Support Mechanisms for Sustainability of Community Health Projects in Arada Vieja, El Salvador

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Abstract

Engineers Without Borders (EWB) at Tufts University is a student-run organization that seeks to find and implement sustainable solutions to problems facing communities in developing countries. EWB affords students a first-hand experience with project research, design and construction. Equally important, students gain an understanding of the necessity of support mechanisms to sustain a project. Since the fall of 2005 the chapter has developed a relationship with the community of Arada Vieja in central El Salvador, and through collaborative efforts sought to improve access to and quality of the community's drinking water. Operating on the university campus and in Arada Vieja, students worked with the community to install a hydraulic ram pump, rehabilitate a pre-existing spring box, and construct a slow-sand filtration system.

The long-term sustainability of the project will rely on the support mechanisms that have developed throughout the course of the project. The community water board, the partnership between the EWB chapter and the local Non-Government Organization (NGO), and interpersonal relationships between individual students and community members provide a critical structure for the future maintenance of the water system.

Introduction

Access to potable water can drastically improve community health\(^1\), yet many community health and development projects that aim to improve water quality and sanitation fail to have a long-term impact because they are not properly maintained\(^2\)-\(^5\). System maintenance is an essential component of any community project, but it can be unrealistic to expect a community to have the capability to address all aspects of system maintenance without outside support. Engineers Without Borders (EWB) at Tufts University\(^6\)-\(^7\) has emphasized the development of support mechanisms as a key to project sustainability throughout the course of its water distribution and filtration project in Arada Vieja, El Salvador. The community water board, the partnership between the EWB chapter and the local Non-Government Organization (NGO), and interpersonal relationships between individual students and community members comprise an essential foundation for the future use and maintenance of the water system.

Background

In 2004, four students founded Engineers Without Borders (EWB) at Tufts University. Tufts EWB is a student-run organization that aims to implement sustainable solutions to address basic needs of communities in developing countries. The chapter’s first project involved the design of a composting latrine and solar cooker to be used in a Gyatsa, Tibet.\(^8\) After completing a successful implementation trip to Tibet, the chapter began investigating additional project opportunities. Through one of its student members, the chapter connected with a small non-governmental organization (NGO) called Epilogos Charities.

Epilogos is located in the municipality of San Jose Villanueva, El Salvador and run by two former Peace Corps volunteers. Epilogos was interested in working with Tufts EWB to improve access to drinking water in the village of Arada Vieja, a small community of about 120 people. A group of students began working to plan a site assessment trip to Arada Vieja. Communicating regularly with Epilogos, they
worked to gain a strong understanding of the water system in Arada Vieja and of the community’s needs. The students researched various water pump technologies, developed a water quality testing schedule, drafted a health survey and sought funding for the initial trip. In the summer of 2006 five students along with a member of the Civil and Environmental Engineering faculty traveled to Arada Vieja. Through community meetings, individual conversations, water quality testing, and health survey, the project team established a clearer picture of the community’s concerns and priorities. Based on the findings of the assessment trip, and taking into consideration the ability of the student EWB chapter, the project team and community decided to implement a filtration system to improve drinking water quality.

In the months following the assessment trip, students worked on the design of the filtration system and developed an education plan to address factors such as system use and maintenance as well as household water storage. The project team expanded considerably, engaging engineering students as well as liberal arts students from various disciplines in order to prepare for the implementation trip. The team constructed two slow-sand filter prototypes, created education materials, maintained communications with community members about design plans and refined the health survey and water testing procedures. In January 2007, six students traveled to Arada Vieja for the first phase of construction of the water filtration system and to help the community establish and train a water board to monitor the up-keep of the system. In March 2007 and July 2007 students returned to complete construction, assess water quality and conduct further health surveys.

While working on campus and in El Salvador, one of the most important considerations for the team was long-term project sustainability. This meant trying to ensure that all aspects of the filtration system were socially, environmentally and economically sustainable. Social, economic and environmental sustainability are not, however, guaranteed by even the best system design. It is therefore necessary to employ additional mechanisms to support sustainability. For the project in Arada Vieja, the community water board, the partnership between the EWB chapter and the NGO, and the interpersonal relationships between individual students and community members, all serve as mechanisms to support the future use and maintenance of the water system.

**Community Water Board**

During the first assessment trip to Arada Vieja the EWB students emphasized the importance of establishing a water board for any community-scale water project. The water board, in working with the entire community, holds ultimate responsibility for the maintenance of the community water system. It is the job of the board to supervise the correct application of water system rules and propose new rules as is necessary. The board must watch over the functioning of the system and make repairs swiftly to ensure the community’s access to water. In Arada Vieja other organizational boards were already in existence and it was therefore easy to accept the idea of a water board to be responsible for a filtration system. Nonetheless, it was essential for the students to convey that the water board comprised of community members, and not the EWB chapter, would be responsible for regular system maintenance.

In January 2007 students traveled to Arada Vieja to begin construction of the water filtration system as well as facilitate the creation of a water board. Since establishing a water board was such an essential component of the trip, students sought out a Tufts alumnus and former Peace Corps volunteer, who had spent two years working with rural water projects and water boards in Honduras, as the January 2007 trip advisor. Several community meetings were organized during the first days of the trip in order to review the role of the board and each of its members and to hold board elections. Once the board was elected students met the four water board members for evening training meetings utilizing training materials developed during the fall semester. The training intended to aid the water board members with financial management of monthly tariffs and maintenance expenses, the evaluation of filter performance, the procedures for testing water quality and conducting regular system performance checks.
The training meetings were critical for the development of the water board and also greatly strengthened
the relationship between board members and the student team. One training meeting focused on the
importance of testing the water quality to verify whether or not the water filters were functioning. The
team explained the process for using presence/absence water tests and recording test results. It was clear
that water quality testing was an extremely unfamiliar process, and the board members had many
questions. This training meeting was one of the longest, and even after a full day of construction it lasted
well into the evening. However, it was also one of the most important meetings of the trip. The
discussions that resulted from board member questions produced a collaborative atmosphere in which
there was little boundary between the project team and the water board.

Reflection
The following is a reflection from Veronica Chouinard (Mechanical Engineering, Tufts '03) leader
“Establishing a water board is arguably the single most important determinant of the success of a
community water project. A functional water system requires physical infrastructure as well as human
resources in order to ensure that it remains operational and meets the needs and goals specified by its
beneficiaries. This involves effective management, training, and community involvement orchestrated by
the members of the water board. The board, elected by its community, financially manages the water
system by collecting funds and budgeting its resources to ensure functionality and demonstrate transparency to
the community. The board schedules and performs preventive maintenance and offers training on basic
sanitation and personal hygiene to the system's users. Having this valuable educational component [run] by
community members fosters a sense of ownership and disseminates important information to others who
will then be able to assume leadership roles on the water board or in the community.”

Partnering NGO

Prior to traveling to the community for the first time, the NGO played an invaluable role as a link between
the students and the community members. Epilogos provided students and community members with the
necessary information for progressing with project. Epilogos helped facilitate the first community
meetings and initiate the partnership between Tufts EWB and the community of Arada Vieja.

The NGO relationship has remained important throughout the course of the project for several reasons.
Epilogos has a consistent presence in the community because of its location and because of its work with
the community on other development projects. This consistent presence means that Epilogos can monitor
system performance and provide Tufts EWB with regular information. Additionally, Epilogos can
connect the community with local resources if problems occur with system components. The NGO
understands the community dynamics and non-technical issues within the community that may impact the
project.

Reflection
The following is a reflection from Kate Siegel (Mechanical Engineering, Tufts '09)
“With every visit, phone call, and email, the bonds between the project team and community members, and
NGO grow stronger. While we all come from very different backgrounds, we respect one another and bring
a multiplicity of strengths to the project. While the project team has the technical knowledge to address
problems and design the project, the community provides labor and has construction experience, and the
NGO has the contacts and know-how to make all loose ends meet. We epitomize an interdependent group
in the best possible way.”
Community Relations

While working through trip logistics prior to the initial assessment trip, the team faced the decision of whether to split up to stay with different families in Arada Vieja or stay as a group in the local community center. In the end, the team decided to stay with separate families and the result was that each individual team member developed an independent relationship with the family with whom he or she was staying. Instead of being viewed from the onset of the project as a group of American engineers, the home-stays fostered a far more personal connection between the project team and community members. The personal link between students and community members has had, and will continue to have, a significant impact on the project. For the community members, a personal connection with students promotes a greater sense of trust in the intentions and commitment of the team. For students it means a deeper sense of connection and responsibility to the project. Additionally, there is an understanding that project success is not determined just by successful implementation, but rather by the project’s ability to serve the people of the community in the coming years. The long-term investment made by students also ensures that the community will be able to rely on Tufts EWB for technical assistance in the future.

Reflections

The following is a reflection from Brad Kelly (Mechanical Engineering, Tufts ’07)

“Any successful project will require a monumental amount of effort from both the community and the EWB team. For this reason both parties must be committed to the project and trust each other to fulfill their responsibilities. The first trip to the community involves not only assessing possible projects but also building a relationship. I found the first trip to the community to be the most important to my personal investment in it. Once I was taken in by a family and treated as one of their own it became much more significant than the engineering endeavor I originally took it as. This personal connection meant more than any contract or mission statement. They could trust our word and we were truly committed to helping. These were now our friends.”

The following is a reflection from Jonathan Crocker (Civil Engineering, Tufts ’07)

“In the last two years I’ve been to Arada Vieja on five separate occasions, and I think one of the main reasons I kept returning and continue to return is the people that I have met and come to know. I have worked with and met almost everyone in the community, but it is with the two families with whom I stayed during my visits that I feel the strongest bond. Knowing them on a personal level, and living and working with them 24 hours a day for up to a few weeks at a time has definitely improved my ability to work on the project, as well as improved my experience overall. When I visit the community I spend time talking with Alfonso and Abel about much more than just the water project. These relationships have been some of the most valuable things I have gained from my experiences with EWB, and they are a large part of what has kept me involved with this type of work since graduating from the program, and I think that getting to know the people I work with is what will keep me in the field of international development in the future.”

Conclusion

EWB projects are based on long-term partnerships and collaborations with a community. For both engineering and non-engineering students the project work affords a unique opportunity to work on a multidisciplinary team, communicate ideas with students and community members, recognize an ethical responsibility and grow as a leader. Perhaps most rewarding for students, however, are the personal connections made with members of a partner community. These relationships instill a deep sense of responsibility to a project, thus promoting a genuine interest in long-term project sustainability. Students recognize that the project is not simply about completing construction of a set of water filters, but rather the goal is to ensure that the project is maintained and effectively serves the community. In order to achieve this broader goal and sustain the project, it is necessary to employ support mechanisms. In Arada Vieja the support mechanisms actively developed by the students were the water board, the partnership with the local NGO, Epilogos, and the relationships with community members.
Student reflections indicate that the EWB experience also significantly enhances their engineering education in ways that complement the traditional classroom experience. Specifically, it supports the Accreditation Board for Engineering and Technology (ABET) Criterion 3 Program Outcomes addressing the students ability to design a system to meet specific needs of a community, function as a member of a multidisciplinary team, identify and solve engineering problems, understand professional and ethical responsibilities, communicate despite the potential language barrier, understand the impact of the project in a global and societal context, recognize the need to engage in life-long learning to allow them to address real problems outside of traditional discipline-based engineering challenges, and show knowledge of the contemporary issues connecting community health and sustainable engineering.

1. Support mechanisms such as the existence of a water board, a partnership with a local NGO, and strong personal relationships with community members can contribute greatly to sustaining a small-scale project.
2. Engagement in hands-on projects in a real-world environment helps students to better understand the engineer's role in society and transition to a successful professional career.
3. Student reflections show how these experiences have enhanced their education beyond the traditional classroom experience.

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Bibliography

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Ms. Schuster is an undergraduate majoring in political science. She currently serves as President of Tufts Engineers Without Borders. Prior to serving as the organization’s president she worked as the co-leader of the Tufts EWB El Salvador project and traveled to El Salvador with the project team on three occasions.

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Mr. Sanchez is a graduate Water Resources Engineer. He is currently serving as Graduate Chair of Tufts Engineers Without Borders. He is the former Vice President of Tufts Engineers Without Borders and was a travel team member on the first two trips to El Salvador with Tufts EWB. His interests are in risk-based approaches to climate change adaptation.

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Dr. Swan is an Associate Professor in the Civil and Environmental Engineering department at Tufts University. He traveled to Ecuador with the student team during the initial visit in 2006. His current interests are the reuse of recovered or recyclable materials and sustainable construction.

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Dr. Matson is an Associate Professor in the Mechanical Engineering Department at Tufts University. He has traveled to Ecuador and Tibet with student teams. His research interests are in manufacturing, materials science and selection of appropriate technology for sustainable engineering projects.