GUIDELINES FOR RESOLUTION OF PROBLEMS WITH WATER SYSTEMS

IMPROVE
INTERNATIONAL

Contents

Written by Susan Davis, Executive Director, Improve International. October 12, 2014

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The goal is to promote learning from the existing body of evidence, innovation, and cross-organizational learning; in support of that goal Improve International thought it more useful to include organizations' names when discussing existing models or approaches. However, reference in this site to any specific model, product, process, or service, or the use of any trade, firm or corporation name is for the information and convenience of the reader, and does not constitute endorsement, recommendation, or favoring by Improve International.

It is difficult to find independent confirmation of any results shared by the nonprofit sector in general, and the international water sector in particular. The author has done her best to include up-to-date information, but cannot guarantee that information included in this report and appendices is the most current or complete.

Acronyms

CBM	Community-based management
DGIS	Directorate-General for International Cooperation (Netherlands)
EWB	Engineers without Borders
GWI	Global Water Initiative
M&E	Monitoring and evaluating
MERL	Monitoring, evaluating, resolving, learning
NGO	Non-government association
O&M	Operations and maintenance
RWSN	Rural Water Supply Network
SANAA	National Water Supply and Sewage Company (Honduras)
TOMs	Technicians in Operation and Maintenance
USD	United States dollars
VLOM	Village level operations and maintenance
VMC	Village management committee
WASH	Water, sanitation, and hygiene
WUA	Water user association

Executive Summary

Resolution is the process of addressing problems identified through post-implementation monitoring and/or evaluation. Resolution reflects the concept that those implementing organizations that are made aware that water systems they have built are non-functional or need major repair are responsible for responding. There is resounding agreement in the water development sector that rural communities in developing countries need some sort of support after installation of water points.

Key questions for implementing organizations, donors, and local stakeholders are:

- Who is responsible for addressing the problems with water systems built by international development organizations and charities?
- How can problems be resolved without creating future dependence or open-ended obligations?
- What are the costs to resolve a problem and how should they be divided among the implementing organization, community, host governmental entities, and external donors?
- How long should the implementing organization be required (contractually or ethically) to confirm post-project resolution of the problem?

These are questions that were addressed in developing this report. Improve International reached out to experts and practitioners around the world and reviewed literature to find themes of what does not work, compile case studies of promising resolution models, and to seek input for guidelines for resolution.

Ideally, resolution activities should be a bridge to sustained, locally-led services. While implementing organizations have a responsibility at a certain level, the goal is for governments to lead the way in ensuring water services for everyone in their countries. These guidelines, approaches, and models are intended to move implementing organizations toward that common goal.

The ultimate goal of this report is to improve the probability of sustainable water services for people in developing countries.

The problem

Most development organizations monitor and evaluate during their programs, but this is not enough to ensure that water and sanitation interventions lead to sustainable services. Post-implementation monitoring, whether by the implementing organization or by another entity, is necessary to ensure that services continue, and post-implementation evaluation can help to understand why systems are working or not. For those few organizations that do monitor functionality or services after building water systems and toilets, big questions remain unanswered, such as “How should implementing organizations resolve issues when they arise?” Below, the case is made for implementing organizations’ resolution of issues identified during post-implementation monitoring and evaluation.

Figure 1 shows the overall global water point failure rate (based on "snapshots" of functionality for hundreds of thousands of water points) has hovered around 40% since the 1990s. Many systems that are considered "functioning" are not providing safe water around the clock. Rural water points are far harder to keep operational than hoped for, and often fail within just a few years. Installation and repeated rehabilitation of failed water points is a massive waste of investment (1).

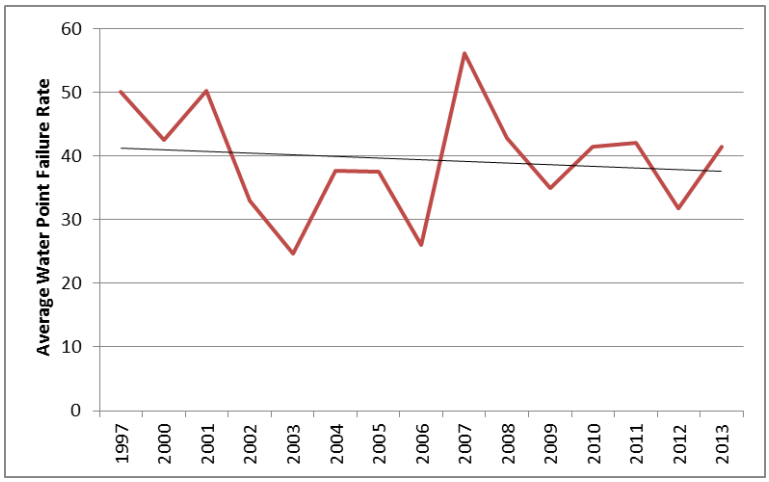

Figure 1. Average Global Water Point Failure Rates (Developing Countries)

The case for resolution vs. rehabilitation

If installing infrastructure did not lead to ongoing services, just rehabilitating the same infrastructure will not lead to ongoing services either. Rehabilitation—major repairs to existing dysfunctional water points—is fairly common in many water supply interventions, mainly because it is less expensive than building new water points. However, rehabilitation programs use the same training and management that led to the breakdown (1). Or worse, rehabilitation programs just repair the water points without any additional support. Because of the trend towards obtaining community capital contributions to water systems, when those water systems fail, implementing organizations are making poor people poorer. Rather than just fixing the immediate problem (broken infrastructure), implementing organizations should find and address the root causes of why the water point failed.

Guidelines for Resolution

It is difficult to determine root causes vs. symptoms, due to the wide range of interventions and a lack of consistency and rigor in evaluation (2); however, the repetitiveness of the problems identified through monitoring and evaluation of water points across the globe suggests that there are common ways to respond.

The following guidelines[1] for implementing organizations resolving problems with water services are based on common failures and recommendations compiled from interviews, the literature review, and a Resolution Workshop in Washington, D.C. in February 2014:

- Overall
    - First, do no harm. To avoid repeating mistakes, implementing organizations must take time to understand and address root causes of problems instead of just repairing infrastructure.

[1] The definition of guideline is a general rule, principle, or piece of advice. Each organization will have to determine the applicability of each guidelines based on the specific situation. Synonyms include: recommendation, instruction, direction, suggestion, or advice.

    - To best serve users, implementing organizations, donors and governments must change their measurements of success from the number of new beneficiaries to measurements like the organization's contribution to the nation's water goals, water-person-years, or percentage households in a district with access to an ongoing basic service level.
    - Implementing organizations must be accountable to water users.
- Implementation
    - Organizations should shift from just building water systems and rehabilitating broken systems to facilitation, such as capacity building for supporting service providers.
    - Implementing organizations and local stakeholders should collaboratively define and agree on roles and responsibilities in ensuring ongoing services.
    - Implementing organizations should improve monitoring to rapidly and accurately identify areas for resolution.
    - Donors should show increased flexibility in funding to support such efforts.
- Institutional
    - Engage local governments and work within national frameworks.
    - Collaboratively define and agree on roles and responsibilities in ensuring ongoing services.
- Social
    - Implementing organizations should make their exit strategy and timeline explicit while planning resolution activities with local stakeholders.

- Environmental
    - Implementing organizations should understand and plan water services based on users' multiple needs and sources of water, seasonal availability of water, and water resource management needs.
- Financial
    - Water services are not free—all stakeholders must understand lifecycle costs and agree on who will pay for which costs over what period of time.
- Technical
    - Implementing organizations should engage local governments and work within national frameworks.

How long should an implementing organization be responsible? There is no consensus or evidence for how long an implementing organization should be responsible for the services provided by systems it has built; however, 10 years as a maximum was suggested by several organizations at the Resolution Workshop, with checks either annually or at three-, five- and 10-year intervals post-implementation (3). This monitoring can be done in partnership with local governments or other entities to reduce the burden on the implementing organization. Whatever the time frame, monitoring increments need to be supported from the initial project planning stages and reflected in the budget.

Who should pay for the costs of resolution? While many implementing organizations initially balk at the idea of having to pay past the initial investment, under the misconception that "building water supply

systems is more important than keeping them working" (4), it must recognized that if the intent is to save or change people's lives, the water must flow forever. The sector is already paying for failure through the costs of rehabilitation. Not all costs need to be covered from one source: Implementing organizations should insist on cost-sharing from users, local government and/or central government (5).

What are ranges of costs? Based on studies of several types of post-construction (also called direct) support, average expenditure is $2.50 USD per person per year. Another way to plan for costs is to dedicate a minimum of 10% of capital costs per year per system for post-construction support (4).

What are models for resolution? Successful models for resolution of problems with water services include the following, sometimes in combination:

- Post-construction (external) support like mechanics associations and circuit riders
- Networks of water committees
- Supporting local governments

More information regarding typical failures, models, and costs will be shared on the WASH Advocates MERL portal.[2]

[2] http://www.washadvocates.org/learn/sustainability/merl/

Introduction

The research that led to this report was prompted in part by USAID's Water and Development Strategy 2013-2018[3]. In the strategy, USAID indicates that they "Will seek investments in longer-term monitoring and evaluation of its water activities in order to assess sustainability beyond the typical USAID Program Cycle and to enable reasonable support to issues that arise subsequent to post-completion of project implementation." What would it mean for USAID and for implementing organizations to address issues identified during post-implementation monitoring?

The United Nations explicitly recognizes the human right to water and sanitation and that clean drinking water and sanitation are essential to the realization of all human rights. Thousands of international development organizations, donors, governments, and businesses agree with this in principle, and have given and invested billions of dollars to help enforce this right. But in practice the international water development sector continues to fall well short of its lofty goals.

Development organizations' vision statements are ambitious:

"We envision the day when everyone in the world can take a safe drink of water."

"Our mission is to bring clean and safe drinking water to every person in the world."

"[Our] vision is of a world where everyone has access to safe water and sanitation."

Yet, beyond the millions of people who still lack access to safe water, investments to date are failing at an alarming rate. The high percentages of failed or poorly working water systems have been documented in many countries for decades. Recent national mapping and monitoring of water points in developing countries confirms that the rates have not improved. Even the water systems that are deemed "functional" rarely provide safe water, in needed quantities, all the time, in a convenient location.

The Human Right to Water is defined by the following dimensions, as shown in Figure 2:

- Between 50 and 100 liters of water per person per day
- The water source has to be within 1,000 meters of the home
- Water cost should not exceed 3 percent of the household income
- Collection time should not exceed 30 minutes.

[3] http://www.usaid.gov/sites/default/files/documents/1865/USAID_Water_Strategy_3.pdf

Figure 2. Dimensions of the Human Right to Water. Source: adapted from (6)

One big question that arises is what organizations in the water sector should do about these failures: haven't donors and implementers done enough by *trying* to provide access? If it is truly believed that safe water access is a human right, then the answer is a resounding "no." To save lives and change lives, implementing organizations and donors must take responsibility beyond the project.

> "The commitment is to provide water and sanitation for that area and that is for the long term until the people in that area can develop their own practices and to take care of what they have been given. . . [It's] reasonable that the givers or supporters stay supportive over the long term." (96)

How should implementers and donors respond to failures? There is no one answer, because the provision of water services has multiple dimensions. One common response is to "rehabilitate" broken water systems. But rehabilitations do not address the root causes of problems. If installing infrastructure does not lead to ongoing services, than rehabilitating infrastructure will not lead to ongoing services either.

Another response to failure is to learn from it and change practices moving forward. However, this approach does not help those people with bad services or non-functioning water systems.

USAID's Water and Development Strategy indicates that they "Will seek investments in longer-term monitoring and evaluation of its water activities in order to assess sustainability beyond the typical USAID Program Cycle and to enable reasonable support to issues that arise subsequent to post-completion of project implementation." This is a positive step forward but details remain to be developed.

Key questions for implementing organizations, donors and local stakeholders are:

- Who is responsible for fixing the problems with water systems built by international development organizations and charities?
- How can problems be resolved without creating future dependence or open-ended obligations?
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These are questions that were researched to develop this report. Improve International reached out to experts and practitioners around the world and reviewed literature to find themes of what does not work, compile case studies of promising resolution models, and to seek input for guidelines for resolution. The ultimate goal of this report is to improve the probability of sustainable water services for people in developing countries.

What is Resolution?

Resolution is a term that attempts to capture in one word the responsibility of implementing organizations for action in response to finding that water systems that they built are non-functional or need major repair. Other terms that are similar to resolution include:

- Services support
- Post-implementation support
- Post-construction support
- External support
- Program quality improvement

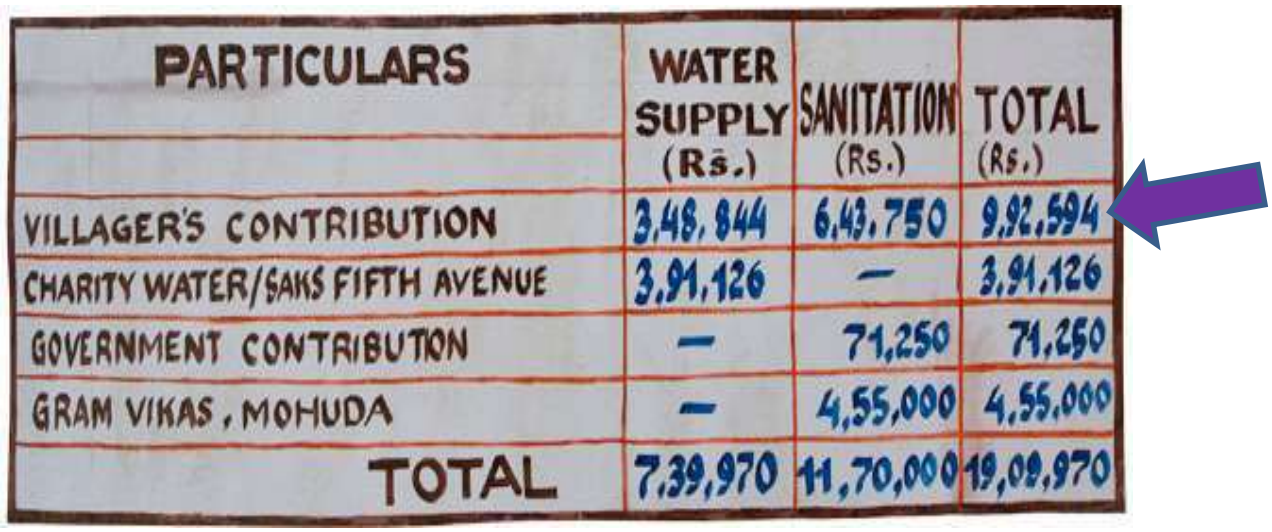
Whatever it is called, there is resounding agreement that rural communities need some sort of support, often in the short and long-term. This report presents guidelines for who should help, and how.

The Case for Resolution

Most development organizations monitor and evaluate during their programs, but this is not enough to ensure that water interventions lead to sustainable services. Post-implementation monitoring is necessary to ensure that services continue, and post-implementation evaluation can help to understand why systems are working or not. For those few organizations that do monitor functionality or services after building water systems and toilets, big questions remain unanswered, such as "How should

implementing organizations resolve issues when they arise?" Below, the case is made for implementing organization resolution of issues identified during post-implementation monitoring and evaluation.

The Rural Water Supply Network (RWSN) and others have compiled data from developing countries around the world showing that, on average, 40% of water points are not functioning at any given time. Water points end up requiring repeated rehabilitation, which is a massive waste of investment. Even worse, given the trend to have communities contribute funds and labor to the construction of water points (Figure 3), when those water points fail, poor families are made even poorer.



PARTICULARS	WATER SUPPLY (Rs.)	SANITATION (Rs.)	TOTAL (Rs.)
VILLAGER'S CONTRIBUTION	3,48,844	6,43,750	9,92,594
CHARITY WATER/SAKS FIFTH AVENUE	3,91,126	—	3,91,126
GOVERNMENT CONTRIBUTION	—	71,250	71,250
GRAM VIKAS, MOHUDA	—	4,55,000	4,55,000
TOTAL	7,39,970	11,70,000	19,09,970

Figure 3. This photograph shows that the villagers contributed significantly to the projects. Source: (7)

Regardless of this well-known problem, tens of thousands of new water points continue to be constructed every year. Unfortunately, governments and funding agencies have short time horizons and frequently measure the success of their water projects by money spent, or the number of "beneficiaries" reached. There seems to be a sense that "building water supply systems is more important than keeping them working" (1), because few organizations know whether or not the water systems they have built are still operating.

Investments continually fail to produce the long-term benefits promised, and yet, no one in a water development organization loses a job because a water system fails. No charitable organization goes out of business when the water systems they built fail. Clearly more incentive is needed beyond our good intentions to make things right. Many developing country governments cannot control implementing organization quality, so who can? Organizations have low incentives to look back at the long-term results of their work, because it costs money, donors are not demanding this information, and—to be honest—the results could make them look bad. Independent verification of outputs and outcomes is even rarer. Almost anyone can work in rural water supply forever without ever being held accountable for their actions (1).

While there are several methods to assess the sustainability (either actual or predicted) of rural water supply projects, few approaches act on those findings to improve the situation on the ground (8).

However, some organizations are recognizing the need for not only looking at long-term outcomes but also resolving problems identified beyond simple rehabilitation.

For example, IRC's Catarina Fonseca says proper development requires us to "fix the problem but also fix and fund the root causes of the problem" (4). The Water and Sanitation Rotary Action Group (WASRAG) guidelines state that "each project should be monitored on a regular basis (e.g., annually) by qualified technical persons to determine if the project is functioning as it was originally intended… Should problems be discovered, the report should include a positive plan for improvement that will result in re-establishing sustainability… Any] necessary improvements be shared with the operators, including procedures required to improve the system and return it to one that is sustainable" (9).

Ideally, resolution activities should be a bridge to sustained, locally-led services. While implementing organizations have a responsibility at a certain level, the goal is for governments to lead the way in ensuring water services for everyone in their countries. These guidelines, approaches, and models are intended to move implementing organizations toward that common goal.

Methodology for This Report

This report is primarily based on in-depth interviews, a synthesis of various data and information from journal articles, reports, presentations, and the Resolution Workshop held in Washington, D.C. in February 2014.

Focus of This Report

Because of the complex nature of water and sanitation services and hygiene behaviors, the causes of failure, and ways to address them, the focus of this report has been narrowed as follows:

- Developing countries
- Water only (vs. water, sanitation, and hygiene)
- Rural water services
- Implications on non-governmental implementing organization actions (vs. government actions)
- Community-managed water systems (vs. private sector or government-managed systems)
- Development (vs. emergency relief)

These guidelines are intended for implementing organizations, which include (but are not limited to) volunteer groups, church groups, civic groups, international NGOs, local NGOs, community-based organizations, and for-profit implementers.

The main reason for the focus on water vs. water, sanitation, and hygiene (WASH) is that water failures have been studied and documented for decades and there are some clearly established models for resolution. Compared to water, sanitation and hygiene have been long ignored, but both have received more attention and investment in recent years. More and more good research on why development interventions fail and what can be done about it is becoming available. Thus, in future reports, Improve International will address implementing organization resolution of sanitation and hygiene challenges.

Research Questions

Research questions that formed this report were:

- Why do water systems (built by external implementing organizations) fail?
- Which problems with water systems can be influenced or addressed by implementing organizations post-project?
- What is the responsibility of implementing organizations for addressing these problems?
- What are the costs of existing resolution models?
- Which resolution models are successful?

Questions that will be addressed in future reports with further discussion and research include:

- What are the barriers to implementing organization resolution?
- Which resolution models are successful?
- What are criteria for successful resolution?
- What are appropriate time frames for implementing organization responsibility?

Desk Review

To get a comprehensive, current picture of reasons for failure and models for resolution, Improve International looked at formal evaluations, published and unpublished research, blogs, and email discussion groups (notably RWSN's D-groups). Appendix A summarizes the literature review. While reviewing the literature for reasons for failure, "saturation," or the point at which no new information or themes were observed, was quickly reached. However, the research team continued to review articles and gather data to get a sense of the commonality of certain types of failure across countries and methods. More and more information on water point functionality and research on the topic of water service sustainability is becoming available, so the author set a cutoff date of July 2014.

In-depth Interviews

Improvement International approached 42 people representing a variety of WASH implementing organizations, donors, and research institutions to participate in in-depth interviews; the 29 people who accepted are listed in Appendix B. Interviewees were selected purposively, attempting to achieve diversity in country as well as type and size of organization. The interviews, which took about an hour, were qualitative, semi-structured by telephone, Skype, or in-person. The questions were designed to identify and categorize problems that have been encountered with WASH programs, and how they or their organizations have addressed those problems, or how they believe they should be addressed. The interview questions are provided in Appendix B.

Resolution Workshop

Desert Research Institute, Improve International, Millennium Water Alliance, and WASH Advocates convened a workshop in February 2014 for WASH sector professionals to share knowledge about Resolution activities. This workshop provided a brief introduction to the monitoring, evaluation, resolution, and learning (MERL) process, and focused on examples of how organizations are addressing problems identified through post-implementation monitoring and evaluation. Participants were asked to

think critically about the most effective ways to influence their organization's approach to MERL and focus specifically on Resolution. The main goal of the workshop was to produce draft guidelines for how to approach the Resolution component of MERL (3). Appendix C compares the guidelines developed in the Resolution Workshop to other recommendations found in the literature. This input was considered in the development of the guidelines in this report.

Defining the Problems with Water Systems

When asked to give an estimation of the extent of the problem of failed water and sanitation projects in their area, three-quarters of respondents described the problem as "very big" (10). Improve international has assembled 126 "snapshots" of functionality for water points in developing countries around the world from 1997 to 2013. Because these snapshots do not cover the functionality of the same water points over time, it is not known whether they were temporarily or permanently non-functional. For purposes of this report, and because the literature almost universally identifies the lack of repairs and maintenance as an issue for water systems in developing countries, it was assumed that non-functionality at the time of the study equaled failure. Linear regression on the average of those rates shows only a slight decrease from about 41% since 1997 to approximately 38% in 2013 (Figure 4). Appendix D has more detail on these non-functionality rates and the reports or studies where they were found.

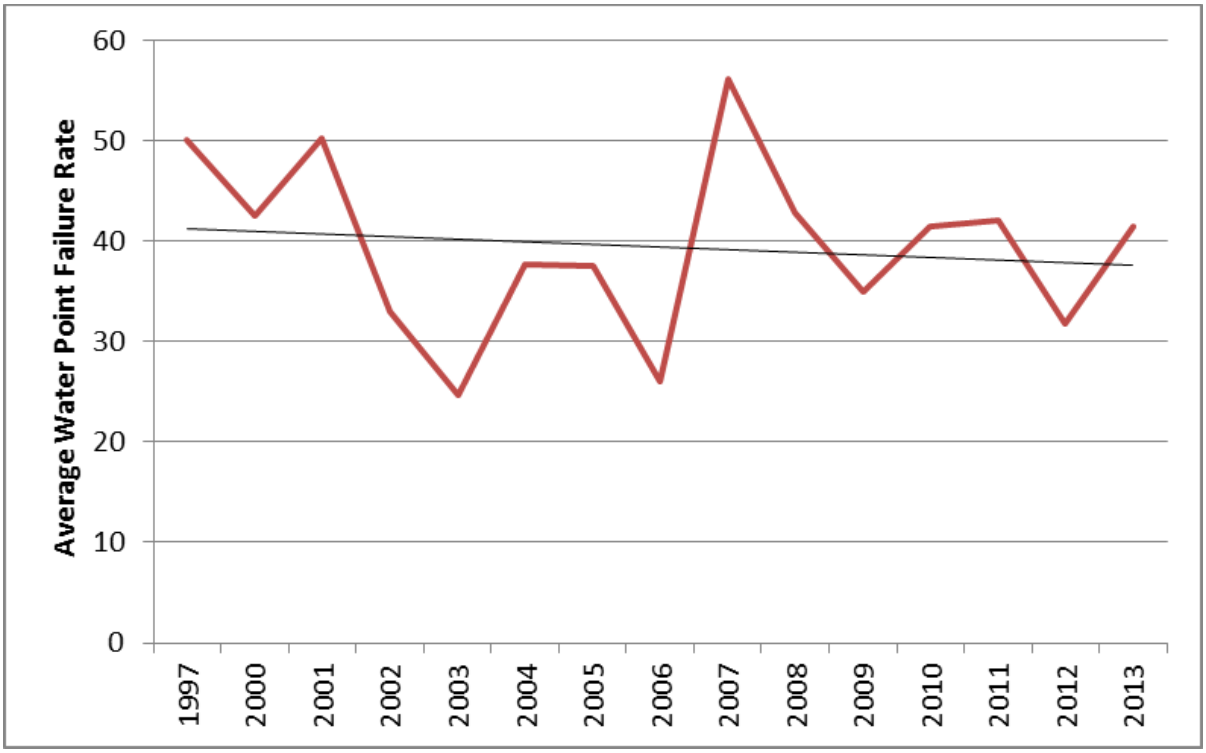


Figure 4. Global Average Water Point Failure Rates

Even if systems are "functional," (i.e., water is flowing) they often still provide poor levels of service (11; 12) in all areas: quantity, quality, reliability, and accessibility. For example, the majority of water points sampled in Liberia had contamination that made the water from them unsafe for drinking (13).

Lack of an Evidence Base for What Works

Another overall contributor to continuing failures is a lack of an evidence base for what works. While there is extensive information on what does not work, one of the more critical barriers to understanding the sector, and a weakness of current approaches, is the paucity of reliable data on how to ensure sustainable services (14). Much greater emphasis on examining what actually works over time is needed to create a body of evidence that justifies a paradigm shift in public and private resources for WASH interventions (15).

Functionality of water services depends on a complex interaction of factors, as confirmed again in an analysis to identify predictors of functionality for more than 25,000 community-managed hand pumps in Liberia, Sierra Leone, and Uganda. Factors significantly associated with a water point not working were system age, distance from district/county capital, and absence of user fee collection. Other variables associated with functionality status included well type, hand pump type, funding organization, implementing organization, spare parts proximity, availability of a hand pump mechanic, regular servicing, regular water committee meetings, the presence of women in key water committee positions, rainfall season, and perceived water quality (16).

When the complex array of "building blocks" is in place, hand pump functionality rates appear reasonably high (16). But given the global failure rates, ensuring this set of factors remains part of every new or rehabilitated water service is a huge challenge.

Why Water Systems Fail

Based on evidence from a wide range of literature and project documentation, five main groups of factors which appear to affect post-project sustainability have been identified: technical; financial; community and social; institutional and policy; and environmental (8). Appendix E shows information culled from the interviews and literature search dealing with multiple aspects of failure, many of which can be organized into the categories above, and several would fail into an "implementation" category, meaning those external organization-controlled activities that lead up to and surround the building of a water point or system.

What this information makes clear is that the same kinds of problems occur in many locations and have been occurring for many years. Many of these problems relate to an overall lack of quality control in planning and execution. Thus, for purposes of determining guidelines for resolution, it is useful to categorize the commonly mentioned reasons for failure by level of implementing organization control. Table 1 shows that most of the 46 problem subcategories in Appendix E are, arguably, fully within or partially within implementing organization control. The fact that a problem was only mentioned a few times does not necessarily mean that it is not critical to sustainability, rather, that it is not well studied.

Table 1 – Common reasons for water system failure that are within implementing organization control

Within implementing organization control	Sustainability Framework Category	Reasons for failure	Total Mentions[4]
Partially	Financial	Inadequate tariff to cover recurrent costs, capital replacement or system expansion costs	Some
Partially	Financial	No capital contribution from community	Some
Yes	Implementation - execution	Poor community engagement, poor government engagement, lack of transparency	Many
Yes	Implementation - execution	Poor manufacturing quality	Many
Partially	Implementation - execution	Lack of tariff payment or collection to cover recurrent costs / lack of effective cost-recovery mechanisms	Many
Yes	Implementation - execution	Insufficient training of service providers, water committees	Some
Yes	Implementation - follow up	Lack of evidence base for what works	Few
Partially	Implementation - follow up	Improper use	Few
Partially	Implementation - follow up	Lack of ability to perform major repairs	Few
Partially	Implementation - follow up	Lack of operation and maintenance	Many
Partially	Implementation - follow up	Lack of skilled people, lack of mechanics, trained mechanics leave, Loss of skills over time, lack of continued training and capacity building	Many
Partially	Implementation - follow up	Lack of some form of long-term external support	Many
Yes	Implementation - follow up	Lack of accountability; no long-term project monitoring and evaluation	Some
Yes	Implementation - planning	Lack of meaningful involvement of women	Few
Yes	Implementation - planning	Poor NGO relationship with community	Few
Yes	Implementation - planning	Installation of water points leads to degradation of other resources	Few
Yes	Implementation - planning	Water supply insufficient for multiple uses	Few
Yes	Implementation - planning	Inappropriate technology; no vetting of new technologies	Many
Yes	Implementation - planning	Project vs. services thinking; inflexible planning approach; unclear objectives of project	Many
Yes	Implementation - planning	Lack of water source protection/production, quality (pollution, arsenic, salinity, turbidity, etc.)	Many
Yes	Implementation - planning	Supply-driven; heavy or inconsistent subsidies	Some
Yes	Implementation - planning	Lack of clarity over roles for operation and management	Some
Yes	Implementation - planning	Planning too brief; poor planning; poor data collection	Some
Yes	Implementation - planning	Lack of cultural understanding	Some
Yes	Implementation - planning & execution	Poor quality workmanship; bad Installation; poor design; poor siting; no monitoring or supervision during project; personnel qualities	Many

[4] Mentions by interviewees and documents found in the desk review; using Guest et al (144) evidence of achieving data saturation at 12 interviews: many is >12 mentions, some is 5-12 mentions, and few is <5 mentions.

Within implementing organization control	Sustainability Framework Category	Reasons for failure	Total Mentions[4]
Partially	Institutional	Legal frameworks for recognition of water committees and ownership	Few
Partially	Institutional	Lack of private sector involvement in goods, services and management contracts	Few
Partially	Institutional	Weak institutions involved in service provision e.g., high turnover, low capacity, low resources, poor information management systems	Many
Yes	Institutional	Lack of institutional coordination	Some
Partially	Social	Ignorance of rights, or fear of demanding rights	Few
Partially	Social	Ownership: Lack of knowledge, desire, leadership for repair, culture of dependency	Many
Partially	Technical	Lack of standardization of components especially for hand-pumps	Few
Yes	Technical	Lack of spare parts, treatment products, tools and equipment (especially for hand-pumps)	Many
Yes	Technical	Corrosion of hand pumps	Many

It is difficult to determine which, if any, of the above problems are root causes of failure vs. symptoms. There is wide range of water interventions and they are not evaluated consistently or rigorously (2); however, the repetitiveness of the problems identified through monitoring and evaluation of water points across the globe suggests that there are common ways implementing organizations can respond.

Why Rehabilitations Are Not Enough

The experience of many users is that a new water point is built, works for a while, then poorly for another year or two, before it finally breaks down. Even well-managed water systems that can collect enough money for minor repairs struggle with the funds, skills, or parts to make major repairs. So often the water point will remain broken for years until some other organization comes to "rehabilitate" it (1; 17; 2). For example:

- In Liberia, 69% of 544 rural water facilities where NGOs intervened were rehabilitations (13).
- In 1980, UNICEF funded a national inventory of boreholes in Uganda and found that, out of a national stock of 5,089, only 25% were working. An extensive rehabilitation program was undertaken, but three years later the percentage of working pumps had only increased to 32% (18).

Rehabilitation is one of the best-kept secrets for counting "beneficiaries" at a much lower cost than for building new water points. Figure 5 shows examples of budget percentages for rehabilitations from the literature and interviewees. These numbers represent programs, organizational budgets, and donor budgets. Information on rehabilitation budgets is not well documented, but based on this small sample, on average 31% of budgets go to rehabilitation of failed infrastructure. Appendix F shows more detail and references for these numbers.

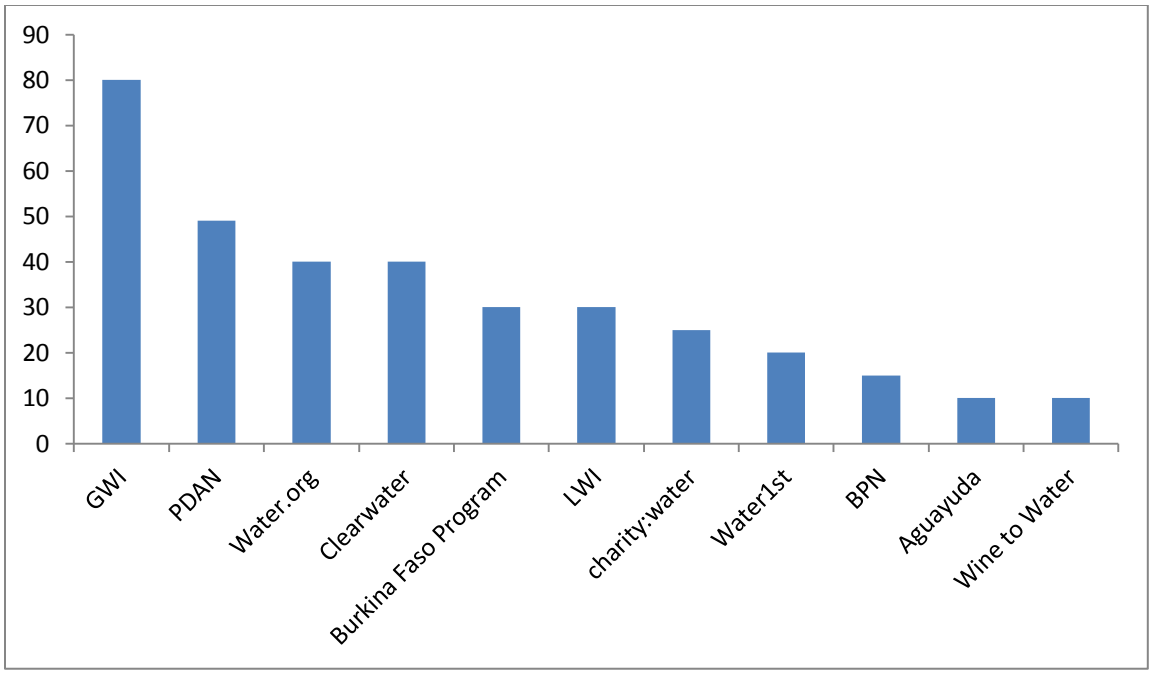


Figure 5. Percentage of program or organizational budgets for rehabilitation of water points

Given the complex mix of factors required to keep water services going, rehabilitation work that focuses only on technical problems with a water point will not succeed in ensuring sustainable water services. Many rehabilitation efforts ignore social, financial, and management problems, and perpetuate implementation issues like poor social mobilization, poor construction, and poor siting of the water point (19). "A project is considered 'broken,' put on a list, and repaired without considering" how various problems at the local level will undermine future sustainability (19).

To contribute to sustained water services, funds used for simple rehabilitation could be better used for comprehensive resolution activities.

Guidelines for Resolution

Based on common failures and recommendations from interviews, the literature, and a February 2014 Resolution Workshop (3), guidelines[5] were developed for implementing organizations when resolving problems with water services. Table 2 presents suggested guidelines for resolution and related approaches. Many of these are relevant to original interventions as well.

[5] The definition of guideline is a general rule, principle, or piece of advice. Each organization will have to determine the applicability of each guideline based on the specific situation. Synonyms include: recommendation, instruction, direction, suggestion, or advice.

Table 2 – Guidelines and Approaches for Resolution by Category

Sustainability Framework Category	Guidelines	Practical Approaches
Overall	• First do no harm. To avoid repeating mistakes, implementing organizations must take time to understand and address root causes of problems instead of just repairing infrastructure. • To best serve users, implementing organizations, donors, and governments must change their measurements of success from the number of new beneficiaries to measurements like the organization's contribution to the nation's water goals, water-person-years, or percentage households in a district with access to an ongoing basic service level. • Implementing organizations must be accountable to water users.	See below
Implementation	• Organizations should shift from just building water systems and rehabilitating broken systems to facilitation, such as capacity building for supporting service providers. • Implementing organizations and local stakeholders should collaboratively define and agree on roles and responsibilities in ensuring ongoing services. • Implementing organizations should improve monitoring to rapidly and accurately identify areas for resolution. • Donors should show increased flexibility in funding to support such efforts.	• Extend implementing organization responsibility past the project • Enable accountability of service providers • Develop (or strengthen or better utilize) platforms for sharing best practices and evidence of what works • Set up agreements with communities and service providers on roles
Environment	Implementing organizations should understand and plan water services based on users' multiple needs and sources of water, seasonal availability of water, and water resource management needs.	• Encourage watershed protection activities • Educate users and service providers on water conservation
Financial	Water services are not free—all stakeholders must understand lifecycle costs and agree on who will pay for which costs over a period of time.	• Clarify water system life cycle costs • Help service providers set and collect appropriate fees • Help service providers install household water meters

Sustainability Framework Category	Guidelines	Practical Approaches
Institutional	Implementing organizations should engage local governments and work within national frameworks.	• Advocate to governments • Stimulate local private sector to deliver services or support service delivery • Help strengthen local governments Facilitate post-construction support of rural community water committees • Enable accountability of service providers
Social	Implementing organizations should make their exit strategy and timeline explicit while planning resolution activities with local stakeholders.	• Set up agreements with communities and service providers on roles • Understand and stimulate demand for better services
Technical	Implementing organizations should engage local governments and work within national frameworks.	• Carefully consider technology applicability in context • Strengthen or build spare parts supply chain

Below, the guidelines are described further. The following sections explain practical approaches and existing resolution models.

Overall Guidelines for Resolution

First do no harm: do not make the same mistakes

Most in the water sector consider one of the primary outcomes to be improved health. In that case, implementing organizations and donors should be held to the same standard as health care workers. That is: first, do no harm. This is a fundamental ethical principle throughout the world. It may be better to do nothing, than to risk causing more harm than good. Given the rampant failures of water systems, implementing organizations and donors must consider the possible harm that any water intervention might cause, especially if it fails (20). RWSN advocates for raising awareness among implementing organizations of the damage that they can actually do with misdirected approaches and actions so that they realize the need to adhere to existing policies (1). Greater accountability means that implementing agencies, both governmental and nongovernmental, move from a project- or infrastructure-focused approach toward a service- or customer-focus (21).

Implementing organizations and donors can contribute to developing a sector capable of delivering sustainable services at scale if they take a systemic approach that builds on the sector's strengths and helps address its weaknesses (22). This kind of systemic change takes time and sustained investment (22).

To avoid doing further harm, it is critical that implementing organizations and donors learn from the past and the context (including relevant local policies and standards) before attempting to resolve

problems. This is not limited to their past work; they should also take advantage of the bountiful information available from the sector.

Change the measurements of success

To best serve users, implementing organizations, donors and governments must change their measurements of success from number of new beneficiaries to measurements like their overall contribution to a country's water sector, water-person-years, or households in a district with access to an ongoing basic service level. Many implementing organizations measure success by the number of systems built or rehabilitated and approximate numbers of people served (or re-served). This is likely due to the way the Millennium Development Goals are defined, but this measurement of success does not consider the quality of water services delivered, and most organizations do not subtract from their totals when water systems fail.

Accepting that a reliable water service requires not only well functioning hardware (for example, pumps and pipes) but also a range of so-called "software" (such as reliable management, long-term support, sound financing plans, continued training for managers and mechanics), which is an important departure from the conventional way of assessing success (8; 23). Donors, not just implementing organizations, must increase their flexibility based on this understanding.

There seems to be a sentiment in the water sector that "we need to fund first those who don't have access rather than fund maintenance for those who already have access" (4). However, Catarina Fonseca disagrees: "the moral imperative to provide aid in the water and sanitation sector has 'physical' and 'time' boundaries. This has no parallel in other sectors. In education, no one claims that aid funds can only be used to pay for the construction of school buildings and then parents need to pay the school teachers and for school materials, or even the maintenance of the schools" (4). A significant body of evidence shows that technological solutions (just installing water points) are not enough. Yet, because maintenance and other "software" are less attractive to donors and implementing organizations than new installations, they continue to be lower priority activities (24). Governments, donor organizations, and implementing organizations must work in a way that recognizes that maintenance of existing water systems is far more important than putting in new facilities.

Some recommend measuring the organization's success by its contribution to a country's performance in the water sector. Overcoming donor dependency is difficult but must in time be transformed into self-sufficiency. The success of WASH programs must ultimately be the result of national spearheaded priorities and support (24). In this case, an implementing organization's means to accomplish this could be (based on the country's needs) advocating and providing evidence to governments for policy changes, providing guidance, and supporting the ability of local governments to implement such policy, and/or collaborating on monitoring and mapping efforts. One specific way to measure success is to consider the level of services[6] delivered over time by each water system, for example, when all water points in a district have at least a basic level of service.

[6] IRC's website has resources on monitoring service delivery.
http://www.waterservicesthatlast.org/resources/building_blocks/monitoring

If implementing organizations must continue to measure success on the project or community level, Koestler et al (25) proposes using "water-person-years." This shifts the focus from new infrastructure development to operation and maintenance of existing water systems, which is crucial for sustainability.

Be accountable to water users

Generally, it seems that no one is accountable to anyone else regarding implementing organizations and rural water supply, except perhaps the poor communities whose accounting books are occasionally checked to see whether people are paying for their poor water services. RWSN says that the lack of accountability leads to "a lack of professionalism and work ethic among many" (1). In many countries, almost anyone can decide to "do good" by attempting to improve rural water supplies (1). A consulting firm, NGO, civic group, church group, or volunteer can work according to its own standards and procedures, ignore best practices, bypass national sector policies and strategies and completely ignore government agencies in the process (1). Sector professionals in governments, donor agencies, and some implementing organizations are often ill-informed about users, never mind their needs and demands (14). This limited understanding means that too often those sector professionals make uninformed assumptions about what sort of services people want or need (14; 26).

If governments cannot control implementing organization quality, who can? Organizations have low incentives to look back at the long-term results of their work, because it costs money, donors are not demanding this information, and the results could make them look bad. Independent verification of outputs and outcomes is even rarer than self-verification. Almost anyone can work in rural water supply forever without ever being held to account for his or her actions (1).

Figures 6 and 7 show how accountability in the water development sector works now and how it could work.

Figure 6. How it is now: no accountability to "beneficiaries" Source: adapted from (14)

RWSN advocates for a high level of coordination between rural water supply actors at national and local levels; strengthened institutions and improved mechanisms to better hold implementing organizations, other government agencies, and donors accountable; development of ways of ensuring that project implementation schedules are for the benefit of water users rather than funding agencies; and high levels of professionalism and work ethic among rural water supply sector actors (1).

Piers Cross, a former Global Manager of the World Bank's Water and Sanitation Program with 30 years of experience working in the WASH sector, suggests, "We really should have an agreement between development financiers that whatever funds they supply: 1) they've got to think about longevity of the services; 2) they've got to engage some kind of political will to monitor this; and 3) they've got to monitor it all" (27).

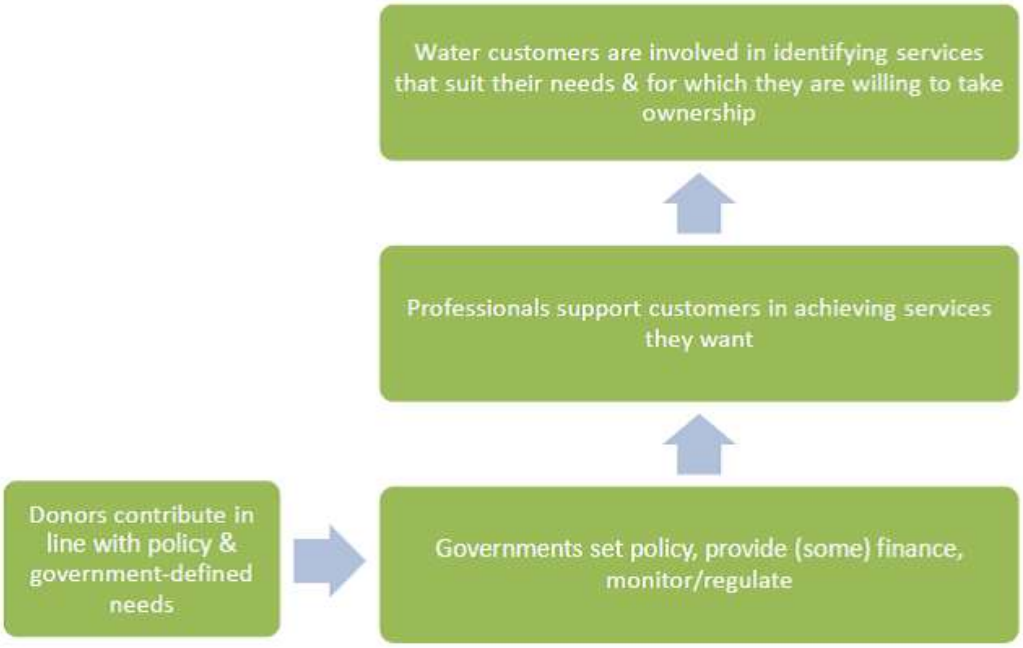


Figure 7. How it could be: professionals are accountable to water customers. Source: (14)

Practical Application of Resolution Guidelines

The following overall guidelines are recommended for implementing organizations when approaching resolution activities:

- Organizations should shift from just building water systems and rehabilitating broken systems to facilitation, such as capacity building for supporting service providers.
- Implementing organizations and local stakeholders should collaboratively define and agree on roles and responsibilities in ensuring ongoing services.
- Implementing organizations should improve monitoring to rapidly and accurately identify areas for resolution.
- Donors should show increased flexibility in funding to support such efforts.

Extend implementing organization responsibility past the project

Lack of implementing organization accountability and no long-term project monitoring and evaluation were mentioned as reasons for water system failure. When this was discussed at the Resolution Workshop in February 2014, there was no consensus on how long implementing organizations should monitor post-implementation and be responsible for the results. Several small groups suggested monitoring projects for at least 10 years with various evaluation checkpoints during this timeframe. While participants thought 10 years was an arbitrary number, they also agreed that five years would be too short to assess sustainability. All attendees agreed that monitoring increments need to be supported from the initial project planning stages and reflected in the budget. Future research will investigate appropriate time frames for implementing organization responsibility.

The figures below show a qualitative depiction of implementing organization and government responsibility levels. In Figure 8, the implementing organization takes on all or most of the responsibility up front and then expects the community to be responsible for the system after that. The government is not involved at all. Figure 9 shows a better way forward that involves longer-term support: an implementing organization transitions responsibility over time to the appropriate service authority or service provider (local government, community, etc.). In this case, the organization's support does not have to involve direct implementation.

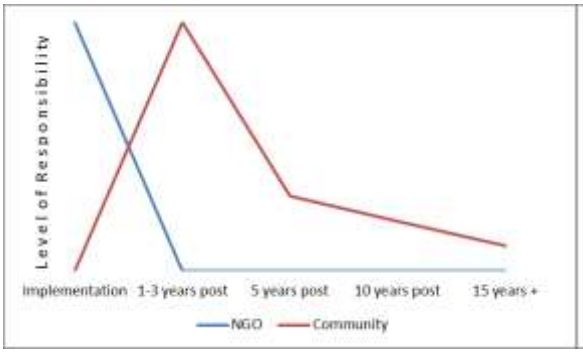


Figure 8. Typical Project-Focused Approach

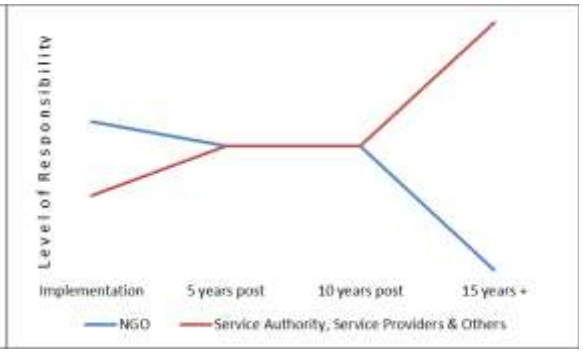


Figure 9. Focus on Sustainability

Increase the length of planning phase

Why: Rather than doing a quick rehabilitation of water infrastructure, implementing organizations should take more time planning to better approach resolution. A key factor mentioned by many WASH experts interviewed about sustainability was to allow for sufficient time in the planning phase for implementing a rural water project (10). Many other mentioned reasons for failure relate to the planning phase, such as a lack of cultural understanding and lack of clarity on roles of various stakeholders (see Appendix E). While these comments referred to planning for original implementation activities, the point is still relevant for planning for resolution. Thorough data gathering, contextual understanding, establishing relationships, and developing clarity on roles also take time beyond what is typically allotted for implementation or rehabilitation (10).

How: Use the evidence base to manage expectations with implementing organization management, donors and partners. Help them to understand that sustained impact at scale in this sector involves technological change, institutional change and changes in user behavior, which all take time and patience (14). Improvements to planning should include a more intensive phase of acquiring contextual data and understanding, building relationships, and calculation of the economic implications of operation and maintenance (10). implementing organizations should especially build time into the planning process to learn from past sector failures and successes as well as understanding of the context and why the existing water system failed or is not providing at least a basic service level.

Key Considerations: There are no quick fixes or "one-size-fits-all" solutions to be found in the delivery or restoration of water services. Development of trust between the implementing organization and the beneficiaries takes time to develop, as does the development of community consensus and demand, if necessary (10).

Develop more useful platforms for sharing best practices and evidence of what works

Why: Numerous platforms exist related to implementation practice, whether on international development sites, monitoring data platforms, or implementing organization websites.[7] Evaluations are difficult to find for most interventions. Some of this information is relevant to resolution activities, but it is rarely categorized that way. A great deal of useful research is hidden behind paywalls, written in inaccessible academic language or only available in one language.

How: Implementing organizations and donors could best strengthen or better utilize existing platforms by sharing their own information and data. Investing in translation of existing documents might be helpful when working with local governments.

Key considerations: WASH Advocates has begun to collect documents for its MERL platform[8].

Resolution - Environmental Issues

While implementing organizations cannot prevent some environmental-related problems, there are some specific areas that implementing organizations can help to resolve. This guideline for resolution is suggested:

- Understand and plan water services based on users' multiple needs and sources of water, seasonal availability of water, and water resource management needs.

Encourage watershed protection activities

Why: Sustainable water services in many countries are threatened by watershed degradation. There were many mentions of a lack of water source protection, which can affect quantity and quality (see Appendix E). For example, up to 60% of the water used in Central America is pumped from aquifers, which are threatened by overuse from urbanization and contamination by agriculture and industrial waste (23). Researchers in Ethiopia also recommend working on integrated watershed management to conserve water resources and prevent contamination of groundwater owing to human activities (28).

How: Protection activities range from planting trees to ensure recharge of the groundwater to more complex activities, including moving households out of watersheds and promoting agricultural practices that prevent contamination of the water source. In some Central American communities, water users can contribute to the protection and improvement of water sources by dedicating a percentage of water user fees toward conservation work, in the form of an "environmental fund" (23). The Ministry of Water and the Environment in Uganda has published Water Source Protection Guidelines[9] that are intended to be used at the local level.

Water Safety Planning for small community water supplies is another method that deals with issues including water quality and water source protection (see "Water safety planning for small community

[7] The Foundation Center has compiled a list http://washfunders.org/Knowledge-Center/Web-Sites/complete-list
[8] http://www.washadvocates.org/learn/sustainability/merl/
[9] Available at http://www.mwe.go.ug/index.php?option=com_docman&task=cat_view&gid=11&Itemid=223

water supplies" and "Water safety plan: a field guide to improving drinking-water safety in small communities"[10]).

To avoid the proliferation of community committees for each natural resource or development activity, implementing organizations can facilitate the organization of more broadly-based user associations for forest, fisheries, and other natural resources consisting of representatives from various villages (29).

Key considerations: Some watershed protection activities require legal access to, or ownership of, the land. Many recharge areas are privately owned, sometimes by multiple people. Securing property rights around the water source is critical for protecting the source (23).

Educate users and service providers on water conservation

Why: Water wastage is a major issue in rural systems due to leaks or overuse. Improved water points can alter usage patterns for other activities, like agriculture, to the detriment of the water source (30). Fixing leaks leads to better pressure in gravity flow systems, meaning there is no need to find (or fund) an additional water source. Better pressure has led to more reliable service for all users, even those living in higher elevations, at no extra cost (23).

How: Installing household water meters is a low-cost way to improve water systems because it provides the ability to identify and fix leaks, among other benefits (23). World Bank project designs have incorporated water conservation components like water saving designs and the construction of recharge mechanisms, such as check dams and infiltration structures in the watershed (8). A massive education plan for the community and service providers in water management may lead to a responsible consumption of water resources (31). The Global Water Partnership has resources on Integrated Water Resource Management (IWRM) on its website.[11] Implementing organizations might also need to educate water users on different water qualities. For example, in Tajikistan, people equated the clear water in the irrigation canal outside their houses with "clean" water, which in some cases impacted their willingness to pay for piped water (32).

Key considerations: Collaboration with local actors is critical for Integrated Water Resource Management. When water users pay by consumption rather than a flat monthly fee, they often are incentivized to conserve water.

Resolution - Financial Issues

One of the critical challenges to ongoing rural water services is the lack of reliable financing for recurrent costs (8). Thus, this guideline for resolution is suggested:

- Water services are not free—all stakeholders must understand lifecycle costs and agree on who will pay for which costs over what period of time.

[10] Available at http://reliefweb.int/report/world/water-safety-plan-field-guide-improving-drinking-water-safety-small-communities

[11] http://www.gwp.org/The-Challenge/What-is-IWRM/

Clarify water system life cycle costs

Why: All water systems require maintenance and repairs, yet adequate funding for this is one of the main challenges to sustainable services. There were many mentions of lack of effective cost-recovery mechanisms as reasons for water system failures (see Appendix E). Life cycle costing is an important new way to improve the sustainability of water and sanitation services by accounting for both the visible and hidden costs of maintaining the services. The cost of operating a water system includes treatment, management, maintenance, repairs, investment in protecting water catchment areas, and funds for eventual expansion to new families (23). Even after a water point is built and has broken or failed, this conversation can be valuable.

Low-income households are often able and willing to pay for the right water services, especially when better quality services are offered at a cost similar to what they are already paying. However, this can be easily undermined by poorly targeted subsidies or free systems (33). Different implementing organizations work with the same communities using different project principles; some require capital contribution and others do not. As a result, the sustainability of water services provided by the original projects suffers because "communities no longer wished to contribute, despite doing so previously for years" (34).

How: The WASHCost calculator[12] is an online tool to help estimate all the different elements of the life cycle costs. Work with governments, water boards, and users to understand actual life cycle costs of the water system and who will pay. Greater alignment and coordination is needed in the sector so those that are able and willing to pay do so, creating a long-term, sustainable solution (33). Water users must pay the real cost of operating, maintaining, and upgrading water services (30; 23). Subsidies should be used to help the poorest families cover costs and to leverage financing for upgrading small and medium water systems. This requires better planning for and accounting of the life cycle costs, better fee collection and clear communication to users over time (23).

The Safe Water Network is using a market-based approach, which aims to cover their operating and maintenance costs through water sales. To date, all of their systems cover their operating costs, most are building a reserve towards their maintenance costs, and one or two are starting to recover capital costs (35).

Sometimes people's ability to pay is limited, particularly in poor rural communities without regular incomes. Creative solutions to make services sustainable might include hybrid models where donors and governments fund capital expenditure but customers pay small fees to cover the costs of maintenance by local entrepreneurs (33). If those who can pay do, philanthropic support can be better targeted to those that really need it (33).

Key considerations: Although more and more people understand that water services have a cost, there are still many users who refuse to accept the actual rates. This is a common case in Central America (23), but likely because the services are poor. Also, there is evidence that water fees might reduce the health

[12] http://www.ircwash.org/washcost

benefits because people will ration their use of the improved water source. Implementing organizations and policy-makers should carefully consider whether fees will decrease the quantity of safe water used (36), and perhaps help service providers establish sliding scales for fees.

Help service providers/water committees set and collect appropriate fees

Why: Even if tariffs are being collected, some interviewees and publications mention that tariffs are Inadequate to cover recurrent costs, capital replacement or system expansion costs (see Appendix E). If the sum of all lifecycle costs indicates a higher price per cubic meter of water delivered to users than is currently collected, the system is not sustainable (31). Water users' involvement in the planning process can lead to improved water point sustainability; for instance, water committees that held more planning meetings with community members were more likely to be collecting user fees sufficient to cover maintenance and repairs several years later (37). Many organizations say it costs $25 USD to provide safe water for one person, making the cost of installing meters seem too high (around $70 USD per house). However, avoiding meter installation to keep per person capital costs low is a false economy: if an amount of water worth $2 USD per month per family was lost due to leaks or wastage, over three years, that $72 USD would easily pay for the water meter and installation[13].

How: Implementing organizations could advocate to governments to standardize a tariff system for operations and maintenance, including poverty and social inclusion sensitive arrangements (38). Household water meters (see below) can be used to establish tariffs based on consumption above a basic amount.

Operations costs that are often overlooked include (31):

- Electricity service
- Purchase and maintenance of at least two pumps (one main and one spare)
- Depreciation of pump use
- Household meters and installation
- A macro-meter at the source to control leaks and illegal connections
- Maintenance costs of the water supply, replacement, reconnection
- Water committee association fees
- Chlorination system and its operation
- Laboratory analysis for water quality
- Cost of interest on existing loans
- Reserve fund for the extension of water service to new users as well as to predict the drilling of new wells that meet the growing demand

If replacing infrastructure is part of the resolution, there must be an explicit calculation of ongoing operation and maintenance costs of any particular technical option, and demonstration by the beneficiaries and/or authorities that they are able and willing to meet these costs long-term (10; 21; 31).

[13] Costs of meters and installation vary. This example is from Central America.

The WASHCost program has established cost benchmarks and ways to estimate lifecycle costs, but more information is needed on costs of operations and minor maintenance and capital maintenance paid by users in a particular area. If they are lower than national policy and international benchmarks, implementing organizations should attempt to understand why. If users are not able and willing to contribute more, implementing organizations and their partners need to discuss whether funds from domestic taxes and international transfers can be used to fill the gaps. Innovative insurance funds for maintenance and devising smart financing can solve some of the problems (4). COCEPRADIL, an association of water committees in Honduras, is establishing a water loan fund to help communities who need to upgrade or replace pieces of larger systems (39).

Key considerations: Plans must be made to ensure that poor families will not be excluded from water points simply because they cannot pay (19). Changes in fees might require approval by the relevant local regulator.

Help service providers install household water meters

Why: A simple tool—the household water meter—has helped to support cost recovery and improve services in several communities in Central America (23). In combination with the approaches above, meters are an essential tool for water service providers (23; 31). Metering contributes to more equitable services: better services that are affordable for the poorest segments of communities (23). Meters allow the water user associations to establish a sliding scale for water fees based on use, rather than assessing a flat fee for all users. When people pay for the water they use, they tend to be more motivated to use water wisely and fix leaks within the home (31; 23). Meters can also lead to better quality water in gravity flow systems, as maintaining positive pressure in pipes prevents contaminants being sucked into the pipes (23).

How: Ultimately, the use of household meters as part of water system management should be required by national policy, so that user expectations are consistent. At a minimum, service providers should coordinate to make sure meter installation is consistently implemented within a region. Water meters, installed at households in all piped water systems, should be used to monitor consumption and calculate payments. Installing meters must also be combined with building local capacity to manage water systems (23). Meters are an area prime for technological innovation: improvements to metering to improve accuracy and reduce cost would contribute to more effective management of water supplies (14).

Key considerations: It is not enough to merely install meters. It can be especially difficult to install a household meter after a family is accustomed to an unlimited supply of water (23). Implementing organizations should work closely with the users, or consider bringing in peers from neighboring communities with meters, to highlight the benefits meters would bring, primarily a more continuous water supply (23). To avoid concerns of eventual privatization, it is important to work through local actors and be transparent about the purposes of meter installation and use. It is critical to use good quality meters, even if they are slightly more expensive, to ensure user trust in their accuracy (23).

Resolution - Institutional Issues

Many interviewees and publications mentioned weak institutions and service providers as a reason for water system failure (see Appendix E). The approaches below support these suggested resolution guidelines:

- Engage local governments and work within national frameworks.
- Collaboratively define and agree on roles and responsibilities in ensuring ongoing services.

Advocate to governments

Why: Some interviewees and publications mention a lack of institutional coordination and a lack of a supportive policy and regulatory environment reasons for failure of water systems (see Appendix E). While these are not fully within the control of implementing organizations, they can collaborate to collect and present evidence to governments. Developing national government's capacity to bring about change is crucial. This needs to include not only the transfer of knowledge and skills, but also changes to organizational culture, nationally-owned policies, systems of positive incentives, and assured resources (14). When national institutions are fully committed to understanding the issues of poverty and the links between poverty and water, sanitation, and hygiene, and when foreign institutions and "experts" learn to facilitate those processes of organizational culture and drive, then real change will begin to accelerate (14).

Raising a strong, collective voice about what can be done to address certain policy or capacity gaps can be a key part of the resolution process. Given the current status of the enabling environment in many countries, the simple rehabilitation of water systems will not address the substantive constraints that have direct effects on long-term services (40). The long-term challenge is how municipalities or districts can use a mix of tariffs, taxes, and transfers as sources of finance for ongoing water services instead of relying solely on funding from implementing organizations for rehabilitations (8). Changing how projects are financed has the potential to grow districts' capacity so that they can find solutions to problems on their own (8).

How: Implementing organizations can consolidate learning from the monitoring and resolution process to bring realities to the attention of policy makers (22). As part of resolution, implementing organizations can advocate to governments to co-finance recurrent expenditures by paying for some of the repair and replacement costs, just like most governments in the Western world still do (4; 41).

A common need for district level advocacy is to encourage coherence in water planning, including placement of water points and tariff setting. If implementing organizations are working with a community or district on cost recovery and governments provide free water services (or vice versa), that can undermine payment. WaterAid works with municipalities to create local sector development plans and to help the municipalities use these plans to seek further funds from other donors (i.e., transfers) and from central government (i.e., taxes or transfers) (41).

Key considerations: Such advocacy efforts are more likely to be successful in countries where the governments have established water policies.

Help strengthen local governments

Why: Many countries are decentralizing responsibility for water services to the local governments. However, local government entities in developing countries are often weak due to high staff turnover, not enough funding from the national government, not enough staff, staff without the right skills, and poor information management systems. Local governments should be providing support and oversight for community water service providers. For example, many district officials do not know the total number of water points in their district or their current levels of functionality, which suggests that the necessary monitoring of rural water supply is not happening (34). A crucial factor for improving sustainability of rural water services is improving the operational capacity and implementation of the country's water policy at the local level (34). Furthermore, it is important to train staff who engage directly with communities in rural areas because the capacity and commitment of such people can be instrumental in determining the success of institutional support (8).

How: There are opportunities for implementing organizations to improve capacity building in discrete intervention, such as the following:

- Support district strategic planning to reach the unreached, increase functionality, map stakeholders, and analyze resource gaps (42; 43)
- Support government's capacity to coordinate and oversee the diversity of implementing organizations working on water and sanitation projects (44; 34)
- Facilitating training of local government staff on project management, administrative, and contract management tasks (8)
- Support trust-building throughout the whole process of resolution (and ideally throughout planning delivering water services)
- Develop or strengthen monitoring by local governments by providing more structured or modern monitoring tools and instruments (45; 46; 47; 43; 40; 45; 48)
- Support local governments/service providers in the process of water quality monitoring by participating in sampling, analyzing data, and reporting (45; 48)
- Help establish implementation guidance in certain key areas, such as technical norms and water quality standards (8)
- Involve district governments in post-construction and resolution activities to ensure proper monitoring and adherence to local policies (47)
- Establish investment tracking and coordination mechanisms (45)

Implementing organizations must let governments lead. For example, SNV oriented, trained, and assisted Congolese institutions in conducting Water Point Mapping. The governmental institutions led the mapping in two districts, which gave them the advantage to train others on the mapping tool and transfer their expertise. When a local capacity building organization led the effort in another district, the reinforcement of the government institutions did not have the same effect (48).

Key considerations: Implementing organizations need to tread carefully here, recognizing the need to support local governments in the national context, rather than distract them. Also, there may be other

organizations more suited to build capacity in particular areas. It would be efficient to understand the landscape of actors and activities in this area before moving forward.

> [In] almost all circumstances [water user committees] will need back-stopping by some district, regional, or national level organization (49).

Facilitate post-construction support of rural community water committees

Why: The theme that arose most often in the interviews and the literature review was that water user committees cannot manage services without some form of external assistance (8; 38; 49; 19; 34; 16; 50). The community management model[14] has well defined limitations. There is a misconception that community management leads to sustainability of systems, but governments and implementing organizations have not facilitated this effectively (50). **"**Rural water systems in high-income countries are not generally managed successfully by communities, so why should there be an automatic expectation that they can be in low-income countries?" (21).

The 'software' component of resolution activities, such as strengthening local capacity to operate, manage, and maintain water services is as important as the physical infrastructure (28; 30). Governments and development partners must significantly strengthen post-construction support for operation and maintenance systems, and greater efforts are needed to evaluate alternative models for managing water supplies (1; 31; 34).

There is evidence that post-construction support leads to better water services. "In one area of Ghana, where a strong local NGO made visits to all communities on a quarterly basis to provide external support, 86% of all rural water systems in the 44 communities surveyed were functioning" (21). Another study of community management of water services showed that as post-construction support increased, so did community participation and financial durability (51).

How: Benefits and challenges of existing models for resolution are described in a following section. Several of those models address post-construction support. Appendix G shows examples of costs for water system repairs. Appendix H summarizes descriptions, results, and costs for various types of post-construction support.

Arrangements for continuing support of community- level organizations should be clearly set out, preferably in a contractual form between the community and the back-stopping agency (49). Institutional, financial, contractual, and legal relationships between communities and back-stopping agencies should have the goal of permanent, improved service (49). Such external support can be provided by a delicate balance of local implementing organizations, local government, or private entities (18; 34). All organizations involved will also need resourcing and training (49). For example, the Safe

[14] During the United Nations Water Decade (1981-90), the "village level operation and management of maintenance" concept for hand pump maintenance emerged (49). For more background on the evolution of the community managed model and its challenges, see Harvey & Reed, 2007 (21).

Water Network is building up sustainable access to technicians while planning a strategic retreat, "so that over time we'll have a lighter and lighter touch on our systems" (35).

Key considerations: Suggestions for facilitating support to rural water service providers:

- Communication lines between community and backstopping agency need to be clear, and response times need to be rapid (49)
- Spare parts and tools and appropriate forms of transport must be available (49)
- Obtain a clear mandate for support so that support agents can be held accountable for their actions (or lack of actions) (5)
- Provide sufficient financial resources (around $2 USD per person per year) (5)
- Identify financial sources in addition to user contributions through tariffs (5)
- Ensure cost-effectiveness through experimentation with different institutional arrangements, benchmarking, and involvement of the private sector (5)

Stimulate local private sector to deliver services or support service delivery

Why: A few interviewees and publications mentioned the lack of private sector involvement in goods, services, and management contracts as contributors to the failure of water systems (see Appendix E). As discussed above, if community managed water systems are to provide sustained services, they require ongoing support from an overseeing institution, monitoring, refresher training, and occasionally specialized technical assistance. In some cases, support becomes so big and costly that different service delivery models, such as private operators, may be more suitable (52). For example, case studies in Uganda show community-based water management has not produced good results despite its promotion and inclusion within the policy and institutional framework for rural safe water supply (53). If during resolution activities, implementing organizations realize that full support for community-based management is not available, alternatives such as private sector service delivery should be considered (1; 16; 21; 44). The involvement of the private sector as water supply operators and managers and post-construction service providers improves sustainability (43).

The Government of Rwanda has decided to extend private management of water supply schemes to all rural areas of the country, based on its success (54). In this approach, each rural water system is metered and the operators charge on the basis of the total amount consumed per month. Private management has benefited communities by generating employment, stimulating grassroots entrepreneurship, and facilitating the systematic collection of operation and maintenance costs, which contributes to the reliable, sustained delivery of water (54).

Limited data suggest privately-managed water points are more sustainable than community-managed ones (55). Initial evidence indicates improvements across financial and operational indicators (55). In Senegal, a pilot project, *Réforme de la Gestion des Forages Motorisés Ruraux* (REGEFOR), introduced private maintenance contracts and water user associations. Results were impressive: water system functionality rates in the pilot region were increased to 98%, compared to the national average of 80%; repair times were reduced from four days to less than 48 hours; and each water user association saved on average $10,000 USD (54). In another example, SNV identified and addressed two main ways of improving performance for AquaVirunga, a private water operator: reducing water leaks and addressing

the mistrust of customers who were unaccustomed to paying for water (43). Within three years, non-revenue water had reduced from 69% to 45%, revenue had doubled, and AquaVirunga was able to invest in extending services to new customers (43).

Furthermore, many interviewees and publications mention the lack of spare parts, treatment products, tools, and equipment as reasons for failure of water systems (see Appendix E). Small businesses already provide many goods and services into the water, sanitation, and hygiene sector. Their continued and enhanced role is crucial and has the potential to be better supported by government policy and external assistance (14).

How: RWSN (1) advocates for strategic support to enable the private sector to develop and become much more active with respect to rural water supplies, such as:

- Documenting viable technologies as well as maintenance and management systems which can harness the private sector.
- Strengthening institutions and improved mechanisms to better hold the private sector accountable.
- Innovating with subsidy mechanisms that allow users to act as buyers rather than recipients of technology.

Privately-operated decentralized water treatment kiosks have emerged over the last decade (chiefly in India), and organizations like Safe Water Network and Water Health International promote this model. Though operated by a local entrepreneur, O&M responsibilities are retained centrally by the parent company, generating economies of scale, and a greater ability to manage supply chains (55). These models are common in urban areas but may have significant applicability in rural areas (1).

Foster compiled an excellent overview of current private sector involvement in rural water services (55). In summary, private sector involvement is now being promoted at a national policy level in more than a dozen African countries, but formal policy endorsement of private sector management models for rural water supplies appears less explicit in India and Latin America (55). Where commercial viability is questionable due to high costs to service remote rural areas, bundling pump maintenance with piped scheme operations would enable cross-subsidization (55).

Table 3 shows advantages and disadvantages of private management compared to community-based management. For maximum sustainability, more than one approach should be considered and the choice should depend on the local context, and water users' desires (50).

Table 3 – Advantage and Disadvantages of Water System Management Models
Source: adapted from (50)

Option	Advantages	Disadvantages
Community-based model/village level operations and maintenance	Fast initial response Community control Community pride	Needs motivation Needs local skills/tools Access to spare parts
Public-Private Operation & Maintenance	Access to spare parts Skills/resources provided Community choice	Higher cost Slower response times Active regulation required
Private Ownership, Operation and Maintenance	Access to spare parts Clear ownership/responsibility Skills/resources provided	Incentive for rapid repair Lack of ownership High initial cost to owner

Key considerations: Full recovery of capital costs through user fees appears to be rare, particularly in rural Africa; thus, widespread capital investment by private enterprises and entrepreneurs remains unlikely without external subsidies (55). Innovation in business models is needed to build demand for WASH products; to provide affordable, high quality services reliably; and overcome the challenges of maintaining technology and infrastructure (33).

Private sector management models have a number of advantages over the community management model but they are not always more effective (50; 56). In Kitgum, Uganda, previous operators mismanaged the water service through poor revenue management, poor recordkeeping, and inadequate operation and maintenance systems. These problems were attributed to the bad procurement practices through which incompetent firms were selected to operate the system (56). Guidance on how to avoid bad procurement is provided in a new World Bank toolkit: Structuring Private-Sector Participation (PSP) Contracts for Small Scale Water Projects.[15]

Even if a vibrant market for rural water services can be established, it is no substitute for government institutions; government needs to establish a favorable policy environment, design and administer subsidies, manage contracts, monitor and regulate service providers, and facilitate the development of businesses if private enterprise is to contribute to the improvement of rural water service delivery (55).

Set up agreements with communities and service providers on roles

Why: Some interviewees and publications mention lack of clarity over roles for operation and management as a reason for failure of water systems (see Appendix E). For community managed rural water supplies, there is ample evidence that accountability of community service providers to water users is a very vulnerable link (54). There is a high risk of falling into a vicious circle of poor service delivery, non-payment of tariffs by unhappy customers, and further deterioration of services (54). Although accountability and community ownership may contribute to sustainability of water services in

[15] Available here: http://www.rural-water-supply.net/en/resources/details/595

many cases, it should not be made a goal in itself with the implicit assumption that it is the principal prerequisite for sustainable water provision (21).

Because the accountability link between users and community service providers is often weak, contractual agreements offer a stronger link of accountability between the service providers and local government, specifying the services to be provided and performance measurements (54). Even if a service delivery contract is not in place, local service authorities should have the regulatory power and resources to check on service providers (54).

How: During the resolution process, it is important for implementing organizations to discuss and define roles that stakeholders will play moving forward. Having an honest, culturally-aware conversation and then codifying that in a contract or agreement can help communities understand the resources and help available to them locally and avoid the expectation of future implementing organization or donor support.

In Kenya, SNV and partners are supporting the design and implementation of various professional management models, which clearly define the role of the private sector, the local authority, and the water management committees in the management of water services in the given geographic area (48). Appendix I shows an example resolution agreement used by Waterlines in Kenya to provide a match of up to $200 USD per water project to improve the functioning of rainwater catchment systems. Water1st makes an annual contract with each of their local NGO partners; the contract is not just about new construction, but also includes budget for the partner to do follow-up activities with communities (39). EWB has templates of agreements so the community understands what they will be asking them to do and pay for in the long term, along with specific roles and expectations for the NGO partner (57). Because significant investments must be made to rehabilitate old broken water points to make them functional again, Safe Water Network develops public-private partnerships where the mayor's office would provide a 25-year contract to a private service provider. The contract includes rules and regulations based on the national water code of the country, tariffs, and use and profitability (35).

Key considerations: Implementing organizations need to improve their communications and make no assumptions to ensure communities and their respective water committees fully understand and implement their roles and responsibilities with a long-term vision to maintain their water points over time (34).

Enable accountability of service providers

Why: The weakness of service providers can be the cause or a system of the inability to collect fees for cost recovery, a failure reason also mentioned by many. Better cost recovery leads to better services. Water systems that had more transparent accounting by service providers had higher compliance with the monthly tariff payments (51).

How: A key aspect of sustainable service delivery is the establishment of accountability mechanisms, which are the ways water users can hold service providers to account for the service they receive (54; 58). Implementing organizations should strengthen the capacity of community service providers to provide high quality services, by providing training on solid financial controls and documentation,

helping to establish bank accounts for collected fees, and effective communication with users (23). Implementing organizations should also explore how rural water system technicians can best access professional advice and ongoing training (23).

Depending on the local context, implementing organizations should also support or advocate for the institutionalization of community water committees into an independent and accountable organization to strengthen accountability (28).

Key considerations: Corrupt water committees will be resistant to changes, so it is important for water users to know the rules of the game, including basics like who they can call with complaints about their service (23; 54).

Organize isolated community water committees into networks

Why: The sustainability of water services in many rural communities depends heavily on the skills of the water system technician. This key player often is trained by an implementing organization and (maybe) provided with a set of tools. Such technicians are often paid very little and their skills are very limited (23). High turnover is common, either because they find better paying jobs, or have to continue doing their previous job, like farming. Even successful rural water system committees face challenges beyond their skills, and have nowhere to go for advice or support. This is why sustainable services require community water committees to be connected to a network for access to advice on technical, financial or other issues (23; 31). Communities can professionalize their water service delivery and increase their capacity by working together in networks, based on the concept of mutual self-support (54). An additional benefit is that water committee networks can lend funds to one another to pay for major repairs (59). Such networks are also ideally placed to facilitate peer-to-peer trainings, communities of practice, and ongoing professional training for water system technicians.

How: Ideally, such networks should be built in at the beginning of any programming, but can also be facilitated as part of a resolution process in areas with existing systems (23). Implementing organizations that address resolution on a district or regional basis may support networks by enabling use of shared facilities and operational support systems to serve a larger number of villagers at a lower unit cost (9). Implementing organizations can strengthen networks by helping them to understand the institutional and legal framework for water management in the country, (31) and providing management advice and modern tools for data collection.

Key considerations: Implementing organizations need to better understand the following (23):

- How many community water committees are linked into these networks across a country, and how does networking link to service level and quality?
- Why are committees not joining existing networks exist?
- What are the characteristics of strong networks?
- What kind of enabling policies at the national and municipal levels can make weak networks work better?
- How to make networks of support for user associations stronger, more accessible, and more desirable for community water committees?

Resolution - Social Issues

Many interviewees and publications mentioned the lack of ownership and leadership and a culture of dependency as contributors to failed water systems (see Appendix E). The approach below supports the following guideline for resolution of social issues:

- Implementing organizations should make their exit strategy and timeline explicit while planning resolution activities with local stakeholders

Understand and stimulate demand for better services

Why: Simply offering products or services will never be enough to ensure good water service provision (33). Without the motivation of the community to use new or rehabilitated water points, sustained services are impossible, especially if an alternate source is available (49; 60). Community demand for a water system is strongly linked to its long-term success (10; 33; 61), yet many donors and implementing organizations do not understand the factors that motivate people to demand water services, and focus solely on health benefits. Status and convenience are often far higher priorities for customers than health (33).

Many water systems fail due in part to the difficulty of collecting fees from users. Reasons that users do not want to pay may be complex and variable, and during the resolution process it is important for implementing organizations to understand them (33). Users might not value health benefits of safe water, and may be unfamiliar with the taste, leading to unwillingness to pay for it (49). A significant further obstacle to the motivation of a community to use a new source may be the change from free water to paying a fee (49), especially if they believe water supply should be a government service and disagree with the concept of community ownership and responsibility (21).

Water user perception of their service quality is a critical element of infrastructure longevity, especially in places where user fees are expected to cover 100% of recurrent costs for operation and maintenance (37). It is common for demand, and levels of motivation, to increase rapidly as the benefits of clean water become more visible (49).

Figure 10 depicts the ideal relationship between users and water service providers. Empowered citizens are the overall driver of sustainable water services (23), and demand and pay for high quality services. Even as government monitoring improves, no one will be more aware of the daily level and quality of service than the users (23). A well-managed water service provider delivers good services and recovers costs by collecting fees. The better the services, the more likely users are to pay (23).

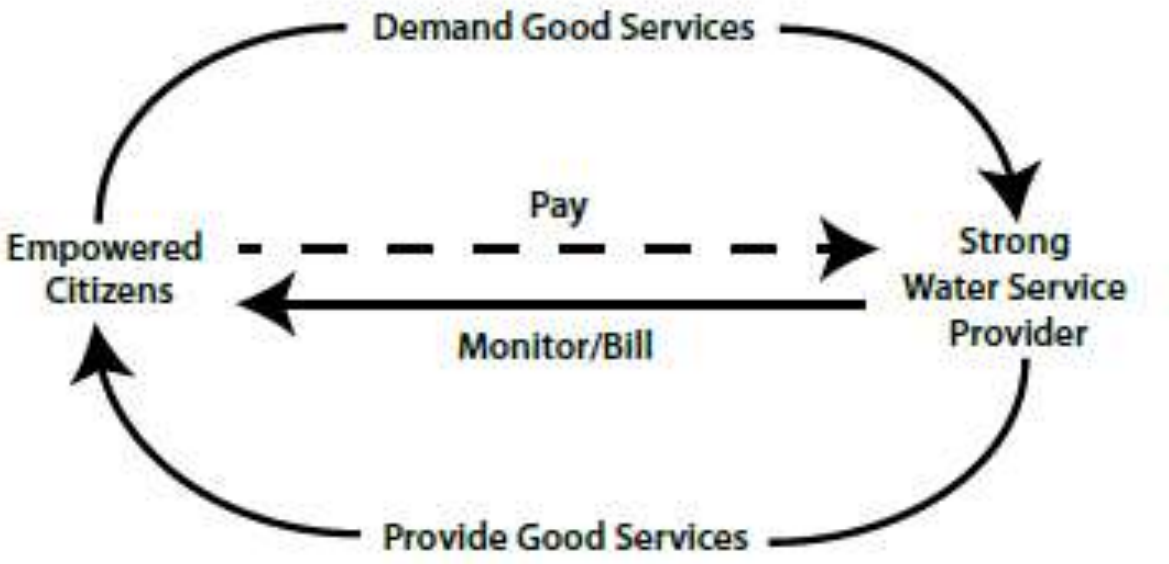


Figure 10. The ideal relationship between water users and service provider. Source: (23)

Capacity building of communities on rights not only enhances processes of downward accountability, but also builds the much needed trust and cooperation among the different actors engaged in community based management for rural safe water supply efficiency and sustainability (53).

How: It is possible to successfully stimulate demand where it is not forthcoming (10). Resolution can include health education and/or involvement of the community in the process of determining life cycle costs and fees. Strengthening and empowering civil society and water user associations to effectively promote and protect the voice and interest of water users is necessary (38).

However, implementing organizations might have more success working with social marketing experts or those who are developing evidence bases for behavior change like the Swiss organization Eawag. Networks or development organizations can support better water services by promoting a culture of valuing water and cultivating local demand for better services (23).

Resolution plans should consider the following aspects of demand and motivation:

- Recognition of community heterogeneity and the rights and preferences of individuals (21)
- User water requirements beyond drinking, such as for occupations, livestock, and crops (1; 62)
- Full consideration of household values, particularly distance to source, reliability, and quality (1)
- Users who will benefit or lose from water interventions (e.g., upstream and downstream users along rivers) (30)
- Current access patterns to water, local customary institutions, water management strategies, and relationships between groups (30)
- Potential conflicts over water points; it is also important to identify pastoral groups, immigrants, Internally Displaced Persons, and refugees (30; 62)

Key considerations: Stimulating demand requires creative, culturally appropriate communication, and marketing strategies that appeal to users' relationships with water beyond health (10). Capacity building approaches require both patience and time to understand and address deep-rooted cultural beliefs (48). Rural communities with strong cultural relations are not likely to deny their neighbors access to their water facilities; therefore, implementing organizations should consider the effects of this culture of "non-denial" on the capacity of the water system they are addressing since it may serve neighboring communities too (62).

Resolution - Technology Issues

The approaches below support the following guidelines:

- Engage local governments and work within national frameworks
- Understand and plan water services based on users' multiple needs and sources of water, seasonal availability of water, and water resource management needs.

Strengthen or build spare parts supply chain

Why: Many interviewees and publications mention the lack of accessibility to spare parts as a contributor to water point failure (see Appendix E). An external supply chain has to exist to ensure spare parts availability across the country and ultimately to achieve a lasting service (34; 53). Community-based management makes developing supply chains difficult because communities are often far from each other, use different technologies, an cannot buy in bulk among other reasons (50).

How: Where in-country private sector providers of equipment, materials, and services do not exist, or are weak, implementing organizations can help strengthen them, keeping in mind genuine competition, choice, and customer service (49). The private sector is no longer viewed as a partner only for the implementation of projects and construction of water systems, but is now considered as being an important complement to the public sector in maintaining projects, specifically in spare parts supply (8; 28). When developing project/resolution budgets, implementing organizations can include small, but significant, sums of money exclusively for training and encouraging the private sector to meet the challenge of supporting rural communities (8).

For example, Plan Uganda initiated a systematic supply chain for spare parts following dialogues between stakeholders, including water committees from their target communities, hand pump mechanics, the district water office staff as well as the spare parts dealers (53). Based on this and other examples, the effectiveness of spare parts supply chains likely lies in forging strategic public-private partnerships between key stakeholders, as well as direct involvement of both central and local government (53). Public-private operations and maintenance of water systems can reduce the pressures on supply chains considerably as spares outlets are needed only in larger regional settlements for private service providers with greater mobility than rural communities (50).

Key considerations: In many places, different private sector approaches have been tried and failed, so it is important to learn from those failures as well as the distribution methods of other sectors like distribution of medicines (34). Furthermore, spare part supply chain would likely be enhanced by standardizing water technology (e.g., hand pumps) within a country to ensure that uniform parts are

available in the country (13; 63). The public-private approach may be limited by the density of communities served, willingness of users to pay for services, and private sector capacity (50).

Carefully consider technology applicability in context

Why: Inappropriate technology is a frequently cited contributor to failed water systems (see Appendix E)**.** Water infrastructure might not be suitable for the environment, hydrogeological conditions, or the users' desired service level. Furthermore, the majority of publicly funded investments in domestic water supplies are made without considering other water uses besides drinking (1). Sustainability can be enhanced by selecting simpler water point technologies which are familiar and have easily obtainable spare parts (30). Technology must suit the socio-cultural, educational, and economic context into which it is to be placed (10). Helping stakeholders to understand how to match technology to its intended social and institutional context appears fundamental to increased success of water services (10).

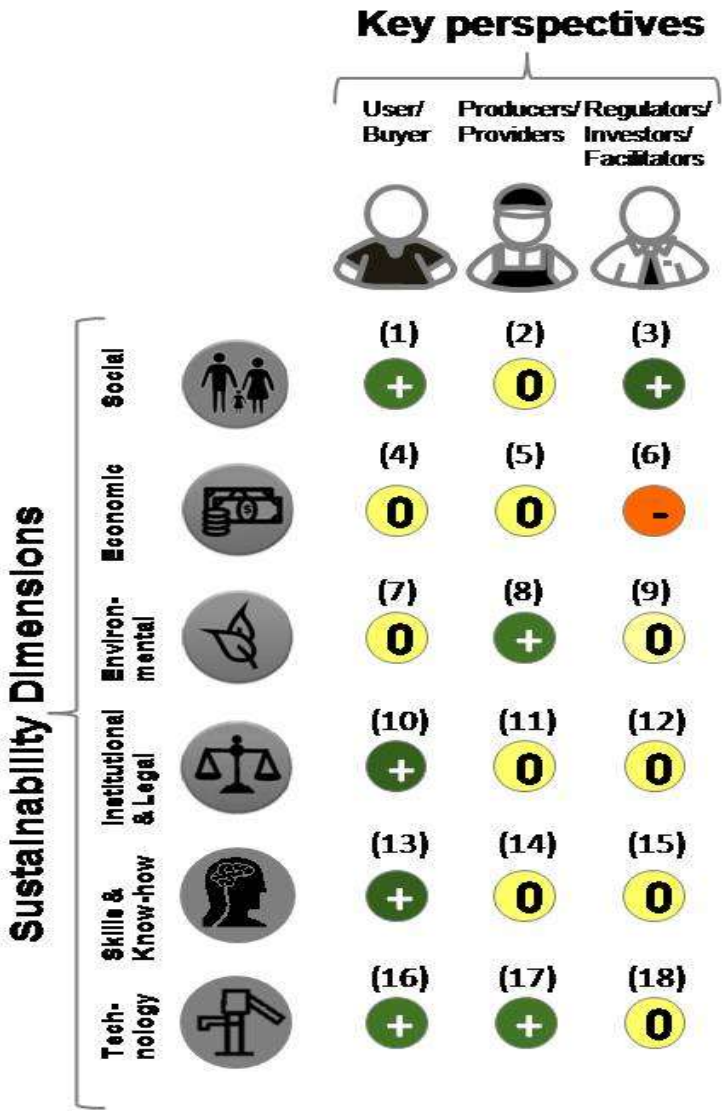


Figure 11 Example TAF Profile. Source (64)

How: If resolution involves upgrading or replacing the water infrastructure, implementing organizations should use the Technology Applicability Framework (TAF) approach[16], or something similar. The TAF is a tool to assess the applicability of a technology in a particular context and its potential to be adopted on a large scale. Using the TAF, implementing organizations can assemble users, technology producers, and regulators to jointly consider economic, technological, social, environmental, organizational, institutional, and legal issues. Specific conversations about reliability and safety, reparability and maintenance, environmental issues, affordability, replicability lead to a TAF profile (see Figure 11) that helps inform whether a particular technology is best for the community (64).

[16] More information and the tools can be found at washtechnologies.net.

No matter what process is used, evaluation of the potential technology should consider at least the following aspects (14):

- Affordability in capital and recurrent terms (by end-users directly, ideally; alternatively to government or NGO programs, which are subsidizing technologies for the very poor)
- Manageability by the network of user-group and support organizations, which must maintain the technology—not exceeding the level of complexity which the support infrastructure can handle
- Physical robustness
- Availability of replacement and spare parts in-country
- Conformity to national policies
- "Fit" to national infrastructure (including roads, energy, and communications)
- Sustainability in natural resource terms

Key considerations: Given that 20 liters per person per day of clean water may not always be enough for rural water users' needs, it is critical when discussing replacement systems to consider their other water requirements, such as for livestock and crops and how these needs can be better linked to requirements for clean drinking water (1).

Benefits and Challenges of Existing Models for Resolution

Given the common reasons for failure described above and the fact that simple rehabilitations are not sufficient to ensure sustainable services, some organizations have developed models for ongoing support of service providers. Where quantitative figures are available, they all point to better quality and improved sustainability of rural water services when service providers receive regular external support (5). On-going external support to community organizations in Africa and India generally contributed both to an increase in the impact of water interventions and to the length of time over which these impacts were sustained, including sustained improvements in hygiene behaviors (8).

Various studies in Latin America have shown that water committees in communities that get post-construction support perform better (65). A study in the Dominican Republic found that community participation was higher in systems that were visited more often by supporting organizations. Financial durability, measured as the ability of tariff-generated income to cover operation and minor maintenance costs, also improved with increased frequency of visits from a supporting institution (5).

The key functions of external support to rural communities for water services include:

- Technical assistance (8) like helping identify or repair problems with infrastructure
- Ongoing training or capacity building of the relevant committee members on topics including physical operation and maintenance, bookkeeping, and hygiene promotion (8)
- Monitoring and information collection for remedial action (8)
- Coordination and facilitation to establish links between community management structures and external support entities, such as the state or private sector (8)

Planning for water systems must be built around local complexities and provide for appropriate transitions of responsibility over time if the services they provide are to become sustainable. Ensuring adequate technical assistance, ongoing capacity building, monitoring, and coordination should be part of planning and preparation for every water service. However, deciding on an effective model or models for resolution mechanism requires knowledge of local political, social, and economic contexts. The benefits and challenges of four models for resolution are reviewed below: Mechanics Associations, Circuit Rider Programs, Networks of Community Water Committees, and Support to Government.

Implementing organizations must carefully consider how to contribute to post-construction or post-project support; the longer the period of support to the community, the higher the sense of dependency the community will have on external support (8). In reality, the support mechanism on the ground may combine different models, with overlapping functions (8). Furthermore, a study of communities using a wide range of post-construction support services provided no evidence that the provision of *free* repairs or *free* technical assistance, or that implementing an intensive supply-driven post-construction support program, are positively associated with improved technical sustainability or increased household satisfaction (66).

Mechanic Associations

Community water committees, no matter how well trained, sometimes need outside technical support. Several organizations have hypothesized that sustainable services can be enhanced by training a local cadre of artisans or mechanics to construct and maintain water points (8; 30; 34). After implementing organizations or bilateral water projects train hand pump mechanics, some go on to set up their own businesses.

Benefits of effective mechanics associations

Area mechanics are the most prominent private sector actors involved in hand pump maintenance throughout Africa, Asia and Latin America (55). Water system functionality, including adequate supply and access, has been shown to improve in areas with well-trained and supported mechanics associations. For example, the Interaide-supported network of Area Mechanics within Salima District, Malawi, and the spare parts supply may have had a positive influence on functionality rates; 60% of water point committees reported that they have good access to support for managing maintenance and repairs (11). Table H.3 in Appendix H shows that the average money collected by area mechanics under one program in Malawi well exceeded that country's minimum wage. However, it is not known whether this income was sustained. Appendix H also contains descriptions of other area mechanic programs in Malawi.

In Uganda, where regular servicing was carried out, water points were functional more often (16). Likewise, hand pumps in Sierra Leone were more likely to be working the closer to the community that spare parts were stored or sold, and where a community had access to a trained hand pump mechanic (16). Improvements in sustainability of water supply in India were partially attributed to setting up a network of hand pump mechanics for major repairs (45). This network has also taken on other water-related tasks, such as preventive maintenance, routine monitoring and plumbing of piped supplies. A

"very vibrant" association of hand pump mechanics in Kibaale district, Uganda, also contributed to improved service delivery (67).

Efforts to form professional pump mechanic associations (rather than train individual mechanics) and organized businesses appear to be yielding more promising results (55). In summary, results of having a district-based mechanics association or network include (67):

- Increased learning and working together
- Increased access to tools, finance, spare parts, and knowledge
- Increased ability to receive service contracts
- Improved coordination and accountability with the district water offices
- Improved accountability, reduced costs, and access to spares

Challenges with mechanics associations

While the presence of mechanics associations can have a positive impact on service sustainability, challenges include the following:

- Follow-up training is rare; experience indicates that area mechanics are likely to require continued support forever, ideally from a local entity, to avoid ending up as another temporary fix for rural water supplies (63).
- There is no common approach to O&M, because there are often no national standards for technology types (e.g., hand pumps) (63).
- There are rarely comprehensive records of people who are trained for future reference in the communities (13).
- The mechanics face competition from many districts, which also repair boreholes for free (63).
- Some communities are reluctant to pay for mechanics' services (53; 68), in part because communities may think that mechanics are already paid by the government or that the mechanics should work as volunteers (63).
- It is difficult for mechanics to secure contracts because community understanding of the importance of preventive maintenance is still lacking. Repair contracts are a reaction to a situation that needs remedial action (63).
- Mechanics have to travel long distances and lack transport (e.g., bicycle) (63)
- Mechanics lack tools (63).
- Technicians trained by implementing agencies then seek paid jobs (13).
- Mechanics find it hard to access spare parts and cannot benefit from economies of scale (13; 67).
- Some mechanics intentionally overcharge for repair for service (13) and there are reported cases of difficulties to access reliable repairs with uniform prices (67).
- Though trained by local government and implementing organizations, hand pump mechanics are not recognized as local private sector players and are mostly segregated individuals (67).
- Mechanics are not involved in decision making in water source development and rehabilitation, and cannot receive any formal government contracts for rehabilitation. This situation has resulted in a lack of adequate information around operation and maintenance such as costs, functionality, and consumer feedback loops (67).

To develop stronger mechanic programs, Baumann and Danert (63) recommend that organizations should:

- Introduce the mechanic(s) to the community during the rehabilitation of the water point
- Support the creation of mechanics associations
- Support monitoring of mechanics by the District Water Office or other relevant authorities, which could include issuing IDs to mechanics
- Provide more hands-on and refresher training to the mechanics

Circuit Riders

Like mechanics associations, post-construction support by circuit riders can address sustainability challenges through the provision of technical, financial, and operational assistance to water systems. Circuit rider programs are based on a model proven in rural communities in the United States. A group of technicians each visit a "circuit" of 30 to 40 communities regularly to check on their water systems. Circuit riders also can provide on-going water quantity and quality monitoring, training, and education to the communities. Communities help pay for the program but the majority of the costs particularly during its initial stage must be funded by local government. Appendix J describes examples of circuit rider programs.

Benefits of Circuit Rider programs

Evidence shows that a well-supported circuit rider program can contribute to improving the reliability of water services. In Honduras, the Technicians in Operation and Maintenance (TOMs) program contributed to increasing the percentage of water systems classified as A (highest level of performance) from 7% in 1986, when it started, to 41% in 2007 (69). Similarly, an evaluation of the circuit rider model in 60 small community-run water supply systems in El Salvador concluded that, in communities visited by circuit riders, there were statistically significant lower rates of contaminated water, higher rates of drinking water disinfection, improved operator knowledge about treatment, less negative community perception of chlorine, higher rates of community payment for water service, greater financial transparency, and greater rates of household water meters than in control communities (Figure 12) (70).

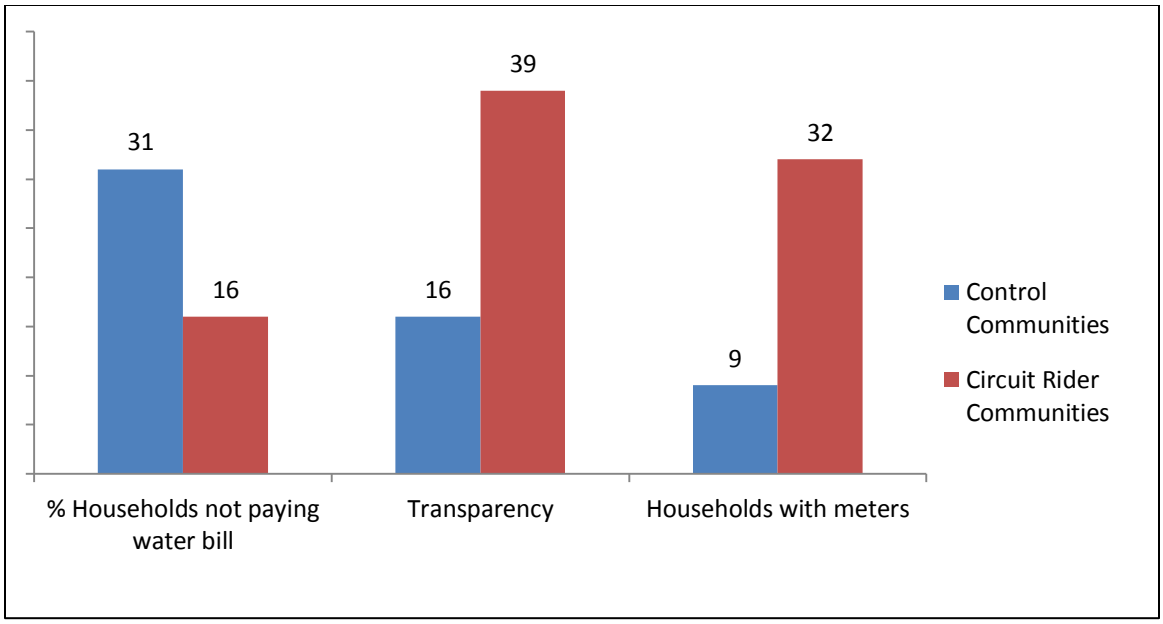


Figure 12. Comparison between communities with support from circuit riders, and those without, in terms of performance of service providers in El Salvador. Source: adapted from (5)

Challenges with Circuit Riders

However, not all circuit rider programs lead to improved services; thus, it is important to look at the frequency and quality of the support visits as well as the type of work done during recurrent support. An implication for implementing organizations considering this model of resolution is that some studies found a more positive impact when the circuit riders' recurrent work is focused on retraining water committees than when carrying out repairs directly (66).

Over-reliance on external donor funding can lead to questions of sustainability for the entire support system itself (8). Engineers Without Borders USA found that the circuit rider programs funded externally did not survive, but circuit rider programs funded by the municipality were "in great shape" (57). Possible financial viability solely based on user fees is still in question, but some believe user fees could contribute a significant amount. It is important to understand what users see as the main benefits of long-term support for water services and how much they are willing to contribute (8).

Networks of Community Water Committees

In rural areas, many implementing organization projects include forming and training community water committees that are the water service providers. Depending on the country or the implementing organization method, these committees have various names, such as water user associations, water boards, or village management committees. In communities that are dispersed and far from towns, these committees can be isolated, which means it is harder for them to access outside advice, technical support, and finance. Appendix K describes examples of networks of water committees.

Benefits of water committee networks

The Global Water Initiative in Central America found that water user associations connected to a network have a better chance of contributing to sustainable services (23). GWI's experience also shows that associations are stronger when they are legally recognized and connected to the relevant

government entities (23). Well-established membership networks for water committees, such as COCEPRADIL, an association of community water committees in western Honduras, and a Honduran association of community water boards called the *Asociación Hondureña de Juntas de Agua* (AHJASA) have demonstrated success in helping rural communities manage their water systems for up to 20 years (54). Such associations could "privatize" their services by charging for working in neighboring communities or regions (8).

Challenges with water committee networks

One overall challenge is the financial viability of such networks. Many depend on the member fees and external finance or donations. Not all water committees are willing or able to contribute a portion of their income to participate in a network. In Paraguay, for example, the association of water boards model has not yet given positive results. This is partly because the income is insufficient to for the network to provide the required assistance, and partly because in many cases not all boards in an area join the relevant association (31).

A 2011 evaluation of COCEPRADIL identified some challenges the network needed to address in supporting or training water committees. For example, after the water system has been built, connections to water services for new households are prohibitively expensive. The high cost is intended to encourage households to participate upfront but leaves new families without an obtainable option (71). Additionally, in some communities, water service outages can last days or weeks during the dry season or while repairs are being made. A further challenge is that communities do not have financial capacities to replace aging systems (71).

To strengthen this support mechanism will require a better understanding of the percentage of water user associations that are linked into networks; why some water user associations choose not to join; the characteristics of strong networks; and enabling policies to strengthen networks (23).

Implementing Organization Support to Local Governments

Typically, local governments serve as the "service authority," which regulates, monitors, and supervises water service providers, whether they are community-based or not (52). These service authorities are also responsible for planning and implementation of water systems, yet they often lack the capacity to adequately fulfil these functions (52). Local governments might receive support from the national government, but some implementing organizations are finding success in providing support to local governments instead of, or in addition to, directly implementing water systems. Appendix L describes several examples of supporting local governments to address challenges with water services.

Benefits of implementing organization support to local governments

Benefits of implementing organization support to local government include improved functionality, better coordination, better cost recovery, and improved government ownership of water services. For example, SNV's support of the local government to envision and strengthen different management models in Marsabit County, Kenya, substantially improved the functionality of the water systems (43). Districts in Zambia with strong district water and sanitation teams that met and monitored communities

regularly demonstrated significantly higher sustainability levels than those of districts with weaker institutional set-ups (21).

In South Sudan, a national WASH Steering Committee was established and resources pooled from different agencies to implement a shared plan. With a joint strategy and systematic approach to water supply management, cooperation has been improved, with one example of this being a functionality pilot involving two international and two local NGOs (43). There is a strong sense of government ownership of WaterAid's program in Mozambique, where they support district governments' planning (72). In the Mangochi district of Malawi, 60% of communities targeted by innovative district management structures supported by EWB have increased payment collection for water point repairs (22).

Challenges with implementing organization support to local governments

One overarching challenge to supporting local governments is that implementing organizations have conflicting models or goals; this could be addressed by implementing organizations working through national or district WASH coordinating committees. Governments themselves might also have overlapping roles that can undermine support efforts. For example, in Ghana, the District Assemblies are formally responsible for planning, decision-making, and delivery of water services, but the same functions are sometimes performed by other actors, such as regional offices of the Community Water and Sanitation Agency (54). Other challenges with supporting local governments include:

- Developing long-term sources of financing of recurrent costs like salaries (8; 41)
- Weak capacity of local governments to access funds and undertake activities, which can be exacerbated by political crises (34; 41)
- Lack of transport for support staff to visit rural communities in isolated areas (8)
- Lack of more general logistical support, like office space and access to computers (8)
- Lack of political will to support long-term support arrangements (8)
- Interference in management due to political favoritism at the local level (8)
- Frequent personnel changes resulting from the successive election of opposing political parties, and the consequent loss of institutional memory and human capital (8)

Costs for Resolution

Recognizing that not much happens in international development if it is not funded, costs of monitoring and resolution should be budgeted as part of each proposal, or that implementing organizations set aside a percentage of the operations budget for resolution.

Ranges of costs

Part of the MERL process is post-implementation monitoring, which is one way for implementing organizations to identify problems with water systems they have built. Responses from interviewees who were able to estimate a percentage are shown in Table 4 for monitoring and evaluation.

Table 4 –Approximately what percentage of your budget goes to monitoring and/or evaluation?

M&E	Post-Implementation M&E	Restricted or Unrestricted Funds	Source
10-30% at headquarters level	Partners encouraged to set aside 5% [of project budget] for evaluation 6-12 months post project completion	Most often restricted	(73)
9% of annual budget	Included	Unrestricted	(39)
5%		Unrestricted	(74)
<2% per project		Restricted	(75)
	60% of staff time	Unknown	(76)
Approximately 1.4% for one large project	A very small percentage of M&E budget	Restricted	(77)
As a rule of thumb put 5% in proposals		Restricted	(78)

Appendix H summarizes descriptions, results, and costs for various types of post-construction (also called direct) support. On average, the cost per person per year is $2.50 USD, which is in line with the WASHCost benchmark of $2 to $3 USD per person per year for direct support for hand pumps and piped schemes. Another way to plan for costs is to dedicate a minimum of 10% of capital costs per year per system for post-construction support (4).

A caveat to the range is that the true costs of external and institutional support are not well understood because many of the current examples are externally supported or driven projects. Reported costs often exclude management and support costs, ongoing costs for transportation and supplies, and regular refresher training (8).

Responsibility for costs of resolution

While many implementing organizations initially balk at the idea of having to pay past the initial investment, under the delusion that "building water supply systems is more important than keeping them working" (4), if the intent is to change people's lives, the water must flow forever. Furthermore, the sector is already paying past the initial investments through the costs of rehabilitation.

Not all costs need to be covered from one source; implementing organizations should consider cost-sharing. Resolution costs can be covered by contributions from implementing organizations, users, local government, and the central government (5). For example, in schools where the NGO Waterlines had previously installed rainwater harvesting systems, they set up improvement agreements. The agreements include cost sharing of 50%, up to $200 USD, to make necessary improvements.

Conclusions

The case for resolution can be summarized by the following points:

- Water is a human right.

- To save lives and change lives, implementing organizations need to focus on the provision of good water services forever.
- Failed and abandoned water systems are a massive waste of investment—not only on the part of the donors, but also on the part of the community. Failed systems make poor people poorer.
- Many problems with water services are attributed to poor implementation.

Ideally, resolution activities should be a bridge to sustained, locally-led services. While implementing organizations have a responsibility at a certain level, the goal is for governments to lead the way in ensuring water services for everyone in their countries. These guidelines, approaches, and models are intended to move implementing organizations toward that common goal.

Obviously, the water crisis remains a huge challenge because it requires a complex set of factors—not necessarily the same ones in each place—to be in place for a permanent solution. For this reason, the overarching principle of "first, do no harm" is critical. To avoid doing further harm, it is critical that implementing organizations and donors learn from the past and the context (including relevant local policies and standards) before attempting to resolve problems. Lessons learned need not be limited to their past work, but should include the bountiful information available from the sector.

This will not be a quick process. Ultimately, what is necessary is behavior change of governments, funders, implementing organizations and their staff, leaders, boards, donors, and volunteers. Behavior change is notoriously difficult. Getting to the ultimate goal will be an iterative, creative process. Implementing organizations must be honest and self-critical, and hold themselves accountable to water users. Donors, implementing organizations, and governments must all heed the lessons from the past.

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Appendix A – Literature Review

The term "resolution" was not found in the literature. The following key words (and in combination) were used to search the literature and reports:

- Rehabilitation of water systems, low-income countries
- Rehabilitation, water system
- Repair of Water Systems
- Post-construction support, water systems
- Water sustainability
- Hand pump mechanic associations
- Circuit riders, water systems

Journal/Publisher	Authors	Year	Title	Web link (citation)
TU Delft University of Engineering	Adams, Alida	2012	Financial Sustainability of Rural Water Supplies in Western Kenya: Comparing technology types and management models	http://repository.tudelft.nl/view/ir/uuid:d55b4e80-1a38-4979-a61f-603f9ad969b0/
Federal Reserve Bank of Cleveland	Aliprantis, Dionissi	2012	Community-based well maintenance in rural Haiti: Independent Working paper	http://www.clevelandfed.org/research/workpaper/2012/wp1201r.pdf
USAID	ARD, Inc.	2010	Northern Uganda Water Supply Services (NUWATER): Consultancy Services for the Baseline Survey of Water Supply Systems and Services in Kitgum	http://www.ircwash.org/sites/default/files/USAID-2010-Northern.pdf
AVINA	AVINA & Gestión Ambiental	2011	*Diálogos por el Agua: Sistematización de 4 foros de escucha con las juntas de saneamiento del Paraguay*	http://www.geam.org.py/v3/blog/presentaron-documento-%E2%80%9Cdialogos-por-el-agua%E2%80%9D/
Waterlines	Barnes, Rebecca; Ashbolt, Nicholas; Roser, David; Brown, Brown	2014	Implementing sustainable water and sanitation projects in rural, developing countries.	http://practicalaction.metapress.com/content/7461018623g22255/?p=f996029c25514b549ac75287904aecd4&pi=7

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14th UK Young Water Professionals Conference proceedings	Barrie, J.; Byars P.; Antizar-Ladislao B.	2013	Assessing the functionality of rural hand pump wells in Sierra Leone using Water Point Mapping	http://www.research.ed.ac.uk/portal/files/11576895/2013_IWA_YWPC_Barrie_Byars_Antizar.pdf
Swiss Resource Centre and Consultancies for Development	Baumann, Erich; Danert, Kerstin	2008	Operation and Maintenance of Rural Water Supplies in Malawi: Study Findings	http://www.rural-water-supply.net/_ressources/documents/default/208.pdf
Graduate School of Cornell University	Beyene, Habtamu Addis	2012	Factors Affecting the Sustainability of Rural Water Supply Systems: the Case of Mecha Woreda, Amhara Region, Ethiopia: A Project Paper	http://soilandwater.bee.cornell.edu/publications/Hab_Thesistss_formatted.pdf
CSIS	Bliss, Katherine E.; Fisher, Matt	2013	Water and Sanitation in the Time of Cholera: Sustaining Progress on Water, Sanitation, and Health in Haiti	https://csis.org/files/publication/130905_Bliss_WaterSanitationCholera_WEB.pdf
IRC/WASHCost	Burr, Fonseca, Moriarty, & McIntyre	2012	The recurrent expenditure gap: Failing to meet and sustain basic water services	
Water International	Burt, Murray; Keiru, Bilha Joy	2011	Strengthening post-conflict peace-building through water-resource management: case studies from Democratic Republic of Congo, Afghanistan and Liberia	http://www.tandfonline.com/doi/full/10.1080/02508060.2011.558885#.UtSbWWRDsYY
Book	Calaw, Roger; Ludi, Eva; Tucker, Josephine (editors)	2013	Achieving Water Security: Lessons from research in water supply, sanitation and hygiene in Ethiopia	http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8606.pdf#page=90
Water and Environment Journal	Carter, R. C.; Tyrrel, S.; Howsam, P.	1999	The Impact and Sustainability of Community Water Supply and Sanitation Programmes in Developing Countries	http://onlinelibrary.wiley.com/doi/10.1111/j.1747-6593.1999.tb01050.x/abstract
Independent Report	Casey, Katherine; Glennerster, Rachel; Miguel, Edward	2011	The GoBifo Project Evaluation Report: Assessing the Impacts of Community-Driven Development in Sierra Leone	http://www.3ieimpact.org/media/filer/2013/08/30/gobifo_project_evaluation_report_gfr.pdf
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Water and Environment Journal	Cotton, Andrew; Adams, Jerry; Shaw, David	2012	Improving water supply and sanitation programme effectiveness: lessons from WaterAid's outcome evaluation studies	http://onlinelibrary.wiley.com/doi/10.1111/j.1747-6593.2012.00317.x/abstract
Bill & Melinda Gates Foundation	Cranfield University, Aguaconsult Ltd., International Water and Sanitation Centre (IRC)	2006	Landscaping and Review of Approaches and Technologies for Water, Sanitation and Hygiene	http://www.aguaconsult.co.uk/uploads/pdfs/Main_Report_FINAL_Apr2007.pdf
Journal of Environmental Management	Cuppens Arnoud; Smets, Isle; Wyseure, Guido	2011	Identifying sustainable rehabilitation strategies for urban wastewater systems. A retrospective and interdisciplinary approach. Case study of Coronel Oviedo, Paraguay	http://www.sciencedirect.com/science/article/pii/S0301479712005452#
Global Water Initiative	Davis, Susan, Pocosangre, Adan and Hicks, Paul	2014	Six Factors for Improving Rural Water Services in Central America	https://www.dropbox.com/s/426lyvr5ym2nh0s/GWI_Water%20report_low_spread.pdf
World Bank	Delmon, Rigby	2014	Structuring Private-Sector Participation (PSP) Contracts for Small Scale Water Projects Water and Sanitation Program: Toolkit	http://www.rural-water-supply.net/en/resources/details/595
RiPPLE	Deneke, Israel; Abebe, Habtamu	2008	The Sustainability of Water Supply Schemes: A case study in Mirab Abaya woreda	http://r4d.dfid.gov.uk/PDF/Outputs/RIPPLE/wp4-sustainability-mirab-abaya.pdf
Engineers Without Borders-Canada	Engineers Without Borders-Canada	2009	Learning from our mistakes: A collection from Overseas Volunteer Staff	http://legacy.ewb.ca/mainsite/pages/whoweare/accountable/FailureReport2009.pdf
Engineers Without Borders-Canada	Engineers Without Borders-Canada	2010	2010 Failure Report: Learning from our mistakes	http://legacy.ewb.ca/mainsite/pages/publications/EWB_2010_Failure.pdf
Engineers Without Borders-Canada	Engineers Without Borders-Canada	2010	Learning from our mistakes 2nd Issue: National Conference 2010	http://legacy.ewb.ca/mainsite/pages/whoweare/accountable/FailureReport2010.pdf
	European Court of Auditors	2012	European Union Development Assistance for Drinking Water Supply and Basic Sanitation in Sub-Saharan Countries	http://www.europarl.europa.eu/meetdocs/2009_2014/documents/droi/dv/1405_specialreport_/1405_specialreport_en.pdf
IRC	Evans, Phil and Appleton, Brian	1993	Community Management Today: The Role of Communities in the Management of Improved Water Supply Systems	http://watsanmissionassistant.wikispaces.com/file/view/Community+Management+of+Water+Systems+%28IRC%29.pdf

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Water For People Report	Foster, Tim	2012	Private Sector Provision of Rural Water Services	http://tap.waterforpeople.org/usercontent/1/2/229600001/1064/WFP_Private%252BSector%252BRural%252BWater%252BDesk%252BStudy_Full%252BReport.pdf
Environmental Science and Technology	Foster, Tim	2013	Predictors of Sustainability for Community-Managed Handpumps in Sub-Saharan Africa: Evidence from Liberia, Sierra Leone and Uganda	http://pubs.acs.org/doi/abs/10.1021/es402086n
RWSN	Furey, Sean	2013	RWSN Handpump Survey 2013: Summary of Findings	http://www.rural-water-supply.net/_ressources/documents/default/1-576-2-1397038177.pdf
Public Administration and Development	Golooba-Mutebi, Frederick	2012	In Search of the Right Formula: Public, Private and Community-Driven Provision of Safe Water in Rwanda and Uganda	http://onlinelibrary.wiley.com/store/10.1002/pad.1638/asset/pad1638.pdf?v=1&t=hqr1kdwu&s=39ee6d26ef9623732090a618e8edbfd9ffda09dc
Government of Liberia	Government of Liberia	2014	WASH Sector Performance Report 2013	http://www.rural-water-supply.net/_ressources/documents/default/1-582-3-1398151980.pdf
Independent Report	Hanyani-Mlambo, B.T.; Mukorera, Odreck	2013	External End of Project Evaluation of the Food Security Project Supported by the Japanese Government and Implemented by IFRC & ZRCS.	http://www.alnap.org/resource/8870.aspx
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Community Development Journal	Harvey, Peter A.; Reed, Robert A.	2007	Community-managed water supplies in Africa: sustainable or dispensable?	http://cdj.oxfordjournals.org/content/42/3/365.full.pdf+html
Water Resources Center	Hazelton, Derek G.	2000	Development of Effective Water Supply Systems Using Deep and Shallow Well Handpumps	http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/TT%20132-00-DEVELOPING%20COMM.pdf
Royal Swedish Academy of Sciences	Hope, Rob; Foster, Tim; Thomson, Patrick	2012	Reducing Risks to Rural Water Security in Africa	http://download.springer.com/static/pdf/746/art%253A10.1007%252Fs13280-012-0337-7.pdf?auth66=1390594685_cf6b4cca16b2b94a1a1b2a9183f81bad&ext=.pdf
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Waterlines	Jones, Stephen	2013	Sharing the recurrent costs for rural water services in four municipalities supported by WaterAid in Mali	http://practicalaction.metapress.com/content/830q251441311381/
IRC Triple-S	Kang, Michael; Campbell, Megan	2013	Seeking Systemic Change in Malawi's WASH Sector	http://www.waterservicesthatlast.org/resources/case_studies/a_systemic_intervention_in_malawi_s_wash_sector

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Journal of Water, Sanitation and Hygiene for Development	Kayser, Georgia L ; Moomaw, William; Portillo, Jose Miguel Orellana; Griffiths, Jeffrey K.	2014	Circuit Rider Post-Construction Support: Improvements in Domestic Water Quality and System Sustainability in El Salvador	
Waterlines	Koestler, Lucrezia; Koestler, Andreas G.; Koestler, Marius A.; Koestler, Valentin J.	2010	Improving sustainability using incentives for operation and maintenance: The concept of water-person-years	https://practicalaction.metapress.com/content/832v390721642205/resource-secured/?target=fulltext.pdf
Engineers Without Borders-Canada	Lewis, Sarah Elizabeth	2011	Failure Report 2011	http://newsite.ewb.ca/sites/default/files/2011%20EWB%20Failure%20Report.pdf
IRC Triple-S	Lockwood, H.; Le Gouais, A.	2011	Professionalising community-based management for rural water services	http://www.rural-water-supply.net/en/resources/details/484
IRC Triple-S	Lockwood, Harold	2013	Fixing the Sector Not Just the Pump: A systemic intervention in Malawi's WASH sector	http://www.waterservicesthatlast.org/resources/case_studies/a_systemic_intervention_in_malawi_s_wash_sector
USAID & Rotary International	Lockwood, Harold	2013	Sustainability Index of WASH Interventions: Global Findings and Lessons Learned	http://www.washplus.org/sites/default/files/WashSustainabilityIndex.pdf
Bank-Netherlands Water Partnership Interim Report	Lockwood, Harold; Bakalian, Alex; Wakeman, Wendy	2003	Assessing Sustainability in Rural Water Supply: the Role of Follow-up Support to Communities. Literature Review and Desk Review of Rural Water Supply and Sanitation Project Documents	http://www.aguaconsult.co.uk/uploads/pdfs/WBAssessingSustainability.pdf
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Government of Uganda	Ministry of Water and Environment	2006	Water and Sanitation Sector Performance Report 2006	http://www.mwe.go.ug/index.php?option=com_docman&task=cat_view&Itemid=223&gid=15
Government of Uganda	Ministry of Water and Environment	2012	Sectoral Specific Schedules/ Guidelines 2012/13 Final	
Government of Uganda	Ministry of Water and Environment	2013	Water and Sanitation Sector Performance Report 2013	http://www.mwe.go.ug/index.php?option=com_docman&task=cat_view&Itemid=223&gid=15
Independent PhD Thesis	Mugumya, Firminus	2013	Enabling Community-based Water Management Systems: Governance and Sustainability of Rural Point-water Facilities in Uganda	http://doras.dcu.ie/19385/
USAID	Nassef, Magda; Belayhun, Mulugeta	2012	Water Development in Ethiopia's Pastoral Areas: A synthesis of existing knowledge and experience	http://www.usaid.gov/sites/default/files/documents/1860/Water%20Development%20in%20Pastoral%20Areas%20of%20Ethiopia_0.pdf
WaterLines	Nekesa, Jacinta; Kulanyi, Rashidah	2012	District hand pump mechanics associations in Uganda for improved operation and maintenance of rural water-supply systems	http://practicalaction.metapress.com/content/b420676616233l67/fulltext.pdf?page=1
Water International	Pinera Jean-François; Reed, Robert	2011	Restoring services, rebuilding peace: urban water in post-conflict Kabul and Monrovia	http://www.tandfonline.com/doi/pdf/10.1080/02508060.2011.566847
Rural Water Supply Network (RWSN)	RWSN	2010	Myths of the Rural Water Supply Sector	http://www.rural-water-supply.net/en/resources/details/226
WHO	Rickert, Bettina; Schmoll, Oliver; Rinehold, Angella; Barrenberg, Eva	2014	Water safety plan: a field guide to improving drinking-water safety in small communities	http://reliefweb.int/report/world/water-safety-plan-field-guide-improving-drinking-water-safety-small-communities
Water & Sanitation for Africa	Samani, Destina; Apoya, Patrick	2013	Service Sustainable Water Service Delivery Project Study Findings (SWSD) [PowerPoint presentation]	http://www.washmel.org/wp-content/uploads/2013/11/SWSD-project-oral-presentation-Final.pdf

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World Bank WSP	Sara, Jennifer; Katz, Travis	1997	Making Rural Water Supply Sustainable: Report on the Impact of Project Rules	http://www.wsp.org/sites/wsp.org/files/publications/global_ruralreport.pdf
Journal of Water, Sanitation and Hygiene for Development	Schweitzer, Ryan W.; Mihelcic, James R.	2012	Assessing sustainability of community management of rural water systems in the developing world	http://www.iwaponline.com/washdev/002/0020/0020020.pdf
WaterAid	Shaw, David; Manda, James	2013	Exploring the long-term sustainability of water, sanitation and hygiene services in Salima district, Malawi	https://t.co/jqrLVdai2U
Working Paper	Smits, Stef; Baby, Kurian	2013	Islands of Success: Towards water, sanitation and hygiene services for everyone, forever in Patharpratima and Sagar blocks, West Bengal, India	
Inter-American Development Bank	Smits, Stef; Uytewaal, Erma; Sturzenegger, Germán	2013	Institutionalizing monitoring of rural water services in Latin America. Lessons from El Salvador, Honduras and Paraguay. Technical Note	http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=38333151
IRC International Water and Sanitation Centre Working Paper	Smits, Stef; Verhoeven, Jeske; Moriarty, Patrick; Fonseca, Catarina; Lockwood, Harold	2011	Arrangements and cost of providing support to rural water service providers	http://www.ircwash.org/sites/default/files/Smits-2011-Arrangements.pdf
	SNV	2013	Case Studies on Functionality of Rural Water Supply Services in Africa	http://www.snvworld.org/en/regions/africa/publications/functionality-of-rural-water-supply-services-in-africa
	SNV	2013	Functionality: The challenge to sustain rural water supply services	http://www.snvworld.org/en/regions/africa/publications/functionality-the-challenge-to-sustain-rural-water-supply-services
	Stone Family Foundation	2014	How to Spend a Penny: 10 lessons from funding market-based approaches in water, sanitation and hygiene	www.thinknpc.org/?attachment_id=10890&post-parent=10871
The World Bank Open Knowledge Repository	Trémolet, Sophie; Evans, Barbara	2010-2011	Output-based delivery and Sustainability	https://openknowledge.worldbank.org/bitstream/handle/10986/10908/578150BRI0OBA010BOX353779B01PUBLIC1.pdf?sequence=1

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UNICEF	UNICEF Regional Office for South Asia	2012	WASH for School Children: State-of-the-art in Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka	http://www.unicef.org/wash/schools/files/UNICEF_WASH_for_School_Children_South_Asia_Report.pdf
	Water & Sanitation Rotarian Action Group (WASRAG)	2012	Guidelines to Planning Sustainable Water Projects and Selecting Appropriate Technologies	http://media.greennexxus.com/Wasrag/Articles_of_Interest/Water_Supply/General/Guidelines_Water_Sept2012sm.pdf
	WaterAid	2011	Sustainability Framework	www.wateraid.org/documents/plugin_documents/sustainability_framework_final.pdf
WaterAid	WaterAid Mozambique	2004	Revisiting Broken Projects Programme, Niassa Province, 2000 – 2004	
WorldView	Wellman, Tim	2011	Riding the Water Circuit: Third year Peace Corps Volunteers support rural water systems	
Water Policy	Whittington, Dale et al	2009	How well is the demand-driven, community management model for rural water supply systems doing? Evidence from Bolivia, Peru, and Ghana	http://www.bwpi.manchester.ac.uk/medialibrary/publications/working_papers/bwpi-wp-2208.pdf
WHO	World Health Organization (WHO)	2012	Water Safety Planning for Small Community Water Supplies Step-by-step risk management guidance for drinking-water supplies in small communities	http://whqlibdoc.who.int/publications/2012/9789241548427_eng.pdf?ua=1
SWSD Policy Brief No 1	WSA	2012	Sustainability of Rural Water Supply Facilities in Africa: Socio-cultural and Demographic Factors	http://wsafrica.org/sites/staging.wsafrica.org/files/js/No%201%20Socio%20cultural%20and%20demographic.pdf
WSUP	WSUP & Nkana Water and Sewerage Company (NWSC)	2014	Reducing vandalism of water and sanitation infrastructure: experience from Zambia's Copperbelt	http://www.wsup.com/files/2014/04/TB013_ReducingVandalism.pdf

Appendix B – In-depth Interviews

Table B.1 - Individuals Interviewed

Contact	Organization	HQ Location
Nicolas Villeminot	Action Without Hunger	USA
Sabrina Zimmermann; Simon Zimmerman; Jean Waagbo	Aguayuda	USA
Lisa Nash	Blue Planet Network	USA
Christoph Gorder	charity: water	USA
Ojara Emmanuel "Sunday"	Clearwater Initiative	USA
Chris Dunston	Conrad N. Hilton Foundation	USA
Paul Hicks	CRS	USA
Cathy Leslie & Tiffany Martindale	Engineers Without Borders USA	USA
Agnes Montangero	Helvetas	Switzerland
Han Heijnen	Independent expert	Uganda
Piers Cross	Independent expert, former Global Manager of WSP	South Africa
Rachel Cardone	IRC	Netherlands
Bjorn von Euler	ITT/Xylem	USA
Jonathan Wiles	Living Waters International	USA
Lynda Rey	One Drop	Canada
Rosemary Trent	Pueblo a Pueblo	USA
Nat Paynter	Safe Water Network	USA
Eric Stowe	Splash	USA
Sam Huston	TetraTech	USA
John Pasch & Jeffrey Goldberg, David Kahler	USAID	USA
Marla Smith-Nilson	Water 1st	USA
Salva Dut	Water for South Sudan	USA
Rich Thorsten	Water.org	USA
Mark Reimers	Waterlines	USA
Kyle Lomax	Wine to Water	USA

Interview script and questions

Background: Improve International has received a grant to develop a brief on resolution of problems with water and sanitation systems. This work was prompted by USAID's recently released Water and Development Strategy. In the strategy, USAID indicates that they "Will seek investments in longer-term monitoring and evaluation of its water activities in order to assess sustainability beyond the typical USAID Program Cycle and to enable reasonable support to issues that arise subsequent to post-completion of project implementation."

The high percentages of failed or poorly working systems and filled or failed latrines have been documented in many countries for decades. So what should the water and sanitation sector do about

these failures? How to take steps to resolve identified problems without creating future dependence or open-ended obligations? How costs to resolve a problem should be divided among implementing organization, community, host governmental entities, external donor? How long should the implementing organization be required (contractually or ethically) to confirm post-project resolution of problem? These are questions that Improve International seeks to answer as we develop this brief.

Improve International will be reaching out to various experts around the world, like you, to develop case studies of what works and to seek input for guidelines for resolution. The goal of the brief is to improve the probability of sustainable water and sanitation services for people in developing countries.

We plan to record this call to facilitate note-taking. Is that okay with you?

<u>Questions</u>

1. Please describe your role at the organization.
2. Does your organization build or facilitate building of water, sanitation, hygiene (WASH) infrastructure?
    a. If yes, how old is your oldest water system or toilet?
        i. Where is it?
        ii. Do you know whether it is still functional?
        iii. Do you still have a presence in that country?
    b. If not, what is your involvement with WASH?
3. Are you doing formal or informal post-implementation monitoring or evaluation?
4. Do you ever go back to look at projects after they are completed?
    a. If yes to above question, please provide details.
        i. What types of projects do you look at (water, sanitation, and/or hygiene)
    b. What indicators do you consider – functionality, number of beneficiaries, health impacts, water quality, etc.?
    c. When and how often?
    d. Who does it (your staff or someone external)
    e. What tools do you use?
    f. Do you know the cost – generally or per project?
    g. Where does the budget come from? Unrestricted funds or project funds, or other?]
    h. Approximately what percentage of your budget goes to monitoring and/or evaluation?
    i. How much of that is allocated to post-implementation monitoring and/or evaluation?
5. Do any of your programs involve rehabilitation of water points?
    a. Approximately what percentage of total water points in the project?
    b. What percentage of the budget are rehabilitations?
6. What issues have you identified? What are the most common? (for interviewer: if needed use examples below to prompt)
    a. What are the underlying causes of these issues?
7. How are these issues addressed?
    a. Who addresses them?

b. Who pays (or should pay) for this resolution
c. How much does it (would it) cost?

8. Do you have formal or informal guiding principles for addressing / resolving these issues?
    a. If yes, please describe. If no, what in your opinion should guiding principles be?
9. USAID's Water Strategy indicates that they "Will seek investments in longer-term monitoring and evaluation of its water activities in order to assess sustainability beyond the typical USAID Program Cycle and to enable reasonable support to issues that arise subsequent to post-completion of project implementation." What do you think about this statement? In your opinion, what is reasonable support?

Closing

10. May we quote you in this brief (we will send you the quote for approval beforehand)?
11. Do you have documents or websites with more detailed information related to the questions above that you can share with us?
12. What other organizations should we talk to?

Thank you for your time!

Common issues for prompting

These are intended to be symptoms rather than full description of root causes of issues.

Water services

A. TECHNOLOGY / INFRASTRUCTURE

a. Not functional or poorly functioning

b. Normal wear and tear

c. Vandalism (e.g., stolen taps, broken pipes)

d. Weather-related damage

B. ORGANIZATIONS

a. Water committee not working well

b. Problems related to governmental entity

C. COMMUNITY

a. Customers not paying water fees

b. Conflict between payers and non-payers

c. Uneven levels of water access

d. Ethnic splits

e. Inability to accommodate connections for new residents

D. ENVIRONMENT/WATER SOURCE

a. Issues related to ownership of water source

b. Reduced quantity at source

c. Quality at source

Appendix C – Guidelines Compared to Literature

Table C.1 – Resolution Workshop Guidelines (3) **Compared to Other Recommendations**

Resolution Workshop Guideline	**Recommendations from the Literature**
Overall: Implementing organizations shift from implementation and rehabilitation to facilitation (e.g. capacity building, supporting service providers to drive, finance, map watersheds, IT support)	Consider shifting the role of NGOs from merely building infrastructure to promoting and supporting water governance led by local, empowered communities. NGOs can serve as technical consultants to municipalities or other service providers to build capacity, or help create support networks among water user associations. They can also help users to understand and trust the process of managing the water system and help them to hold the service provider accountable (23). Simply building more rural water systems, even where this is done on the basis of best practice will not be enough. The question then becomes how do we go about scaling up of support arrangements and avoid the projectisation of donor-driven efforts? (8) The ultimate myth is that there is a quick fix for rural water supplies; a simple idea, such as a new pump or a clever way to organize a village committee. To provide a basic level of reliable service to all rural dwellers, there is no quick fix to substitute for many years of political negotiation, institution building, education, long term investment and innovation (1). [A] chorus of voices advocate for a paradigm shift away from project implementation toward long-term service delivery (16).
Financial	
• Water is not free/no free systems	Water users must pay the real cost of operating, maintaining, and upgrading water services (23).
• All stakeholders understand lifecycle cost approach at all levels	"The system of paying for the life cycle of the services is the number one thing that needs government focus and needs the focus of all the partners" (27). NGOs and donors need to know the system they seek to help, because money alters those systems. Donors must determine how resources affect people's incentives and whether people would continue to pay for a water point that came without resources (22). This requires an understanding of actual costs (22). Conduct a study to determine the total costs of human and financial resources required to sustain continuous water supply services and maintain service levels at scale (in order to develop decision making tools to rationally determine the cost benefit of major repair/ rehabilitation/reconstruction) (38).

Resolution Workshop Guideline	Recommendations from the Literature
• Increased flexibility in donor funding (motivated by sustainable development goals of 2030)	Develop much more flexible, adaptive approaches that respond to local conditions; consider rural dwellers as consumers; choose from the full range of technological innovations available, and fully harness the capacity of private enterprise (1). Shift funds away from rehabilitation and replacement of infrastructure to supporting the administration, operation and maintenance of water systems and services (23). Many donor agencies should take a good look at themselves; some spend more money on themselves than on the development they support. And it must never be forgotten, people living and surviving in the rural areas perhaps have the greatest knowledge of survival methods. They too have a part to play – they should have a voice (24).
Institutional	
• Engage government	Interviewees' most commonly proposed solution was to support the institutionalization of rural water and sanitation provision in governments' activities (10).
• Understand and follow national framework	If the country defines service access in a certain way, NGOs should go along with that and help the country to use its own project monitoring to link in to national monitoring so that you can all end up supporting one system and don't end up burdening understaffed and harassed local governments….[Donors should engage] at national or district level with respect to linking this infrastructure into the national infrastructure, and linking the monitoring and evaluation of those services on a regular basis, within those national systems (27). Top priority: Establish common guiding principles and minimum requirements and standards for planning, designing, implementation, operations and maintenance (O&M), and lifelong follow up of water supply services (38). Approaches should be in line with, and inform, national policies (1). Coordination between governments, donors, and NGOs in improving water services is most cost efficient and makes maintenance easier long-term when it happens from the start. Ideally, this coordination is led by the national governments (23).
• Define roles and responsibilities from the planning process (Appendix M shows examples of roles and responsibility mapping). Implementing organization exit strategy timeline should be explicit in planning stage.	An understanding of costs should lead to discussions about pays for what (40). Services should be designed in such a way that it is in every stakeholder group's best interests to fulfil its part of the service delivery. Voluntary roles are unlikely to be sustainable in the long term (49).

Resolution Workshop Guideline	Recommendations from the Literature
• Improve monitoring to rapidly and accurately identify areas for resolution. Costs of monitoring and resolution should be budgeted as part of organization's implementation package	Monitor water service delivery rather than infrastructure and use ongoing services as a measure of success instead of focusing solely on access (23). Regular monitoring of water services is critical. The initiative to design and build a common monitoring system in Central America (SIASAR) is an important step forward. The system has the potential to become the standard for monitoring in Central America (23).
Technical	
• Address the root causes vs. fixing infrastructure	Develop and test post-construction support mechanisms (for institutionalization at a later stage) (38). Investing in household and water committee training pays off in terms of sustainability. Communities that receive household-level training in O&M and hygiene education are more satisfied with their systems, more willing to pay the costs of maintenance, keep the system in better physical condition and take better care of their systems. At the same time, training members of the organization in charge of managing the water system will lead to better O&M and financial management (61).
• Improve indicators that reflect future sustainability. Demonstrate that over time local resources are increasing for covering resolution costs.	Use of more rigorous and evidenced-based assessments to inform internal reflection and planning decisions is an important step in promoting change. Evidence from monitoring and sustainability assessments can also be used to engage with local and national stakeholders in efforts to improve WASH programming and to promote changes in policy and practice (40). Key indicators of sustainability should be identified and clearly discussed with all stakeholders (49). Study key success and fail factors that determine functionality of water supply services in different geographical areas (38).
• Develop platforms/handbooks for sharing best practices (data management, standardization of indicators)	Establish common guiding principles and minimum standards for the performance of sector actors at all levels (38). Recommendation: Develop [water point] technology standardization policy/regulation/rule (28). Recommendation: develop a computerized database system of documentation (28).
Social	
• Clear resolution framework shared among stakeholders; identify ways to approach these Resolution questions by engaging ALL stakeholders in the conversation (donors, government, recipients)	Household-level demand should guide key investment decisions. Sustainability is increased when selection of service level options, technology and siting are placed in the hands of well-informed community members rather than traditional leaders or water committees. Projects should take steps to ensure that community representatives truly stand for all members of the community, including women and other traditionally excluded groups (61).

Resolution Workshop Guideline	Recommendations from the Literature
• Stakeholder agreement to define roles and responsibilities (including Resolution)	User choice should not be limited to service levels and technology, but should include how, when, and by whom services are delivered and sustained. Supply agencies should be accountable to communities for providing agreed upon services in an efficient and effective manner. Communities should be allowed to participate in contractor selection, when appropriate, and have greater control over supervising works and authorizing payment when works are completed (even if services are provided directly by line agencies) (61). Clarify functions, roles and responsibilities of sector stakeholders, highlighting the essential and functional relation between water committees and local entities (38).
• Participatory monitoring and evaluation to increase the value of M&E for all stakeholders (especially the end users)	Improve existing information management system(s) to monitor and update the functional status of existing schemes with standard key indicators (38). Most organizations - government or non-government--aren't set up to react to data collected during monitoring. There are two sides to that: resources and incentives. It seems like many organizations are incentivized to put in new water systems rather than fix existing ones (35). Smart hand pumps which automatically and cheaply transmit water use and performance data over the mobile network offer low cost, reliable, and universal information. At scale, the flow of automated data can bridge the information gap between rural residents and distant policy-makers that disconnects the rights and responsibilities of water service delivery, and enhances accountability, performance and transparency in the rural water sector (79). Recommendation: create a proper information exchange system among stakeholders (28).

Appendix D – Failure Statistics

Figure 1 in the report shows that the average global failure rate for water points in developing countries has varied over time, but the trend line shows failures have only slightly decreased from 1997 to 2013. These averages are based on summary data from 126 functionality studies or estimates, listed in Table D.1 below. Because these snapshots do not cover the functionality of the same water points over time, we do not know whether they were temporarily or permanently non-functional. For purposes of this report, and because the literature almost universally identifies the lack of repairs and maintenance as an issue for water systems in developing countries, it was assumed that non-functionality at the time of the study equaled failure. This table represents data found through July 2014. The averages have not been weighted by sample size because the numbers of water points monitored were not included in all reports.

Table D.1 – Water Point Failure Statistics

Year	Country	Total Number Water Points Monitored	% failed	Link to Study (if available)
1997	Malawi	900	50	http://www.sciencedirect.com/science/article/pii/S0305750X99001552
2000	Ethiopia	30046	35	RWSN 2009 http://www.rwsn.ch/documentation/skatdocumentation.2009-03-09.7304634330/file
2000	South Africa	unknown	50	http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/TT%20132-00-DEVELOPING%20COMM.pdf
2001	Mozambique	20000	35	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf & DNA survey 2001. DNA Survey in 2003 show some 4% more operating, mainly through major_rehabilitation programmes
2001	Peru	unknown	65.3	http://www.bvcooperacion.pe/biblioteca/bitstream/123456789/3753/1/BVCI0003101.pdf
2002	Malawi	17000	33	Improving Community-based management of boreholes: Case Study from Malawi. Joseph de Gabriele March 2002.
2003	Kenya	12000	30	http://www.rural-water-supply.net/en/resources/details/203
2003	Mozambique	20000	31	DNA survey 2001. DNA Survey in 2003 show some 4% more operating, mainly through major rehabilitation programmes
2003	Mozambique	13000	30	http://www.wateraid.org/~/media/Publications/rural-water-sustainability-supply-study-mozambique.pdf
2003	Peru	104	2	http://www.wsp.org/sites/wsp.org/files/publications/tarea1.pdf
2003	Uganda	unknown	30	http://www.mwe.go.ug/index.php?option=com_docman&task=cat_view&Itemid=223&gid=15
2004	Benin	unknown	19	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	Burkina Faso	unknown	25	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	CAR	unknown	40	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	Chad	unknown	50	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	Cote d'Ivoire	unknown	64	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	DR Congo	unknown	60	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	Ecuador	unknown	38	http://www.oas.org/dsd/MinisterialMeeting/CRITERIOS%20Y%20ACCIONES%20EN%20PRO%20CUMPLIMIENTO%20ODM%20AGUA%20Y%20SANEAMIENTO.pdf
2004	Guinea	unknown	18	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	India	unknown	25	(Ray, I., 2004, "Water for all? Peri-urban and rural water delivery options: The case of India." Presentation: UC Berkeley Energy and Resources Group Fall Colloquium Series, 6 October)
2004	Kenya	unknown	50	http://eml.berkeley.edu/~emiguel/pdfs/miguel_tribes.pdf
2004	Liberia	unknown	90	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	Malawi	17000	40	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf

Year	Country	Total Number Water Points Monitored	% failed	Link to Study (if available)
2004	Mali	unknown	35	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	Mozambique	15000	26	http://www.wateraid.org/~/media/Publications/rural-water-sustainability-supply-study-mozambique.pdf
2004	Niger	unknown	35	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	Nigeria	unknown	50	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	Peru	unknown	34	Calderon, J., 2004. Agua y saneamiento: El caso del Perú rural. Lima, Peru: ITDG.)
2004	Sierra Leone	unknown	35	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	South Asia	unknown	33	http://www.gse.pku.edu.cn/lib/gse_lib/edu-search/e_publication/e_pub/268950PAPER0WDR02004.pdf
2004	Tanzania	unknown	30	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	Uganda	unknown	20	www.mwe.go.ug/index.php?option=com_docman&task=cat_view&Itemid=223&gid=15
2004	Uganda	unknown	30	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2004	Zambia	unknown	20	http://www.rural-water-supply.net/_ressources/documents/default/264.pdf
2005	Burkina Faso	22400	25	http://www.rural-water-supply.net/en/resources/details/203
2005	Cote d'Ivoire	19500	65	http://www.rural-water-supply.net/en/resources/details/203
2005	Guinea	12500	20	http://www.rural-water-supply.net/en/resources/details/203
2005	Liberia	1350	31	http://www.rural-water-supply.net/en/resources/details/203
2005	Mozambique	16000	28	http://www.wateraid.org/~/media/Publications/rural-water-sustainability-supply-study-mozambique.pdf
2005	Niger	7175	35	http://www.rural-water-supply.net/en/resources/details/203
2005	Sierra Leone	2500	65	http://www.rural-water-supply.net/en/resources/details/203
2005	Swaziland	unknown	23	Government of Swaziland, Rural Water Supply Board, 2005
2005	Uganda	unknown	18	http://www.mwe.go.ug/index.php?option=com_docman&task=cat_view&Itemid=223&gid=15
2005	Zimbabwe	817	65	http://www.sciencedirect.com/science/article/pii/S0277953605001759
2006	Ethiopia	unknown	31	http://hdr.undp.org/en/media/HDR06-complete.pdf A survey found that 29% of hand pumps and 33% of mechanized boreholes in rural areas were not functioning because of maintenance problems.
2006	Mozambique	17000	23	http://www.wateraid.org/~/media/Publications/rural-water-sustainability-supply-study-mozambique.pdf
2006	Rwanda	unknown	33	http://hdr.undp.org/en/media/HDR06-complete.pdf
2006	Uganda	unknown	17	http://www.mwe.go.ug/index.php?option=com_docman&task=cat_view&Itemid=223&gid=15
2007	Bolivia	100	73	http://www.water-alternatives.org/index.php/volume6/v6issue3/222-a6-3-3
2007	Ethiopia	unknown	60	Schimann and Philpott, 2007 in http://www.usaid.gov/sites/default/files/documents/1860/Water%20Development%20in%20Pastoral%20Areas%20of%20Ethiopia_0.pdf
2007	Ethiopia	unknown	33	http://r4d.dfid.gov.uk/PDF/Outputs/RIPPLE/wp4-sustainability-mirab-abaya.pdf
2007	Haiti	unknown	100	(Center for Human Rights & Global Justice, 2007). In Port-de-Paix there were no functioning public water sources in the city
2007	Malawi	unknown	49	http://www.rural-water-supply.net/_ressources/documents/default/208.pdf
2007	Mozambique	17500	17	http://www.wateraid.org/~/media/Publications/rural-water-sustainability-supply-study-mozambique.pdf
2007	Mozambique	19000	20	http://www.wateraid.org/~/media/Publications/rural-water-sustainability-supply-study-mozambique.pdf
2007	South Africa	1067	97	http://www.dwaf.gov.za/Masibambane/documents/monitoring-evaluation/MIGSpotcheckApr07part1.pdf
2008	Ethiopia	70	42	http://r4d.dfid.gov.uk/PDF/Outputs/RIPPLE/wp4-sustainability-mirab-abaya.pdf
2008	Malawi	unknown	31	http://www.rural-water-supply.net/_ressources/documents/default/208.pdf

Year	Country	Total Number Water Points Monitored	% failed	Link to Study (if available)
2008	Nepal	36038	32	http://dwss.gov.np/file/file_down/UBDryoNMIP_WatSan_Survey_2010_Report.pdf
2008	Tanzania	549	42	http://www.snvworld.org/en/regions/world/our-work/stories/water-point-mapping-the-channel-to-accountability
2008	Tanzania	540	32	http://www.snvworld.org/en/regions/world/our-work/stories/water-point-mapping-the-channel-to-accountability
2008	Tanzania	229	36	http://www.snvworld.org/en/regions/world/our-work/stories/water-point-mapping-the-channel-to-accountability
2008	Tanzania	502	65	http://www.snvworld.org/en/regions/world/our-work/stories/water-point-mapping-the-channel-to-accountability
2008	Tanzania	161	83	http://www.snvworld.org/en/regions/world/our-work/stories/water-point-mapping-the-channel-to-accountability
2008	Tanzania	568	44	http://www.snvworld.org/en/regions/world/our-work/stories/water-point-mapping-the-channel-to-accountability
2008	Tanzania	631	18	http://www.snvworld.org/en/regions/world/our-work/stories/water-point-mapping-the-channel-to-accountability
2008	Tanzania	1087	58	http://www.snvworld.org/en/regions/world/our-work/stories/water-point-mapping-the-channel-to-accountability
2008	Tanzania	533	59	http://www.snvworld.org/en/regions/world/our-work/stories/water-point-mapping-the-channel-to-accountability
2008	Tanzania	1309	30	http://www.snvworld.org/en/regions/world/our-work/stories/water-point-mapping-the-channel-to-accountability
2008	Timor-Leste	134	26	http://resources.oxfam.org.au/pages/search.php?search=covalima&resetrestypes=yes&resource5=yes&Submit=%C2%A0%C2%A0Search%C2%A0%C2%A0&field__year=&field__month=&field__day=&year=&month=
2009	Angola	4500	30	http://www.rural-water-supply.net/en/resources/details/203
2009	Benin	6700	22	http://www.rural-water-supply.net/en/resources/details/203
2009	Burkina Faso	22400	25	http://www.rural-water-supply.net/en/resources/details/203
2009	Cameroon	9000	25	http://www.rural-water-supply.net/en/resources/details/203
2009	Cote d'Ivoire	19500	65	http://www.rural-water-supply.net/en/resources/details/203
2009	DRC	1500	67	http://www.rural-water-supply.net/en/resources/details/203
2009	Ethiopia	30046	35	http://www.rural-water-supply.net/en/resources/details/203
2009	Guinea	12500	20	http://www.rural-water-supply.net/en/resources/details/203
2009	Kenya	12000	30	http://www.rural-water-supply.net/en/resources/details/203
2009	Kenya	unknown	42	Kenya Ministry of Water & Irrigation. 2009. Sample Survey on Water Quality and Functionality of Water Systems mentioned here).
2009	Liberia	1350	31	http://www.rural-water-supply.net/en/resources/details/203
2009	Madagascar	2500	10	http://www.rural-water-supply.net/en/resources/details/203
2009	Malawi	19000	40	http://www.rural-water-supply.net/en/resources/details/203
2009	Mali	14200	34	http://www.rural-water-supply.net/en/resources/details/203
2009	Mozambique	17000	25	http://www.rural-water-supply.net/en/resources/details/203
2009	Niger	717	35	http://www.rural-water-supply.net/en/resources/details/203
2009	Nigeria	80000	50	http://www.rural-water-supply.net/en/resources/details/203
2009	Pakistan	unknown	20	http://www.adb.org/sites/default/files/IES-PAK-2009-26.pdf

Year	Country	Total Number Water Points Monitored	% failed	Link to Study (if available)
2009	Sierra Leone	2500	65	http://www.rural-water-supply.net/en/resources/details/203
2009	Tanzania	65000	46	http://www.wateraid.org/~/media/Publications/sustainability-crisis-rural-water-management-tanzania.pdf
2009	Uganda	30000	20	http://www.rural-water-supply.net/en/resources/details/203
2009	Zambia	15000	32	http://www.rural-water-supply.net/en/resources/details/203
2009	Zimbabwe	38200	30	http://www.rural-water-supply.net/en/resources/details/203
2009	Zimbabwe	unknown	38	http://www.jsd-africa.com/Jsda/V11N02_Fal2009/PDF/AnEvaluationSustainablity.pdf
2010	Afghanistan	unknown	45	www.unicef.org/wash/schools/files/UNICEF_WASH_for_School_Children_South_Asia_Report.pdf
2010	Bhutan	unknown	30	www.unicef.org/wash/schools/files/UNICEF_WASH_for_School_Children_South_Asia_Report.pdf
2010	Ethiopia	unknown	20	http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8606.pdf#page=90
2010	Kenya	1011	27	http://www.virtualkenya.org/pdf/Knowing-or-going-blind-with-the-flow-WPM%20Kenya.pdf
2010	Madagascar	unknown	50	http://www.rural-water-supply.net/_ressources/documents/default/1-401-2-1349694919.pdf
2010	Nepal	38000	50	http://www.codefnepal.com/uploaded/Position_Paper_Functionality_of_Water_Supply_Services%5B1%5D.pdf
2010	Pakistan	unknown	39	www.unicef.org/wash/schools/files/UNICEF_WASH_for_School_Children_South_Asia_Report.pdf
2010	Sierra Leone	2,859	70	www.rural-water-supply.net/en/resources/details/515
2011	Central African Republic	unknown	90	elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-5697
2011	Kenya	100	14	http://improveinternational.files.wordpress.com/2012/10/kenya_expost-final-report.pdf
2011	Liberia	10000	40	http://www.rural-water-supply.net/_ressources/documents/default/1-582-3-1398151980.pdf
2011	Malawi	13985	58	http://www.rural-water-supply.net/_ressources/documents/default/1-504-3-1369649610.pdf
2011	Mali	unknown	41	http://practicalaction.metapress.com/content/830q251441311381/?p=5197c0b2f0fb450aa3eb5940ff71d7c8&pi=4
2011	Rwanda	126	9	Water For People, 2011
2012	DR Congo	295	68	(Hambadiahana & Tolsma, 2012. Water Point Mapping in DR Congo)
2012	DR Congo	480	14	(Hambadiahana & Tolsma, 2012. Water Point Mapping in DR Congo)
2012	DR Congo	1276	24	(Hambadiahana & Tolsma, 2012. Water Point Mapping in DR Congo)
2012	Ghana	126	36	http://www.irc.nl/page/73942
2012	Ghana	130	36	http://www.irc.nl/page/73942
2012	Ghana	255	33	http://www.irc.nl/page/73942
2012	Ethiopia	163	19.6	http://soilandwater.bee.cornell.edu/publications/Hab_Thesistss_formatted.pdf
2012	Haiti	1096	50	http://improveinternational.files.wordpress.com/2013/11/othale-blanc-_poster-2-unc-2013-haiti-functionality.pdf
2012	Haiti	2266	41.6	http://improveinternational.files.wordpress.com/2013/11/othale-blanc-_poster-2-unc-2013-haiti-functionality.pdf
2012	Sierra Leone	28,000	17	sl-wash.org/uploads/Review_Version_-_SL_WP.pdf
2012	Swaziland	2689	30	Government of the Kingdom of Swaziland Ministry of Natural Resources & Energy, Department of Water Affairs, Water & Sanitation Point Mapping Pilot Project Report 2012)
2012	Tanzania	unknown	25	http://listeningtodar.org/15-water/
2012	Uganda	79413	19	practicalaction.metapress.com/content/b420676616233l67/fulltext.pdf?page=1
2013	Ghana	1509	21	Samani, Destina and Patrick Apoya, Sustainable Water Service Delivery Project: Study Findings, 2013 Water and Health Conference, Chapel Hill, NC.)
2013	Malawi	48	50	https://t.co/jqrLVdai2U
2013	Nepal	40000	82	http://www.dwss.gov.np/content/49/NMIP_PROJECT

Year	Country	Total Number Water Points Monitored	% failed	Link to Study (if available)
2013	Tanzania	74,331	38	http://wpm.maji.go.tz
2013	Uganda	unknown	16	www.mwe.go.ug/index.php?option=com_docman&task=cat_view&Itemid=223&gid=15
		Average	**38**	
		Max	**100**	
		Min	**2**	

Appendix E – Reasons for Failure of Water Systems

Table E.1 – Reasons for Failure of Water Systems

Within implementing organization control	Sustainability framework category	Reasons for failure	Total mentions	Number of informants[17]	Number of publications	References
Yes	Implementation - execution	Poor community engagement, poor government engagement, lack of transparency	23	15	8	(19; 34; 47; 62; 76; 80; 81; 82; 83; 84)
Yes	Implementation - execution	Poor manufacturing quality	14	14		
Yes	Implementation - execution	Insufficient training of service providers, water committees	11		11	(1; 4; 16; 19; 28; 31; 34; 63; 85; 86)(87)
Yes	Implementation - follow up	Lack of accountability; no long-term project monitoring and evaluation	6	1	5	(1; 9; 14; 30; 76; 88)
Yes	Implementation - follow up	Lack of evidence base for what works	2		2	(14; 4)
Yes	Implementation - planning	Inappropriate technology; no vetting of new technologies	24	17	7	(9; 16; 19; 28; 30; 31; 76; 80; 81; 82) (86; 88; 89; 90)
Yes	Implementation - planning	Project vs. services thinking; inflexible planning approach; unclear objectives of project	18	13	5	(1; 4; 14; 35; 49; 73; 75; 77; 81; 91) (92; 93; 94; 95; 96)
Yes	Implementation - planning	Lack of water source protection/production, poor water quality (pollution, arsenic, salinity, turbidity, etc.)	17	8	9	(8; 9; 16; 28; 29; 31; 40; 58; 76; 81) (91; 61; 97; 98)
Yes	Implementation - planning	Supply-driven; heavy or inconsistent subsidies	10	7	3	(31; 61; 100)
Yes	Implementation - planning	Lack of clarity over roles for operation and management	8		8	(8) (28) (84) (53) (26) (41) (63)
Yes	Implementation - planning	Planning too brief; poor planning; poor data collection	6	5	1	(9) (103) (104)
Yes	Implementation - planning	Lack of cultural understanding	5	5		
Yes	Implementation - planning	Lack of meaningful involvement of women	4		4	(8) (16) (29) (88)
Yes	Implementation - planning	Poor NGO relationship with community	2	2		
Yes	Implementation - planning	Installation of water points leads to degradation of other resources	1		1	(30)
Yes	Implementation - planning	Water supply insufficient – seasonally, for multiple uses	2		2	(62) (101)

[17] Improve International interviews (10); (136); plus RWSN D-group emails on the topic “Why water projects fail?”

Within implementing organization control	Sustainability framework category	Reasons for failure	Total mentions	Number of informants[17]	Number of publications	References
Yes	Implementation - planning & execution	Poor quality workmanship; bad Installation; poor design; poor siting; no monitoring or supervision during project; personnel qualities	48	36	12	(16) (99) (49) (28) (81) (9) (85) (103) (105) (17) (61) (12) (91) (19) (89) (63) (29) (93) (92) (39) (75)
Yes	Institutional	Lack of institutional coordination	5	2	3	(84) (106) (63) (29) (87) (97)
Yes	Technical	Lack of spare parts, treatment products, tools and equipment (especially for hand pumps)	55	38	17	(47) (8) (16) (28) (83) (9) (17) (72) (89) (31) (2) (34) (11) (44) (1) (19) (63) (107) (76) (75)
Yes	Technical	Corrosion of hand pumps	>100	>100		(32)
Partially	Financial	Inadequate tariff to cover recurrent costs, capital replacement or system expansion costs	11	4	7	(8) (82) (107) (58) (34) (31) (26) (89) (40) (77) (73) (39)
Partially	Financial	No capital contribution from community	6	3	3	(85) (63) (30) (87) (88)
Partially	Implementation - execution	Lack of tariff payment or collection to cover recurrent costs or lack of effective cost-recovery mechanisms	23	10	13	(8) (16) (49) (83) (84) (9) (103) (105) (17) (21) (79) (34) (28) (109) (62) (2) (19) (107) (35) (73) (27) (76) (87)
Partially	Implementation - follow up	Lack of operation and maintenance	41	33	8	(8) (16) (99) (80) (84) (85) (17) (91) (89) (13) (14) (93) (57) (39) (87) (110)
Partially	Implementation - follow up	Lack of some form of long-term external support	17	13	4	(8) (81) (9) (105) (12) (65) (1) (46) (73)
Partially	Implementation - follow up	Lack of skilled people, lack of mechanics, trained mechanics leave, Loss of skills over time, lack of continued training and capacity building	22	10	12	(8) (16) (12) (13) (89) (34) (19) (63) (73) (49) (9) (31) (51) (17) (95) (93)
Partially	Implementation - follow up	Improper use	3	2	1	(19)
Partially	Implementation - follow up	Lack of ability to perform major repairs	2		2	(8) (89)
Partially	Institutional	Weak institutions involved in service provision e.g., high turnover, low capacity, low resources, poor information management systems	20	7	13	(99) (49) (28) (84) (85) (14) (53) (13) (89) (34) (58) (44) (31) (2) (63) (98) (93) (107) (73) (88)
Partially	Institutional	Legal frameworks for recognition of water committees and ownership	4		4	(8) (28) (84) (45)
Partially	Institutional	Lack of private sector involvement in goods, services and management contracts	3	1	2	(8) (1) (96)
Partially	Social	Ownership: Lack of knowledge, desire, leadership for repair, culture of dependency	28	14	14	(47) (49) (85) (1) (24) (14) (53) (8) (2) (99) (62) (58) (17) (19) (111) (112) (107) (76) (98) (74) (110) (87)

Within implementing organization control	Sustainability framework category	Reasons for failure	Total mentions	Number of informants[17]	Number of publications	References
Partially	Social	Ignorance of rights, or fear of demanding rights	2	1	1	(53) (98)
Partially	Technical	Lack of standardization of components especially for hand-pumps	3		3	(8) (84) (13) (89)
No	Environmental	Natural disasters	1		1	(28)
No	Institutional	No or poor community management capacity lack of "champion;" no regular water committee meetings; lack of trust in committee	22	5	17	(8) (16) (113) (49) (28) (82) (9) (85) (47) (34) (114) (89) (42) (1) (90) (58) (31) (12) (115) (116) (51) (21) (19) (78) (87) (117) (21)
No	Institutional	Greed/corruption/political wrangling	16	9	7	(80) (81) (82) (31) (14) (53) (19) (63) (29) (112) (98)
No	Institutional	Lack of government support/involvement distance from district/county capital, no monitoring, no integrated MIS	16	8	8	(47) (16) (80) (84) (40) (31) (58) (89) (46) (106) (73) (92)
No	Institutional	Lack of supportive policy and regulatory environment	6	1	5	(8) (84) (40) (31) (29) (93)
No	Institutional	Profit-focused private service provider	3	3		
No	Social	Conflict of individual interests/priorities; lack of cohesion	12	10	2	(8) (82) (29) (93) (118)
No	Social	Vandalism/lack of security/illegal connections	12	3	9	(47) (62) (81) (82) (9) (31) (12) (58) (19) (63) (112)
No	Social	Too much demand	5		5	(62) (28) (13) (31) (12) (112)
No	Social	Cultural practice of community	3	3		
No	Social	Lack of demand, user dissatisfaction including perceived water quality, motivation availability of other sources, and willingness to pay	24	9	15	(8) (16) (113) (80) (49) (81) (82) (119) (47) (13) (58) (19) (61) (14) (34) (91) (17) (53) (112) (107) (73) (93) (118) (74) (88)
No	Technical	Power shortages, poor electricity supply and affordability	2		2	(47) (8)

Appendix F – Percentage of Program or Organizational Budgets for Rehabilitations of Water Points

Appendix F.1 - Percentage of Program or Organizational Budgets for Rehabilitations of Water Points

Percentage of Budget	Source	Notes
80%	(95)	80% of program budget; In the Global Water Initiative, a large, 5-year, multi-partner, multi-country program in Central America, 68% of the water projects were rehabilitations of previously built systems.
49%	(19)	49% of program budget; under the PDAN project, rehabilitation of water points accounted for 81% of the water points, and 62% of the beneficiaries
5-40%	(73)	Network of implementing organizations
40%	(87)	Implementing organization
30%	(120)	In a program in Burkina Faso
30%	(110)	Implementing organization
25%	(121)	On average, 25% of funding budget for a donor goes to rehabilitations
<20%	(39)	Donor organization
Majority	(92)	Majority of program expenses are for rehabilitation of school WASH infrastructure
15%	(78)	Network of implementing organizations
10%	(118)	Implementing organization
5-10%	(74)	Implementing organization
5-80%		**Range**
31%		**Average using high ends of ranges**

Appendix G – Examples of Costs for Water System Repairs

IRC estimates that expenditure of less than $1 USD per person per year is insufficient to ensure reliable service delivery, and that expenditure above $2 to $3 USD per person per year is probably sufficient (5). UNEP's International Environmental Technology Centre (1998) puts the expected operation and maintenance cost to *the community* at between $52 USD and $156 USD a year. Village water committees reported spending about $100 USD annually on repairs. None of these estimates include the real resource costs associated with the time invested by the water committee, the caretakers, or borehole attendants (66).

Table G.1 – Recurrent costs of rural water services

Source: Source: adapted from (41)

	Cost ranges USD 2011 per person served per year		
Cost component	**Expenditure in four municipalities Mali 2008-2011**	**National guidelines in Mali**	**International benchmarks WASHCost 2012**
Operating and minor maintenance expenditure for hand pumps	<0.1 in all municipalities	0.4	0.5-1
Capital maintenance expenditure for hand pumps and "modern wells"	0.05-1.5	0.5[18]	1.5-2[19]
Expenditure on direct support[20] for hand pumps, "modern" wells, and small piped systems	0.5-1.5[21]	N/A	1-3[22]

Table F.2 – Classifications of repairs and costs developed with WaterAid's partners

Source: Adapted from (41)

Classification of repair	Description	Typical frequency	Opinion of partners on who should pay
Small repair	Spare parts and labor costing <US$100	Every 1-2 years	Users, although some WaterAid partners do contribute
Major repair	Spare parts and labor costing >US$100	Every 2-5 years	User if possible but more often WaterAid partners
Rehabilitation	Complete replacement of the whole lifting mechanism and/or the surrounding superstructure, e.g., replacing entire hand pump or pulley mechanism on a well and/or replacing the surrounding concrete wells	Less frequent than every 5 years	Users only occasionally despite what official policy suggests
Major rehabilitation	Complete rehabilitation of the whole works, e.g., clearing borehole or excavating collapsed well	Up to every 20 years	WaterAid partners or central government

[18] For hand pumps, excluding eventual replacement after 20 years
[19] For hand pumps
[20] Costs of ongoing support to users and local stakeholders, for example on local government or district support staff
[21] Including some support to sanitation
[22] For hand pumps or piped schemes

Table F.3 – Hand pump operations and maintenance cost estimates, excluding major rehabilitation/replacement

Source: Adapted from (55; 66)

		Estimated annual O&M cost, USD [range]	
Hand pump types	**Locations**	**Per water point**	**Per household**
[not stated]	[not stated]	[12-60]	
Afridev	Mozambique	[50-65]	0.60
Afridev	Tanzania	58	
Afridev	Malawi	[10-40]	
Afridev	Ghana	60	
Afridev, India Mk II, Nira	Kenya, Zambia, Uganda	36 [0-270]	0.62
India Mk II	India	[59-107]	
India Mk II	Angola	30	
India Mk II	Ghana	35	0.70
India Mk II	Zambia	117	
Nira	Tanzania	26	
Nira	Ghana		0.65
Nira	Ghana	40 [0-102]	
Vergnet	Chad	30 [10-115]	
	Average	**44**	**0.64**

Appendix H - Costs and Results for Various Post-construction Support Models

Most post-construction support is ad hoc or project-based, and thus below what is needed. It is highly likely that current expenditure is insufficient to provide the support that is formally agreed in the national policy or legislation (5).

As a rule of thumb, dedicating a minimum of 10% of capital costs per year per system for preventive maintenance and repairs—independently of who funds it—can contribute to more sustainable service delivery (4). Below are examples of costs for external support models and results, where available.

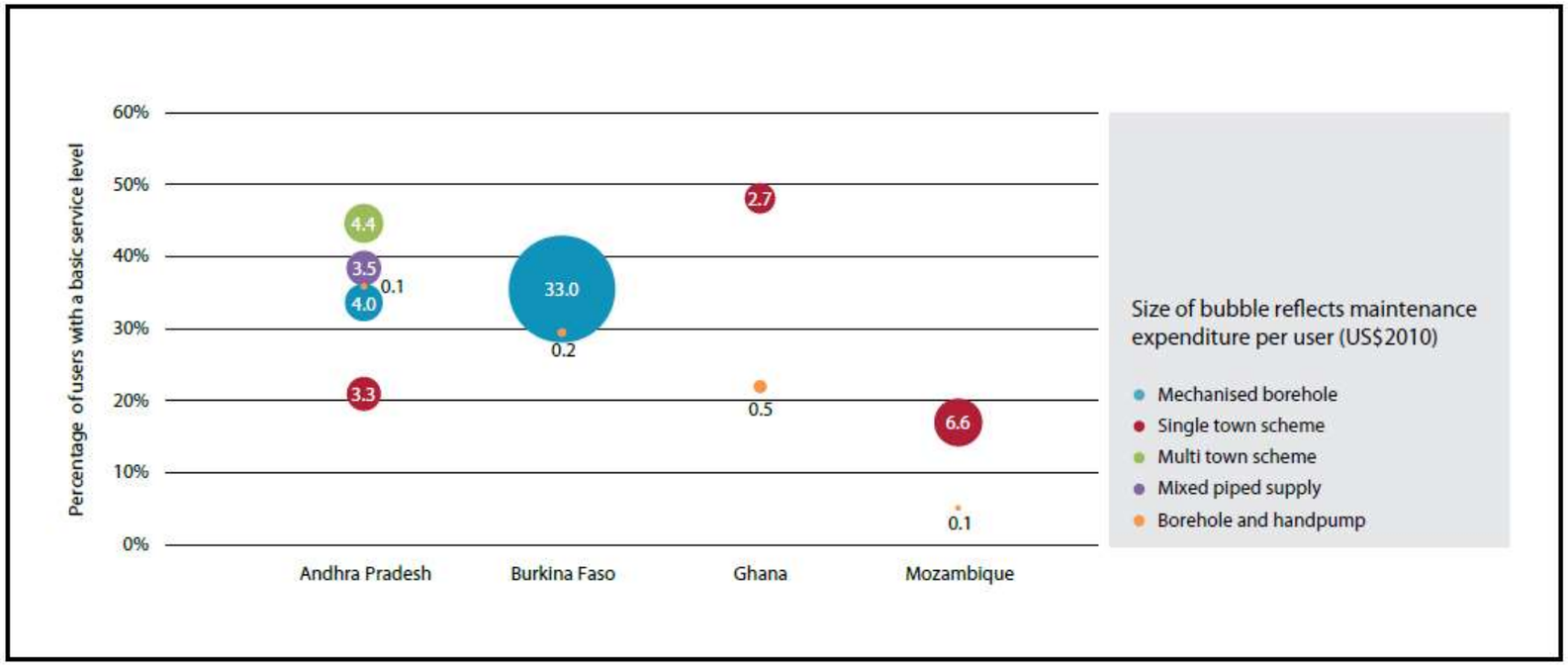
Table H.1 – Costs for Regional O&M Promoter – Nicaragua

Source: (8)

Item	Cordobas Per Year
Salary	26,016
Social benefit payments (15%)	3902
Travel allowance	5280
Fuel costs	6336
Office materials	11,600
Transport – replacement costs	11,600
Transport – maintenance costs	3,600
Total in 2003 Cordobas	**59,734**
Total in USD[23]	**3,982**

[23] Indicative exchange rate of $1 USD = 15 Cordoba

Figure H.1 – Comparison of percentage of users receiving a basic service level with maintenance expenditure per user of different schemes
Source: (122)



The table below shows that the average expenditure per person for post-construction support is $2.50 USD per year. Whether any one method is adequate is debatable as there are sometimes overlaps in the type of support provided (5).

Table H.2 – Costs and results for various types of post-construction support

Source: adapted from (5)

Country	Type of support	Per person expenditure USD per year	Description	Who Pays	Results	Source
International	International benchmark	1.00-3.00	For direct support for hand pumps and piped schemes	Various		WASHCost 2012

Brazil	SISAR association	3.63	• The Integrated System for Rural Sanitation or SISAR started in 1996 as associations of community-based service providers, with a dedicated operational unit which provides technical and administrative support to its individual member communities.
			• In the State of Ceará, eight SISARs cover between 25 and 112 systems each, representing between 15,000 and 72,000 users
			• A SISAR has the following responsibilities:
			  ○ To jointly administer, maintain and coordinate operations for its associates' water and sanitation systems; tasks are shared with the local water users group.
			  ○ To set and secure payment for realistic tariffs.
			  ○ To represent the affiliated associations.
			  ○ To promote hygiene education, along with greater participation in associations.
			• Each community has one operator for day-to-day operations and possibly more if a supply system has more than 300 connections. The tariff is sufficient to fund: Operation and maintenance expenditure.
				Set up: co-financed between the State, through CAGECE, German Development Bank and World Bank
				Operating: The operator receives a monthly payment from the SISAR. Financing through a user tariff, based on metered connections and collection of bills. Some cross-subsidization from larger rural systems to smaller communities in rural areas.
					• Full direct support costs of an association are borne by the users though tariffs.
					• External donors play only a minor role in covering the costs of direct support, and then limited to the initial establishment of the support agents.
						(5)

Chile	Regional utility support	3.44	• Providing technical assistance and advice to rural water systems, as well as supporting the identification of capital maintenance projects. • Ministry of Public Works establishes a contractual agreement with the regional utility, monitored through the regional divisions of the ministry. • The costs per system range from $117- $1,316 USD/system/ month average $3,460 USD/ system/ year, depending on distance of the systems from a central point and system size and complexity. • Technical support thus represents 5% to 8% of capital maintenance expenditure.	Ministry of Public Works	Analysis of the technical, financial and administrative factors comparing data from 2008 and 2010 showed an overall increase in performance, with differences between regions.	(5)

Country	Type of support	Per person expenditure USD per year	Description	Who Pays	Results	Source
El Salvador	*Asociación Salvadoreña de Servicios de Agua* (ASSA) Circuit Riders	0.25	• Technical assistance, financial training, operational management, environmental sustainability. • ASSA employs six people: three circuit riders, a secretary/laboratory technician, a marketing representative and a director. The marketing representative and the director also perform circuit rider activities. • Cost: $50,000 USD a year, serving 170 communities or 51,000 households.	ASSA	A study in 60 small rural and peri-urban community-run water supply systems concluded that, in communities visited by circuit riders, there were statistically significant lower rates of microbiologically contaminated water, higher rates of drinking water disinfection, improved operator knowledge about treatment, less negative community perception of chlorine, higher rates of community payment for water service, greater financial transparency, and greater rates of household water meters.	(5)
Ghana	CWSA Community Water and Sanitation Agency & DA	0.78	• CWSA is mandated to support District Water and Sanitation Teams with capacity building and training. • They also monitor WATSANs and performance and functionality of water systems. • Supporting districts and communities.	CWSA/Universities and NGOs support districts on a project basis	While well-resourced in terms of human capacity, the regional CWSA offices only operate effectively when there are projects ongoing in their region to which they provide operational and logistical support.	(5)
Haiti	CDC & DINEPA – Water & Sanitation Technicians (TEPACs)	Unknown	• 256 potable water and sanitation technicians for the Communes (French acronym TEPACs) are provincial level staff hired by DINEPA. • TEPACs are responsible for testing the level of chlorination at specific water points throughout the country. • CDC helped train community health workers and provided technical support for the National Public Health Laboratory. • CDC also provided DINEPA & MSPP with technical assistance on integrating household water treatment practices into the national cholera elimination strategy and are assisting Haitian public officials with creation of a cholera incidence database through geographic mapping.	CDC funds salaries and commodities for 54 TEPACS	Unknown	(44)

Country	Type of support	Per person expenditure USD per year	Description	Who Pays	Results	Source
Honduras	The Municipal Association of Water Committees (*Asociación de Juntas de Agua Municipa*l or AJAM)	0.13[24]	• Brings together all water committees in the municipality's area of jurisdiction. • The members provide support to each other by: reviewing financial accounts and annual reports, providing advice on reported problems, providing access to materials e.g. buying chlorine in bulk and then distributing it and through coordination with the municipality. • To cover costs of travels and purchase of materials, a surcharge of 1 Lempira (around $0.05 USD) is added to the water bill of each household in the municipality. There is no remuneration to cover the time costs of AJAM members.	Households	Unknown	(5)
Honduras	Water Board Association AHJASA	Unknown	Example of delegated support system operating in approximately 300 member communities in specific areas of the country.	Unknown	Unknown	(8)
Honduras	Municipal water and sanitation technical unit	0.59[25]	Expenditure on salary costs of the technician, his transport and office costs.	Municipality	Unknown	(5)

[24] $685 USD divided by assumed Chinda population of 5,474
[25] No registry exists of actual expenditure. This is based on an estimation of salary of the TOM and his transport costs. $3242 USD divided by assumed Chinda population of 5,474

Country	Type of support	Per person expenditure USD per year	Description	Who Pays	Results	Source
Honduras	SANAA TOMs	0.18[26]	• "Técnico en Operación y Mantenimiento" or Technicians in Operation and Maintenance (TOMs) are employees of The National Water Supply and Sewage Company SANAA and work from regional offices that have substantial authority to make decisions, • In 2003, TOMs provided support to more than 4,000 rural water systems servicing more than 2 million people • Each TOM is responsible for an average of 50 communities and is expected to visit each system at least twice per year. • TOMs received 12 weeks of training in community development, technical repairs and engineering design, education and communication as well as water and sanitation concepts. • Role is to support community water boards in all aspects of system operation, administration and maintenance by providing informal training, advice and encouragement. • Municipal authorities and NGOs can now request assistance from the regional TOMs for training of rural water boards for new or rehabilitated systems being built independently of SANAA.	Set up: USAID Ongoing: SANAA	• A growing number of municipalities have active AJAMs, and various programs are supporting their establishment • Elevated the percentage of water systems classified as A (highest level of performance) from 7% in 1986, when it started, to 41% in 2007	(5) (8)
India	State government	0.32	• There are block-level 'mother Gram Panchayats' local government unit that are used to support Gram Panchayats in need. This is also done via capacity building and exposure visits. • Strong Gram Panchayat in each district act as key resource centers for other Gram Panchayats in the district. • Contracting or organizing training; outsourcing to NGOs; supporting donor initiatives; monitoring.	State Government	Unknown	(5)

[26] $1000 USD divided by assumed Chinda population of 5474

Country	Type of support	Per person expenditure USD per year	Description	Who Pays	Results	Source
Malawi	District Water Office & Interaide - Area Mechanics	Unknown	• 28 Area Mechanics were trained in 2006 by the District Water Office (DWO) • Expected to cover an area of about 110 km2. • No tools or bicycles were issued. • Area mechanics submit reports on their work to the District on a monthly basis. • Interaide and Badea have trained area mechanics to maintain and repair boreholes. • Interaide rewarded area mechanics who performed well with loans to purchase mobile phones. • Interaide worked with retailers to support continued supply chain for spare parts; however, spares were sold at cost, and were effectively subsidized by the NGOs. • The budget for building up and supporting this maintenance system was approximately MWK 7.5 million ($52,000 USD).	Interaide; as of 2008, the mechanics were being paid by some communities to repair their hand pumps.	• At first, did not achieve much. In 2008, Interaide relocated the area mechanics and issued them with bikes and tools. They are now working considerably more than before. • Interaide-supported network of area mechanics within Salima District, Malawi and the spare parts supply may have had a positive influence on functionality rates; 60% of water point committees for both MALDA and Afridev pumps reported that they have good access to support for managing maintenance and repairs.	(63) (11)
Malawi	Plan Dedza – Area Mechanics	Unknown	• 13 area mechanics selected and trained to cover two Traditional Authorities. • Issued with tools but not bicycles. • Expected to cover one village development committee area	Not paid, but rather provided a “token” for the work from the communities.	Unknown	(63)
Malawi	Nkhata-Bay – Area Mechanics	Unknown	• Thirty area mechanics were trained in 2007, and equipped with bikes and tools.	Unknown	“Not enough money to call them” back. There seems to have been no follow-up.	(63)
Malawi	Kasungu District – Area Mechanics	Unknown	• Introduced and trained 45 area mechanics in 2007 but there has been no follow-up to date. • 45 shop owners were also trained and issued with starter packs.	Unknown	The need for more area mechanics, retraining and sharing of experience was acknowledged by the District assembly.	(63)

Country	Type of support	Per person expenditure USD per year	Description	Who Pays	Results	Source
Mali	WASH Technical Units – small municipalities	1.50	• Since 2008, WaterAid has introduced a system of direct support to its partner municipalities to create a WASH technical unit within each of these local governments. • It is a way of allowing local governments to act as service authorities. The Technical Unit staff are employed as civil servants of the municipality and report to the elected mayor, but their salaries and overheads are funded by WaterAid • Each Technical Unit consists of one or two members of paid staff who support the planning and implementation of new infrastructure and provide ongoing support to community management committees. • The arrangement of direct local government partnership and budget support has been introduced so far on a gradual rolling basis.	WaterAid	• The expenditures on operations and minor maintenance and capital maintenance of rural water services observed in the four municipalities in Mali in this study are lower than international benchmarks for basic sustainable services. Unsurprisingly, the associated service received is substandard for many users. The expenditure on direct support costs in the form of local government WASH Technical Units does fall within the costs range of international benchmarks. However, it is not clear how municipalities can fund these costs in the long-term through a mix of taxes and transfers from other donors. • Expanding the model is being reassessed following the coup and political crisis in Mali in 2012, because the capacity of local governments to access funds and undertake activities has become even weaker.	(41)
Mali	WASH Technical Units – large municipalities	0.50	See above	WaterAid	See above	(41)
Mali	Direct support	1.00[27]	Direct support for hand pumps, “modern” wells, and small piped systems	Unknown	Unknown	(41)

[27] Reported range for four municipalities: $0.5-$1.5 2011 USD. $1 USD was used for purposes of this table.

Country	Type of support	Per person expenditure USD per year	Description	Who Pays	Results	Source
Mali, Niger, Chad	Suivi Technique et Financier STEFI Technical and Financial Follow-up	0.34	• Management information system for monitoring the functionality of water facilities and the financial costs of small town and rural water services. • Has decision-support capability for formulating recommendations aimed at improving functionality • Mali: DNH contracts with STEFI operators. They provide advice and assistance to service providers CBOs and private operators and provide information to service authorities. • They are responsible for: checking the functionality of water facilities collecting the bi-annual financial accounting of water service providers of their operation expenditures sending technical and financial reports every six months to local water authorities, local water service providers and users formulating recommendations to improve functionality and planning consolidating cost data and reporting to the government	Set up: National Water Supply Directorate DNH, with German assistance Mali: Monitoring costs divided between the users via tariffs established by providers, the communes and the government.	• Increases in the financial performance of rural operators supported by STEFI • MEME/DNH report differences in the systems supported by STEFI and those without support: ○ higher water consumption registered and reduced water losses ○ life expectancy of small networks doubled with according cost savings ○ Water prices and tariffs decreased because of higher efficiency. ○ Advocacy for fundraising both from the government and the communes facilitated. ○ Reduction in unaccounted for water equivalent to US$ 0.16/ m3/ 2010. • The approach has not yet been extended to support hand pumps, partly because of the lower willingness to pay by users for water at hand pumps.	(5) (41)
Mozambique	District	0.0015	• Contracting community organizations. • Contract management. • Monitoring.	District government	Unknown	(5)

Country	Type of support	Per person expenditure USD per year	Description	Who Pays	Results	Source
Mozambique	PEC Zonal	1.10	• Districts contract NGOs or private firms to provide direct support to water and or sanitation interventions, since 2011. • A mix of support activities which also includes Capital Expenditure Software and support to Capital maintenance expenditure • Since 2011, PEC Zonal has existed in 38 of the 128 districts in Mozambique. • Based on 94 one-year contracts from 2008 to 2011, the per-person per-year direct support expenditure for this model ranges from $0.20 to $4.70 USD average $1.10 USD and mean $0.60 USD	Unknown	Slowly being rolled out over the country after positive experiences with a pilot from 2008 to 2011 in 18 districts in the central region of Mozambique.	(123)
Mozambique	District mechanic	Unknown	• In Sanga district a district mechanic who works closely with the Director of District Planning and Infrastructure Services DSDPI. • DSDPI technically trained him • Mechanic provides technical support to communities through carrying out repairs, and he also trains and supports water committees • Government monitors his work.	Communities pay his transport and the cost of spare parts	As a result of his work they have very few problems with rural water supply in terms of technical challenges. Communities know him well and they contact him directly for help, or through the SDPI. He has a very good presence in communities and is well respected. He has a very good working relationship with the government The challenge was that his work is voluntary no salary, so he was unsure for how long he would continue to do this work. To ensure sustainability of his own work he would like to get registered as an association to be able to receive a salary to continue to work in the future.	(34)

Country	Type of support	Per person expenditure USD per year	Description	Who Pays	Results	Source
Namibia	Direct support	2.00	• Technical support is provided by the local offices of the DWSSC which is based in each region. • DWSSC receives requests for major maintenance on an ad hoc basis as and when problems are reported. These requests can be mechanical, electrical or related to civil works maintenance. • Provides support on administrative matters to water point committees. It does not provide preventive direct support.	Directorate of Water Supply and Sanitation Coordination DWSSC	• A 2010 evaluation in the Kavango and Caprivi regions showed access to safe rural water supply is 53%, in Kavango compared to 82%.in Caprivi • There were constant and substantial backlogs in attending to requests and these appeared to be growing: • "The maintenance work performed by DWSSC was considered effective but often late due to long supply chain times in receiving spare parts and insufficient travel funds. The lack of a travel budget meant support could often only be provided for part of each month"	(124) (5)
Rwanda	Private sector management of rural scheme	Unknown	• A Dutch/Rwandan joint venture, AquaVirunga, was contracted by Rubavu district to manage its rural water supply scheme; later this venture won contracts for two more schemes in neighboring districts, serving a population of 239,000. • Despite AquaVirunga's efforts, they were operating at a loss and requested help from the districts, who in turn approached SNV. SNV identified two main ways of improving performance: reducing water leaks and addressing mistrust between AquaVirunga and its customers who were unaccustomed to paying for water. • SNV trained AquaVirunga's local staff, whose income is related to water volumes sales, to locate and fix leaks. SNV also supported AquaVirunga to communicate with communities the improved service benefits of private management.	Training: SNV	• Within three years, non-revenue water had reduced from 69% to 45% and revenue had doubled. • The population using safe water has further increased thanks to AquaVirunga's investment in new infrastructure which it undertook once its business became financially viable.	(43)

Country	Type of support	Per person expenditure USD per year	Description	Who Pays	Results	Source
South Africa	Support Services Agency SSA - Chris Hani District	18.76	• SSA can be a private company or a NGO. Service level targets were set in the contract between the SSA and the municipality, which the SSA was expected to achieve. • Schemes included in the SSA program varied in technology and population served, • The SSA responsibilities included: ○ supporting local operators in carrying out repairs and maintenance service ○ 75% of all mechanical and electrical installations were to be visited each month, ○ delivering diesel where required ○ procuring and delivering material and spares ○ preparing monthly reports ○ providing technical support engineering ○ facilitating the functioning of the CBOs each CBO was to be visited every month ○ training local operators • Costs include both expenditure on operation, capital maintenance and direct support. The greater distance of the Chris Hani District Municipality schemes from the base of the operations also increased the costs significantly; schemes were located on average at a distance of 100 km from the base of the operations, compared to 50 km in Alfred Nzo see below	SSA bills the municipality	The service level received was significantly higher in the Chris Hani District Municipality in terms of water quality and continuity of supply than in Alfred Nzo District Municipality. Difference in service delivery likely an inherent function of the infrastructure; the communities in the Alfred Nzo District Municipality rely predominantly on surface water sources without treatment facilities and this tends to deliver water of lesser quality than those with treatment systems	(125)
South Africa	SSA - Alfred Nzo District	8.06	[see above]			
	AVERAGE NOT INCLUDING BENCHMARK	**2.50**				

As described in the table above, Interaide trained area mechanics in Malawi to maintain and repair boreholes. As of 2008, the mechanics were being paid by some communities to repair their hand pumps. Table H.3 provides a snapshot of performance over five months of the mechanics in terms of number of contracts and money collected. The average money collected was $9.75 – $12.92 USD per mechanic per month. Area mechanics rely on the community to buy the spares (63). NGOs provide initial and refresher training, tools, and bicycle (63). For comparison, the minimum wage in Malawi was recently raised from K317 ($0.80 USD) per month to K551 ($1.38 USD) per month[28].

Table H.3 - Performance of Area Mechanics in Mchinji District, Malawi May to September 2008

Source: adapted from (63)

	May		June		July		August		September		Total Number of contracts	Total Money collected (MWK)
Mechanic	Number of contracts	Money collected (MWK)	Number of Contracts	Money collected (MWK)	Number of contracts	Money collected (MWK)	Number of contracts	Money collected (MWK)	Number of contracts	Money collected (MWK)		
FS	4	2470	1	1000	2	3000	6	8200	2	2500	15	17170
HM	1	500	6	3000	2	1000	3	1750			12	6250
JP	4	2750	2	750	5	3250	5	3200	7	3800	23	13750
LS	5	2500	4	2000	3	1500	1	500	2	1000	15	7500
MM	1	300	1	400			2	850	1	700	5	2250
NZ	2	1000			2	1500	3	2250			7	4750
SY							1	500	2	1300	3	1800
EK							3	1750	2	2000	5	3750
EM			13	6800							13	6800
AK			2	1000							2	1000
GM			3	1600	1	1500	1	1000	3	1300	8	5400
NZ			3	2500	2	2000	4	2000	1	500	10	7000
JK					1	1500					1	1500
EC			1	200	1	600	1	1500			3	2300
CB			1	200			3	2150	3	1900	7	4250
FJ			3	0	2	0	3	1500	2	900	10	2400

[28] http://mwnation.com/malawi-minimum-wage-74/

	May		June		July		August		September		Total Number of contracts	Total Money collected (MWK)
Mechanic	**Number of contracts**	**Money collected (MWK)**	**Number of Contracts**	**Money collected (MWK)**	**Number of contracts**	**Money collected (MWK)**	**Number of contracts**	**Money collected (MWK)**	**Number of contracts**	**Money collected (MWK)**		
JK			2	600	3	600	2	800			7	2000
SJM			7	2550			2	1000	2	1000	11	4550
HM					1	500	2	1000	2	1000	5	2500
TOTAL (MWK)	**17**	**9520**	**49**	**22600**	**25**	**16950**	**42**	**29950**	**29**	**17900**	**162**	**96920**
AVERAGE (MWK)	**3**	**1587**	**4**	**1614**	**2**	**1413**	**3**	**1872**	**2**	**1492**	**9**	**5101**
AVERAGE (USD)		**10.95**		**11.14**		**9.75**		**12.92**		**10.29**		**35.20**

Appendix I – Example Resolution Agreement

Improvement Agreement Date
School name:
Address:
Rain Water Harvest Project Review And Plan of Action. Complete on:_____
Major Problem or Deficiency requiring action.
Description of repair or improvement:
Cost estimate: (May have separate attachment with budget estimate – summarize below.) **Materials:** **Labor: Skilled Unskilled** **Artisan to do the work: _____** **Total Cost: _____**
Cost Sharing Plan: WATERLINES is willing to fund 50% of the cost, up to a maximum of 16,000 Ksh (exchange rate $1.00 USD or 80Ksh). Provided that the school agrees to provide the balance of the funds and material required to complete the improvement project.
When can the work begin? Date_____
School Representative: Name_____ **Signature_____** **Mobile Phone_____**
Waterlines Facilitator: : Name_____ **Signature_____** **Mobile Phone_____**
Please notify the facilitator when the work has been completed. **Date:_____**

Source: adapted from Waterlines Rainwater Harvesting Project Monitoring and Action Plan, April 2013

Appendix J – Descriptions of Circuit Rider Programs

ASSA - El Salvador

Who established program: unknown

Who funded program: unknown

Description of program: ASSA employs six people: three circuit riders, a secretary/laboratory technician, a marketing representative and a director. The marketing representative and the director also perform circuit rider activities:

- Technical assistance: on-call assistance, monthly visit by technician, water quality testing, operator training in disinfection.
- Financial training in accounting, budgeting, transparency.
- Operational management: Village Water Committee responsibilities and importance of disinfection.
- Environmental sustainability: Protection of water source, encourage metering.

Scale: Serves 170 communities or 51,000 households per year

Budget: In 2010, $50,000 USD a year; a little less than $1.00 USD per household per year or $0.25 USD per person per year, assuming an average household size of four.

Source: (70)

Honduras - Technicians in Operation and Maintenance (TOMs)

Who established program: the National Water Supply and Sewage Company (SANAA)

Who paid for program: funded jointly by SANAA (65%) and USAID (35%)

Description of program:

- SANAA launched a pilot program from 1993 to 1995 and expanded it to the national level.
- A national system of support offices. TOMs are employees of SANAA and work from regional offices that have substantial authority to make decisions, independent from higher levels of the national institution.
- The TOMs received 12 weeks of training in community development, technical repairs and engineering design, education and communication as well as water and sanitation concepts.

Responsibilities of circuit rider:

- Each TOM is responsible for an average of 50 communities and is expected to visit each system at least twice per year.
- Principal role is to support community water boards in all aspects of system operation, administration and maintenance by providing informal training, advice and encouragement.
- Not intended to replace the need for community management and O&M, but rather to support the community, particularly in areas where they do not have the resources or skills to resolve specific problems.
- Both municipal authorities and NGOs can now request assistance from the regional TOMs for training of rural water boards for new or rehabilitated systems being built independently of SANAA.

Scale: In 2003, TOMs provided support to more than 4,000 rural water systems servicing more than 2 million people (the total rural population was 3.2 million).

Budget: In 2000, the TOM program budget was approximately $1.25 million, Costs included salaries and administration, fuel, per diems, equipment, maintenance and technical studies.

Source: (8)

Appendix K – Examples of Networks of Water Committees

Association of Communes – Burkina Faso

In Burkina Faso, "Associations of Communes" provide mutual support and pool resources for small towns and rural villages (41 water systems across ten communes). These associations have revolving funds to support life cycle costs of members' water systems. This approach has yielded positive results and was working well after ten years of operation, but is currently considered illegal because it was developed prior to full decentralization and the establishment of communes in 2006 (54).

Association of Water Boards – Paraguay

The limited support that government institutions can provide to community water committees has prompted the creation of an Association of Water Boards (31). Community water boards must pay a fee to be in the association. Funds are used for the recruitment of qualified professionals, provision of vehicles, spare parts and other supplies (31).

COCEPRADIL - Honduras

Each community water committee chooses to be part of the larger network. Membership requires the committee to pay a fee to the network organization. In return the network provides training, technical assistance, and greater political capital to advocate for support from municipal governments, NGOs, and donors. This model has been particularly effective in Honduras, where there is a decades-long tradition of NGO, government, and donor collaboration to build and support these networks (23).

OCSAS – Latin America

The Community Organizations for Access to Water and Sanitation (OCSAS) movement, led by partners of the Freshwater Action Network, advocates for legal recognition, empowerment, and support for community water user associations as a regional strategy to secure the right to water. The initiative seeks to strengthen the skills and the political clout of water user associations (23). The Confederation of Latin American Community Water and Sanitation Organizations (CLOCSAS) promotes partnerships, capacity building, and advocacy for water and sanitation in Latin America and the Caribbean. They also organize annual conferences.

SISAR - Brazil

Integrated System for Rural Sanitation, or SISARs, started in Brazil in 1996 as associations of community-based service providers, with a dedicated operational unit which provides the following support to members (5):

- Jointly administer, maintain and coordinate operations for members' water and sanitation systems
- Set and secure payment for realistic tariffs
- Represent the affiliated associations
- Promote hygiene education

Each community has one operator, who receives a monthly payment from the SISAR. The financing comes from a user tariff and some cross-subsidization from larger rural systems to smaller communities. Support costs were $3.63 USD per person (in 2010) (5).

Appendix L – Examples of Implementing Organizations Supporting Local Governments

Developing Management Models for Rural Water Systems - Kenya

To address the failed community-management model, SNV focuses on building relations directly between local governments and communities. In Tanzania, Mozambique and Uganda, communities have formal arrangements with local government for requesting and receiving support and line agency accountability is enforced. In addition, SNV is developing alternative models for operation and maintenance including models involving the private sector. A number of countries (among them Kenya, Rwanda, Tanzania and Zambia) have adopted public private partnership models (47).

SNV supported government in Kenya at community, district, regional and national levels to develop a shared vision for future management models of rural water systems. Follow-up actions included the training of technicians to operate the water points, training of committees on bookkeeping, inventory management and accountability issues, and the signing of professional management contracts between the Water Service Board and the committees. These actions have substantially improved the functionality of the water systems in Marsabit County. The refined approach is being scaled-up countrywide by the Kenya Market Assistance Programme (43).

In six sub-districts in Ethiopia, SNV has tried a preventive operation and maintenance (POM) approach to improve water scheme functionality. In this approach, options for improving the water supply are discussed with water users, operators, and regulators to select the most appropriate technology and develop POM guidelines for these technologies. The intervention includes training of trainers for key government staff and local capacity builders. Shifting to preventive interventions has reduced downtime in service provision. Limiting the technology choices simplifies operation and maintenance training and the management of spare parts. The POM approach is now being replicated in other woredas and districts by both the government and other NGOs (43).

OMAS - Guatemala

In Guatemala, Global Water Initiative partners promoted a model called OMAS (*Oficina Municipal de Agua y Saneamiento* or Municipal Office of Water and Sanitation). The main function of the OMAS is to manage water services in an urban area while also providing technical and financial support for rural water service providers. This has led to stronger municipal administration, refocused municipal investments, municipal rate adjustments in urban areas, increased water quality, and better services in rural areas (23).

PATS – Latin America

Technical assistance support providers (*Prestadores de Asistencia Técnica* or PATs) who monitor community-based service providers on a regular basis could help them anticipate problems and better target their support. Such regular monitoring may also provide governmental entities with information to adjust and improve policies and regulatory frameworks for the rural water sector (46).

PEC Zonal - Mozambique

In Mozambique, districts have been able to contract NGOs or private firms to provide direct support to water and or sanitation interventions since 2011 (123). Since 2011, PEC Zonal has existed in 38 of the 128 districts in Mozambique and the cost ranges from $0.20 USD to $4.70 USD (123).

Post-Construction Support Units - Nepal

SNV Nepal has successfully encouraged two local district water offices to develop more formal post-construction support systems for rural water systems, specifically to clarify the roles and responsibilities of the district water office and the user groups, including accountability for poor design and construction (113).

Strengthening Coordination and Learning - Malawi

In 2008, Engineers without Borders (EWB) in Malawi shifted to a strategy to enhance the sector's overall effectiveness at providing sustainable rural water and sanitation services (40). Rather than implement more projects, EWB field staff began strengthening coordination and learning by working alongside local officials in devising appropriate, low-resource solutions, and using local experiences to inform the strategies of national and international stakeholders (22).

EWB works with 22 out of Malawi's 28 districts to help them set priorities for solving sustainability problems, given their resources. Depending on the district, EWB may work closely with government officials and field staff in water, health, environment, monitoring and evaluation, financing, and planning and development. EWB then brings its district-level perspective to national sector policy and strategy forums and encourages national – local government feedback loops (22). While these activities are still in progress, there is preliminary evidence of progress in coordination, learning, and service-oriented thinking. For example, in four districts, the WASH sector is coordinating with other sectors to obtain data on water and sanitation coverage. This is more efficient than waiting for donor-funded data collection projects, which are temporary (22).

Supporting Management Information Systems – Malawi

In four districts in Malawi, Engineers without Borders (EWB) supported the WASH sector in using existing public systems to solve the information problem, rather than waiting for donor-funded data collection projects. EWB was able to leverage that experience at the national level to convince the Ministry of Health, the Ministry of Irrigation and Water Development, and the Japan International Cooperation Agency to align monitoring pilots. In addition, EWB also demonstrated to the Technical Working Group for Monitoring and Evaluation the need to shift their priority from obtaining precise data to helping local governments to update data regularly using available resources (40).

Supporting Planning and Mapping – Mozambique

In Mozambique, WaterAid works closely with the government in the planning process. District governments plan the installation of new water points, manage the procurement process, and pay for the required services. WaterAid agrees with the government on an annual work program to support them (72). WaterAid directs funds to the District Administration, which manages the disbursement for WaterAid's projects; the government views this as a demonstration of trust. WaterAid has addressed technical capacity in district governments by providing appropriate embedded support (72).

Monitoring of water points and necessary follow up is vital to ensure water point sustainability, as only through tracking services will those with responsibility to fix water points know they need to take action to repair services. The provincial government in Niassa asked WaterAid to support mapping exercises to survey existing infrastructures and to create a database for planning and monitoring services. The success of this activity contributed to the creation of the National Water Sector Information Management System in 2006 (34).

WASH Technical Unit - Mali

WaterAid helps its partner municipalities to create a WASH technical unit. Each technical unit consists of one or two members of paid staff who support the planning and implementation of new infrastructure and provide ongoing support to community management committees. While the technical unit staff are employed by the municipality, their salaries and overheads are funded by WaterAid (41).

Water Point Mapping – DR Congo

SNV Congo piloted a Water Point Mapping exercise and water quality testing in three provinces. In one of the provinces data were collected by a local organization, while in the other two the exercise was implemented by government agencies. SNV introduced the mapping concept and provided staff with training in GPS data collection and processing. Data were collected on different aspects of service provision, including functionality and water quality, and shared at the district level. By being directly

involved in all aspects of mapping, participating government institutions are now in a position to undertake future mapping and analysis (43).

Appendix M – Mapping of Roles and Responsibilities for Sustained Water Services

In many places, the community water committee is still primarily responsible for service provision. The effectiveness of NGO contribution to water sectors in developing countries can be improved if their activities are coordinated and linked to or integrated with central program efforts (84). The table below, suggesting ideal roles for various stakeholders related to water services, is adapted from one developed as a result of a Sustainable WASH Forum in 2013.

Table M.1 – Mapping of ideal roles for sustainable water services
Source: Adapted from (126)

	Responsible Parties						
Role	**National Government**	**Local Governments**	**Water Users**	**Multilaterals**	**Civil Society**	**Private Sector**	**Donors**
Core work	Sets policy and national targets	Identifies needs, oversees or provides service delivery	Use water wisely	Set global targets	Mobilize, educate communities based on local government guidance	Infrastructure development based on local government guidance; sometimes provide ongoing service delivery	
Financial	Primary responsibility for access – often distributed through local governments	Responsibility for access and services using national funds	Pay for services	Contribute to service development			Contribute to service development
Monitoring	Establishes framework		Report problems or illegal connections to service provider		Build capacity for monitoring and evaluating for learning	Provide and/or manage data collection technology and/or management information systems	Donors fund capacity building
	All stakeholders share monitoring and evaluation data within the national framework						
General capacity support				Help build capacity of national government	Help build capacity of national & local governments		Fund capacity building of national & local governments
Innovation					Support innovation		Fund innovations

Kang & Campbell (94) suggest further detail on the role of districts in supporting sustained water services. In Malawi, some districts already play these roles. This can inform the roles that implementing organizations can play in supporting local governments to resolving problems with water systems.

Table M.2 – Potential role of district governments for sustained services

Source: Adapted from (94)

Role	Examples
Creating and sustaining community behavioral changes that enable water point repairs and continual improvement of sanitation facilities	Incorporate new approaches—such as community-led total sanitation and community sensitization to increase willingness to pay for water repairs—into existing management structures and reporting lines
Enabling markets by supporting private service providers and defining roles	Support private pump mechanics and sanitation providers by explaining the role of mechanics to communities and regulating mechanics' activities. Use existing contacts with communities and private service providers (development committee meetings, field-staff visits) to ensure that communities have a clear understanding of what the district will pay for and what communities must pay themselves.
Planning, coordinating, and monitoring stakeholders	Monitor water and sanitation services indicators based on their own context and using their own (rather than the project's) resources. Coordinate with other sectors that collect related data. Set expectations that NGOs harmonize their approaches with public policy and engage district structures with genuine collaboration rather than simply reporting activities or paying to use district field staff for implementation.