

## *Innovative Approaches to Strengthening the Water and Health Sector in Latin America: Experiences in Guatemala and Bolivia*

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### **Abstract**

The Millennium Development Goals launched by the United Nations in 2000 included the need to reduce by half the proportion of people living without drinking water supply and basic sanitation services by 2015, which requires a paramount effort of solid partnerships. Comprehensive and innovative approaches are immediately needed to strengthening the water and health sector and decrease rates of water related diseases in Latin America. This paper describes two experiences about building solid partnerships at the international, national, and local levels in Guatemala and Bolivia.

The Guatemalan experience was the implementation of a public health action plan in the rural town of San Mateo Ixtatán. Partners included an international foundation; national institutions of the municipal, education, and health sectors; the local municipality, health center, and NGOs working locally. Principles of social capital were applied to assure participation of community representatives as decision-makers. These principles are aimed to (1) provide a forum for cross-discipline dialogue, (2) facilitate coordination and dissemination of information, and (3) stimulate cutting-edge research efforts by linking practitioners, researchers, and policy makers in specific knowledge areas. Working with health officials and educating children and adults of both genders on the fundamentals of water quality and solid waste management helped to start building local capacity.

The Bolivian experience focuses on a collaboration project between researchers at East Carolina University and Universidad Mayor de San Simón using water management issues to strengthen capacity and protect human health. Implementing a water quality-monitoring program might have a positive influence to improve the current status of water supply and sanitation services in rural and urban areas of Cochabamba, Bolivia.

### **Introduction**

In the developing world, water related diseases (mainly diarrheas) are the second leading cause of morbidity and mortality. This is the case of Guatemala and Bolivia, two Latin American countries of comparable economic conditions (UNICEF, 2005a, b). In spite of efforts carried out by multilateral and bilateral development agencies in the last several decades, access to safe drinking water, basic sanitation, and health services have neither increased nor improved for the poor (Bryce J et al, 2003; Victora CG et al, 2003; Pokhrel and Viraraghavan, 2004; Diergaardt et al, 2004). Numerous studies have shown that interventions directed to increase coverage and improve drinking water quality, in the pipes or at the point-of-use, and basic sanitation have positively impacted developed (Burmstrom et al., 2005) and developing countries (Lloyd and Helmer, 1991; Cairncross et al, 1996; Conroy et al, 1996; DFID, 1998; Semenza et al, 1998; Conroy et al, 1999; Crump et al, 2004). However, most efforts in the developing world have failed to reduce the number of people living without drinking water and basic sanitation services probably because efforts made by development agencies were not sustainable.

The UN launched the Millennium Development Goals (MDGs) in 2000 (UN Millennium Project, 2005). The seventh goal and 10th target is to reduce by half the proportion of people living without drinking water supply and basic sanitation services by 2015. This ambitious goal might follow the standards of previous aid efforts conducted by the UN and other international agencies. Those efforts were measured by the quantity of the services created, rather than the quality of the interventions. This happened in the past when the UN designated the period 1981-1990 as the International Drinking

Water Supply and Sanitation Decade (IDWSSD), which focused on reducing by half the number of people living without drinking water supply and basic sanitation services in developing countries. As a result, millions of drinking water and basic sanitation systems were built during that decade. Unfortunately, the majority of those systems broke down short after being commissioned. Two outcomes of this costly decade were (1) the outbreak of the 7th cholera pandemic in Peru in 1991, and (2) little improvement in the indicators of people living with no drinking water and sanitation services (ECLAC, 2004).

According to UNICEF (2005a, b) Guatemala, in Central America and Bolivia, in the Andes have the lowest indices for human development. In spite of the collaboration that the World Health Organization (WHO) and UNICEF provided during the IDWSSD, current coverage indicators for drinking water supply and basic sanitation services in Guatemala and Bolivia are not significantly better than those of 1980s (PAHO, 2001). The basic conditions for effective drinking water supply services to protect public health presented by Lloyd and Helmer (1991) were quality, quantity, coverage, and continuity; however, cost also was added as a basic condition to plan interventions during that decade considering the economic conditions of most developing countries. The goals and evaluation of the IDWSSD only addressed coverage, with the exception that WHO included water quality in its interventions. As we can learn from evaluating the impact of drinking water supply and basic sanitation interventions in the last century, all conditions are equally important (Lloyd and Helmer, 1991; DFID, 1998; PAHO, 2001; Jensen et al, 2003; Clark and Gundry, 2004; Gundry et al, 2004; Singh et al, 2004; Crump et al, 2004; Jensen et al, 2004), and it is necessary to include them in future interventions.

If improvement of current status of drinking water supply and sanitation services is going to be effectively addressed, in countries such as Guatemala and Bolivia, the conditions for proper water supply have to be included at different stages of future interventions. These conditions were incorporated in the design and implementation stages of the public health action plan for San Mateo Ixtatán (SMI), a rural town in Guatemala. These conditions are also key components in the collaborative work between researchers at East Carolina University (ECU) and Universidad Mayor de San Simón (UMSS) to develop a drinking water quality monitoring program. The experiences in both Guatemala and Bolivia are described in this paper.

## **The Experience in Guatemala**

The first project described in this paper was conducted in SMI, Guatemala between 2002 and 2003. During this time, SMI had an estimated population of 10,000, and because of the effects of the civil war that ended in 1996, its institutional infrastructure was still in development. The primary achievement of this project was the development and implementation of a public health action plan. A survey of the public health problems affecting the health and economic development of people living in SMI was conducted with the participation of community members and their representatives. Design of the public health action plan centered on the problems identified and incorporated principles of social capital, which refers to the norms and networks that enable collective action that is critical for poverty alleviation and sustainable human and economic development (World Bank, 2002). Design of the plan also incorporated principles of sustainable water resources management, safe water, and capacity building. The development of a network of collaborators was a parallel activity to the implementation of the plan.

### **Identification of Public Health Problems in San Mateo Ixtatán**

One of the initial visits to SMI from members of the Ixtatán Foundation, a US-based foundation who were developing educational projects in this rural town, had the purpose to learn about water and health problems as they were perceived by community members. A meeting was held with representatives from eight local water systems and other community members. They identified drinking water quality, solid waste disposal, and wastewater collection and disposal as their main public health problems impacting community well-being and economic development. During the meeting, an illustration of the local water cycle helped community members to locate the problematic

sites in town. This, in turn, began a dynamic interaction between community members and the foundation representatives (Zarate, 2002a).

After the meeting, and on subsequent days, field visits were conducted to water systems, streets with sewage pipes, sewage discharge points, and to sites where solid waste was dumped. Interviews with water committee members were arranged during those visits to learn more about the history and the problems of the water systems and, if applicable, of the sewage systems. In addition, meetings with municipal and health authorities served to inform the people about the Foundation's interest in collaborating to address local public health problems (Zarate, 2002a).

### **Design and Implementation of the Public Health Action Plan**

A public health action plan was designed after the initial visit to SMI, incorporating social capital principles as agreed in the meetings with community members and authorities. The plan included the development of three programs to address the main public health problems, and proposed implementation in three to five years through education courses and other capacity building programs at local level. The programs included: (1) monitoring drinking water quality, (2) solid waste management, and (3) wastewater management (Zarate, 2002b).

A second visit to SMI served to present and explain the plan through open meetings held in each neighborhood. In those meetings, neighborhood representatives were nominated to attend a water quality and solid waste management educational course. Participation of elected neighbors grew through the duration of the course, indicating the high degree of organization and sense of accountability felt by community members. It also indicated the interest of community members in being dynamic participants for the implementation of the plan (Zarate, 2002b).

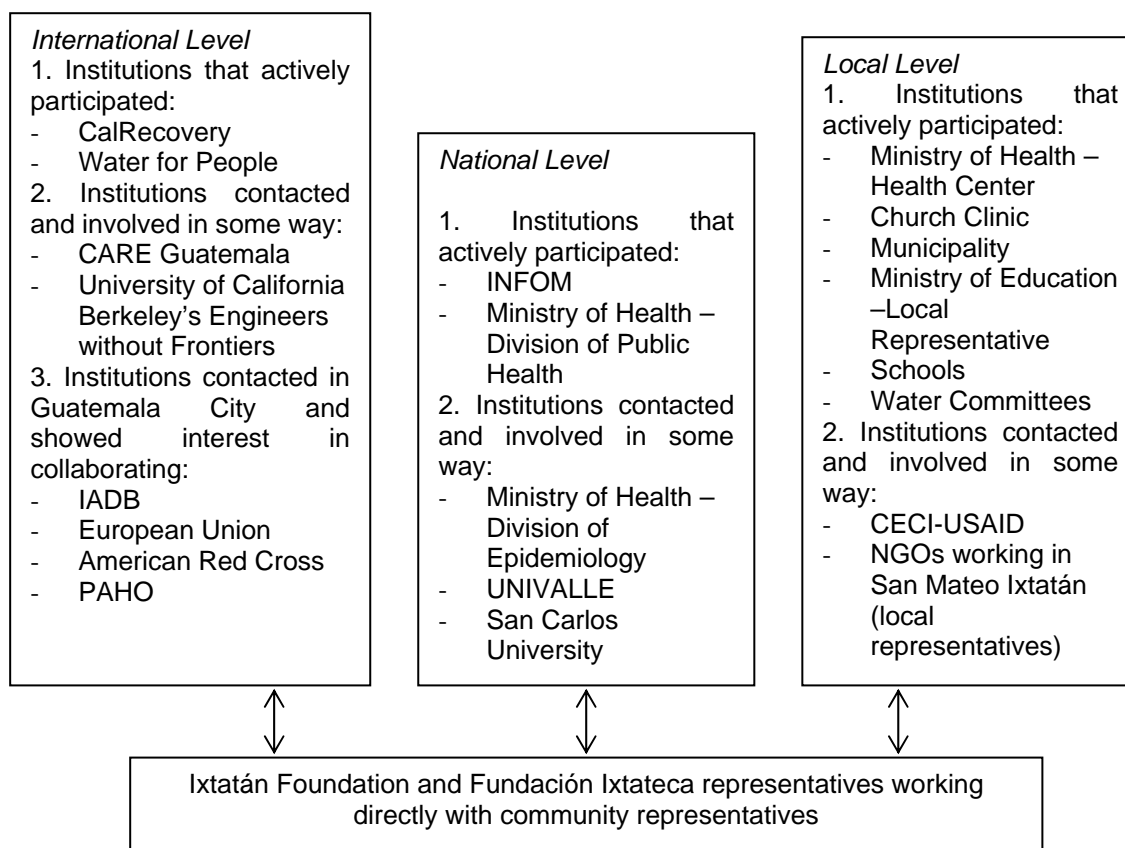
### **Building Networks of Collaborators**

Guatemala has concentrated the headquarters of its institutional infrastructure in the country's capital Guatemala City with regional in the Departamentos (Counties), and local offices in urban and rural municipalities. This infrastructure includes the drinking water supply and basic sanitation services at country level. Agencies for international aid, multilateral and bilateral, also have their main offices in Guatemala City. Research related to water and health is conducted in at least three universities located in Guatemala City, but their geographic area of coverage does not reach SMI. Thus a need existed to build a network of collaborators for SMI (Figure 1). This collaboration would result in a replicable program capable of expanding to a wider range of communities than the local universities alone could support.

The responsibility of water and health services for rural areas was transferred from the Ministry of Health to the National Institute for Municipal Development (INFOM) in late 1990s under the national plan for reorganization of the institutional infrastructure. In spite of the fact that INFOM runs the modern and well equipped National Laboratory for Water Quality, most of the beneficiaries of its water analyses work live in the capital city and nearby towns. Also, the number of water analysts was not sufficient to plan for services that would include other regions of the country. Since the public health action plan for SMI included a capacity building component for water analysts, INFOM took special interest in collaborating with this plan (Zarate, 2002c).

The public health action plan was instrumental in facilitating connections for building a network of collaborating interests. Contacts with representatives of international organizations and agencies (e.g. European Union, IDB, American Red Cross, and CARE) working in Guatemala helped to publicize the collaborative efforts, identify funding sources, and identify additional potential stakeholders working regionally and locally.

**Figure 1: Nnetwork of collaborators, Public Health Action Plan (2002-2003)**



The plan was also instrumental in contacting researchers from three groups at Universidad del Valle (UNIVALLE) and San Carlos University. Two of these research groups were working on water and health issues and a third focused on epidemiology projects funded by the US Centers for Disease Control and Prevention. The group at San Carlos University and one of the groups at UNIVALLE were working on water quality issues, but mostly near Guatemala City and in Lake Atitlán –a tourist area 200 miles northwest from the capital. Researchers in the three groups were interested in the development of the plan for SMI, but raised concerns about sustainable funding.

At the local level, contact was made with representatives of national and international NGOs working in development and ecological projects in SMI. Directors and teachers from the elementary and middle school were contacted and they facilitated contact with the representative of the Ministry of Education locally. The educational programs prepared for the Ixtatán Foundation were given to teachers and education officials to consider its incorporation into the school teaching curriculums.

### Capacity Building

Two neighborhood groups, comprised of both genders and diverse age groups, were assembled and taught the fundamentals of conducting sanitary surveys for water systems, sampling techniques, and characterizing solid waste qualitatively and quantitatively. Students from the middle school and a health technician from the health post were also educated in using a portable water test kit for microbial analysis using the membrane filtration method.

During the summer of 2003 four master of public health students from the University of California, Berkeley and Emory University conducted their internships in SMI. Their activities were coordinated by the Ixtatán Foundation and the interns team worked with local health officials, teachers, and students in conducting water quality analyses, solid waste density determinations, hygiene practices survey, and compilation of health statistics (Zarate, 2003).

A sister organization of the Ixtatán Foundation was created in SMI at the end of 2003 with the objective of taking over the education and public health work already started. An additional objective was to start seeking for their own funding to make their projects sustainable. The locally-run organization had the continuous support of the Ixtatán Foundation financially and technically, and prioritized educational programs.

### **Lessons Learned**

The lessons learned through the experience in SMI can be summarized as follows:

1. A public health framework facilitated the implementation of water and health programs (e.g. monitoring drinking water quality and solid waste management);
2. the water cycle can be used as an effective tool to engage community participation while addressing water and health problems in local settings;
3. institutional support is required for water and health projects to (a) seek starting up funding, and (b) support building capacity efforts at local level; and
4. the application of social capital principles in planning and implementing water and health projects is important to gain support from the community.

## **The Experience in Bolivia**

### **Initial Collaborative Efforts between UMSS and ECU – Background**

The recent reverse privatization of the water sector in La Paz, Bolivia at the end of 2004 led ECU researchers to contact colleagues at Universidad Mayor de San Simon (UMSS) in Cochabamba, Bolivia. This was the second water system returned to public ownership in the country since 2000, when Cochabamba underwent a similar process (ECLAC, 2004). One of the outcomes of water system privatization was the maintenance of status quo (at best) or the degrading of health status of vulnerable populations (at worst).

In Bolivia and other developing countries, diarrheas are the second leading cause of morbidity and mortality in children under five years of age. Several interventions were carried out over the last 25 years to improve the water and health status, but the creation of international, national, and local partnerships that encompass scientific and technological disciplines to address water management and health related problems in Bolivia has not yet been addressed.

Water science and technology have made tremendous progress toward good sanitation and hygiene practices, and are effective in reducing incidence of microbial water related diseases in the developed world. This is not, however, the case in developing countries. In spite of worldwide advances, water scientists and engineers still need to collaborate with other professionals to keep improving the management of water resources and protect human health. Collaboration with environmental health scientists, social scientists, economists, educators, and community leaders would allow for innovative ways to improve and protect human health.

Based on the Guatemalan experience, a partnership between UMSS and ECU colleagues was established. Collaborators will use the water cycle as a public health tool to develop an integrated water quality monitoring program to enhance the understanding of the relationship between safe water and health. Other examples of collaboration between ECU and UMSS include research, and short courses in geology, wastewater management, and environmental planning.

Since 1997, an ECU Geology professor has been conducting research with ECU MS students in Bolivia through NSF-funded projects, which allowed collaboration with scientists and engineers in Bolivia who have provided significant experience and arranged long-term projects in the country (Rigsby, 2005). Last year a one-week course on Natural Systems for Wastewater Treatment was taught at UMSS by an ECU professor (Zarate, 2004). These combined experiences will strengthen the opportunities for long term collaborations with UMSS counterparts. Ongoing collaboration will focus on assembling a research team to address water quality problems and develop a drinking water quality monitoring program for Cochabamba.

## UMSS Capacity

The Office of the Director for Research in Science and Technology (DICyT) and the Center for Water and Environmental Sanitation (CASA) at UMSS are part of this collaboration effort with ECU. For two years, DICyT led the design of an Action Plan for Research to develop and implement the university's research system. This effort was made possible through collaboration with the Swedish Agency for International Development. The following programs were developed as part of this research system, and they fit common interests of UMSS and ECU researchers (DICyT 2002a, b):

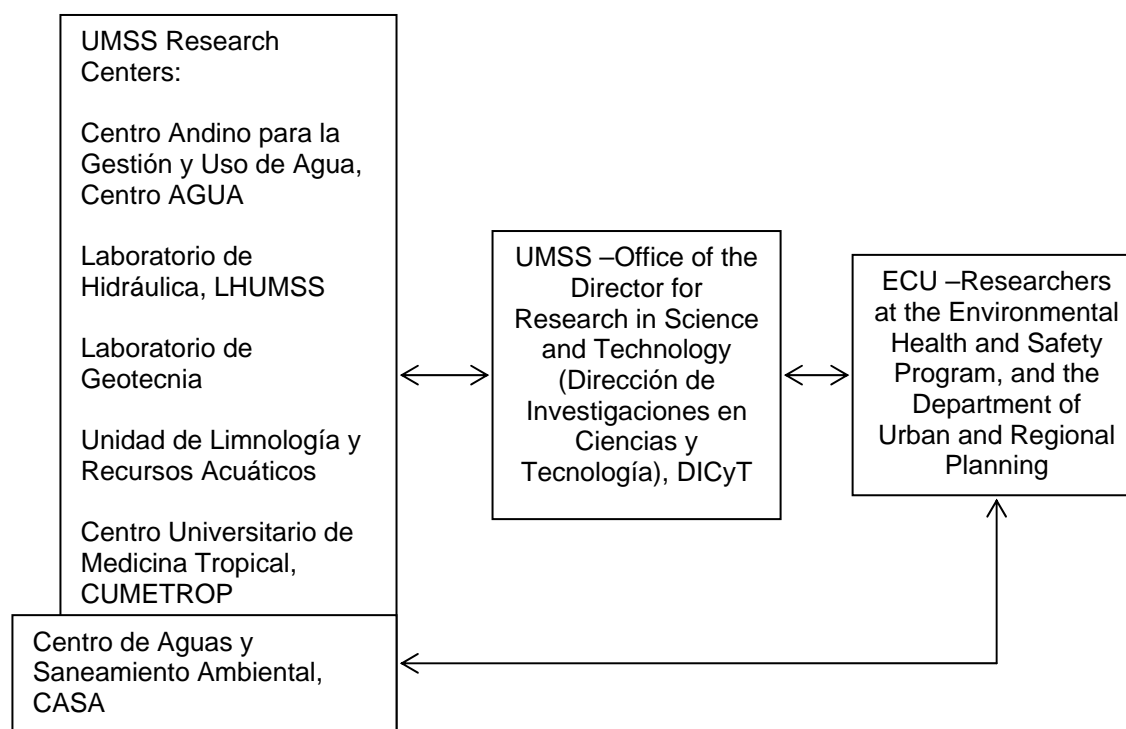
- Program for Research Development covering the following areas of research: Agriculture, Farming, and Agro industry; Water, Soil, and Non-renewable Natural Resources; Biodiversity and Renewable Natural Resources; Social Sciences and Humanities; Medicine and Health.
- Program for Research Promotion, intended to request funding for participation in international scientific events, workshops organization, and support publication of scientific papers.

Scientists and engineers from different research units at UMSS prepared grant proposals and presented them to international funding agencies. The UMSS-ECU collaboration includes writing grant proposals to seek funding in the water and health field. These initiatives will help UMSS researchers interact with international peers while addressing the needs of Bolivian communities in rural and urban settings. It is expected that, through this collaboration new and innovative ideas will be developed and shared to address water and health issues globally.

The potential of UMSS in the water and health field is centered on research units such as Center for Water and Environmental Sanitation (CASA), Andean Center for the Use and Management of Water (Centro AGUA), Hydraulics Laboratory (LHUMSS), the Soil Sciences Laboratory (Geotecnia), Limnology and Water Resources Unit (ULRA), and University Center for Tropical Medicine (CUMETROP) (<http://sigespi.dicyt.umss.edu.bo/grupos/grupos.html>).

These research units began a systematic coordination of their activities during the implementation of the Action Plan for Research, which created a collaboration network within UMSS and it will serve as the basic infrastructure for future research (Figure 2).

**Figure 2: UMSS Action Plan for Research Network and links that have been established with researchers at ECU**



The Center for Water and Environmental Sanitation (CASA) was created in 1982 as the Regional Laboratory for Water Quality Control and, in 1984 became the Pilot Laboratory for Water Quality Control at national level, covering urban and rural areas. The main objectives for the creation of the laboratory were to:

- (1) research improvement of water handling and quality by implementing and developing projects linked to the education of university students.
- (2) analyze environmental samples (water, soil, and sediments).
- (3) service water treatment and monitor water quality in urban and rural areas.
- (4) offer scientific and technical training and education, and consulting services advice in areas related to environmental and human health.

Currently, CASA's laboratories are undergoing an accreditation process. These laboratories are suited to conduct the following work:

- (1) physical-chemical analyses of drinking- and waste-water samples;
- (2) microbiological analyses of drinking- and waste-water samples;
- (3) determination of organic and inorganic traces in water samples; and
- (4) water treatment processes.

Research at CASA follows the mandate of a research plan that responds to academic and community service needs of water quality. This plan includes analyzing for organic and inorganic traces, nutrients, and microorganisms to monitor water quality. Other research include the development of an alternative process for disinfecting drinking water using solar energy, which effectiveness was demonstrated elsewhere (Conroy *et al*, 1996; Conroy *et al*, 1999). Additionally, the impact of this program on the health of rural children under five years of age is being evaluated in response to that plan.

In the international field, CASA has expertise in conducting collaborative research in water and health projects. This new collaboration with ECU researchers is aimed at developing water and health research topics for (1) interdisciplinary research and (2) community involvement incorporating social capital principles.

## **ECU Capacity**

The Environmental Health and Safety Program (EHST) at the Health Education and Promotion Department and the Department of Urban and Regional Planning (URP) are part of this collaboration effort with UMSS (Figure 2). The EHST has the experience and capacity to conduct research in (1) water quality and water resources management; (2) solid waste management and water quality; and (3) monitoring and surveillance programs for drinking water quality. This expertise includes working in close collaboration with interdisciplinary groups nationally and internationally. The EHST Water Laboratory has the capacity to analyze environmental samples for projects related to its areas of research. Community-based participatory research is also an area pursued by the Program.

The URP has experience working with university and governmental partners in Crimea (Ukraine) in planning for a national park in the Crimean Mountains. Through this effort, proposals for university and quasi-governmental organizations were developed and funded to expand environmental protection and governance, and to support technology and faculty exchanges between the US and Crimea. In addition, URP participated in the first survey of public environmental perceptions of residents in the post Soviet Crimea, conducted in the capital city. This survey assessed social, economic and political value constructions of environmental quality, and the perceived responsibility of stakeholders in environmental protection. This information was used to assist local and regional officials to better define strategies for improving water quality and waste management (Stone, 2005)

The capacity that URP brings includes the development of the Galveston Bay Non-Point Source Pollution Watershed Based Education Program, using a watershed approach for improving water quality in the coastal region of Texas. Water quality data from the urban-rural interface were used to focus the efforts of the university and six state and federal agencies to mitigate water quality degradation that had resulted from urban and suburban development on previously agricultural lands. The result is a replicable program to better focus environmental quality efforts in watersheds.

## **Common Goals**

The common goals of the collaborative research between UMSS and ECU are:

1. **Water Quality Monitoring Program – Safe Water:** Implementing water quality monitoring programs is a goal that can help in identifying sources of contamination and plan interventions and/or corrective actions. This can also help disseminate concepts of safe water to the general public and authorities.
2. **Improved Water Resources Management:** The goal of improving water resources management will help in improving water quality and lowering incidence of diarrheas among the poor. This could have a positive impact on development projects by lowering disease incidence since diarrheas are a leading cause of mortality and morbidity in Bolivia.
3. **Interdisciplinary Research:** The goal of assembling an interdisciplinary team between ECU and UMSS researchers to conduct water and health projects follows previous experiences on the part of the researchers.
4. **Social Capital:** Based on the experience of SMI, this goal will show that developing trust in communities is crucial to gain their support. Instilling ownership of the decision making process can lead to positive interventions and responses from communities.
5. **Community Participation:** This goal recruits participants into a research project allowing them to teach and learn throughout the entire process.

## **Implementation Strategy**

The following is the implementation strategy for the collaborative work between UMSS and ECU researchers:

1. **Universities Collaboration:** The collaboration that already began through the efforts of researchers from UMSS and ECU is aimed to improve the water and health status in Bolivia. The researchers' expertise and commitment to this collaboration will help in planning and implementing initial and further steps pursuing common goals.

2. Establishing Partnerships: The establishment of solid partnerships at local, national, and international levels will be a long process and will require the inclusion of social capital principles. Researchers at UMSS who are currently working with local communities will be invited to participate in the project. Also, UMSS and ECU researchers will work together in identifying and approaching national and international partners.
3. Drinking Water Quality Monitoring Program: The design of the drinking water quality monitoring program will bring together researchers from multiple disciplines. Water quality is an “old” problem and the main cause for diarrheas occurrence. Thus a well designed and implemented program has the potential to (1) mobilize resources in pursuit of the improvement of health indicators, (2) address water resources management issues, and (3) be replicable.
4. Capacity Building: The research infrastructure at UMSS in the water and health field offers a good opportunity to make progress at a relatively fast pace. The role of well trained local human resources will be important for the advancement of the collaborative work between UMSS and ECU researchers and for the efforts of solving water resources management issues in Bolivia and elsewhere.

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