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Clear Necessity

Addressing Global Water and Sanitation Challenges

ENTREPRENEURIAL SOLUTIONS TO GLOBAL CHALLENGES

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Lead Essays

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Organization of the Journal

Each issue of *Innovations* consists of four sections:

1. Lead essay. An authoritative figure addresses an issue relating to innovation, emphasizing interactions between technology and governance in a global context.

2. Cases authored by innovators. Case narratives of innovations are authored either by, or in collaboration with, the innovators themselves. Each includes discussion of motivations, challenges, strategies, outcomes, and unintended consequences. Following each case narrative, we present commentary by an academic discussant. The discussant highlights the aspects of the innovation that are analytically most interesting, have the most significant implications for policy, and/or best illustrate reciprocal relationships between technology and governance.

3. Analysis. Accessible, policy-relevant research articles emphasize links between practice and policy—alternately, micro and macro scales of analysis. The development of meaningful indicators of the impact of innovations is an area of editorial emphasis.

4. Perspectives on policy. Analyses of innovations by large scale public actors—national governments and transnational organizations—address both success and failure of policy, informed by both empirical evidence and the experience of policy innovators. The development of improved modes of governance to facilitate and support innovations is an area of editorial focus.

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Allerd Stikker and Dorota Juchniewicz

"Water, Water Everywhere..."

Innovations to Improve Global Availability of Clean Water and Sanitation

The global water situation, which has received increasing public attention during the last decade, is one of the most serious issues confronting the world today. However, despite numerous efforts to improve the situation, billions of people still lack access to clean drinking water and to sufficient water for basic sanitation. Moreover, around 10,000 people, about half of them young children, die every day from illnesses related to unclean water. To address this problem, the UN included among the Millennium Development Goals (MDGs) the objective of halving the number of people lacking adequate access to clean water by 2015.

In 2000, 1.2 billion people lacked access to drinking water, while 2.4 billion lacked access to water for basic sanitation. The estimated figures for 2009 are 900 million and 2.5 billion, respectively, indicating that we are not on target to meet the MDGs. Furthermore, if we remove the relatively favorable performance of India and China, we are left with an even direr picture for Africa and the rest of Asia—this despite the fact that we are more than halfway to our goal year of 2015.

To alleviate this alarming situation, the global development community clearly needs to invest in finding alternative and innovative solutions to improve the water supply for the countries with the most urgent need. The importance of such an investment becomes particularly apparent when we look at the rate of return: every five U.S. dollars invested in improving the water supply in rural areas in developing countries yields thirty to forty U.S. dollars by way of lower medical costs, income-generating activities for women, smaller losses in the production of goods, and more children attending school, especially girls. Some solutions will be presented in this paper, but we first examine some basic facts about the issue of water scarcity.

Water is a renewable resource, yet we are amazed to note that in articles, speeches, and discussions about water, many people, including policymakers and politicians, state that only 1.5 percent of the water on earth is fresh water, most of

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it locked in under ice caps, so that we have to be extremely careful with its use. The reality is that more than 100,000 cubic kilometers (km^3) of fresh water falls on the continents of the earth every year. This vast resource is the result of what is known as the hydro cycle: solar energy evaporates salt water from the seas and oceans, which then falls to the ground as precipitation. Clearly, not all of this fresh water is accessible to humans. In the absence of human habitation, a major example being the Amazon, a substantial proportion of the water runs directly back through rivers to the sea. A great deal also is lost through evaporation and transpiration. Nevertheless, estimates are that at least 12,000 or more km^3 of fresh water is accessible to humans every year.

The main uses of water are for agriculture, drinking and sanitation, and industry. Of these, agriculture is by far the largest user (75 percent in the developed world and up to 90 percent in the developing world). Agriculture is responsible for most of the reduction in the world's water tables, for major rivers running dry, and for increasingly saline groundwater. Even so, our present withdrawal of water amounts to only about 5,000 km^3, far less than what is available. We clearly have no scarcity of fresh water if we look at it from a global perspective. However, substantial differences in geography, climate, seasons, and population density lead to severe scarcity in many regions in the world. So, although we have no scarcity globally, regionally and locally we do, the worst situation being in many developing countries. Whereas countries in the North can solve scarcity problems because they have the technology, financial resources, and professional capabilities to do so, those in the South are less fortunate.

Both developed and developing countries, however, will benefit from ongoing innovation in the water industry. In the technological sphere, for example, the conversion of dirty, brackish, and salt water into fresh water using economically and ecologically acceptable techniques is particularly important, as is the design of appropriate small-scale, stand-alone, and affordable technologies for providing safe water at the community level in rural and peri-urban areas in developing countries. There are also gains to be had from social, financial, institutional, and educational innovation, and from innovative communication methods that facilitate transfer of knowledge from the North to the South. We will elaborate on these innovations below.

SOCIAL AND FINANCIAL INNOVATION

In the past decades, many attempts have been made to improve access to clean drinking water and sanitation facilities in rural areas of developing countries. The lessons learned from these attempts are that the improvements should be appropriate, meaning that they should fit in with the needs, culture, and conditions prevailing locally, and that to ensure quality and sustainable access, they should be community based.

Most of the aid programs run by multinational agencies such as UNICEF, the World Bank, and the United Nations Development Programme (UNDP), and by

international or local NGOs, have been and continue to be based on donations and charity, making use of the conventional techniques available and economic and operational ownership by the household or community. Although community ownership has been successfully promoted, there is now an innovative new approach that focuses on entrepreneurial ownership.

The idea is that when entrepreneurs are empowered to own water-service facilities and sell water to the community, the associated income-generating activities will initially benefit the economic and social environment in the local community, and eventually the wider region and the nation as a whole. Entrepreneurial ownership will deliver the required maintenance, efficiency, and water quality and provide sustainable service. The water entrepreneurs can also be expected to set up side businesses from the kiosks where they sell water, leading to other local income-generating activities. But the essence of the approach is to motivate local entrepreneurs to take a stake in the supply of safe water.

In order to test the novel idea of entrepreneurial ownership, the Clean Water Foundation (CWF), a U.S.-based not-for-profit organization, initiated a project for Bangladesh. CWF was established by Iqbal Quadir, entrepreneur and founder of MIT's Legatum Center for Development and Entrepreneurship, and a co-editor of this journal, and Allerd Stikker, a water expert and founder of the Dutch Ecological Management Foundation (www.emf.nl), and a co-author of this essay. CWF is dedicated to improving the availability of potable water and to creating income-generating opportunities in developing countries. The organization's first initiative, the village-based Unnoti Station project helps local entrepreneurs establish businesses that provide clean, arsenic-free water for communities in Bangladesh, where as many as 49 million people ingest unsafe levels of arsenic in their water. The scale of the arsenic problem, and the simultaneous lack of working water-treatment options, has generated considerable interest from the international organizations, the scientific community, NGOs, and donors. (See case narrative authored by Abul Hussam, in this issue.) Despite significant efforts and funds directed at finding solutions to this problem, millions of people in Bangladesh (and worldwide) are still exposed daily to dangerous levels of arsenic in their drinking water.

Preparing for the Unnoti Station project, CWF commissioned a study by a Bangladeshi NGO to examine the feasibility of entrepreneurial ownership. At the same time, a technology assessment study was commissioned in the Netherlands and Bangladesh to investigate existing and new technologies in water purification and arsenic removal, with the aim of implementing the most appropriate, effective, affordable, and sustainable method of water purification, including arsenic mitigation, in the entrepreneurial model.

The feasibility study, recently completed in 100 Bangladeshi villages, showed that people in rural villages are willing to pay .07 U.S. cents per liter for clean, arsenic-free water delivered to their home. The study also showed that a good many entrepreneurs are interested in owning water facilities and starting a business. (The result of the technology assessment is described later in this paper.)

Based on the results of the feasibility study and technology assessment, optimal conditions have been formulated for setting up and running the Unnoti Stations. CWF has also designed a tentative financial plan for the entrepreneurial ownership and operation of the stations. Using the results from these studies, this plan assumes that a typical water station will have a capacity of 240 liters per hour, cost a total of $4,200 U.S. to build, and serve 160 households. With users' willingness to pay .07 cents U.S. per liter and a reasonable return for the owner, the stations would require that funding be split approximately 50-50 between donor money and entrepreneurial financing, with the latter part equity and part microfinance. This is a very different model from the prevailing conventional system of 100 percent donor-based aid programs. Introducing entrepreneurship and microfinance into rural water provision is a remarkable innovation in the sector, one that has barely been tested.

Many people fail to realize that technological innovation means not only the production of fancy, self-operating, state-of-the-art devices but also the creation of simple, affordable solutions that can be used efficiently in poor communities.

In 2010, when the results of the feasibility study and technology assessment have been fully evaluated and a realistic cost picture and financing structure have been carefully developed, CWF will launch a pilot project in Bangladesh that includes five installations in selected areas. The carefully chosen entrepreneurs and a formal project-management team based in Bangladesh will work with local partners. If the pilot sites are successful, the project will be extended to eventually cover 10,000 villages in cooperation with local, national, and international partners. The project will be the first of its kind and could develop into an innovative socioeconomic approach to providing clean drinking water in rural communities throughout the developing world.

TECHNOLOGICAL INNOVATION

Providing clean water in developing countries is a challenging task that requires innovative thinking. To be effective, the technology must be efficient, affordable, and easy to operate and maintain. Many people fail to realize that technological innovation means not only the production of fancy, self-operating, state-of-the-art devices but also the creation of simple, affordable solutions that can be used efficiently in poor communities. Recently there have been a great many ideas developed in Bangladesh, which serves as kind of "cradle of innovation" where ideas

have been initiated, further developed, and tested, especially in the area of arsenic removal.

Since the early 1990s, Bangladesh has faced what the World Health Organization (WHO) has called the "largest mass poisoning of a population in history." Forty-nine million people there drink water contaminated with arsenic, far exceeding the WHO guidelines for safe water. Arsenic, which is odorless, colorless, and tasteless, has come to be known as the "silent" killer, as it damages human health in a host of ways, especially after extended exposure

Due to the scale of the problem, not only in Bangladesh but also in many other parts of the world, a tremendous amount of work has been done to find a solution. And yet, no technology has been found that is both affordable and effective in all contaminated areas, leaving millions of people exposed to dangerous arsenic concentrations in their drinking water. However, one recently developed technology offers hope for the millions of Bangladeshis who want access to clean drinking water. But let's start from the beginning.

In recent years, a great deal of research has been conducted to identify novel technologies for removing arsenic, particularly low-cost, low-tech systems that could be applied in rural areas. Many of them, however, are not effective in certain areas of Bangladesh. The groundwater in many places is rich in manganese, and in the south of the country the water is also brackish. This means that the technology must be sophisticated enough to treat several pollutants in a range of water types.

Most of the technologies for arsenic removal are adsorption based and are effectively used in many countries. There are various types of arsenic-adsorbing media, but ferric hydroxide is the most widely used as it satisfies cost-quality criteria. The groundwater in Bangladesh, however, is particularly challenging, as it contains high concentrations of competing agents that exhibit a high affinity to metal oxides, the media typically used in arsenic-adsorption technologies. The biggest concern is phosphates, which have higher affinity to ferric hydroxide than arsenic. The presence of more than one anion (negative ion) can have a significant influence on the efficiency of arsenic removal. Adding either silicate or phosphate has some effect on arsenic removal but, according to Feroze Ahmed, an environmental engineering professor at Bangladesh University of Engineering and Technology, the presence of both silicate and phosphate can reduce the effectiveness of arsenate removal by 39 percent. Given that these conditions require a frequent change of media, which significantly increases both maintenance costs and production of solid waste (a byproduct that has to be properly handled), the adsorption-based technologies fail in certain areas of Bangladesh.

Another type of arsenic-removal technology is based on oxidation. This is usually a very simple, affordable, and efficient solution, but it requires high concentrations of naturally occurring iron that, after proper oxidation, has the affinity to adsorb arsenic. Phosphate and other dissolved components limit the efficiency of these solutions as well, thus impeding their implementation in many areas of Bangladesh.

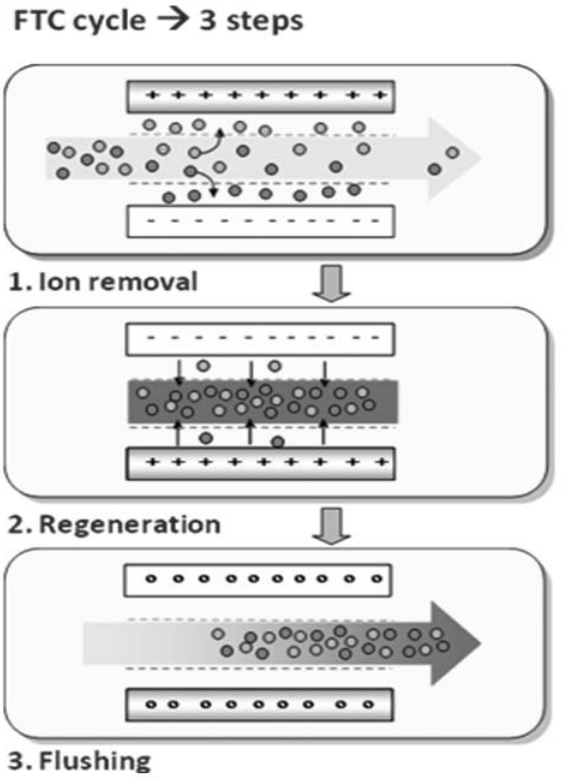

Figure 1. FTC Mode of Action

In addition to arsenic contamination, there is a growing problem with brackish water in Bangladesh and at present no affordable technology for desalination. People living in areas with brackish water have to walk long distances to find clean water, and some have no alternative but to consume the saline water. In view of the complexity of the water chemistry in Bangladesh, a newly developed electro-membrane-based technology known as the Flow Through Capacitor (FTC) opens an avenue of hope for supplying clean water to Bangladeshis living in areas with water rich in various chemical components. FTC is a unique desalination technology for brackish water treatment, and thus far the only one that can eliminate the major contaminants present in the groundwater in Bangladesh. It effectively removes charged dissolved contaminants in a low-voltage (< 2.0 V) electrical field and temporarily stores these ions on high-surface-area electrodes. FTC can deliver high-quality drinking water without requiring maintenance, addition of chemicals, or significant energy input. Since the technology requires little energy and operates under direct rather than alternating current, it is well suited to being powered by solar energy.[1]

The Flow Through Capacitor operates through a process of capacitive or electrostatic adsorption. It means that ions and other small charged particles are attracted to and held on the electrode of opposite charge. A simplified cycle of FTC

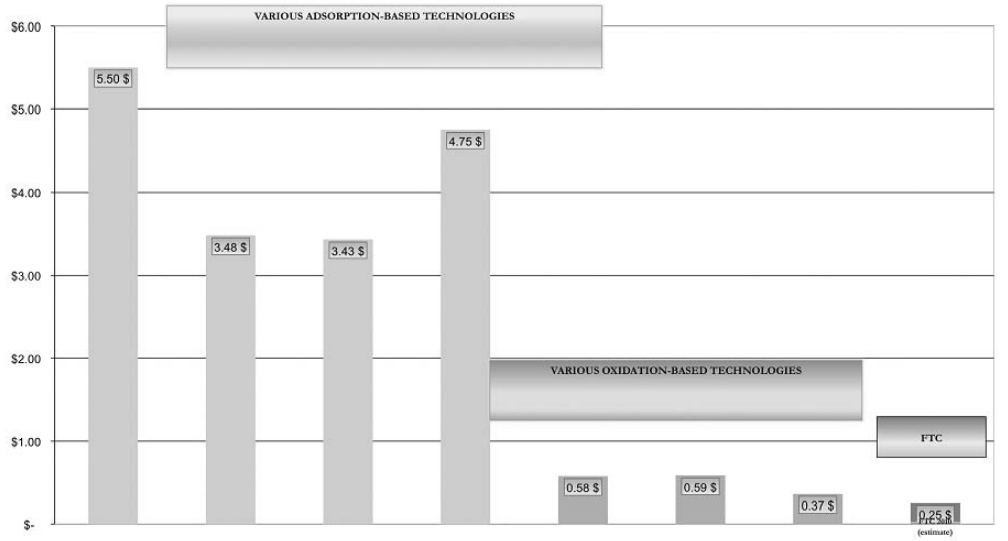

Figure 2. Total Cost of Ownership for Chosen Technologies (the figures are for the production of one m3 of water assuming a 10-year unit lifetime, linear depreciation, and an interest rate of 5 percent).

Note: The TCO for adsorption-based technologies is very high because of the high cost of consumables (cost of the media change), which depends on the water quality.

The figures shown are based on the following conditions:

pH	7.3
Arsenic	436 μg/L
Iron	8 mg/L
Phosphates	2.8 mg/L
Manganese	0.7 mg/L

operation is demonstrated in Figure 1. When ion-rich water enters the cell, it flows between two so-called ion-selective membranes, one for negative ions (anions) and one for positive ions (cations). These membranes are separated by a spacer through which water flows. The ions are attracted to the electrodes of the opposite charge and stored there until the electrodes are full and need to be regenerated. This is achieved by reversing the polarity of the electrodes so that the stored ions move away from them. As a result, the ions become trapped in the flow spacer between the ion-selective membranes. In the final step of the cycle, the FTC cell is flushed with water and the ions are removed in a small-volume waste stream. The concentrate is washed out within minutes after its formation. FTC can operate at both low and high pressure and in a wide range of temperatures, which makes the technology distinctive. It is also characterized by a water-recovery rate as high as 95 percent. Figure 2 provides estimates of the Total Cost of Ownership for the production of one cubic meter of clean water.

The figure shows that FTC is not only technically efficient but also appears to be the most affordable. FTC is an example of an innovative technology that can eliminate various pollutants from the water and produce clean drinking water for a very low price. Being maintenance free as well, it is the optimal technology for developing countries.

COMMUNICATION INNOVATION

Are traditional marketing and communication methods adequate in this day and age? Do they really open up access to the market? Do they fulfill our requirements and expectations? Any organization aiming to promote itself must compete for advertising space, so the main question is, Where do people look for information and inspiration nowadays? In magazines? On television? No. The answer of course is the Internet. The past decade has seen a rapid development of web-based services like Wikipedia, YouTube, eBay, and PayPal. eBay, for instance, is an easy-to-use tool that enables us to trade in all kinds of products with people we have never met. The company currently has nearly 100 million users, and revenue on the website is $60 billion annually.

The Internet also has inspired innovations in the areas of water and sanitation, which have long needed fundamental changes in terms of available information and communication technology. With the Internet and other new technological tools, simple, appropriate technologies for the supply of water can be implemented in weeks rather than years, and progress can be reported using text messages, digital cameras, and short movies rather than time-consuming reports.

The development community has an immense need for a single global home that provides easy access to information and dissemination tools, especially if it is to achieve the Millennium Development Goals. At present, poverty is not being reduced fast enough to meet the goals, and we need more "action heroes" to get things done. *Akvo,* meaning "water" in Esperanto (www.akvo.org), is an example of one such hero. It is an innovative global nonprofit foundation established in September 2008, since which time it has launched more than 75 pilot projects through the investment of the Netherlands Water Partnership, Partners for Water, and UN HABITAT. Its development team, which is based in the Netherlands, Sweden, and California, works with over 100 organizations ranging from NGOs and commercial enterprises to knowledge institutions and funding partners.

Akvo is a truly open source of information on water and sanitation. Using the Internet, it disseminates information about innovative marketing and communication strategies and makes it possible to post short, simple bits of information that can be easily accessed by anyone. The communication system used may be direct or person-to-person, but generally it is ambient, meaning that certain information is published and hence available to those who are interested but is not forced on anyone. Akvo's objectives are to accelerate the implementation and improve the quality of small-scale water and sanitation projects by providing

Internet tools that enable all stakeholders to share their experience and knowledge, and to help build a network of trusted partners and search for project sponsors.

Akvo is structured around three interrelated tools: (1) Akvopedia, which is a knowledge bank of low-cost sustainable water and sanitation technologies and of approaches to using them in rural areas and small towns and villages. It works like Wikipedia in the sense that anyone can edit it; (2) Akvo Marketplace, which is a market for small-scale projects (total budget under $28,000 U.S.) that require funding; and (3) Akvo Really Simple Reporting, a feedback and reporting system. The benefit of this structure is that Akvo not only gathers the relevant technical knowledge but also collects feedback in the form of practical knowledge from people who are using the technology locally—its advantages and disadvantages or limitations, and how it operates in different countries under different conditions. In terms of project funding, the Akvo Marketplace attracts various supporters and sponsors and allows them to work directly with workers in the field, without any complex requirements or controls imposed by NGOs. Another strong point is the completely new and innovative idea of reporting. Institutions, funders, and individuals who support a project want to know how it is progressing. Akvo's web- and SMS-based reporting system allows for updates in the form of short text messages, images, or movie clips. Results can be captured visually in an appealing way and be sent frequently to satisfy funders and other people connected with the project—and receiving feedback means happy donors. Moreover, dialogue among field workers builds their skills and improves quality while saving time and money.

Akvo offers an important approach to fulfilling the MDGs. If the number of people who live in poverty is to be halved by 2015, then there is no time or capacity to proceed with large-scale, centralized initiatives. Akvo's mission, therefore, is to facilitate many small, decentralized drinking water and sanitation projects using affordable, repairable, and easily maintainable technologies.

To summarize, Akvo applies the power of the Internet and open source tools to solve one of the most pressing problems in the world: the lack of safe drinking water and adequate sanitation for nearly half the world's population. It has been known for a long time that investments in the area of water and sanitation have been very effective in reducing poverty and promoting development, and by joining these efforts, Akvo could well have a tremendous impact and help millions of people have a better quality of life.

EDUCATIONAL INNOVATION

A key element in providing adequate access to clean water in both rural and urban areas in developing countries is to introduce the requisite facilities in schools. Throughout the world, but predominantly in developing countries, poor hygiene and health caused by the lack of adequate water and sanitation facilities at the school level is a major and costly problem. Lack of suitable sanitation facilities at school results in illness and absence; girls in particular will remain absent during their menstruation periods. Numerous examples show that illness and absence

drop by up to 50 percent where sanitary facilities are provided at school. Worldwide programs to improve school facilities in developing countries have been developed by agencies such as UNICEF, UNDP, the World Bank, and the WHO, as well as government agencies and NGOs in the North. A wealth of documents, courses, and experiences are available on this topic, which we discuss in more detail below.

In order to broaden the scope of these programs, an innovation was recently initiated with a proposal to link up the secular institutions listed above with faith institutions in developing countries, where more than 50 percent of all schools are faith-based and run by local faith organizations. Apart from some incidental cooperation between faith-related schools and secular institutions, no such link has ever been formally structured. Furthermore, faith-based schools have little affinity with the new and rapidly spreading modern techniques developed by innovators from the secular North that are aimed at creating affordable, accessible, and simple solutions to providing access at school to clean water and sanitation facilities.

Linking faith with access to water and school toilets does not sound like an obvious step, yet it is critical. Water is in fact central to many religions; as the source of life, it often represents birth and rebirth. It cleans the body and, by extension, purifies it, which confers on water a highly sacred status. This is reflected in the way people use water, in the way they design water systems, and in the need for access to water to wash hands, especially after toilet use.

Providing water for drinking, hand-washing, flushing, cleaning, preparing meals, and providing clean toilets and urinals in schools is critical to keeping children healthy. Schools are places where many children gather, often in cramped spaces with limited ventilation, unhygienic conditions, and no hand-washing, and thus children often get infections. A study in Colombia showed a direct link between diarrhoea and hygiene in schools: more than 40 percent of cases in schoolchildren were transmitted at school. Some additional reasons for a link between faiths and water include:

- Only recently has sanitation been addressed at national, municipal and household levels, partly because for many years some have felt it rather distasteful.
- Faith organizations run hundreds of thousands of schools around the world; the Catholic Church alone runs some 200,000 schools.
- There are almost no extant religious writings on water, even about water in baptism, and very little about the theology of water, its symbolism, and its ritual use. However, new theological writings are now in preparation as a result of the above initiative.
- Improving sanitation, water, and hygiene reduces related infectious diseases by more than 15 percent.
- Good facilities and practices in schools can reach many children at an age conducive to their internalizing the habits for cleaner lives and a reversal of environmental destruction.

- Schools, teachers, and religious institutions are respected in virtually all cultures, bringing trusted knowledge, values, and skills to children, their families, and communities.
- Many faith organizations run informal education networks, such as youth groups, where information and experience related to health and hygiene can be exchanged.
- The world faiths could be a powerful force in achieving good health and environmental knowledge, attitudes, and practices.

Initiating a partnership between faith institutions, multilateral agencies, and innovators was the aim of a workshop called Faith in Water that was held in Salisbury, England, in July 2009. Seven key traditions—Buddhists, Catholics, Hindus, Jews, Muslims, Protestants, and Zoroastrians—were represented, and 15 countries. Each faith was represented by a theologian, as well as somebody working practically in the field, each of whom had fascinating and sometimes moving stories of engagement with water-related issues. The workshop was also attended by top water experts from UNICEF, UNDP, the World Bank, and the UK's Department for International Development (DFID). Working directly with faith organizations was a novelty to some.[2]

The unique outcome of this initiative was not only that faith institutes linked up with secular agencies and innovators for the first time, but that they recognized among themselves the communality in their fundamental and religious relationships with the sacred aspects of water, and in their preoccupation with water, sanitation, and hygiene in their schools. A whole new kind of partnership arose from this initiative, which inn the coming years will be consolidated through more extensive and in-depth programs, thus substantially contributing to a better water world.

INSTITUTIONAL INNOVATION

The inadequate supply and quality of drinking water, lack of sanitation facilities, and poor hygiene cause about 10,000 of the world's poorest people to die daily from preventable diseases. Women and children are the main victims. Because institutional innovation is essential to improving the water, sanitation, and hygiene sectors, the United Nations declared 2008 the International Year of Sanitation (IYS). The main goal was to raise awareness—especially among decisionmakers—of the importance of proper sanitation and hygiene. As part of IYS, UNICEF initiated Global Handwashing Day (GHD), in which 200 million schoolchildren in developing countries participated by washing their hands with soap. The event was widely publicized and engaged some well-known celebrities, but it is still too early to judge its long-term impact. However, there are some indications that progress is already being made.

To help achieve Millennium Development Goal 7 (one of whose targets in to halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation), the United Nations created an innovative program

called WASH (Water, Sanitation and Hygienne) which is essential in improving people's health, education, and lifestyle, as well as in reducing poverty around the world. WASH is also an integral aspect of and a prerequisite for the achievement of many other development goals. It is a key factor in achieving universal primary education and reducing child mortality (Goals 2 and 4), and is directly linked to the eradication of poverty and hunger, the empowerment of women, improvements in maternal health, and the fight against disease (Goals 1, 3, 5, and 6). Nevertheless, as many as 2.5 billion people lack access to sanitary facilities, so that achieving any of the Millennium Development Goals is still a big challenge.

WASH is often identified with the presence of some major world problem. In fact, while being the key factor in the improvement of health, social, educational, and even economic situations, it should be emphasized that WASH is a solution-oriented approach. By improving and implementing simple solutions, millions of lives are saved every year. For example, according to several studies, child mortality caused by diarrhea can be reduced by 15-20 percent through access to water of sufficient quality and quantity, by 35 percent through better hygiene like washing hands, and by 40 percent through improved sanitation.

Access to clean water, sanitary facilities, and proper hygiene are especially important in schools, as they are key determinants of children's learning capacity, which in turn influences many other aspects of development. Some 400 million school-aged children are affected each year by various diseases, most of them caused by limited access to adequate water and sanitary washing facilities. In an atmosphere of poor health, children are unable to fulfill their education potential. Schools are also an ideal place to promote good WASH practice, as children are often eager to learn and willing to absorb new ideas. New hygiene behavior learned in school can lead to lifelong positive habits, which can be passed along to other members of the family.

WASH has become the major focus of various multinational agencies, governments, and NGOs. The WASH programs form a key part of many projects in the developing world, including the following:

- The Water Supply and Sanitation Collaborative Council (WSSCC), a global multi-stakeholder partnership organization whose mission is to improve the quality of life of poor people, uses WASH as a key element in its efforts to reduce poverty, improve human health and environmental conditions, fight gender inequality, and effect long-term social and economic development.
- WSSCC is hosted by the World Health Organization, which is also very active in the WASH sector.
- WaterAid, an international charity, shares the WSSCC mission. They believe that by focusing their efforts on improving water, sanitation, and hygiene, they will maximize benefits and produce long-lasting, wide-reaching results.
- Innovative programs run by the United Nations Development Program, such as GoAL (Governance, Advocacy and Leadership), seek to accelerate achievement of the MDGs dealing with water and sanitation by strengthening governance of the water and sanitation sectors at the appropriate levels.

- The Water and Sanitation Program, a multidonor partnership administered by the World Bank, initiated the Global Scaling Up Sanitation Project with the support of the Bill & Melinda Gates Foundation. It aims to develop methods to both promote the demand for sanitation and hygiene, and respond to that demand through innovative institutional, financial, and promotional approaches.
- International Water and Sanitation Centre (IRC), which is also very active in the WASH program, has developed an innovative idea of implementing "floating toilets" in Cambodia, the country with the world's highest health risk due to improper sanitation. According to the World Bank, only 16 percent of rural Cambodians have a proper toilet, the lowest level in Southeast Asia.
- UNICEF plays a major role in the expanding global effort to fulfill the MDGs. It contributed significantly to the success of International Year of Sanitation and Global Handwashing Day and has supported WASH activities in over 100 countries. It is closely involved in improving sanitation and hygiene in schools. A total of 13 million people have benefited from UNICEF's direct support for improved sanitation facilities, and 24 million for water supply.

Another important WASH activity was an initiative of the UK's Department for International Development with the active support of the Organization for Economic Co-operation and Development (OECD), WSSCC, UNICEF, WHO, WaterAid, and many others to establish a campaign called Global Framework for Action (GF4A). The aim of GF4A is to improve implementation strategies and increase the effectiveness of the aid sector.

CONCLUSION

There is an enormous global effort underway to overhaul the water sector through innovation. This effort will continue to expand with the growing knowledge that is being accumulated and shared worldwide. More and more organizations realize that everything they want to accomplish hinges on improving the health, hygiene, and environment of local communities because only healthy people can act as a catalyst for further development.

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1 FTC was originally invented by Biosource Inc., a company in Worcester, Massachusetts, that researches and develops new technologies in the field of water quality and treatment. In 2008 it was acquired by Voltea Ltd. (www.voltea.nl), a company funded by Unilever Ventures to commercialize FTC. In 2006, the Ecological Management Foundation joined the Voltea team.

2 The event was cohosted by the Alliance of Religions and Conservation (ARC), the Dutch Ecological Management Foundation (EMF), and the International Water and Sanitation Centre (IRC). ARC is a secular organization that began as a sister body to the World Wildlife Fund and works to broker partnerships with the faiths on conservation matters. EMF is an ecological body with a particular focus on water. IRC specifically works on water, sanitation, and hygiene and brought 40 years of experience to the conference. Information on this innovative education initiative can be viewed on www.arcworld.org.

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