment and cooking habits, number of people in the family, and economic status will be collected to gain additional insight into the performance and usage data. Monitoring data will be disseminated to partner organizations and their response analyzed.

The SWEETLab is currently demonstrating this concept in water, sanitation, household-energy, and rural-infrastructure programs with diverse partners (including Mercy Corps, the Lemelson Foundation, Gates Foundation grantees, and DelAgua) in several countries (including Indonesia, Haiti, India, and Rwanda).

With Mercy Corps, for example, we have implemented the instrumentation for a statistically significant sample of hand washing stations and latrines in areas directly adjoining the city of Jakarta, Indonesia. By incorporating our technology, Mercy Corps is now able to identify usage trends between latrines and hand washing stations, seasonal differences, impact of events, and strengths, weaknesses, and differences that will allow Mercy Corps to improve program implementation. These data are publicly available, and Mercy Corps has been able to show partners, funders, and recipients the direct impact of its efforts.

### Carbon Financing

In addition to improved accountability through objective data collection, organizations need mechanisms to sustain their programs and reduce reliance on short-term grant funding. Linking climate change mitigation mechanisms (like energy efficiency) with drinking water treatment and in-home energy technologies in developing countries may yield financially sustainable and accountable programs. One of our projects currently in development has already resulted in access to water treatment for millions of residents in rural Kenya. This model decreases greenhouse gas emissions while providing the continuous community engagement coupled with health education and monitoring needed to achieve sustainable improvements in public health.

The carbon-finance markets created by the United Nations Framework Convention on Climate Change exist to enable the reduction of greenhouse gas emissions worldwide through economic incentives, while allowing cleaner economic development to take place. Each emission-reduction credit represents one ton of carbon dioxide not emitted into the atmosphere. The carbon credits can then be traded in the marketplace, and are mainly sold to carbon-credit buyers who want to reduce their carbon footprint or improve their environmental stewardship.

However, carbon markets have not yet been well utilized for humanitarian technologies in the least developed countries, particularly in Africa. For example, the United Nations Clean Development Mechanism is a multibillion-dollar-a-year industry, yet less than 2 percent of that benefits African nations.

A social enterprise I cofounded, Manna Energy Limited, has worked with the disease control textile company Vestergaard Frandsen to conceive and develop the first-ever carbon-financed water treatment program, now treating water for over four million people in rural Kenya.[4] Meanwhile, Manna developed and registered the first-ever United Nations carbon credit for a water treatment program, now operating in Rwanda.

We worked with Vestergaard Frandsen to develop a program resulting in the successful distribution of almost 900,000 LifeStraw Family water-treatment systems in rural Kenya. The project sustains its presence in the communities through the sale of the voluntary carbon credits.


*DelAgua Health and Development Programs*

With the help of DelAgua Health, local community health workers in Rwanda train residents on stoves and water filters. This 600,000-household project is financed in part through carbon credits and will include the application of the SWEETSense monitoring program.

We are now working with DelAgua to develop a 600,000-household cookstove and water filter program in Rwanda. DelAgua will own and finance the program and be repaid through carbon credit revenue.[5]

These projects treat contaminated drinking water and reduce cooking fuel use. With the assistance of carbon finance, these projects can be economically sustainable and provide a significant improvement in public health. These projects directly address several of the United Nations Millennium Development Goals, including halving, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation; integrating the principles of sustainable development into country policies and programs and reversing the loss of environmental resources; reducing child mortality; improving maternal health; combating disease; ensuring environmental sustainability; and developing a global partnership for development.

These projects combine political and economic climate change mitigation and adaption mechanisms with water-quality efforts for developing communities. However, the most critical element of these programs is the accountability built through data collection and analysis of water treatment effectiveness.

In these projects, ongoing monitoring is required by the registration authorities; carbon credits are not issued unless it can be demonstrated and independently verified that the water treatment systems are both functional and used by the target communities. The project only starts on the day when water treatment is made available. There is a direct financial incentive for the project developers to invest significant resources in ongoing operation, maintenance, and education to ensure success of the program and guarantee carbon revenue streams. This breeds measurable sustainability, the standard all programs seek to achieve. Directly linking further funding to the operational success of water treatment programs ensures a higher likelihood of continued success.

However, these programs continue to be challenged by the difficulty of monitoring the performance and adoption of the implemented technologies. The carbon-finance markets tend to be wary of programs conducted in developing countries, primarily because it has been challenging to address concerns of data integrity when reporting claimed emissions reductions. The instrumentation and data collection methods proposed here can address this concern. The use of effective instruments by projects in developing countries can provide third-party auditors with data reliability and integrity. It truly allows them to “read the meter” to know how well a project is performing and to validate actual emissions reductions achieved. This breakthrough will allow investors to monitor the value of their holdings and gain confidence in implementing agencies.

We are demonstrating this with DelAgua through the installation of sensors in a statistically significant sample of the 600,000 households, to measure adoption and performance of the water filters and cookstoves. We are hopeful that instrumentation may soon prove to be an effective monitoring mechanism for global development programs.

## References


1. Gibson, CC, Anderson, K, Ostrom, E & Shivakumar, S. *The Samaritan’s Dilemma: The Political Economy of Development* (Oxford University Press, Oxford, 2005).
2. Properzi, F. *Rapid Assessment of Drinking Water Quality (RADWQ) WHO and UNICEF Joint Monitoring Program (JMP) for Water Supply and Sanitation* (World Health Organization, Geneva, 2010).
3. Thomas, E, Zumr, Z, Barstow, C & Linden, K. Proving Sustainability: The International Development Monitoring Initiative. IEEE Global Health and Technology Conference, 2011.
4. Carbon for Water: LifeStraw Family Campaign in Kenya [online]. www.carbonforwater.com.
5. DelAgua Health [online] www.delaguahealth.com