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UNDP-
World Bank
Water and
Sanitation
Program

Making Rural Water Supply Sustainable:

Report on the Impact of Project Rules

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Contents

I. Introduction

This study analyzes different approaches to rural water supply delivery. It seeks to:

i) clarify what is meant by "demand-responsiveness" both in theory and in practice,

ii) assess the degree of demand-responsiveness in project rules, and

iii) evaluate the relationship between demand-responsiveness and sustainability of water systems.

The study applies multivariate regression techniques to indicators collected from 125 community water systems in six countries. The indicators are based upon primary data obtained through in-depth household surveys, structured interviews with groups charged with system management, and technical evaluations of each system. The study also includes qualitative data collected using participatory methods in a focus group format.

The Study: A Concerted Effort

The UNDP-World Bank Water and Sanitation Program designed and implemented this study in partnership with its five Regional Water and Sanitation Groups (RWSGs) located in East Asia, South Asia, East Africa, West Africa and the Andes. It also collaborated with a wide range of international donor agencies, non-governmental organizations (NGOs), government agencies and community members[1]. A small team based in Washington coordinated the implementation of the study. In each country, a field team of six to eight people, managed by a lead consultant, conducted field work and a country-level analysis over a two to three month period. [2]

The methodology of the study was initially developed and field tested in Honduras. A member of the Washington coordination team directly participated in surveyor training and the first week of activities in each country in order to ensure consistency between countries. Each study team incorporated the particular interests of local project staff and tailored the questionnaires and focus group techniques to local circumstances.

The study also benefited from the input of project staff, representatives of government agencies, and other key sector actors who participated in a workshop to review the study's objectives, methodology, and strategy for disseminating results. A separate report was prepared for each country study. Field work began in Honduras in August 1996 and was completed in Pakistan in May 1997. The global analysis of data took place in Washington.

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[1] The field work was funded in part by the Swiss Development Cooperation (SDC) for Honduras, and the Danish Agency for International Development (DANIDA) for Uganda.
[2] The study team members include: Jennifer Sara (task manager), Travis Katz, Kihoon Lee (Washington, DC), Annie Manou Savina (Benin); Rafael Vera and Jose Quiton Daza (Bolivia); Mario Nunez, Tony Brand, Steve Maber (Honduras); Gillian Brown and Richard Pollard (Indonesia); Shahrukh Khan, Raja Rehan and K.M. Minatullah (Pakistan); and Asingwiire Narathius and Rose Lidonde (Uganda). The peer reviewers include: Tim Campbell, Mike Garn, Christine Kessides, Caroline Van den Berg and Dale Whittington (University of North Carolina).

The UNDP-World Bank Water and Sanitation Program

The UNDP-World Bank Water and Sanitation Program (the Program) has been working to improve poor people's access to rural water supply (RWS) for over 15 years. The Program benefits from a strong field presence in more than 30 countries and operates through its five Regional Water and Sanitation Groups. The Program's central office operates from the Transport, Water and Urban Department of the World Bank in Washington, DC. The Program assists in the design and supervision of many RWS projects worldwide. It also promotes systematic learning within and across projects, in order to continually improve the delivery of RWS. Finally, the Program supports policy development by drawing on lessons and undertaking analytical studies.

Background

The Water and Sanitation Decade

The Water and Sanitation Decade of the 1980's has shown that achieving lasting benefits from water supply interventions involves much more than building facilities. It focused on the importance of involving the community in all aspects of service delivery, the use of appropriate technologies, and the role of governments as service promoter rather than provider. It also demonstrated the limitations of top-down and supply-driven approaches to delivering services. In many ways, the decade represented a transitional period in the RWS sector—moving from the traditional to a new approach.

The traditional approach: Building water systems

Government support to the RWS sector has traditionally focused on designing and constructing systems based on prescribed needs. These needs are usually linked to perceived health improvements and give little consideration to demand for or sustainability of services. Furthermore, in many countries government policies for RWS are either inconsistent or do not exist. As a result, governments and donors often end up supporting projects within the same country that have incoherent strategies.

The traditional approach to RWS has frequently resulted in services that have not been sustained. Governments tend to pay more attention to building new facilities than to ensuring the use of existing ones. Roles for project planning, implementation, cost recovery, operations and maintenance (O&M), and asset ownership are poorly defined and communicated. Although communities are usually expected to provide a share of costs (mainly through in-kind contributions), it is often unclear how the level of contribution has been determined or how the level relates to demand. Furthermore, governments frequently assume that communities will somehow "manage" their facilities, but do not help build capacity or commitment to do so.

The new approach: Water as an economic good

During the 1990s, water and sanitation professionals reached a global consensus on a new approach to RWS. This approach is based mainly on two principles that were endorsed by the Nordic donor community at the 1992 International Conference on Water and the Environment in Dublin. They are:

i) Water is an economic as well as a social good and should be managed as such;

ii) Water should be managed at the lowest appropriate level, with users involved in the planning and implementation of projects.

Managing water as an economic good requires careful attention to consumer demand—in other words, to the quantity and quality of water that consumers want at a given price. Demands for community water supply are localized demands. Therefore, a demand-responsive approach requires that managerial decisions about levels of service, location of facilities, cost recovery and O&M should be made locally as well. The main role of government should be to establish institutional rules and processes that encourage such local decisions.

Paying attention to consumer demand has tremendous implications for RWS projects. In particular, project planners must establish rules and procedures that encourage efficient and effective choices, permit valid inferences about the level and intensity of local demands, and reduce transaction costs. An increasing number of projects financed by the World Bank and other external support agencies are applying these principles as a means to create incentives that encourage demand-responsive services. This study is designed to learn more about the nature of demand in rural water supply projects and the linkages between demand-responsiveness and sustainability of water systems.

Objective

The study objective is to evaluate the impact of different project rules and the applications of such rules on sustainability. The rules will be evaluated in terms of responsiveness to demand at the community level. The study also attempts to design better sets of rules for future projects and policies. The primary hypothesis to be treated in the study is:

> *Water-supply services which are more demand-responsive are more likely to be sustainable at the community level than services which are less demand-responsive.*

The study includes ten projects in Benin, Bolivia, Honduras, Indonesia, Pakistan, and Uganda. These are both stand-alone RWS initiatives as well as multi-sector projects. They are primarily financed by the World Bank, but also involve financing by other donors.

The Concept of Demand

Demand for a good or service is an economic function. It is influenced by an individual's budget, the price of the good, the price of other goods, and individual preferences. In RWS, demand is defined as the *quantity and quality of water community members will choose to consume at a given price*. Price, as used here, signifies all valued resources including an individual's time or labor given in exchange for service.

In its purest form, a demand-responsive RWS service is provided by the private sector through market mechanisms. Users select a level of service for which they are willing and able to pay and bear the full cost of these services. Historically, there are numerous examples of purely demand-responsive investments in RWS where communities have used their own resources to improve their water supply services without any external support. Community groups often organize themselves to ameliorate a community spring, build a footpath down to the river, or hold traditional well-cleaning days.

Even in low-income countries where there is substantial external and government subsidy to RWS, there is evidence that communities with high demand for an improved water supply find ways to solve their own problems. Many communities, such as those under the Self Help Water program in Kenya, have arranged to borrow funds and hire a contractor to design and build a more complex water distribution system (Gichuri, 1995). In Bangladesh, a recent study in found that over half of the rural population is supplied through private provision (Garn, 1997).

Despite such successes, governments and external agencies have generally opted to provide large subsidies (often up to 100% of total costs) for RWS schemes. Such high levels of subsidy have often been justified by citing the expected benefits of improved health and living conditions and increased productive capacity of rural communities. The link to these outcomes, however, has not been well established. Although any level of subsidy tends to distort price signals associated with the true costs of services, subsidized projects can still be designed to incorporate some elements of demand-responsiveness. To do so successfully, projects must create opportunities and incentives for communities to express demand for services, and allow this demand to guide key investment decisions.

Why is demand important?

The most compelling argument in support of the demand-responsive approach is that an expression of demand is an expression of value. A person's willingness to give up valued resources in exchange for a service indicates that the person values that service. If this value at the community level is greater than or equal to the cost of providing and maintaining the service, one can assume the community will be willing and able to maintain the service. In a community where the value placed on the service is less, it is likely that the community will not be willing to maintain the system over the long term.

In addition, due to fiscal constraints in most developing countries and the institutional and financial constraints of even large RWS projects, not all communities can be immediately be provided with RWS services even at marginal costs (Garn 1997, Khan 1997). Thus, the important policy question becomes which communities should receive services first. It makes sense to give priority to investments in communities that have expressed demand for the services in advance. It can be assumed that these communities are ready and willing to maintain the service. This willingness is critical since nearly all government projects expect the communities to manage and maintain their systems once they have been constructed.

The demand-responsive approach

For the purposes of this study, a demand-responsive approach allows consumer demand to guide key investment decisions. In other words, a project is more or less demand-responsive to the degree that users make choices and commit resources in support of these choices. The approach includes three key aspects.

i) ***Prioritization****:* It gives participation priority to communities that are actively seeking improvements to their water services.

ii) ***Willingness-to-pay***: It establishes clear linkages between the type and level of service people want and how much they are willing to pay for these services.

iii) ***Informed decisions***: It allows communities to make informed choices about the level of service they want, with an understanding of the implications of their decisions.

The concept of informed choice is critical to the demand-responsive approach. An informed choice is a decision made by a group or individual with a clear understanding of the implications of that choice. The implications may be in terms of investment or recurrent costs, expected participation in planning and implementation, and responsibility for O&M of the water system.

The importance of project rules

Project rules—eligibility criteria, technology and level of service options, financial policy, ownership rights, and procedures for project implementation and O&M—guide the operation of the project. They are the essential elements of project design because they establish a framework through which demand can be expressed and interpreted.

Box 1 outlines rules that are particularly important to a demand-responsive approach in RWS. These rules are designed to provide incentives for communities to express and act on their demand for services. Ideally, demand-responsive project rules channel resources first to communities which express a high demand for service. They also clarify the rules of engagement for communities that do want to improve their service. Table 1 illustrates the different technologies and service levels common in RWS projects.

Other project rules not directly related to demand are also evaluated in the study. Their relevance to sustainability will be analyzed in the conclusions.

Box 1: Project Rules

This study examines not only the design of project rules, but also the quality of rule application at the community and household level. There are five broad categories of project rules.

1. ***Eligibility criteria***: Rules for participation should be broad enough so that eligibility does not, by itself guarantee that every eligible community will receive service. Service commitments should follow, not precede, community initiative in seeking the improvement.

2. ***Informed request from community***: The project should set up procedures to allow an adequate flow of information to the communities. Communities should be able to make informed choices about whether to participate in the project. They must know in advance the terms of their participation and responsibility for sustaining the project.

3. ***Technical options and service levels***: Communities should be actively involved in selecting service levels. A range of technical options and service levels should be offered to communities, with the related cost and operational implications made clear.

4. ***Cost-sharing arrangements***: The basic principles of cost sharing should be specified and made clear to all stakeholders at the outset. Cost-sharing arrangements should be designed so that the community chooses the levels of service for which it is willing to pay. Ideally, communities that demand a higher (i.e. more costly) level of service should pay more than those preferring a basic level of service.

5. ***Responsibilities for investment support***: Rules regarding asset ownership, O&M, and ongoing recovery of system costs should be established and agreed upon with all stakeholders.

Table 1. Common types of technology and level of service options for RWS

Technological Options	***Level of Service***
Point sources per hand dug well	Number of users per distribution point
Hand dug or drilled well with hand pump	Individual house connection or water point
Hand dug or drilled well with solar or electric pump	Public facilities
Rain water catchment, or Storage tank (connected to irrigation canal, spring or other)	Mixed system: public and individual in same community
Distribution systems	
Spring or river with gravity flow	
Deep well with pump and storage	

Stand-alone vs. Multi-sector Projects

In recent years, World Bank lending for RWS increased dramatically. It now supports more than a dozen sector-specific lending programs and provides resources for RWS as components of multi-sector projects. This study examines projects that follow both approaches to RWS: stand-alone and multi-sector projects. The two approaches have important differences in their design.

Stand-alone projects typically provide only water and sometimes sanitation services to communities. They are implemented directly by the sector agency responsible for RWS, either by in-house staff or a contracted third party. The projects are usually run by social and technical staff who specialize in RWS. Objectives typically focus on improving the health and living conditions by increasing access to clean and safe water. Stand-alone projects have been heavily supported by bilateral support agencies and NGOs in particular. In addition, many stand-alone projects implemented through the government can also serve as important instruments of policy reform.

Multi-sector projects are quasi-financial intermediaries that channel resources to small-scale projects for poor and vulnerable groups. These multi-sector projects include Social Investment Funds and integrated health, rural development and agricultural projects. Social Investment Funds in particular have increased in importance in recent years and usually include large RWS components. More than 45 such projects have already been approved by the World Bank and more are underway. Projects may differ in specific objectives but have several key features in common. These include:

i) a focus on poverty alleviation,

ii) a design that gives beneficiaries choice between different sub-projects, such as schools, clinics, roads and water systems,

iii) sub-projects that are proposed, designed and implemented by public or private agencies, such as local governments and NGOs, or by the community, and

iv) management that is autonomous from traditional government institutions.

Most multi-sector projects funded by the World Bank are now in their second or third phases of implementation. Although many early projects were designed as temporary and emergency interventions, the more recent projects have adopted long term goals and focus on building institutions and sustainability to a greater degree.

Projects Included in the Study

The study analyzes RWS projects in six countries: Benin, Bolivia, Honduras, Indonesia, Pakistan, and Uganda. These countries were selected because they all have large projects which follow two different approaches to RWS. In four of these countries, the World Bank supports both these approaches. Country selection was based primarily on three factors. These include:

i) at least one of the projects in the country is funded by the World Bank,

ii) the project adopts rules with a high degree of demand-responsiveness, and

iii) the interest of the project director (and/or World Bank task manager) to participate in and provide funds for the study.

Due to the lack of a large World Bank funded RWS projects under implementation in East Africa, a Danish-funded project which was receiving RWSG support was selected to be surveyed in Uganda.

The projects examined in this study have broad differences in terms of objectives, rules, size and implementation arrangements. Four of the 10 projects are multi-sector, and three of these are funded by the World Bank. The Bank also supports three stand-alone projects that are implemented by RWS and health sector agencies. Bilateral donors support the remaining stand-alone projects and provide technical assistance to agencies for implementation. Two projects are implemented by NGOs. Since many of the projects have received funding in several phases and adjusted rules and procedures over time, the table identifies the specific phase that was included in this study. Table 2 gives a summary of the project characteristics.

Procurement procedures vary greatly between the projects. In particular, three of the five multi-sector projects financed by the World Bank have streamlined procedures for the project. These allow local governments to participate in contracting without many of the bureaucratic procedures required by government agencies. Two stand-alone RWS projects that received World Bank funding follow the usual government procurement procedures. Five projects supported by bilateral donors and NGOs follow their own procurement procedures.

Box 2. Projects included in the study

CfD	Caisse française de Développement (Benin)
FHIS	Honduran Social Investment Fund (Honduras)
LGRD	Local Government and Regional Development Department (Pakistan)
NRSP	National Rural Support Program (Pakistan)
PROPAR	Project for Wells and Rural Aqueducts (Honduras)
RUWASA	Rural Water and Sanitation Project (Uganda)
SIF	Social Investment Fund (Bolivia)
VIP	Village Infrastructure Project (Indonesia)
WSSLIC	Water and Sanitation for Low Income Communities Project (Indonesia)
YRWSS	Yacupaj Pilot Project (Bolivia)

Table 2. Project characteristics

Country	Benin	Bolivia	Bolivia	Honduras	Honduras	Indonesia	Indonesia	Pakistan	Pakistan	Uganda
Project	***CFD***	***SIF-1***	***YRWSS***	***FHIS-1***	***PROPAR***	***VIP - Java***	***WSSLIC***	***LGRD***	***NRSP***	***RUWASA***
Objective	water	employment generation, improve basic services.	water, sanitation, hygiene	employment generation, poverty alleviation	water, sanitation, health	public infrastructure, employment generation	water, sanitation, hygiene, health	water, sanitation	water, sanitation, agriculture, microcredit	water, sanitation, health
Source of Funds	France	IDA	Netherlands, UNDP-WB (TA)	IDA, IADB, KfW, USAID	Switzerland	IBRD	IBRD	IDA	Government/ Donors	DANIDA, Gov't of Uganda
Project Type	Stand-alone WSS	Multi-sector	Stand-alone WSS	Multi-sector	Stand-alone WSS	Multi-sector	Stand-alone WSS	Stand-alone WSS	Multi-sector	Stand-alone WSS
Implementing Agencies	Directorate of Water	SIF--autonomous gov't agency	NGOs and Govt. coordination	FHIS--autonomous gov't agency	Ministry of Health	BAPPENAS, the National Dev. Planning Agency	Ministry of Health, Min. Pub Works, Home Affairs	Government ministry	NGO	Directorate of water dev.
Procurement arrangements	Set by donor	Project specific	Set by donor	Project specific	Set by donor	Project specific	Regular gov't	Regular gov't	Set by donor	Set by donor
International Technical Assistance	Full-time advisors	No	Partial	No	Full-time advisors	Partial (for Monitoring)	Partial	No	No	Full-time advisors
Year Initiated	1989	1990	1991	1990	1986	1995	1994	1992	1991	1991
Duration of phase included in study	4 yrs	4 yrs (SIF1)	4 yrs	5 yrs (FHIS1)	10 yrs	4 years	6 yrs	9 yrs	On going	5 years (phase 1 of 2)
Total Project Cost (M US$)	8.2	95.6	2.8	68.0	1.90	83.8	123.3	194.2	16.4 (GOP only)	35
Cost WS component	8.2	16.4	2.8	n/a	1.90	about 1.7	123.3	194.2	5.41 (GOP only)	35
Intended Beneficiaries	200,000	n/a	31,000	n/a	n/a	3 million	2 million	1.5 million	385,273	761,400
Number of communities	33	n/a	520	284	n/a	1200	1400	1600	986	2892

II. Methodology

This study involves model testing, applying multivariate regression techniques to indicators based on primary data from 125 rural communities in six countries. Research teams collected quantitative data during household user surveys, water system assessments and interviews with water committees. The study complements this data with detailed qualitative information gathered during the surveys and using project documents.

The current methodology builds on that employed by Deepa Narayan in *The Contribution of People's Participation: Evidence from 121 Rural Water Supply Projects* (1995). The Narayan study combined model testing using multivariate analysis of data and in-depth qualitative analysis of particular case studies. It drew upon earlier studies by Esmann and Uphoff (1984) and Finsterbusch and Van Wicklin (1987).

The Narayan study obtains quantitative data by applying a questionnaire to **project documents**. That questionnaire measured 145 characteristics relating to participation and project impacts. Most items were rated on a scale from zero to seven, with some key performance variables rated on a scale of one through 10. Fifty factors were selected to be included in the model. Each rated item served as a quantitative measure of a specific characteristic. Several related characteristics were combined to form variables to be tested in the model.

The current study bases its analysis on similar, indicator-based scoring techniques. **The crucial difference is that these indicators are based on primary data collected in the field** rather than case studies or reports. Data for the study was collected from four sources in each community:

i) Household interviews with a random sample of 15 households in each community. In total, data from 1,875 households were used in the study.

ii) A structured focus group interview with the water committee or other organization in charge of managing the water system.

iii) A technical assessment of the physical condition of the water system, management and technical capacity of its operators, and financial health of the organization.

iv) Qualitative information, obtained through gender-segregated focus group discussions and surveyor observations.

For the first three data sources, the study used a multiple-choice questionnaire containing roughly eighty items. In addition, it used open-ended questions and semi-structured interview guidelines to collect qualitative data. The study also documented project rules with a questionnaire and interviews with project staff.

Hypothesis and Model Testing

Sustainability of a rural water system is a function of a number of factors. Sustainability depends not only on factors controlled by the project such as training, technology, the cost of the system, and construction quality, but also on factors beyond the control of the project such as the community's poverty level and their access to technical assistance and spare parts.

The primary hypothesis of the study is that the sustainability of a water system is directly related to how well the project responds to the demand of community members. The study is designed to test this hypothesis, while gauging the relative importance of demand-responsiveness and other factors (both project-related and external). To this end, the study applies multivariate regression techniques to a series of indicators. An *indicator* is defined as a group of statistical values that taken together is indicative of a particular characteristic such as the relative sustainability of a system.

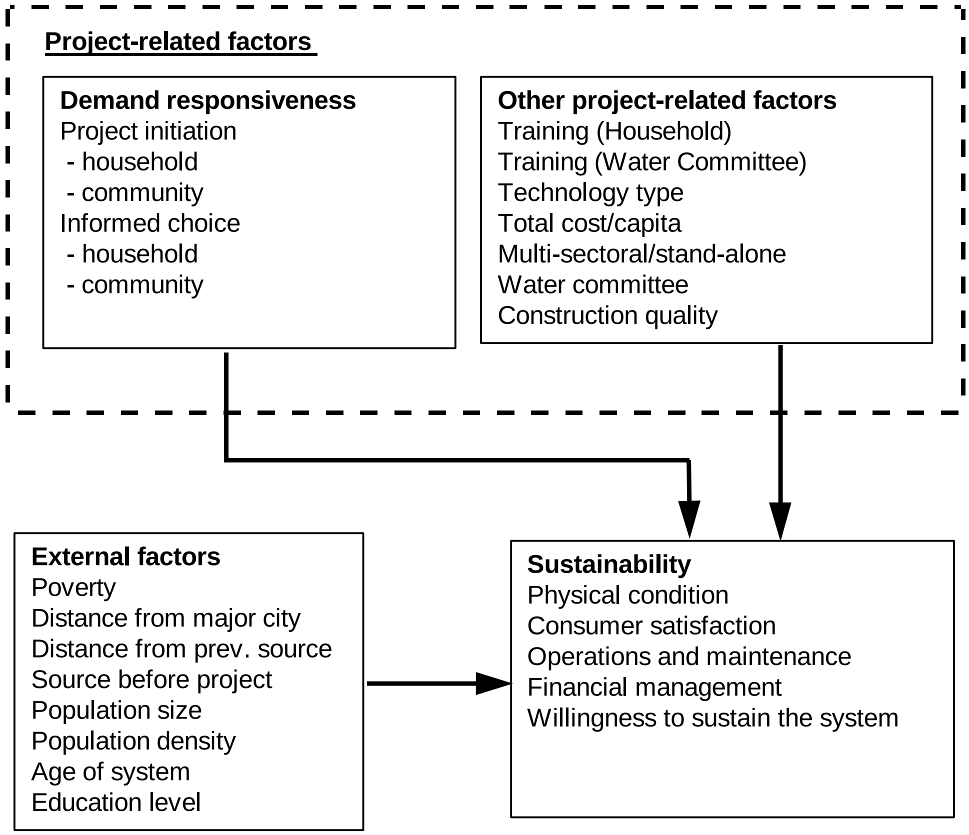
The model for testing impact of project rules is shown in figure 1. The model states that the sustainability of an individual water system is a function of two broad groups of factors: (i) Project Rules and (ii) External Factors. The category of project rules has been subdivided into two categories: (a) project rules relating to demand responsiveness, including community participation and cost sharing arrangements, and (b) other project related factors, including technology type, sub-project costs and training. In a simplified format, this relationship may be expressed by the following equation:

$$S = \beta_0 + \beta_1 [DR] + \beta_2 [PR] + \beta_3 [EX] + u$$

Where:

S: measure of sustainability (dependent variable)
DR: level of demand-responsiveness (independent variable)
PR: project-related factors (rules not related to demand)
EX: external factors
$\beta_0, ..., \beta_3$: intercept and slope terms
u: stochastic [random] error term.

Figure 1: Model for testing impact of project rules on RWS sustainability



Testing this hypothesis presents a number of methodological challenges. The principal challenge lies in the fact that a number of the variables included in the model -- particularly demand-responsiveness and sustainability -- are not directly observable at a fixed point in time. To overcome this limitation, indicator sets were developed to serve as proxies for the variables in question. While the use of such indicators is not uncommon in the literature, it does place limitations on both the type of analysis that can be done and the conclusions which can be subsequently drawn from the results. These issues are discussed in more detail in the following sections.

Indicator categories

The indicators are grouped into four broad categories: demand-responsiveness, other project-related factors, external factors, and sustainability. These categories are further subdivided into indicators and sub-indicator categories. Each indicator draws upon a different source of data. A summary of the major indicators and sources of data are presented in table 3. The indicators are defined in box 3.

Table 3. Indicators and sources of data				
	Source of Data			
Indicator/ Sub-Indicator	***household***	***water committee***	***technical evaluation***	***other***
Independent variables				
Project Rules: Demand Responsiveness				
Project initiative	X	X		
Informed choice made	X	X		
Contribution to project	X	X	X	
Other Project Rules				
Household Training	X	X		
Water Committee Training		X		
Technology			X	
Total Cost, p/c			X	
External Factors				
Poverty				X
Education				X
Distance from major city, etc.				X
Dependent variables				
Sustainability				
Physical Condition			X	
Consumer satisfaction	X			
Operations and Maintenance		X		
Financial Management			X	
Willingness to sustain system	X			

As mentioned above, the primary limitation of these indicators is that they are approximations, rather than observable, cardinal data. Thus, any conclusions that can be drawn from the regression analysis -- i.e. that an increase in demand responsiveness will improve sustainability -- must be taken with the understanding that these conclusions only apply to the variables *as measured by the study indicators*.

Furthermore, since the indicators are composite statistics, made up of a number of distinct but related pieces of data, this raises serious questions about how to interpret relative changes in the variables. There is little ambiguity, for example, in stating that an increase in rainfall of one centimeter results in a 10% increase in crop yield. The same cannot be said of the statement that a one-point increase in the indicator of demand-responsiveness score results in a 40% increase in the sustainability indicator. The indicators provide relative, not absolute measures. Consequently, the numeric value of each are dependent, in part on judgment calls as to which factors to include in each indicator, and the weighting of each factor. We have made every effort to be transparent in the way these indicators are composed and scored, including details of how each indicator was composed in Annex E. At the same time, for the reasons mentioned above, the study does not attempt to draw any conclusions about the magnitude or relative importance of different factors in determining sustainability (as reflected by correlation coefficients in the multiple regressions).

Box 3: Indicators

The analysis is based on indicators developed specifically for this study. Indicators were used to measure demand-responsiveness and sustainability of the community's water system. Demand-responsiveness is considered from the perspective of household members and water committees.

Indicators of demand-responsiveness

1. ***Project initiation*:** This measures the degree to which community members felt responsible for initiating the project, as opposed to being selected by the project or government.
2. ***Informed choice:*** This measures the degree to which individuals felt involved in decision-making processes surrounding the system, and how well they were informed about the implications of their decisions in terms of costs and responsibility for O&M.
3. ***Contribution:*** This measures how much people contributed to the initial capital investment. This includes cash, labor, and in-kind contributions.

Indicators of sustainability

1. ***Physical condition of system:*** This measures the overall physical condition of the water system. It is based on factors such as construction quality, pressure level in the system, and leaks or defects in the masonry or pipe.
2. ***Consumer satisfaction:*** This measures overall consumer satisfaction with the water system. It is based on expressed opinions on factors such as satisfaction with quantity and quality of water received, taste and color, and continued use of alternative sources.
3. ***O&M practices:*** This examines factors such as whether the community has a designated system operator, access to tools and spare parts, and information about follow-up support.
4. ***Financial Management:*** This assessment is based on a review of each community's financial records and interviews with the water committee and treasurer.
5. ***Willingness to sustain the system:*** This measures community support for sustaining the water system. It assesses the degree to which community members feel responsible for their maintenance of their system.

Instead, the study focuses on the *strength* and *direction* of the resulting relationships, employing significance levels of 95% or higher.

The conclusions drawn from the analysis were supplemented by qualitative assessments conducted in each community. These assessments allowed us to check our indicators against the perceptions of community members and field staff, to ensure that they were accurately reflecting the reality of each community, as well as to make necessary adjustments to the composition of each indicator. Finally, the initial conclusions of the global analysis were compared with those drawn from a more qualitative review of the same data conducted independently by each country team. Summaries of these country studies are presented in Annex A. The final conclusions presented in Chapter VI were drawn from both the statistical analysis and the country reports, and agreed upon by the study team leaders in a week-long seminar held in Washington, DC in September, 1998.

Scoring

Each sub-indicator score is based on a group of nine to 15 related questions collected by the survey teams. Each question is scored on a scale of zero to two, and the total score for the sub-indicator is calculated by combining these scores and converting to a ten-point scale. Thus, a community which performs poorly on 50 percent of the parameters receives a score of five. A community performing perfectly on all parameters receives a score of ten. A community which performs poorly in all areas receives a zero. See Annex E for a detailed look at the analytical framework.

III. Findings: Project Rules and Demand Responsiveness

The study documents not only the "official" rules of a project, as defined in project documents and reported by project staff, but also how these rules were implemented and interpreted by community members. The following section is divided into three sections. The first two focus on the project rules related to demand responsiveness -- presenting first the official rules, then comparing them to how people reported the projects operate in the field. The later of these two sections introduces the indicator scores for demand responsiveness. The third section follows a similar pattern in discussing other project rules, including those related to contributions and training.

Analysis of official project rules

The ten projects included in this study were selected because they were designed to be at least partially demand-responsive. Table 4 presents a summary of each project's rules, as they relate to demand-responsiveness. The information is based on a review of project documents and interviews with project staff. The table shows that eight of the ten projects have many elements of the demand-responsive approach (all except RUWASA and CFD).

Project Initiation

Do the official rules give priority for participation to those who actively seek it?

A basic tenet of the demand-responsive approach is that more communities should be eligible for service than can be served. Priority for service should be given to those communities who actively seek improvements to their water supply system. This criteria provides a clear mechanism through which communities can express their demand for a service, and allows projects to target funds to those communities with the highest demand. It is presumed that these communities are most likely to sustain the system.

Seven of the ten projects included in the study base their selection criteria on demand. These projects require communities to request assistance directly from the project before any intervention is made. In the case of multi-sectoral projects, communities must identify water as a priority in order to receive a water system. Three projects base their selection criteria on poverty or need. Two of the demand-responsive projects rely on the municipal or district government to act on behalf of the community. The results indicate these local governments do not always represent the demand of the community.

Table 4. Official project rules

Country	Benin	Bolivia	Bolivia	Honduras	Honduras	Indonesia	Indonesia	Pakistan	Pakistan	Uganda	Scoring
Project	***CFD***	***SIF***	***YRWSS***	***FHIS***	***PROPAR***	***VIP***	***WSSLIC***	***LGRD (IDA)***	***NRSP***	***RUWASA***	***scale***
Project Initiation											
Community requests intervention?	no	yes	yes	somewhat (municipal govt. decides)	no (not initially)	Somewhat (allocation is made - they choose to participate)	yes	yes	yes	no	1.3
Options											
Multi-sectoral choice	no	yes	no	yes	no	yes	no	no	yes	no	0.7
Can community select technology?	no	yes	yes	yes	no	yes	yes	no	yes	no	0.7
Can community select service level options?	no	yes	yes	yes	no	yes	yes	no (standposts only)	yes	no	0.7
Financial policy											
Expected contribution to capital costs	Standard fee per household (about 1%)	10-20% in-kind	30% in cash plus labor, 100% for higher LOS	10% in-kind	25-30% (cash and in-kind)	Labor paid at 2/3 min. wage	4% cash, 16% in-kind (100% higher LOS)	Not very clear (build tanks, land)	30-40%	in-kind	-1.3
Is there a cost ceiling?	no	no	yes, for basic LOS	no	yes	yes for entire village	yes, for basic LOS	no	no	no	0.7
Pay more for higher LOS?	n/a	no	yes	no	no	yes (if above total ceiling)	yes	no	no	no	
Informed choice											
Are community O&M responsibilities clear from the outset?	yes	no	yes	yes	yes	Somewhat (not very explicit)	yes	yes	yes	yes (partially)	1.3
Does project provide qualified assistance to allow for choice?	no	Not explicit (depends on NGO/consultant)	yes	no	yes	Somewhat (1 engineer)	yes	yes	yes	yes	1.3
Does community make informed choice to participate and sign request?	yes	yes	yes	no (municipality signs)	yes	Somewhat (O&M not stipulated in request)	yes	yes	yes	Partially	1.3
Rating of DR based on documents	**3.3**	**6.7**	**9.3**	**4.7**	**6**	**6**	**9.3**	**6**	**8.7**	**3.3**	**10.0**

Informed choice and financial policy

In a demand-responsive project, communities should be allowed to make informed choices about whether to participate in the project, and technical options. This principle has several important implications.

First, in order for people to make informed choices, projects must provide them with adequate information about which technical options are feasible as well as the relative costs of each option and complexity of O&M. Because this information is often delivered to people with relatively low levels of education, projects must have resources and trained staff to effectively transmit this information to community members. Second, projects must establish formal procedures for communities to express their preferences. Third, demand-responsive projects must adopt financial policies that link user contributions to system costs. This link is critical to making these informed choices expressions of demand, rather than a wish list for improved services.

Do rules allow communities to make informed choices about whether to participate?

Most projects appear to allow communities to make informed choices about whether to participate. Nine projects require communities to sign requests for project intervention in which they accept responsibility in advance for O&M. The tenth project, FHIS, requires the local government to sign the request.

The projects differ greatly, however, in the amount of resources they allocate to communities to assist them in making decisions. Seven projects allocate substantial resources to community organization and training activities. However, in only three projects (WSSLIC, YRWSS and NRSP) do community mobilization activities start before investment decisions are made, providing communities with the information to make a truly informed choice. In three others (RUWASA, PROPAR and LGRD) communities are provided with necessary information only after they have been selected to receive services. In CFD, community training follows the water system construction.

Do projects offer choices of levels of service, and are these choices linked to contributions?

Very few projects apply a consistent financial policy that links service level options to willingness to pay. While all projects require contributions, only the YRWSS and WSSLIC projects require households to pay substantially more for individual waterpoints rather than for shared facilities. Two other projects, VIP and PROPAR, place ceiling caps on the amount of subsidy provided for the entire village. Four projects do not allow communities to choose between service options (CFD, PROPAR, LGRD and RUWASA). The two social fund projects, FHIS and SIF, officially require that communities pay 10 percent of the water system cost, and therefore, could provide a link between the levels of service and willingness to pay. However, these contributions may be given in-kind, and are rarely quantified. Indeed, field surveys reveal that in many cases, communities served by these projects made no contribution at all.

Field Results for Project Rules

Surveys were conducted of households and members of the water committee in a sample of fifteen communities for each project to verify how closely project staff and intermediaries adhered to the official rules.[1] Indicators measuring the level of demand-responsiveness of the project at different stages of the project cycle were computed separately for household and community level data. The following section summarizes the field results and the indicator scores for the two sub-indicators of demand responsiveness -- project initiation and informed choice -- as well as that for overall demand responsiveness. Details on the composition of each indicator are presented in Annex E.

The study finds a similarity between the official rules and the average indicator scores for each project. However, it also finds in many cases a difference between the involvement of members of the water committee and the involvement of household members. Projects demonstrate inconsistency in their approaches to different communities within the same project. The study shows that it is not uncommon for a project to be very demand-responsive in one community, and very supply-driven in another.

Field Results for Project Initiation

The first indicator of demand-responsiveness is project initiation. Scores for project initiation measure the degree to which community members felt that they were responsible for initiating the request for a water system. This is in contrast to the perception that the project had been initiated individuals outside the community such as project staff, local or other government representatives. The scores are based on a series of five questions regarding whether people were aware that they could get assistance to build the system and perceptions about who participated in the decision to initiate the system.

The indicators were calculated on a scale from zero to ten for each community. At the water committee level, a score of ten indicates that someone from the community initiated a request for assistance and made the final decision to participate. By contrast, a zero indicates that someone outside the community chose the community and did not give community members an option of whether or not to participate. At the household level, the scores represent the average response by fifteen members in each community.

Survey results

The survey results show that perceptions of project initiation are generally consistent with project rules at the water committee level. Three-quarters of the water committee members feel that the idea for the water system came from within the community. The results are shown in table 5.

The same consistency did not occur at the household level. Less that half of the respondents feel that the idea for the water system was initiated in the community. Results vary considerably between projects. One hand, more than 60 percent of the households feel that the water system was initiated by the community in NRSP, WSSLIC and PROPAR. On the other hand, 30 percent of respondents in FHIS, SIF and LGRD do not know who initiated the water system. The majority of respondents from RUWASA and CFD feel that project staff initiated the work. In VIP, most household members feel that the water system was initiated by the local government. This is consistent with project rules. See box 4.

[1] In Honduras only ten communities were selected from each project.

Households were also asked if a member of their family directly participated in the decision to build the system. Overall, sixty percent of respondents felt they participated. However, in three projects only about one-third of the households perceive that they participated in the decision. These results appear consistent with the project rules since CFD has a predetermined list of communities to be served, and FHIS and VIP both rely on local governments to decide which villages will be served. In PROPAR, YRWSS, LGRD and NRSP, more than 75 percent of the households sense that they participated in the decisions. Not surprisingly, these four projects allocate resources to community mobilization and organization activities before a decision is made to construct the water system. These four projects also require the highest level of upfront financial contribution from community members.

Table 5. Perceptions of project initiation

	Whose idea was it to build the project? (Responses in percent)			
Water committee level	Water committee neighbor or community group	Local or municipal gov't.	Project	I don't know
CFD	20	0	70	10
SIF	53	7	20	20
YRWSS	71	0	29	0
FHIS	83	17	0	0
PROPAR	100	0	0	0
VIP	92	8	0	0
WSSLIC	93	0	0	7
LGRD	100	0	0	0
NRSP	100	0	0	0
RUWASA	29	14	57	7
	Whose idea was it to build the project? (Responses in percent)			
Household level	Water committee neighbor or community group	Local or municipal gov't.	Project	I don't know
CFD	25	5	46	24
SIF	41	8	12	37
YRWSS	46	0	31	21
FHIS	59	2	2	31
PROPAR	63	0	19	18
VIP	32	48	1	20
WSSLIC	62	25	1	13
LGRD	44	14	10	31
NRSP	87	0	9	11
RUWASA	13	25	28	16

An analysis of the project initiation scores also reveals that the water committees feel they helped initiate the project to a greater degree than the households. The scores are shown in table 6. This difference is substantial in FHIS and VIP, indicating a weak flow of information between community leaders and households. The difference stems from a variation in project rules. In particular, both projects are designed to work through local representatives--community leaders, in the case of VIP, and municipal governments for FHIS. Four of the six projects where household perceived a greater role in initiating the project spent time mobilizing communities in advance of making specific decisions.

The two projects with the lowest scores for project initiation were CFD and RUWASA. Both selected communities based on an external determination of need and did not let communities choose whether to participate. The project with the highest score, PROPAR, also selects communities based on need. However, the difference is that communities served by the project must agree to participate before construction is approved. In addition, they must organize water committees and collect a substantial cash contribution in advance.

The study found that project staff and intermediaries are not enforcing their rules equally in all communities. For example, in Juan Latino, Bolivia only three of the fifteen people surveyed stated that they or a member of their family participated in the decision to build the system. However, in Chuquiago community members unanimously reported participating. This difference is significant, given that both communities were served by the same project with standard procedures requiring a community request for services.

Table 6. Average scores for project initiation

	Project initiation	
	Household	***Community***
CFD	3.22	1.75
SIF	5.44	5.18
YRWSS	6.40	5.36
FHIS	5.22	7.92
PROPAR	8.40	8.89
VIP	4.27	5.63
WSSLIC	6.29	6.07
LGRD	5.29	5.00
NRSP	6.39	6.00
RUWASA	3.92	4.06

Box 4: External determination of need

Galiraya, Uganda (RUWASA)

According to the standards of the Rural Water and Sanitation Project, the community of Galiraya did not have a reliable and safe source of water. The community, however, claimed that they were satisfied with boiling their lake water to make it safe for drinking. The community had other equally pressing needs including a road and a school.

Nevertheless, the community accepted the project of the water system since they did not want to lose the opportunity for funds. They perceived the water project as a first step in obtaining government support for a road and school. Community members were reported not to have actively participated in the water project. Sustainability is poor and repairs are rarely done.

Field Results for Informed Choice

The second set of indicators used to measure the demand-responsiveness is informed choice. Scores measure the degree to which community members felt that they participated in design decisions about the water system, including the level of service, and location of facilities. It also includes the amount of information people had about their expected contributions and responsibilities for O&M.

Scores for informed choice were calculated based on a survey of households and water committee members. See tables 7 and 8. A score of ten indicates that people felt they had made choices about design questions, knew what their responsibilities would be, and that their choices had been honored. A score of zero indicates that the community was not involved in decision-making, and was not informed about its responsibility for payment or O&M until after construction had begun.

An analysis of the average scores for informed choice reveals several trends. First, in nine projects, the average score is higher at the water committee level than at the household level. In most cases this difference is substantial, indicating that projects are involving water committees to a much greater extent than household members. As a result, water committees are better informed about the consequences of their decisions. In addition, projects tend to rely too heavily on community representatives to represent demand. See box 7.

The average scores for both water committees and households are fairly low, with the exception of Yacupaj. This indicates that most projects do not offer communities a substantial role in decision-making processes, or provide communities with sufficient information about their expected responsibilities. Overall, only 30 percent of households claimed that they were offered different levels of service, and only 42 percent reported that someone from the community made the final decision about what type of system to build.

Although all of the projects selected were chosen in part for their demand-responsive design, the scores indicate that many of the projects continue to operate in a supply-driven fashion. Most projects do not consult adequately with community members about their preferences. Although several allow for community participation, they must also adhere to national design standards, thus, allowing for little real flexibility to meet community demands.

Table 7. Average scores for informed choice		
	Informed choice	
	Household	***Community***
CFD	2.31	5.35
SIF	4.85	5.61
YRWSS	7.03	8.14
FHIS	1.58	3.92
PROPAR	3.27	5.56
VIP	3.33	5.67
WSSLIC	3.64	6.50
LGRD	4.13	2.60
NRSP	5.66	6.63
RUWASA	4.02	4.41

Table 8. Overall results for informed choice Percent of respondents who perceived a choice				
	Water source	***Technology***	***Level of service***	***Location of facilities***
Households	33	25	43	55
Community	59	45	37	75

Box 7: Example of community leaders misrepresenting demand

Village of Baran, Pakistan (LGRDD)

In the community meeting, people very vehemently demanded house connections. However, at the behest of community leaders, they accepted public standposts instead of house connections because they did not want to lose the opportunity for funds. People complained that during the final selection of the location of public standposts, the poorest people were discriminated against. The standposts are located near the friends and relatives of the water committee chairman and other notables who were influential in decision making.

As a result, people seem to be able, but not willing to maintain the system. The general impression is that the government should provide money to cope with the serious problems in the scheme if there are any. There is no tariff structure because they are not maintaining the system properly. There is no sense of ownership about the scheme. Almost all the respondents said that the scheme belongs to World Bank, not to the community.

Multi-sectoral choice is not perceived at household level

Social funds are often described as being demand-responsive since they allow eligible communities to choose between subproject options. However, the results of this study suggest that most communities and households are not aware of the multi-sectoral options. See table 8.

There are to two main explanations for this lack of awareness. In some cases the municipal or district government decides which subproject type the community will receive. In other cases, the NGOs or the private sector are responsible for promoting and designing subprojects with a view towards a contract for their future implementation. In the absence of an adequate flow of information, community choice is often intercepted and distorted by these actors. If the municipal government is making decisions on behalf of the community, this could have important implications for sustainability, especially since in all projects the community members are responsible for the long-term maintenance of their water system.

In only two projects did a large part of both households and committee members feel that they were offered choices between subproject options (VIP and YRWSS). In the Latin American social funds, only 12 percent and 6 percent of household respondents claim they were offered a choice between different subproject types. SIF and NRSP, however, do a better job at letting authorities know of the multi-sectoral options, since about 50 percent of the leaders were aware of options. However, this information did not flow down to community members. On the other hand, although YRWSS is a stand alone project, it spends a significant amount of time with communities to identify development priorities. As a result, 43 percent of households believed they were offered choice of different subproject types and chose water.

Table 8. Perceptions of multi-sectoral choice

	Multi-sectoral project	***Percent who perceived they were offered a multi-sectoral choice of subprojects***	
		Households	Water committees
CFD	No	21	0
SIF	Yes	12	53
YRWSS	No	44	92
FHIS	Yes	5	0
PROPAR	No	3	0
VIP	Yes	60	100
WSSLIC	No	4	7
LGRD	No	5	13
NRSP	Yes	38	40
RUWASA	No	5	0

Field Results for Demand-responsiveness

The scores for overall demand-responsiveness were calculated by taking a weighted average of the project initiative and the informed choice results. Predicted scores for demand-responsiveness were based on an analysis of project rules.

The average demand-responsiveness scores for each project are presented in table 9. The results show a connection between the degree of demand-responsiveness of project rules and the demand-responsiveness perceived in the field by community leaders and households. See box 9.

The three projects that were the least demand-responsive by design—RUWASA, FHIS and CFD-also had the lowest average scores in the field. Three of the four projects that had scores of about 6.0 for its rules (SIF, VIP and LGRD) performed slightly worse than expected in the field. PROPAR showed the closest connection between expected scores and outcome, with an average field score of 6.07 and a rules score of 6.0.

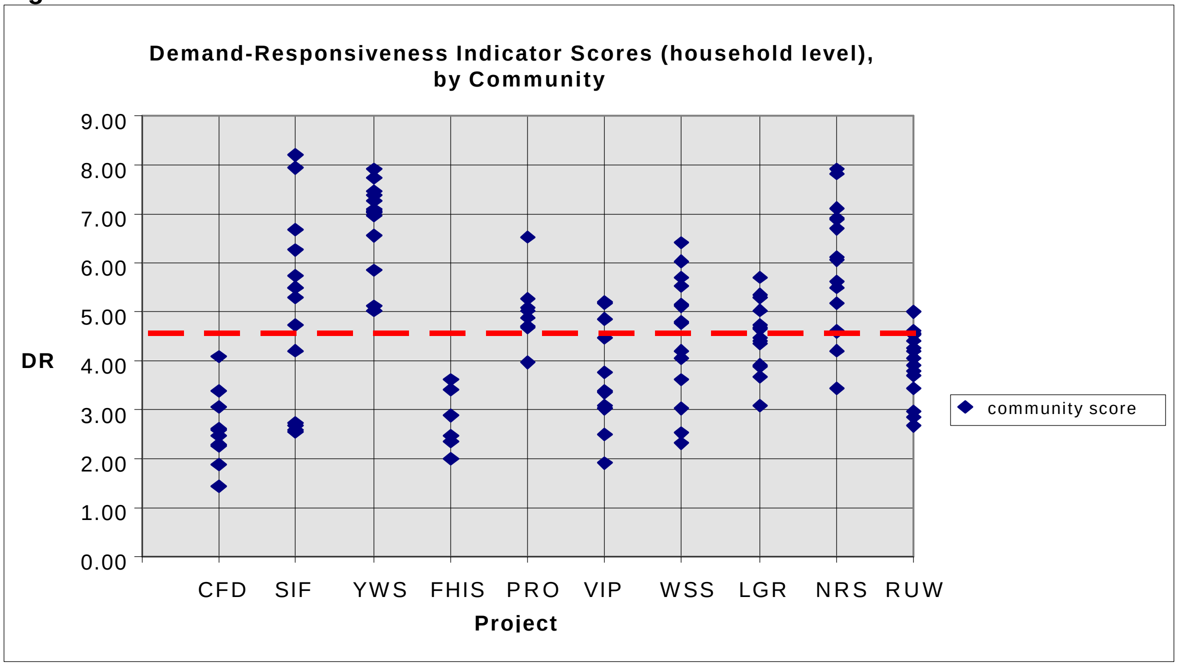
The three projects that had the highest score based on rules (NRSP, YRWSS and WSSLIC) performed as expected. Their field results showed the highest degree of demand-responsiveness relative to the other projects. However, these three projects also show the greatest numeric deviation between field results and expected results.

Table 9. Total demand-responsiveness			
	Field results		***Project Rules***
	Household	***Community***	***Expected results***
CFD	2.61	4.15	3.30
SIF	5.05	5.55	6.70
YRWSS	6.82	6.17	9.30
FHIS	2.79	7.06	4.70
PROPAR	4.98	7.15	6.00
VIP	3.65	5.08	6.00
WSSLIC	4.52	6.67	9.30
LGRD	4.52	4.81	6.00
NRSP	5.90	5.32	8.70
RUWASA	3.98	4.05	3.30

Figure 2 presents a distribution of community scores for demand-responsiveness at the household level. As in the project initiative and informed choice diagrams, the data reveal an inconsistency in the overall level of demand-responsiveness of each project. If the projects were to apply their rules consistently, scores would cluster around the same value. However, the degree of scatter across communities shows that this is not the case in any project. The two more supply-driven projects, RUWASA and FHIS, provide the only exceptions. Indeed, field results show several projects to operate in a demand-responsive fashion in some of the communities that they serve, and a supply driven fashion in others.

Similar scatter was found in the scores for demand responsiveness measured at the water committee level. These results indicate that even when a project is demand-responsive on paper, the quality of intermediation between the project and community members is crucial to ensuring consistency in rule application. In general, projects that invest in upfront activities to help communities and individual households decide whether and how to participate in the project tend to have more positive results in terms of demand-responsiveness. However, these results vary dramatically from one community to the next, and may depend largely on the quality and training of the staff working in communities.

Figure 2



Box 9: Example of demand responsiveness

Ghulam Rasool Jamali, Pakistan (NRSP)

Members of the community had a strong desire for improved water supply and contacted NRSP to improve their system. NRSP provided training to community activists to give them the skills to maintain the scheme on their own.

The people were offered different levels of service and technological options. People preferred handpumps close to their houses rather than a single shared source. NRSP offered a single shared connection in the middle of the village by installing an electric pump on the well. But the community declined the offer keeping given the higher cost and extensive O&M problems associated with it. They chose the handpumps because they were simpler and the community was aware of their O&M responsibilities.

The people themselves monitored the implementation process. They labored at the scheme as well as made cash contributions. The community formally took responsibility for O&M.

Community contributions

The factor that best differentiates a demand-responsive project from a project in which people simply participate is the requirement of a community contribution. Community contribution is the amount people give in cash, in kind, and labor in exchange for services, and should, in a demand-responsive project be linked to the relative costs of providing different levels of service. Although a complete analysis of the relationship between contributions and sustainability was beyond the scope of this study, the study found that project rules for cost sharing arrangements are poorly defined in most of the projects.

In a demand-responsive approach, contributions should serve as mechanisms for signaling demand. The level of contribution should reflect both initial investment costs and recurrent costs, so that a community's contribution provides a strong indication that it is willing and able to bear the expected costs of the system. Although all projects included in the study had a financial policy in place, none had a clear rationale for the contribution level. In addition, many projects do not consistently enforce their own rules, especially when expected contributions are relatively small or in-kind.

The study also found that information about cost and contributions was difficult to obtain and unreliable. In four projects data about total costs for individual systems was unavailable. Few projects keep any data about the indirect costs of building systems such as staff time, training, and overhead. Only two projects kept official records on how much money people contributed in each community.

The field survey did not fully clarify how much people generally contribute towards their water systems. In all communities people reported making some kind of contribution toward the system, either in cash or kind. However, households often disagreed with each other and with the water committee about how much they had contributed. Less than a third of the households knew the total value of their cash and in kind contributions. In several communities, households reported paying as much as three times the per capita costs of the system. In others, people even reported paying significant amounts of cash for projects that do not require a contribution. Table 10 shows a summary of community contributions.

Some of the most interesting information about contributions came from qualitative assessments and focus group interviews. See box 10. In Indonesia, for example, some people were forced to pay for services whether or not they wanted them by powerful community groups. People perceived the contribution as a tax, not as an expression of demand for a water system. The VIP project does not require a contribution, but rather pays people for work they perform in constructing the system. Even so, many villagers still viewed their labor as a contribution, since they worked longer hours and at a lower wage than they typically earn. In the LGRD project in Pakistan, the contribution is often through the construction of a water tank.

These examples illustrate that although the projects require people contribute to the construction costs, they often fail to make clear linkages between what people pay and what they receive. Contributions are often ad hoc and informal. In these circumstances, contributions may be seen as cost-sharing mechanisms, but not as an expression of demand for a service.

A few projects, however, did succeed in making these linkages. See box 6. In PROPAR, NRSP, and YRWSS, communities were aware of the service for which they were paying. These were the three projects that required the highest amount of financial contribution. The contributions were significant, ranging from 20-55 percent of construction costs. All three projects required contributions as a prerequisite to participation. In YRWSS and NRSP, communities had the option of paying higher costs for higher levels of service. These projects also had much lower system costs than similar projects implemented in the same country.

Table 10. Summary of reported contributions by household and water committee										
	CFD	***SIF***	***Yacupaj***	***FHIS***	***PROPAR***	***VIP***	***WSSLIC***	***LGRD***	***NRSP***	***RUWASA***
Project Rules: Expected beneficiary contribution to capital costs	6%	10-20% in-kind	30-50%	10% in-kind	25-30% cash and in-kind	labor paid at 2/3 min. wage	4% cash, 16% in-kind	not specified	30-40%	no fixed %
Average reported cash contribution (H)	4%	21%	30%	3%	36%	7%	6%	0%	14%	24%
Average reported cash contribution (WC)	4%	17%	32%	0	33%	3%	4%	0%	17%	23%
Average reported days of labor (H)	8	8	20	15	12	6	10	8	8	8
Average reported days of labor (WC)	10	0	31	13	9	8	13	16	11	10

Box 10: Effective financial management (FHIS)

El Sauce, Honduras

The town of El Sauce is located in the municipality of San Buenaventura at the base of the Cerro de Hule. The 840 residents enjoy paved roads--a rarity in rural Honduras. The town chose to improve its water services through the FHIS project.

The town's treasurer managed the finances for the water system effectively. The system accumulated over US$400 in savings despite that less than 50 of the residents were fully up to date with their monthly payments. The savings will be used to cover the major repairs. The town implemented a flexible tariff structure and adjusted it on several occasions to cover costs.

Training

The study found that projects differ substantially in the amount of training they provide to water committees and households. There is also a difference in the amount of training provided by stand-alone and multi-sectoral projects. Regardless of the implementing agency, stand-alone projects provide substantially more training than the multi-sectoral projects. See figure 6 and 7.

Water Committees.

In three projects (CFD, WSSLIC and RUWASA), 100 percent of the water committees surveyed reported receiving training in O&M and other topics to manage the system. In two other projects (YRWSS and PROPAR) more than half of the committee members reported that they had participated in the training provided. In these projects, it was reported that while the current water committee had not been trained, previous committee members had. This raises the issue of how to ensure that the knowledge is transferred when individuals or roles change. The four multi-sectoral projects, generally provided little, if any, training to water committee members. See table 11.

Household Training.

The difference in training between projects is even more pronounced at the household level. Few projects have trained a large percentage of community members (only RUWASA and YRWSS surpass 40 percent of those surveyed). The stand-alone projects again perform much better than the multi-sectoral projects. The most common topics remembered by the participants include O&M and hygiene education. See table 12.

Table 11

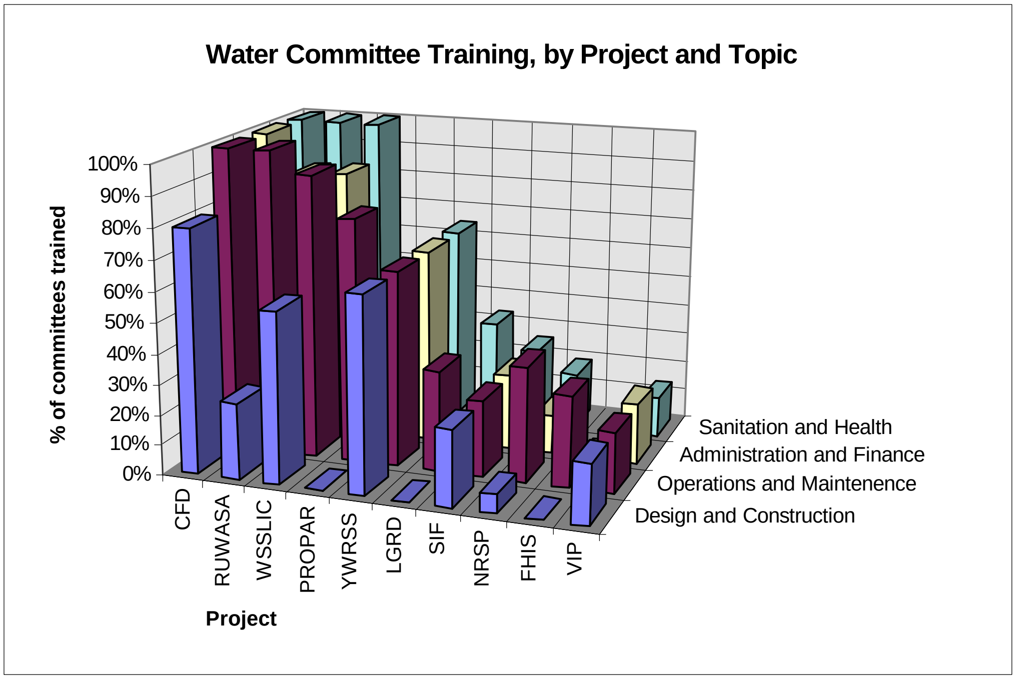
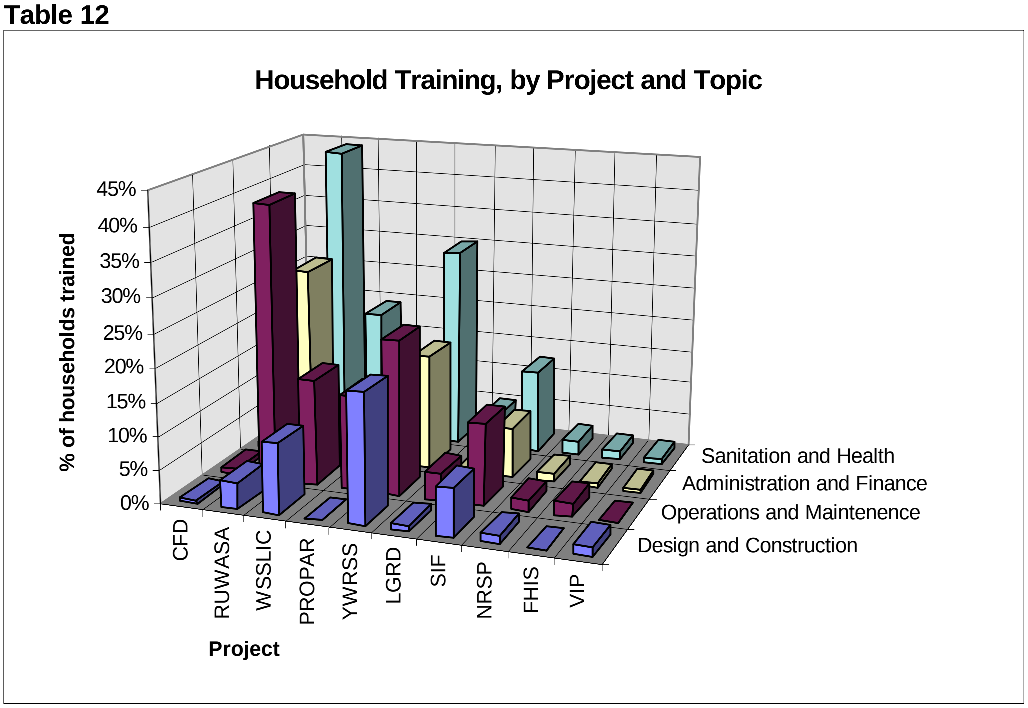


Table 12



IV. Findings: Sustainability

The first half of this chapter presents a discussion of how sustainability was defined and measured for the study. This discussion is followed by a presentation of the five sub-indicators of sustainability included in the analysis.

Defining sustainability

The term sustainability is one that is used loosely to cover a whole range of topics. The term is frequently used to refer to project sustainability—the capacity of a project to continue to deliver its intended benefits over the long term (Bamberger and Cheema, 1990). This study, however, focuses not on projects, but on water-systems. Therefore, sustainability has been defined as:

> *The maintenance of an acceptable level of services throughout the design life of the water supply system.*

A number of studies have identified various determinants of water system sustainability, including technical, institutional, and social aspects. These determinants are described below.

Technical aspects

Technical issues relating to the design and construction of a rural water system are the most obvious determinants of water system sustainability. Poor construction quality or the use of low-grade materials may lead to the failure of the water system before the end of its design life. Similarly, design flaws—including shallow wells or boreholes, and overestimates of the water sources—may cause a system to fail from the outset. Most of these factors may be identified through examinations of the system and interviews with system operators.

Institutional aspects

Experience has shown that even a well-constructed water system needs proper institutional arrangements to keep it functioning over time. Most systems require some sort of preventive maintenance. Hand-pumps may require grease for moving parts. Gravity systems may require sediment be removed from storage tanks or repairs for leaky taps and cracked pipes. In addition, work is required to keep the water source free from contamination. Because most rural water systems are shared by a number of families, providing these inputs requires some sort of community management structure, such as a water committee, to oversee O&M and collect money to cover the costs of these services.

Social aspects

The sustainability of a rural water system depends on the willingness of users to provide the necessary time, money and labor to keep the system functioning. This willingness may be affected by socio-economic factors such as income level, ethnic homogeneity, or the willingness of villagers to work together. More commonly, however, the willingness will depend on consumer satisfaction with the service, usually compared to the previous water source in a community. When communities perceive a significant improvement in water services, they are usually more willing to pay for O&M.

Willingness-to-pay is also affected by community perceptions of ownership or sense of entitlement to free services from the government.

Measuring sustainability

Because water system sustainability depends on a number of factors which vary between communities and change over time, measuring sustainability is a difficult task. This study bases its analysis on indicators that measure the key technical, institutional and social *determinants* of sustainability at the community level. The study employed different survey instruments to measure each of these factors. It collected information on the technical factors from technical assessments of the water systems, institutional factors from the technical assessment and interviews with the water committee or system operator, and social aspects from households. See box 11 and Annex E.

These categories were divided into five sub-indicators of sustainability: physical condition, O&M, consumer satisfaction, financial management and willingness-to-sustain the system. They are presented in table 13. Sub-indicators were scored on a ten-point scale for each community. Overall sustainability was calculated by taking a weighted average of the different sub-indicator scores and converting it to a ten-point scale.

Table 13. Sub-indicators of sustainability

Aspect	***Sub-indicator***	***Source of Data***
Technical	Physical condition	technical assessment
Institutional	O&M	water committee interview
	Financial management	technical assessment/water committee interview
Social	Consumer satisfaction	household survey
	Willingness-to-sustain	household survey

A potential weakness of this approach, mentioned earlier, is that information was collected only at single point in time (usually 3-5 years after system construction) for systems with a design life of ten years or more. The indicators must, therefore, be taken at face value as indicators, or predictions of sustainability, not as observable measures of long-term sustainability. The indicators are, however, composed of a broad range of factors and collected from various sources of data, and thus highly robust to changes over time in individual factors. A one-point improvement in a single factor will affect the overall sustainability score by less than 2 percent. A total of 59 factors contribute to the overall score for sustainability.

A low sustainability score indicates that the system is performing poorly in most of the social, institutional and technical aspects that are considered crucial to system sustainability. A high score indicates that the system is performing well in most aspects, and is likely to be sustained even if performance in a few key areas worsens.

Box 11. Sample survey questions

For a complete list of the survey questions refer to the analytical framework in Annex E.

Physical condition

1. Is most of the water system working?
2. Are most of the handpumps working?
3. If the system is not working, is it being repaired?
4. Are there serious defects in the construction of the water catchment or wells?
5. Have you noticed any exposed pipe leakages?

Operations and maintenance

1. Are there people appointed to manage the water system?
2. Is there a water system operator?
3. Are these employees paid?
4. Do you think that the operators are sufficiently trained to perform their job?
5. How many times has the system failed in the last year?
6. When the system breaks down, how many days does it take on average to repair?

Consumer satisfaction

1. Are you satisfied with the job performed by the organization in charge of providing water?
2. Now that you have the water project, do you use more or less water in your house?
3. How many other sources of water do you continue to use for domestic use?
4. Are you satisfied with your water pressure?
5. How do you rate the flavor and taste of the water?
6. Do you feel confident to drink the water without boiling it or using chlorine?
7. In general, how do you rate the service provided by your water system?

Willingness-to-sustain the system

1. To whom does the system belong? (i.e. community, local government, government, etc.)
2. Do you think that the community will have the financial capacity to keep the system working over the next 10 years?
3. Are you willing to pay more than what you pay now for improved service?
4. Do you know what the tariff is used to pay for?
5. Have you had difficulty meeting your monthly payments?

Financial management

1. What percentage of the water system users are current with their tariff payment?
2. Is the service cut off for non-payment?
3. If there were a major breakdown of the system, would you be able to finance all repairs with funds available within the community?
4. What costs are covered by the tariff?
5. Is the tariff adjusted to meet costs?
6. Is there a connection fee charged?

Sub-Indicators of Sustainability

Physical condition

Physical condition scores are based on a series of 14 questions from the technical questionnaire. The study involved 12 questions regarding piped water systems and 11 questions regarding hand pumps, wells, rain water catchments. The scores measure the existing condition of the system and reflect the quality of the water system design, construction, and O&M.

The physical condition indicator measures the overall functionality of the water system and construction quality. A perfect physical condition score indicates that a water system is free of contamination and has high quality construction without visible defects in the wells, catchment or masonry. For piped systems, it must have sufficient pressure in all points of the system and no leaks in exposed pipes, standpipes or house connections. Handpumps or wells should provide an abundant flow water at the first pump.

Table 14 presents the average physical condition scores for each project. Average scores were highest in the RUWASA project in Uganda and in both projects in Bolivia. They were lowest in PROPAR, Indonesia and Pakistan.

Table 14: Average scores for physical condition

Project	*CFD*	*SIF*	*YRWSS*	*FHIS*	*PROPAR*	*LGRD*	*NRSP*	*VIP*	*WSSLIC*	*RUWASA*	*Ave.*
Average Score	6.30	7.05	7.01	5.62	4.83	5.00	5.30	5.05	5.13	7.06	5.84

Construction quality. Overall construction quality was evaluated by a survey team engineer following a full inspection of the water system. Table 15 shows that construction quality was reported to be good in just under half of the water systems. Quality was poor in only 10 percent. In addition, the results also show the physical condition of systems in each project widely varied. While the condition of some systems was excellent, it was poor or non-functional in others.

Table 15. Construction quality

Rating	*Number of systems*	*Percent of systems*
good	60	48
fair	53	42
poor	13	10
Total	126	100

Piped water systems. Piped systems—gravity-based or pumped—have the potential to offer higher levels of service than point sources because they have extensive distribution networks. In addition, since the entire community shares the same infrastructure, piped systems lend themselves to community management solutions.

Piped systems were the most common system type in all projects except for those in Africa, comprising 70 percent of the systems. The most common problem with piped systems was leakage from exposed pipes, affecting 34 percent of the systems (24 percent of all sub-projects). Twenty-nine (29) percent of systems were reported to have leaking standpipes or house connections and lacked sufficient water pressure in the critical parts of the system. See table 16.

Table 16: Performance of piped water systems in percent			
	Exposed pipe leakages	***Leaking standpipes or house connections***	***Enough water in critical points of the systems***
Yes	34	25	71
No	66	75	29
Total	100	100	100

Point sources. Hand-pumps, dug wells, and storage tanks are considered point-source systems because they are not connected to any distribution network. Point sources may be managed communally, by individuals, or by groups of households. They are used in RUWASA, CFD, Yacupaj, WSSLIC and VIP. The most common problem among handpumps and wells was a lack of abundant water flow, affecting 23 percent of water systems. See table 17.

Table 17. Performance of point sources in percent		
	Water flows at first pump	***Abundant flow of water***
Yes	62.5	58
Yes for majority of water points	28.1	23
No	9.34	19

Operations and maintenance

Data for this sub-indicator is based on 15 questions from the technical assessment and interviews with the water committee. The O&M score measures how well a community is performing on the institutional and organizational aspects of system maintenance. A perfect score indicates the community has a trained system operator, who was hired based on ability and knows how to perform basic maintenance procedures. The operator must have access to tools, spare parts, manuals, and blueprints for the system, and know where to get help for major repairs. Finally, a perfect-scoring community will not have experienced a decrease in water flow since the construction of the system, and must have sufficient water flow to meet community needs.

The results indicate that there is significantly less scatter in O&M scores than in physical condition scores. In addition, the data show that many communities were not well organized to operate and maintain their water system. The overall results are as follows:

i) Only 62 percent of communities had a system operator.

ii) 64 percent of the system operators were hired based on ability.

iii) 64 percent received training to operate the system.

Even where communities had system operators, many lacked the necessary tools to operate and maintain their system. Only 50 percent of communities claimed to have access tools or spare parts, and 45 percent claimed to have access to system manuals or blueprints.

Only 30 percent of system operators have ever performed a major repair, raising questions about their ability to maintain the system over the long-term. However, 84 percent claimed to know where to get help if necessary. As shown in table 18, O&M scores averaged between 4.3 and 6.9.

Table 18: Average scores for O&M											
	CFD	***YRWSS***	***SIF***	***FHIS***	***PROPAR***	***LGRD***	***NRSP***	***VIP***	***WSSLIC***	***RUWASA***	***Ave***
Average Score	6.10	6.29	5.95	4.44	5.70	4.27	4.62	4.94	5.71	6.96	5.55

Consumer Satisfaction

Consumer satisfaction data was based on answers to 10 questions from the household surveys. The score for the community represents the average score of each of the 15 households surveyed in each community. This indicator measures people's perceptions of how well their system works. For a community to receive a score of 10, all members of the community would have to rate their service as good. They would be satisfied with their water pressure, the number of hours water is available, and the quantity, color and taste of the water. They would no longer use other sources of water, and would report increased water consumption and use of water for new purposes. Table 19 shows the average scores for consumer satisfaction.

Table 19: Average scores for consumer satisfaction											
	CFD	*SIF*	*YRWSS*	*FHIS*	*PROPAR*	*VIP*	*WSSLIC*	*LGRD*	*NRSP*	*RUWASA*	*Total*
Average score	4.50	5.58	6.49	5.52	6.34	5.95	5.91	7.12	5.99	7.32	6.18

The average consumer satisfaction scores were slightly higher than the other sub-indicators of sustainability. Scores ranged from 0.0 to 9.55. The low score was for two communities in Benin where the system was not functioning, and the high score for a gravity system in Indonesia. Consumers expressed most satisfaction in RUWASA and LGRD and least in CFD and the Latin American Social Funds.

The study found a relative degree of consistency among communities within the same project. It is important to consider that these scores are measures of perceptions. Thus, people at times reported being very satisfied with a poorly functioning system, because they considered it to be better than what they had before. In addition, these scores may reflect a cultural bias and a community's willingness to be openly critical.

Table 20 shows people's overall satisfaction with their water system. More than 60 percent report that their system is good, while only 5 percent rate their service as poor. This indicates that a majority of people are happy with their current water system, or consider it to be an improvement over previous sources. The overall results are as follows:

i) Fifty-four (54) percent of respondents reported that they continue to use alternative sources of water either regularly or seasonally. Of these, 33 percent cited system unreliability as the primary reason.

ii) Only 72 percent of respondents have water every day of the week.

While only 56 percent of respondents claim to have water available more than 12 hours/day, 72 percent claimed to be satisfied with the number of hours per day that water was available. These figures suggest that official measures of functionality based on technical standards do not always match perceptions.

The analysis also found consumer satisfaction to be linked positively with labor contribution. That is, people who contributed labor towards their system tend to be happier with the results than those who did not.

Table 20. Consumer satisfaction	
Overall satisfaction	***Percent of communities***
Good	60
Fair	23
Poor	5
N/A	12
Continued use of alternative sources	***Percent of communities***
Yes, regularly	25
Yes, seasonally	29
No	34

Financial Management

Data on financial management is based on 12 questions from the technical assessment. Surveyors obtained this information from a review of each community's financial records and interviews with the water committee and treasurer. A community scoring a perfect ten would have a designated treasurer or accountant and employ a tariff structure that covers O&M and generates savings for future repairs and system replacement. In addition, these communities would charge people for connecting to the system, sanction people for non-payment, and would have tariff collection rates over 90 percent.

Table 21: Average scores for financial management										
	CFD	*SIF*	*YRWSS*	*FHIS*	*PROPAR*	*VIP*	*WSSLIC*	*LGRD*	*NRSP*	*RUWASA*
Average score	4.62	4.91	4.17	5.35	4.86	0.09	1.28	0.28	2.18	4.53

The study found basic financial management of water systems including tariff collection and savings to be generally low. See table 21. In Pakistan and Indonesia, basic financial management is often not practiced at all. According to the survey:

i) Only 47 percent of communities have a treasurer or designated individual in charge of managing funds for the water system.

ii) 42 percent of communities either collect no tariff or collect a tariff that too low to cover the basic cost of operating the system.

iii) Only 18 percent of communities generate savings to cover future repairs.

iv) Where tariffs do exist, collection rates are often low.

A closer examination of financial management practices in the field revealed that these indicator scores only tell part of the story. Qualitative data collected in focus group discussions revealed that communities often employ alternative methods for financing their water system. In communities where no tariff exists, it is not unusual for residents to contribute when there is a system failure. Table 22 shows what items the tariff covers assuming 100 percent collection.

Table 22. Items and activities covered by the tariff	
	Percent of communities
O&M, repair and savings	6
O&M, repair	12
O&M, no savings	29
operations only	10
does not cover operations	3
no tariff	39

The study has some shortcomings in how it measures financial management. The sub-indicator scores are heavily biased toward traditional, western styles of management. While a high score provides evidence of strong financial management, a low score does not clearly indicate poor performance. As a result, the financial management indicator was given less weight than the other sub-indicators in the overall sustainability score. The financial management score is equal to one-half that of each of the other four sub-indicators.

Willingness-to-sustain the system

This indicator gauges popular support for sustaining the water system. Scores are based on nine questions from the household questionnaire. Community scores represent the average score for the 15 households in that community.

The indicator measures the degree to which community members feel responsible for maintaining their water system. A perfect score in this category would mean all members of the community believe that the water system belongs to them. Community members would express satisfaction with the management of the system and willingness-to-pay monthly fees for service. In addition, people would expect the community to finance future maintenance, repair, and system replacement. They would express a willingness-to-pay for improvements, and report health improvements since the system's construction. See table 23.

Table 23: Average scores for willingness-to-sustain											
	CFD	***SIF***	***YRWSS***	***FHIS***	***PROPAR***	***VIP***	***WSSLIC***	***LGRD***	***NRSP***	***RUWASA***	***Total***
Average Score	5.15	6.37	6.82	7.02	8.61	5.42	6.34	5.00	5.89	6.47	6.21

Perception of ownership. A community's perception of who owns the system is essential to ensuring that the community will maintain the water system. A total of 60 percent of respondents believed that the system belonged to the community, while 22 percent claimed that they did not know to whom the system belonged.

Perception on where to obtain funds for repairs. All of the projects included in the study expect communities to be completely responsible for operating and maintaining their systems. Overall, 63 percent of communities stated that if the system were to break down, they would provide the money for repairs themselves, either through a monthly tariff or from household contributions. The remaining 37 percent, however, stated that they did not know where they would find such resources or expected that it would be provided to them from outside sources.

It is interesting to note that while 28 percent of respondents believed that the monthly tariff would cover a major breakdown, the tariff structure designed to cover more than basic O&M in only 18 percent of communities. This means that more than half of the individuals who believe their tariff will cover the cost of repair are misinformed, and may not be prepared to cover the cost of a system failure.

Willingness to pay for desired improvements. Respondents were asked if they would like to see improvements in their water system. The 74 percent who answered positively were then asked if they would be willing to pay more for these improvements. Overall, 69 percent answered yes, 14 percent no, and 18 percent were unsure. This figure indicates that even very poor rural communities express a continued demand for improved services and a willingness to contribute towards the costs of that service. Table 24 shows where the community would get money for repairs if there were a serious problem with the water system.

Table 24. Where communities get revenue for repairs

Sources of revenue	***Percent of communities***
From the monthly tariff	28
An additional household contribution	35
A contribution from the local government	7
Donations from outside the community	4
Others	7
Do not know	19

Sustainability

The overall score for sustainability in each community is an average of the five sub-indicators. It is adjusted to a ten-point scale, with financial management comprising 11 percent of the overall sustainability score, and each of the other four indicators comprising 22 percent. See table 25.

The average sustainability score across projects is 5.71. This score indicates that the projects are performing well on only 57 percent of the technical, institutional and social aspects. At the same time, however, only 5 percent of the water systems included in the sample were not functioning at the time of the survey.

Table 25: Composition of the sustainability indicator

	Percent
Physical condition	22
Consumer satisfaction	22
O&M	22
Willingness-to-sustain the system	22
Financial management	12

Distribution of sustainability scores

Sustainability scores vary widely within the sample. Figure 3 is a histogram presenting the frequency distribution of sustainability scores in the sample. While scores range from a high of 8.7 to a low of 0.6, the majority are clustered in a nearly normal distribution around 6.5. This distribution reveals that some systems are sustainable, some clearly are not. Communities scoring lower than 5.0 would be considered unsustainable, based on conditions at the time of the survey. Systems scoring between 5.0 and 6.67 are considered "potentially sustainable," and systems scoring above 6.67 sustainable.

Figure 4 below presents the distribution of sustainability scores of communities in each project. Each point on the chart represents the sustainability score given to the water system in a particular community. The chart reveals a high degree of scatter in most projects, with no clear patterns emerging between communities of different projects.

Figure 3

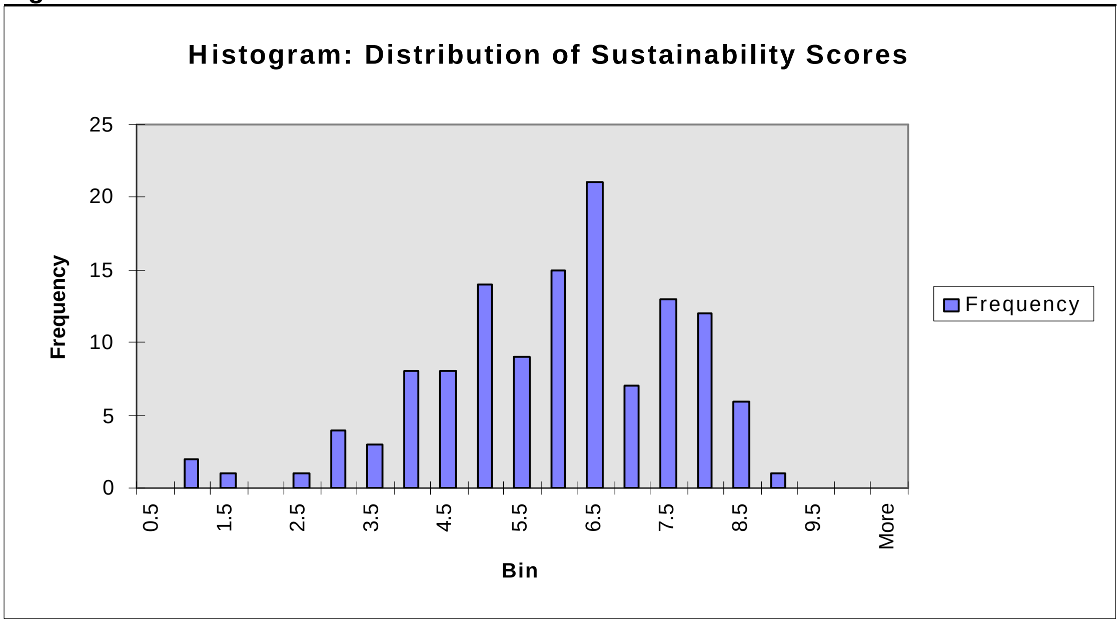
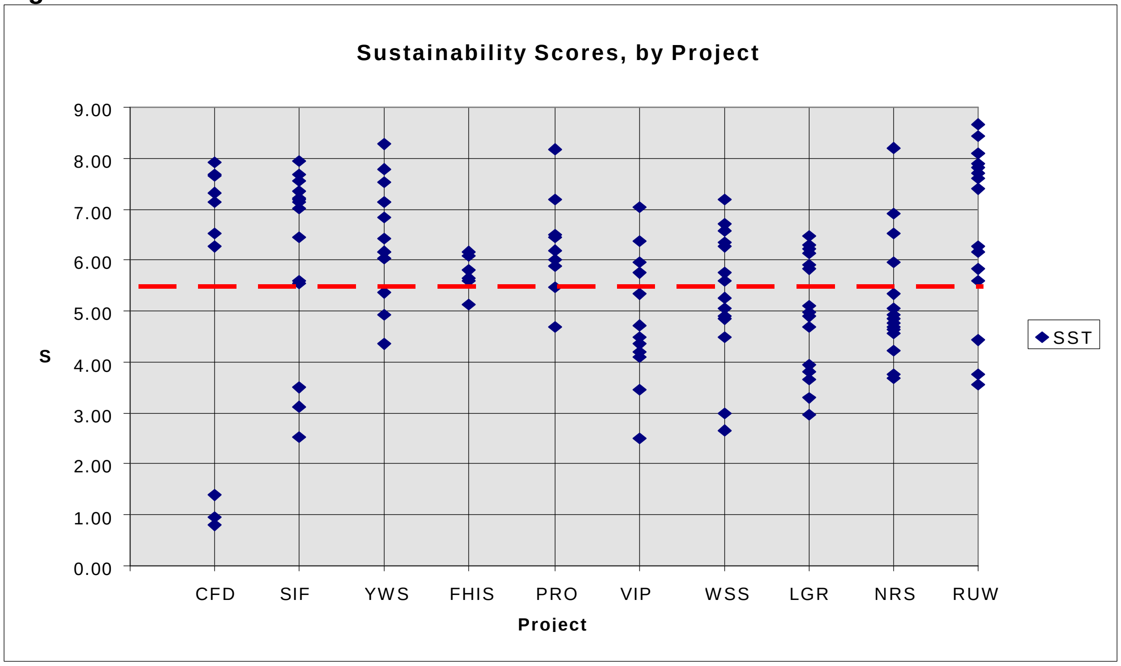


Figure 14



Overall sustainability scores

Table 26 presents an overview of the scores for each sub-indicator of sustainability and the score for overall sustainability. The sub-indicator scores are fairly consistent within projects. In other words, a project with high scores in overall sustainability usually has high scores in most of the sub-indicator categories as well. Those projects that score poorly on overall sustainability tend to score below average in all categories.

Table 26. Scores for each sub-indicator of sustainability

Project	*Financial management*	*O&M*	*Consumer satisfaction*	*Physical condition*	*Willingness to pay*	*Sustainability*
CFD	4.62	6.10	4.50	6.30	5.15	5.37
SIF	4.91	5.95	5.58	7.05	6.37	6.14
Yacupaj	4.17	6.29	6.49	7.01	6.82	6.44
FHIS	5.35	4.44	5.52	5.62	7.02	5.74
PROPAR	4.86	5.70	6.34	4.83	8.61	6.29
VIP	0.09	4.94	5.95	5.05	5.42	4.86
WSSLIC	1.28	5.71	5.91	5.15	6.34	5.33
LGRD	0.28	4.27	7.12	5.00	5.00	4.95
NRSP	2.18	4.62	5.99	5.30	5.89	5.21
RUWASA	4.44	6.96	7.32	7.06	6.47	6.71
Average	3.02	5.55	6.18	5.90	6.21	5.71

V. Analysis: The Link Between Demand Responsiveness and Sustainability

The following section presents statistical evidence of a link between demand-responsiveness and sustainability, as measured by the study indicators. A demand-responsive approach at the household level significantly improves the chance that a water system will be sustainable.

The link between demand-responsiveness and sustainability proves to be highly robust, with a significance level of more that 99 percent. This result holds even after controlling for external variables such as poverty, distance from a major city, and project-specific variables such as technology type, total cost, per-capita, and training. The section also presents evidence linking household training, the existence of a water committee, and construction quality to sustainability.

Analytical Methods

This study uses econometric tests to evaluate the link between demand-responsiveness and sustainability. The relationship between these two variables is not immediately apparent. A simple project-by-project comparison reveals few clear patterns or indications that the project approach affects its outcome. However, by applying bivariate and multivariate regression techniques, the study tests the hypothesis that greater demand-responsiveness at the community level will lead to increased water system sustainability. The test controls for other important factors. The analysis is supported by Chow tests, which rank communities by their sustainability score and compare the top and bottom 20 percent of communities.

Test 1: A significant relationship exists between demand-responsiveness and sustainability.

The first test was to run a bivariate linear regression (ordinary least squares) to test for a singular relationship between demand-responsiveness and sustainability. The test found a highly significant relationship between the two variables.

Table 27 presents the partial correlation coefficient of overall demand-responsiveness on sustainability. A correlation coefficient of 0.41 signifies that for each one point increase in the demand-responsiveness rating of a community, sustainability is expected to increase by 0.41. For each 2.5 point increase in demand-responsiveness, overall sustainability is expected to increase by one point. The *t statistic* tests the validity of the null hypothesis that the coefficient is zero. A t-value of 4.82 implies that the estimated coefficient is significant at the 99 percent confidence level.

In short, the results imply a significant, positive relationship exists between demand-responsiveness and sustainability at the community level. As demand-responsiveness increases, so too does sustainability. See figure 5.

Figure 5

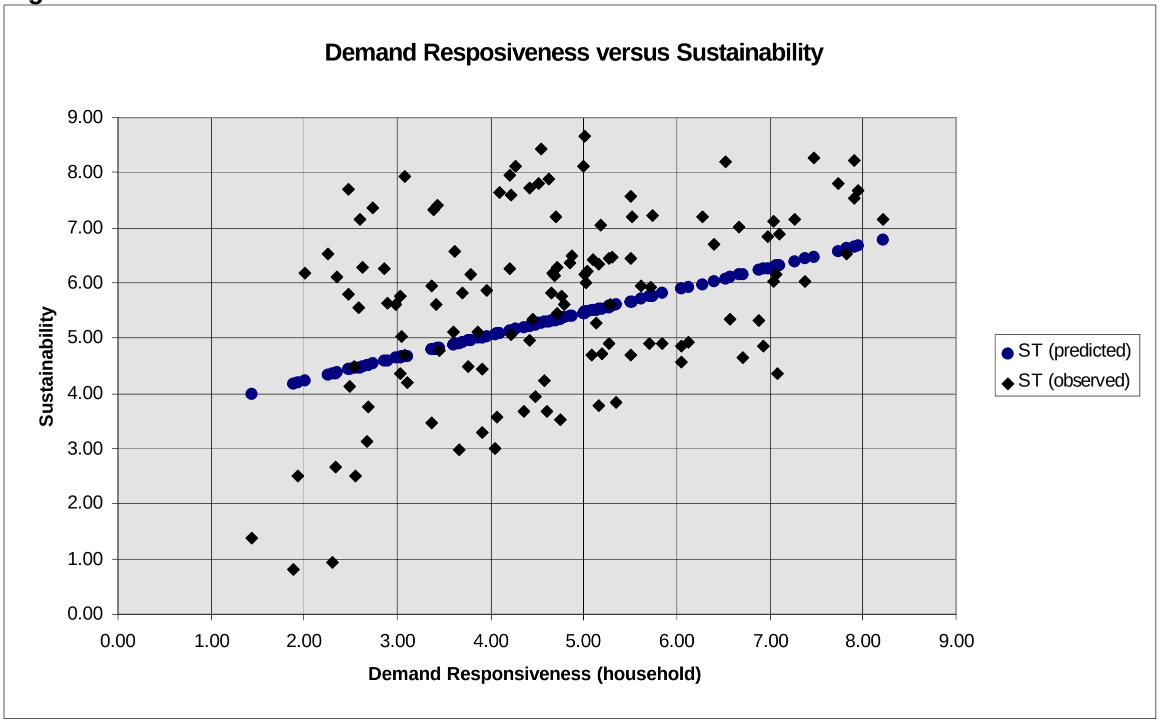


Table 27 Bivariate regression of demand-responsiveness on sustainability	
Demand-responsiveness	***Regression 1***
Parameter est.	0.41
T-value	4.82
N observations	124

Test 2: Demand-responsiveness is a significant determinant of sustainability, controlling for external factors.

While a strong bivariate relationship between variables is a good initial indication of causality, it does not provide proof. Rather, the positive coefficient may indicate an underlying relationship between the two variables and another factor external to the model. For example, it is possible both variables are related to poverty. In higher income communities, people may be better able to participate in project activities and maintain their water system. That is, in higher income communities, people may have more time to participate in project activities, giving them a higher score in demand-responsiveness, and also be better able to maintain their system. This, in turn, could lead to higher sustainability. Hence, the results presented above may indicate a correlation of both of these variables with income level, not with each other.

In order to rule out this possibility, the analysis incorporates factors often considered to have linkages with water system sustainability into a series of multivariate regressions. The second regression controls for the effects of external factors including: poverty level, distance from a major city, community population, population density, age of the system, water source used before, technology type, and average distance of households from the previous source.

Table 28 presents the results of this regression. The results show a highly significant relationship between demand-responsiveness at the household level, and sustainability, when controlling for the effects of these other variables.

The coefficient for demand-responsiveness actually improves slightly from the first regression from 0.41 to 0.46. This indicates that holding these external factors constant, there is a closer link between demand-responsiveness and sustainability. The *t value* of 4.93 indicates that the null hypothesis—that there is no relationship between the two variables—can be rejected using a significance level of 99.9 percent.

Table 28. Multivariate regression of demand-responsiveness on sustainability controlling for external factors	
Demand-responsiveness	***Regression 2***
Parameter est.	0.46
T-value	4.93
N observations	124

Test 3: Demand-responsiveness is a significant determinant of sustainability controlling for external and project-specific factors.

There are a number of project-related factors which also could affect sub-project sustainability other than demand-responsiveness. The third regression tests the hypotheses by including project-related factors as well into the model. These factors include:

i) training of the water committee,

ii) training of households,

iii) technology type,

iv) total cost of the system per capita,

v) existence of an organization to manage the water system,

vi) contribution, and

vii) whether project offers a multi-sectoral choice.

Table 29 presents the results of this regression. It shows demand as a significant determinant of sub-project sustainability, even when controlling for project-related factors. While the coefficient on demand-responsiveness drops to 0.21, the *t value* of 2.64 indicates that this relationship is significant with a significance level of 99 percent.

Table 29. Multivariate regression of demand-responsiveness on sustainability controlling for external factors and project specific factors	
Demand-responsiveness	***Regression 3***
Parameter est.	0.21
T-value	2.64
N observations	124

Demand-responsiveness at the household level

The previous sections show that when projects employ a demand-responsiveness approach at the household level, they increase the likelihood of sub-project sustainability. In other words, the more project staff involve household members in decision-making and inform them about costs and responsibilities, the greater the potential for sustainability. Projects which deliver services in a more top-down fashion, with project staff making most of the decisions about level of service and technical options, decrease the chances of sustainability.

It is important to emphasize that the relationship between the demand-responsiveness and sustainability described here is measured at the household level. As shown earlier, demand-responsiveness at the household level varies dramatically between different communities served by the same project. A similar, but looser relationship exists at the community level. Demand-responsiveness as perceived by households is the most critical factor.

To achieve better results, projects must ensure that project staff or intermediaries apply demand-responsive rules correctly and consistently. A project with demand-responsive rules which are not enforced at the household level is no more likely to be sustained than one without.

Household training, social organization and construction quality

The model reveals that demand-responsiveness is not the only factor which influences the sustainability of rural water systems at the community level. The regression results show that household training, the existence of a water committee, and the quality of construction are all strongly correlated with water system sustainability. These results are shown in table 30.

Table 30. Overall sustainability			
	Parameter estimate (slope coefficient)	***T-value for H_0***	***Significance level in percent***
Demand-responsiveness	0.21	2.64	99.1
Training, Household	0.44	4.32	99.9
Water committee	0.68	2.79	99.4
Construction quality	0.97	5.69	99.9

Summary

Table 31 presents a summary of the correlations of each variable included in the model for the three different regressions. The correlation coefficient indicates what percentage of the movement of the sustainability score can be attributed to changes in the variable in question, when all other variables are held constant. Thus, for demand-responsiveness a one point increase will lead to a 21 percent increase in sustainability score, even after controlling for external and project specific factors.

The results show four major factors affecting the sustainability of water systems at the community level with a significance level of 99.9 percent. They are:

i) demand-responsiveness at the household level

ii) training at the household level

iii) the existence of a water committee (or other organization to manage the water system), and

iv) the quality of construction.

All of these factors are project-related variables, while no external variables are significant at this level. In other words, the study finds that project rules are the single most important factor in determining the success or failure of a water project. This refers to rules as they are implemented and interpreted at the household level. These rules vary significantly within projects.

Table 31. Correlations with sustainability with significance levels			
	Bivariate Relationship	***With controls for External Factors***	***With controls for Project-specific Factors***
Demand-responsiveness	0.41 (99%)	0.46 (99%)	0.21 (99%)
External factors			
distance from previous source		n/s	n/s
population density		0.57 (90%)	n/s
age of system		0.18 (99%)	n/s
population size		n/s	n/s
distance from city		n/s	n/s
Project related factors			
household training			0.46 (99%)
existence of a water committee			0.65 (99%)
construction quality			1.14 (99%)
training, water committee			n/s
total cost, per capita			n/s
multi-sectoral choice			n/s
level of service			n/s
technology			n/s

The Chow Test Analysis

These three regressions, taken together, provide strong statistical evidence of a link between demand-responsiveness, training and sustainability. To test the robustness of these results, communities were ranked based on overall scores of sustainability, and Chow Tests were conducted to compare the average score of the top 20 percent of communities with the average scores of the bottom 20 percent. The Chow Test measures whether there are structural differences in different parts of the sample. The full results of this test are presented in **Annex 1**. The analysis supported the findings of the regression analysis.

Demand-responsiveness at the household level. The Chow test revealed demand-responsiveness to be significantly higher for the 20 percent of communities with the highest sustainability than for those with the lowest. The analysis also shows that those communities with the lowest sustainability also have demand-responsiveness scores below average. The reverse, however, did not prove to be true. That is, the communities with the highest sustainability scores did not have above average demand-responsiveness scores.

Households and water committee training. The results show that household and water committee training is important. Communities in which water committees were trained performed significantly better than the average. Those where committees were not trained performed significantly worse. Household training, while significantly higher for top 20 percent communities than for bottom 20 percent communities, did not show significant variations from the average for the population.

Indicators of sustainability

The results presented above are also the result of significant aggregation. While each of the indicators of sustainability is highly correlated with each of the questions it represents, the sustainability measure may give an incomplete picture of what is actually going on in each community.

Table 32 summarizes the results of the full regression (including project-related and external factors) for each sub-indicator of sustainability, to provide a more complete view of how demand-responsiveness affects each of these measurable outcomes. The table marks where a positive significant relationship exists for each variable using a level of significance of 95 percent.

Table 32. Positive relationships between sub-indicators

Independent variables	***Sub Indicators of Sustainability***					
	Physical condition	***Consumer satisfaction***	***O&M***	***Financial management***	***Willingness to sustain***	***Sustainability***
Demand-responsiveness, household		X			X	X
Training, household	X	X	X	X	X	X
Construction quality	X		X			X
Water committee			X		X	X
Distance from previous source		X				
Age of system				X		
Poverty level				X		
Population density	X					
Level of service					X	

Consumer satisfaction and willingness-to-sustain the system

Demand-responsiveness at the household level is a determinant of overall sustainability primarily due to its role in increasing consumer satisfaction and willingness to sustain the system. This outcome is not surprising. Consumers are more likely to be satisfied with results when they initiate the project, are involved in decision-making, and are informed about their responsibilities in terms of costs and O&M. It is expected that under such circumstances, users express a higher sense of ownership, greater confidence in their ability to maintain the water system, and a better understanding of how the tariff is used and willingness to pay for improvements. Demand-responsiveness, however, does not seem to be a determining factor in the physical condition, O&M, or financial management of the water system.

Importance of household training

The study found that household training plays an important role in the sustainability of water systems. Controlling for all other factors, household training proves a significant determining factor for all five sub-indicator categories. This helps explain the high sustainability scores awarded to communities in the more supply-driven RUWASA project, which spends a great deal of time mobilizing and training the community in O&M and hygiene. Those projects which provided no training tended to have lower sustainability despite good construction.

The two most common training topics—O&M and hygiene education—relate directly to the sustainability of the water system. First, O&M informs people of what expectations they should have for their water system, and how to identify and address minor problems in the system before they become major. It also educates community members that the responsibility for maintaining the system rests with them, not with the project or the government.

Second, hygiene education plays a crucial link in increasing people's willingness to sustain the system. Although waterborne disease is common in many rural areas, people often do not make the link between the disease and its cause. While an improved water source does not eliminate the risk of contamination, educating people of the health benefits of protecting the water source may affect how people value their water source, and increases their satisfaction and willingness-to-sustain the system.

Importance of water committees

The study found the existence of a water committee or other organization charged with operating the system improves sustainability through better O&M and higher willingness-to-sustain the system. For many projects the creation of a water committee is a prerequisite for receiving project assistance. The purpose of a water committee in most cases is to manage and oversee the system's operation. This may include conducting preventive maintenance, collecting tariffs or payments for repairs, keeping records of financial transactions, manuals and blueprints, and sanctioning people for non-payment.

Communities which do not have water committees often rely on traditional leaders to manage the water system. The study found this traditional system of management often was ineffective. In many cases, leaders located the system on their property and excluded some residents from using the service.

Sustainability and independent variables

The study examined the link between sustainability and independent variables. It found that sustainability is not linked to technology, total cost per capita, or the age of the system.

Technology. The study included projects with several different types of technology. Although many studies on appropriate technology have suggested that some technologies are more sustainable than others, the team found no correlation between technology type and sustainability.

Total cost per capita. It is easy to assume that sustainability will be higher in more expensive systems, and that higher up-front costs will pay off in the longer run. The study, however, did not find any significant correlation between the per capita cost of the system and sustainability. In other words, higher cost systems are not necessarily more sustainable than low cost systems.

Age of the system. A weakness in the study is that the sustainability indicators are based on one-time observations. Since the systems vary in age by as much as five years, one might argue that this type of measurement is biased against older systems, since they simply have had more time for things to go wrong. However, the study found no correlation between the age of the system and sustainability. Indeed, some of the worst performers were less than two years old, while some of the best were more than five years old.

Other relationships

The analysis uncovered relationships between independent variables and the sub-indicators. The variables did not affect overall sustainability, but provide insight into each of the sub-indicator categories.

Distance from previous source affects consumer satisfaction. The amount of time people had to walk to their previous source turned out to be a significant determinant of consumer satisfaction. Communities where people had to spend longer amounts of time fetching water prior to the construction of the water system tend to be more satisfied with the results. This variable may be seen as one proxy for demand, since people are giving up valued time and effort to obtain water from a distant source.

Age linked to financial management. Communities with older systems tend to manage their finances better than communities with newer systems. This makes sense since communities who have had a system longer, and perhaps experience a number of repairs are more likely to see the importance of financial management than those with new systems.

VI. Conclusions and Lessons for Project Design

Conclusions

The following section presents the major findings from the study. The conclusions are based on the statistical analysis described above, as well as detailed qualitative data from each communtiy and observations of field staff involved in the study.

Demand-responsiveness increases sustainability

- ***Sustainability is higher in communities when projects followed a demand-responsive approach.*** The study found that in communities where household members made informed choices about whether to build a system, what type of system and level of service, sustainability was higher than in communities where they did not. This relationship proved statistically significant, even after controlling for the effects of independent factors such as poverty level and distance from a major city, and project-related factors such as training, technology type and the per-capita cost of the system.

- ***Most projects do not apply their rules consistently in all communities.*** Regardless of their rules, most projects fail to apply a consistent approach in the communities where they work. The study found that several projects were supply-driven at times, not offering communities options or informing them of expected costs or responsibilities, and other times demand-responsive, organizing communities and involving them in much of the decision-making process. The survey reports similar findings on the issue of training. That is, projects commonly conducted training in some villages and not in others. These findings illustrate that the official project rules do not always lead to consistent operations in the field, especially when a wide range of intermediaries are involved. Projects vary significantly in implementation strategies. In some cases, project staff directly implement the project, while in others, projects are implemented indirectly by independent contractors or NGOs. However, the measured inconsistency of approach was common to all projects, suggesting a need for better implementation procedures across projects.

Household members should make choices

- ***The demand-responsive approach is most effective when demand is expressed directly by household members, not through traditional leaders or community representatives.*** The study found that the relationship between demand-responsiveness and sustainability is strongest when household members, rather than community representatives (i.e., water committees, traditional leaders, local governments) are involved in the initiation and design phase of the projects. The study found that large gaps often exist between the perceptions of demand of households and community leaders. There were many cases where community representatives obtained project benefits, by placing the water system on their own property, excluding certain groups from using the system, or selecting a design option that community members did not want. In other cases, community representatives ignored the demand of certain groups, such as women or the poor, leading to a design which did not adequately reflect the needs of the community. In such cases, community members often expressed dissatisfaction with the service, possessed a low sense of ownership, and had little willingness-to-pay for the maintenance of the service.

- ***Households did not perceive choices in multi-sectoral projects.*** Multi-sectoral projects are designed to fund a range of small-scale projects such as health clinics, roads, and schools. The goal is to allow communities to chose between sectors based on their demand for services. However, most households served by these projects reported not knowing that they had options about type of project. This suggests that a procedural gap exists between project design and implementation.

- ***Effective household involvement requires good information flow and social mobilization.*** Projects must devote enough resources to social mobilization to ensure that all members of the community including women and other traditionally excluded groups participate in decision-making. The study shows that information flow improves when projects employ well-trained extension staff, designated specifically for this purpose, regardless of whether these staff work directly for projects or are contracted out to NGOs or other intermediaries.

Training and Technology

- ***Training for household members and water committees improves sustainability by building capacity and commitment.*** One of the most conclusive findings of this study is that both household and water committee training plays an important role in ensuring the sustainability. Even when communities have high demand for water, they may lack the capacity to operate and maintain the system on their own. Training provides knowledge of how to operate the water system, and repair parts, and prevent major problems. It also informs community members that the responsibility for maintaining the system rests with them, not with the project or the government. In addition, it educates people about potential health benefits of protecting the water source, and thus enhances their willingness to sustain the system. Although the study did not examine the difference between training before and after project construction, future research may want to focus on this in greater detail.

- ***A designated community organization is a necessary component of success***. The existence of a water committee or other community organization affects overall sustainability of a water system. The purpose of a water committee is to manage and oversee the system's operation. This includes conducting preventive maintenance, collecting tariffs or payments for repairs, keeping records of financial transactions, manuals and blueprints, and sanctioning people for non-payment. For many rural water projects, the creation of a water committee is a pre-requisite for receiving project assistance. The study found that communities should be allowed flexibility in deciding what kind of organization they want to operate and maintain the system. In some cases, communities decided to delegate management of the system to an existing community organization, with no noticeable decline in management quality.

- ***Quality of construction is crucial to ensuring sustainability.*** The study found that construction quality had a major impact on sustainability. While construction quality is difficult to evaluate quantitatively, the qualitative data indicates that if construction quality was poor, systems had a lower chance of sustainability. However, neither construction quality nor sustainability was linked to per-capita costs. Systems built by private contractors were not consistently better or worse than those built by community members. Instead, the evidence suggests that poor construction quality was more likely to occur when contractors or project staff were accountable to a distant project manager, rather than to communities. In community-built systems, construction quality was often linked to the provision of adequate technical support by the project.

- ***Adopt flexible design standards.*** Projects should adapt flexible design standards that allow communities to bear the cost of household connections as part of their original design. Many countries apply design standards that promote over-design and allow for little flexibility, regardless of project rules that allow for community choice. The study also showed that users prefer house connections strongly and are willing to pay the additional costs of these connections. However, some projects are designed to provide only a "minimum" service level, and do not take this incremental demand into account. As a result, users expand the system on their own, often jeopardizing the technical viability of the system. The study found no relationship between technology type, age of the system, and sustainability.

Financial policies and accountability

- ***The lack of accountability and transparency in some government agencies leads to higher costs, delays in implementation, and lack of trust by community members.*** Field assessments in several countries reveal that even in projects where communities make informed choices about their water system, construction of the water systems often rests in the hands of non-responsive agencies. In these circumstances, communities have no way of ensuring that contractors or line agencies will build the system as requested, and no channels for complaint if a system is poorly constructed or incomplete. Furthermore, the study revealed a troubling lack of financial accountability. Most projects surveyed kept no record of how much a particular system cost nor how much a community contributed to the project. The study found evidence that willingness-to-pay for investment costs increases dramatically when communities have control over how the funds are spent.

- ***Financial policies fail to link service level to costs and do not provide incentives for projects to reduce costs.*** The study found that the financial policies of most projects are not well prepared. Frequently, there is no clear rationale for their design, and no incentives in place to promote more cost-effective investments. Most projects require very small contributions from communities. Those that do require contributions rarely link the amount to the cost of providing the service. Projects that claim to have higher contributions often do so by requiring communities to provide unskilled labor, which is difficult to quantify. Cash contributions are less frequent. The study did find a consistent willingness-to-pay for services by community members in all projects. In addition, per capita costs are lower where there are higher community contributions, strict cost control measures, a defined per capita subsidy ceiling, and where projects are managed by NGOs, rather than government agencies.

- ***Contributions are viewed as a tax, not as an expression of demand.*** The study found that the contributions required by projects often were perceived by household members as a tax, rather than a contribution to the type and level of service they would receive. In most cases, the cost of different options were not presented to people when they were making decisions. Furthermore, the contributions were usually so low or so vague that communities did not perceive that they faced an economic trade off for a higher level of service. In addition, projects did not always give individuals a choice on whether or not they would contribute. People often paid their contribution because they felt they had to, often without clear understanding of for what they were paying. In order for contributions to be used as an indication of demand, these linkages must be more clearly established.

Policy Recommendations

The most important lesson of the study is that project rules matter, and their design and implementation can profoundly affect sub-project sustainability. These rules, which define eligibility criteria, decision-making roles, financial policy, service level and technology options, set the framework and create incentives that will determine the success of a project. The study suggests:

Adopting a demand-responsive approach will improve the sustainability of sub-projects.

The study finds that communities where projects employ demand-responsive approach, sustainability is higher. However, the study also provides evidence that the definition of the approach should be both expanded and refined, as follows:

- ***Household-level demand should guide key investment decisions.*** Sustainability is increased when the role of project initiation and 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.

- ***"Social mobilization" facilitates the aggregation of demand.*** Traditional demand theory assumes that if the incentives are correct, individuals will express their preferences. Since a water system is a good to be shared by individuals with very different priorities and needs, being demand-responsive requires an aggregation of individual demand to formulate a single, community demand. Projects whose staff or intermediaries facilitate this aggregation process tend to have greater success in implementing the demand-responsive approach than those who do not. When social mobilization is weak or absent, projects run the risk of having their benefits appropriated by community leaders or dominant ethnic groups. In addition, women and weak groups within the community may be excluded from decision-making and project benefits, jeopardizing the overall commitment to sustain the water system.

- ***Choice should not be limited to service levels and technology, but should include how, when, and by whom services are delivered and sustained.*** Projects often stop short of being truly demand-responsive by giving communities choice over participation and service levels, but not over how services are delivered. 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). In addition, communities should be given flexibility, once construction has been completed, over how they want to manage the water system. While most projects require communities to establish a separate water committee, communities may prefer alternative arrangements (i.e. contracting a water system operator or using existing community organizations).

Better focus on implementation of rules by project staff, intermediaries, contractors or NGOs will improve performance.

A large gap exists in most projects between the approach the project is designed to employ and that which its staff or intermediaries actually employ in the field. To improve sustainability, project staff must ensure that their rules are well communicated and understood by those who are expected to implement them, especially to undertake social mobilization activities. In addition, staff need to be adequately trained and have adequate resources available to them. Finally, supervision mechanisms should be established to ensure that project rules are implemented correctly.

Investing in household and water committee training pays off in terms of sustainability.

Projects should include training as part of their project design. 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.

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Annex A: Country Summaries

Bolivia

The study examines communities in the departments of Potosi, Cochabamba, and Santacruz served by the Bolivian Social Investment Fund (SIF), and the Yacupaj Pilot project. The Social Investment Fund (SIF) is a multisectoral project and is the most important financier of rural water and sanitation in the country. The project was originally designed as a poverty alleviation project aimed at generating employment through the construction of social infrastructure. Project requests were submitted by communities to Regional Development Corporations, which selected projects based on strategic or political criteria. Construction was typically carried out by contractors or NGOs, with monitoring by a SIF technician.

Yacupaj was a pilot project design to test the workability of a demand-responsive approach to RWS. The project operated from 1991-1994. The project operated through NGOs and allowed communities to select a level of service and technical option, bearing in mind that the community would have to contribute 30 percent of sub-project costs. Construction was implemented by contractors with community oversight. Health and hygiene training was provided.

Project Rules and Demand-Responsiveness

Yacupaj may be considered one of the more demand-responsive projects included in the study. It selects communities on the basis of demand, allows communities to make informed choices about levels of service, and links these choices to contributions. The aim is for the community to make an economic choice. Because the SIF did not clearly define its rules regarding community decision-making, its demand-responsiveness varied based on the intermediary it employed in each community.

SIF Findings

- Community members were not aware that they had a multi-sectoral choice.
- The SIF has no incentive to reduce costs. Therefore, per-capita costs are much higher than in Yacupaj. In Yacupaj, where people contribute 30 percent, there is a strong incentive to reduce costs.
- Construction quality varied significantly between communities, with some of the best and some of the worst systems built by SIF.

Yacupaj Findings

- The high degree of community involvement led to higher consumer satisfaction and willingness to sustain the system among users.
- Community members felt that the project responded well to their demand.

General Findings

- The study found no significant difference between the average sustainability from the two projects. However, Yacupaj systems tended to perform more consistently, with SIF projects making up some of the best and some of the worst systems.
- The role of water committees was identified to be the most important component to ensure sustainability.
- Communities where a demand-responsive approach was used tended to have better performing systems.
- Training water committees significantly improves sustainability.
- More expensive systems performed better.
- External factors such as poverty level, education, income, and distance from major city have a strong impact on sustainability.
- Well-built systems have not shown problems with sustainability.
- The degree to which people are informed how the tariff is used is related to better system operation.

Honduras

The Honduras study focused on poor rural communities from both Northern and South-Central Honduras served by the Honduran Social Investment Fund, phase one (FHIS-I) and the Swiss Funded Project for Wells and Rural Aqueducts (PROPAR).

The two projects operate in very different fashions. Modeled closely after its Bolivian counterpart, FHIS-I was originally designed as poverty-alleviation project. It operated as a quasi-financial intermediary, channeling funds to municipal governments to build social infrastructure. During its first phase, FHIS did not emphasize either demand-responsive project design, contributions, or sub-project sustainability. Sub-project types were typically selected by municipal officials and constructed by contractors.

PROPAR is a single-sector project which operates through the Honduran Ministry of Health. The project is designed to be participatory but not demand-responsive. Selection of communities to be served and sub-project types is done by project staff. However, the project spends a great deal of time informing communities of their responsibilities and training them, and requires communities to provide 25-30 percent of project costs and form a water committee before construction can begin.

Project rules and demand-responsiveness

Neither project in Honduras was designed to be demand-responsive, although both could be with a few simple modifications of their project rules. While FHIS offers communities multi-sectoral options, no effort was made in FHIS-I to systematically involve community members in decision-making processes. Moreover, the 10 percent in-kind contribution was not applied or enforced in a way that users would perceive its linkage to system costs. Due to a reliance on existing technical standards, FHIS-I lacked the flexibility to fund lower levels of service than house connections.

PROPAR does an excellent job involving communities in the decision to participate, and making a linkage between the expected contribution (25-30 percent) and the system cost. However, since PROPAR selects communities based on an external determination of need, rather than allowing communities to self-select, and because design decisions are made by project staff, rather than communities, PROPAR may be considered participatory, but still supply-driven.

FHIS Findings

- Households and water committees served by FHIS did not participate in decision-making processes and were poorly informed of their responsibilities for operations and maintenance.
- Neither households nor water committees were aware that the project offered them a choice between different sectoral types.
- Construction quality in many FHIS subprojects was mixed. In some communities, systems were quite good. However, in two communities, no water system had been constructed, despite MIS data indicating all money had been disbursed. In another community, due to poor construction, the system ceased functioning three months after completion and had since been abandoned.

PROPAR Findings

- Households felt very involved in project processes and were well informed of the costs and responsibilities for maintaining the system, leading to high consumer satisfaction.
- PROPAR trained households and water committees.
- Construction quality in PROPAR was poor in several communities and lacked sufficient pressure in all points of the system.

General Findings

- Communities where people felt they participated in decision-making processes had more sustainable systems.
- Water committees training led to more sustainable systems.
- Cost and contribution data was poor in both projects. Neither project keeps any record of how much communities contribute in cash or in-kind. PROPAR also does not keep data on construction costs.
- Rehabilitated systems were less sustainable than new systems.

Indonesia

The Indonesia country study focused on villages in Central & East Java, Yogyakarta, Southeast Sulawesi served by the Village Infrastructure Project (VIP) or the Water and Sanitation for Low-Income Communities (WSSLIC) Project. Both projects are funded by IDA.

The projects differ significantly in design and objectives. VIP is a multisectoral project which channels grant funds directly to communities. Communities are responsible for selection of sub-projects from a predetermined menu which includes roads, bridges, jetties and water and sanitation facilities. Works are typically built by communities with support from one of the project's field engineers, unless the community decides to contract out services. Communities do not make a financial contribution to the capital costs. Rather, workers are paid for their labor.

WSSLIC is a single-sector water and sanitation project. The Ministry of Health is primarily responsible for the project. However, funds are channeled through four line agencies. The project is designed to allow for a great deal of community participation in the design process. Sub-projects are usually built by contractors, but occasionally are community-built. The community is expected to contribute 4 percent of project costs in cash, and 16 percent in-kind.

Project rules and demand-responsiveness

Despite very different project rules, both projects are designed to be at least partially demand-responsive. VIP does this by offering communities choice of different sectoral options. Since it is designed with a focus on poverty alleviation, however, the choices people make in VIP are not economic choices, leaving the question open as to whether the communities served have sufficient demand to sustain the system. Infrastructure costs are fully subsidized and labor is paid. WSSLIC takes a more traditional, sector-oriented approach to demand responsiveness, offering communities different levels of service and linking contributions to system costs. How clearly these linkages are communicated to and understood by communities during the decisionmaking process is not clear from the rules.

VIP Conclusions

- Decision-making control was given to existing community leaders for planning, design, construction. The study found that in several cases these leaders did not always represent the will of the community. In a few cases, community leaders "hijacked" the sub-project, placing the water system on their own property and denying some community members access.
- Water was a low priority for some villages because water collectors and managers were not given a voice in decision-making. In many cases, community leaders selected sub-project types other than water, even when demand for water services was high among women. In Indonesia, women are primarily responsible for collecting and managing water. VIP does not have any mechanism to ensure women's voice is heard in the decision-making processes.
- VIP's simple administration and transparency meant greater financial accountability and more cost-effective projects. Sub-projects were implemented rapidly (1-2 months from planning to construction).
- The project paid insufficient attention to empowering and training communities to operate and maintain systems.

WSSLIC conclusions

- WSSLIC was more effective than VIP at reaching water managers and collectors during the decision-making process.
- Communities were given full control of water systems only after construction. That is, despite a high degree of participation, communities had little control over whether systems would be constructed as agreed.
- Complex administration and low transparency led to high transaction costs (6 - 12 months between village action plan and construction), and made it difficult to get data on costs.
- Construction was the responsibility of non-responsive agencies. Several cases appeared where communities could see things going wrong in the construction process, but could do nothing to solve the problem.

- The role of the community facilitators was important in preparing communities to take over responsibility.
- The requirement of cash and in-kind contributions did not seem to increase ownership and responsibility. While contributions were required as part of a demand-responsive approach, they were generally applied like a tax. For example, community members were told by their leaders that they had to pay, so they did, although they were not necessarily aware of the linkages between what they paid and what type of system the received.

General findings

- Systems performed best in communities where the projects were truly demand-responsive and involved the entire community, rather than just the leaders.
- Greater flexibility and more management options are needed so that traditional roles and responsibilities are not ignored.
- It is easier to ensure equity and accountability with gravity piped systems than with dug wells.

Pakistan

The Pakistan study focused on the provinces of Punjab and Sind, served by the National Rural Support Programme and Azad Jammun & Kashmir(AJK) by Local Government and Rural Development Department(LGRDD).

LGRDD is an IDA funded, single-sector project run out of the government ministry. It is designed to be somewhat demand-responsive, informing communities of their responsibilities and requiring a significant contribution toward the up-front capital investment. Choice of service levels was limited to public standpipes. Construction was implemented directly by communities with design and supervision provided by project staff.

NRSP is a small government-funded project designed to function independent of government, much like an NGO. It is a multi-sectoral project with a strong social component. Extension workers mobilize communities, help them identify preferences of project types, and help them determine how to fund these projects using a combination of community and grant funds. Construction is implemented and managed by a village organization created for the sub-project.

Project Rules and Demand-Responsiveness

While both projects are designed to be demand-responsive, NRSP is more effective in achieving this goal. This is due to better allocation of resources and training of extension agents. In addition, it allows communities choice of service levels and of sectoral options. Both projects employ extension agents whose role it is to organizing communities and facilitate their role in the project. LGRDD, however, employs a limited number of staff and has poorly defined their roles in the communities. NRSP, on the other hand, trains its extension agents and allocates significant resources to facilitating the decision-making process with communities, and linking their expected contributions to costs. In addition, while NRSP offers communities choice, LGRDD is limited to rigid design standards that supply only the minimum level of service.

Findings: Field Evaluation

The study found sub-project sustainability to hinge largely on issues of social mobilization and the way in which projects approached villages.

LGRD Findings

- Project staff tended to enter the communities via traditional leadership structures. This approach, in many cases, led to leaders either appropriating the scheme for their own use, or excluding significant portions of the community from using the system.
- Often, in LGRD, project staff were not clear on their roles in community mobilization, beyond ensuring the formation of a water committee and ensuring community participation in construction.

NRSP Findings

- Staff tended to make a large effort to ensure all members of the community were involved in the planning and implementation of the scheme. This approach, when implemented correctly, often led to better built and more equitable water systems.
- NRSP also tended to better inform communities of their options and responsibilities, leading to higher consumer satisfaction and greater willingness to sustain the system.

General Findings

- Financial management was poor in both projects. In no case were community resources enough for scheme replacement and in only 5 villages was a regular tariff collected.
- Physical condition of services could be very good or very bad in communities of both projects.

Uganda and Benin

In Benin, the study looks at communities served by the French-funded CfD project from 1989-1993. The project works in an area of difficult hydrogeological conditions and high population density. Trade is the primary activity in this area, generating considerable revenue for the community. The project offers a range of technical options, but selects the technology for communities. Maintenance of the project is the responsibility of the communities, who contract it out to a single private sector company. Communities also set up a guarantee fund to cover costs or system replacement.

In Uganda, the study examined the DANIDA-funded RUWASA project (phase I). This project is a very traditional, supply-driven project. The project works with very low levels of service, which are selected and constructed by the project itself. The project devotes considerable resources to training in hygiene and sanitation. Operations and maintenance is the responsibility of the community, but involves a network of pump-mechanics, each serving several communities, and significant financial and technical backstopping by the project itself.

Project rules and demand-responsiveness

Both the project in Benina and Uganda are, by design, supply-driven. Both select communities based on an external determination of need, and neither offers communities choice in the level of service or technological option. In addition, both projects lack a clear financial policy linking contributions with system costs.

Benin findings

- Very little information is provided to community members.
- In most communities, men are better informed about the project than women.
- The project is highly supply-driven, but many of the water systems appear sustainable.
- People buy water by the bucket and express demand on a daily basis. Because of this arrangement, however, people are less willing to pay separate maintenance fees.
- Three systems were not functioning at the time of the survey. In each case, technical problems were to blame. In addition, an alternative water supply was readily available.
- Water consumption increased in the villages after the systems were constructed.
- Investment costs are very high, no community control over costs.
- Weak willingness to sustain the system may be explained by the lack of demand-orientation of the project, as well as the lack of transparency in the management of maintenance funds.

Uganda findings

- The project is highly supply-driven. In this case, the high sustainability may be attributed to the significant technical and financial support given to communities by the project. The responsibility for maintaining these systems is currently 0being transferred to local governments as part of Uganda's decentralization program. The impact of this transfer on the sustainability of these systems cannot be determined at this time.
- Where system caretakers were not paid for their work, systems were poorly maintained and dirty.
- The large investments in training produced an increase in consumer satisfaction.
- In communities where systems were functioning poorly, there was often a decent traditional water source. Similarly, in those communities where systems were functioning well, there was not a good traditional source.
- People had little knowledge of linkages between water quality and health in rural areas.
- Project employs low-levels of service, but consumer satisfaction high.

ANNEX B: Community and Household Characteristics

The study drew its sample of communities for each project at random from a list of completed sub-projects provided to our survey team from the projects themselves. Fifteen communities were sampled from each project, with the exceptions of FHIS and PROPAR (Honduras), which was the test case, in which 10 communities were drawn from each project. To ensure maximum comparability between communities, the following parameters were given for sampling:

1. Communities with greater than 2500 people should be eliminated.
2. Communities with 15 or fewer households should be eliminated.
3. All urban or peri-urban communities should be eliminated.
4. where possible, we would like to sample only projects that are between 2-5 years old.
5. in countries with regional differences which may have a large impact on project performance, or where distances may make country-wide sampling too costly, the sampling universe may be limited to a few geographical regions.

The study aimed to include a representative sample of the overall project in terms of diversity of technology and remoteness. However, a number of irregularities led to modifications in our sample size. Thirteen communities were eliminated from the final analysis because their populations exceeded the recommended 2,500 person limit. In addition, 4 of ten FHIS communities were not included in our analysis because our survey team reported that no water system had been completed in the communities. An investigation is underway in Honduras to determine the source of the discrepency. The total number of communities included in the sample is 125.

Table 1. Community Descriptive Data

Q#		CFD	SIF	Yacupaj	FHIS	PROPAR	VIP	WSSLIC	LGRD	NRSP	RUWASA
T01	Population										
	Avg	1278	637	234	535	385	1566	1383	654	293	356
	Min	463	210	40	340	180	330	839	192	110	160
	Max	2504	1500	485	900	645	2469	1914	2056	854	700
T02	Number of Households										
	Avg	269	145	59	102	71	349	306	86	41	87
	Min	95	48	20	64	36	99	183	24	21	28
	Max	516	400	100	180	129	586	440	257	122	180
T03	Households Served by the System										
	Avg	75%	77%	68%	63%	83%	n/a	n/a	84%	71%	79%
	Minimum	0%	69%	57%	42%	86%	n/a	n/a	92%	29%	38%
	Maximum	91%	80%	90%	61%	95%	n/a	n/a	71%	59%	100%
T06	Distance from a major city	13	24	58	13	23	28	27	39	28	47
T04	Poverty										
	a. below poverty line	40%	14%	64%	20%	0%	33%	0%	0%	25%	6%
	b. at poverty line	40%	50%	36%	80%	100%	67%	100%	40%	31%	50%

	c. above poverty line	20%	36%	0%	0%	0%	0%	0%	60%	44%	44%
T08	Electricity										
	a.yes	100%	43%	7%	80%	11%	42%	50%	93%	81%	6%
	b.no	0%	50%	93%	40%	89%	50%	50%	7%	19%	94%

Table 2: Technology and level of service options by project and project type

		Pumping Option						Level of service			
Project	**Type**	**gps**	**hpb**	**hpd**	**rts**	**sol**	**sub**	**h**	**m**	**s**	**Total**
Multi-sectoral projects											
FHIS	m	6	0	0	0	0	0	6	0	0	6
NRSP	m	6	0	1	3	0	5	7	1	7	15
SIF	m	14	0	0	0	0	0	10	2	2	14
VIP	m	11	0	1	0	0	0	1	0	11	12
Subtotal		37	0	2	3	0	5	24	3	20	47
%		79%	0%	4%	6%	0%	11%	51%	6%	43%	100%
Stand-Alone Projects											
CFD	s	0	5	0	0	5	0	0	0	10	10
LGRD	s	15	0	0	0	0	0	1	8	6	15
PROPAR	s	9	0	0	0	0	0	8	0	1	9
RUWASA	s	0	12	0	4	0	0	0	0	16	16
WSSLIC	s	7	0	5	2	0	0	0	5	9	14
YRWSS	s	12	0	2	0	0	0	3	6	5	14
Subtotal		43	17	7	6	5	0	12	19	47	78
%		55%	22%	9%	8%	6%	0%	15%	24%	60%	100%
Grand Total		80	17	9	9	5	5	36	22	67	125
%		64%	14%	7%	7%	4%	4%	29%	18%	54%	100%

gps - gravity piped system
hpb - hand-pump with borehole
hpd - hand-pump with dug well
rts - point source
sol - solar pump
sub - submersible (electric pump)

h - house connection
m - mixed system
s - shared system

Household data

Nearly 1900 household surveys were conducted. In order to avoid a gender bias in the study, surveyors were asked to collect answers from approximately equal numbers of men and women. In the final count, 54% of respondents were female. 59% reported being head of the household. The bulk of resposndents (50%) claimed to make their living as subsistance farmers. Another 15% reported working in civil service. 89% of respondents were between 20 and 59 years of age.

Table 3: Summary data, household respondents											
	CFD	**SIF**	**YRWSS**	**FHIS**	**PROPAR**	**VIP**	**WSSLIC**	**LGRD**	**NRSP**	**RUWASA**	**Total**
# of respondents	150	223	208	90	135	179	210	224	224	256	**1899**
H1. Sex											
n/a	0%	1%	1%	0%	0%	1%	0%	0%	0%	0%	**0%**
a. female	59%	52%	67%	61%	58%	75%	61%	34%	37%	52%	**54%**
b. male	41%	48%	33%	39%	42%	25%	39%	66%	63%	48%	**46%**
H3. Head of household	50%	62%	52%	57%	51%	68%	59%	63%	50%	68%	**59%**
H5. Primary Occupation											
n/a	0%	3%	2%	0%	0%	0%	0%	0%	0%	0%	**1%**
a. Civil Service, government employee	0%	6%	2%	49%	88%	6%	14%	15%	18%	4%	**16%**
b. Private company	1%	2%	2%	6%	2%	1%	0%	3%	2%	11%	**3%**
c. Agriculture, works own land	89%	69%	70%	1%	1%	60%	66%	26%	20%	66%	**50%**
d. Trade/commerce	6%	6%	7%	0%	0%	10%	4%	7%	4%	1%	**5%**
e. Craftsman	3%	3%	3%	1%	1%	2%	5%	2%	1%	1%	**2%**
f. Agriculture laborer or farm worker	1%	1%	1%	9%	5%	13%	3%	4%	13%	2%	**5%**
g. Pensioner	0%	0%	1%	34%	1%	1%	0%	8%	6%	0%	**4%**
h. Others	1%	10%	11%	0%	0%	8%	6%	24%	27%	14%	**12%**
i. None	0%	1%	2%	0%	0%	1%	0%	11%	10%	1%	**3%**
H6. What is the highest level of education obtained by a member of the household?											
a. Did not go to school	45%	8%	16%	2%	2%	2%	0%	4%	12%	12.1%	**10%**
b. Attended elementary school	47%	26%	38%	18%	34%	9%	6%	9%	5%	32.0%	**21%**
c. Completed elementary school	2%	17%	16%	47%	45%	58%	37%	15%	9%	20.7%	**27%**
d. Attended secondary school	6%	25%	22%	18%	7%	18%	21%	24%	27%	21.5%	**19%**
e. Completed secondary school	0%	16%	5%	13%	11%	12%	32%	24%	23%	12.5%	**15%**
f. Attended University	0%	6%	3%	2%	1%	0%	1%	5%	7%	1.2%	**3%**
g. Completed University	0%	1%	1%	0%	0%	1%	1%	10%	12%	0%	**3%**
h. Post-secondary	0%	0%	0%	0%	0%	1%	0%	10%	5%	0%	**2%**

ANNEX C: Details, Regressions on sub-indicators

This annex presents the results of the multivariate regressions on each of the five sub-indicators of sustainability. It is intended to provide greater insight into the dynamic that underlie the results presented in Chapter V. As mentioned in Chapter II, because the results are based on composite indicators, rather than on observable, cardinal data, it is the *significance* and *direction* (positive or negative), rather than the *magnitude* of the coefficients, that is significant for our analysis.

Physical Condition

Demand-responsiveness, while demonstrating a significant relationship with physical condition in the first two regressions (bivariate and controlling for exogenous factors), it is not shown to be significant when controlling for project-related factors are included in the model. Instead, we see household training and the quality of construction emerging as the principal determining factors of physical condition.

Table 1. Physical condition regression

	Parameter	***T-value for H_0***	***Prob > ïTï***
Demand Resp.	n/s	n/s	n/s
Training, Household	0.43	2.15	0.0334
Population Density	1.22	2.14	0.0338
Constr. Quality	2.58	8.00	0.0001

Consumer Satisfaction

The demand-responsiveness of a project is an important determinant of consumer satisfaction with rural water systems, controlling for both external and project related factors. The regression reveals that again, household training, and the amount of time spent fetching water previous to the improvement are also important determining factors in consumer satisfaction.

Table 2. Consumer satisfaction regression

	Parameter	***T-value for H_0***	***Prob > ïTï***
Demand Resp.	0.39	3.47	0.0007
Dist. previous source	0.66	2.34	0.02
Training, household	0.49	3.45	0.0007
Training, water committee	-0.12	-2.27	0.025

Operations and Maintenance

According to the regression results, it is principally household training, the existence of an organized water committee and construction quality, rather than demand responsiveness, which influences the quality of operations and maintenance. Demand responsiveness is shown to be significant using a significance level of 95 percent in the first two regressions, but not when controlling for other factors.

Table 3. Operation and maintenance regression			
	Parameter	***T-value for H_0***	***Prob > ïTï***
Demand Resp.	n/s	n/s	n/s
Training, Household	0.30	1.99	0.004
Water Committee	0.64	1.74	0.080
Constr. Quality	0.84	3.26	0.0014

Willingness to sustain the system

Demand responsiveness is a highly significant determinant of willingness to sustain the water system, even after controlling for independent and project related variables. The T-value of 4.03 shows this relationship to be significant at almost any level of significance. In addition to demand-responsiveness, the model also shows that household training and the existence of a water committee are important determining factors.

Table 3. Willingness to sustain the system regression			
	Parameter	***T-value for H_0***	***Prob > ïTï***
Demand Resp.	0.34	3.40	0.0009
Training, Household	0.47	3.53	0.0005
Water Committee	1.17	3.77	0.0002

Financial Management

Demand-responsiveness does not appear as a significant factor in determining the quality of financial management for a particular water system. Instead, the age of the system, the level of poverty, the level of service, and household training are significant factors influencing financial management. The first factor, age, is logical, implying that communities who have had a system longer (and perhaps lived through a number of repairs) will manage their water system better than those who have not. The relationship with poverty is less clear, as it implies that communities with higher poverty levels are better managing their finances than higher income communities. While this notion has interesting implications, due to the relative (i.e. country specific) and aggregate (average rating for a community) nature, more research should be done in this area before drawing any strong conclusions. The third factor implies that communities who receive higher levels of service are also better at financial management. This also is logical, since higher levels of service are more likely to require maintenance and users are more easily excluded from service if they do not pay.

Table 4. Financial Management			
	Parameter	***T-value for H_0***	***Prob > ïTï***
Demand Resp.	n/s	n/s	n/s
Age of System	0.34	3.34	0.001
Poverty	1.12	2.11	0.0001
Level of Service	0.69	2.4	0.0120
Training, household	0.53	3.25	0.0009

Annex D: Chow Test Results

Country	PROJECT	Pump (g)ravity, (s)lsctric, (d)isssl, (s)olar	SFI	SOM	SCS	SPC	SWL	SST	SHPI	SCPI	SHIC	SCIC	DRCJ	DRHJ
UG	RUWASA	hpb	6.25	9.33	7.93	10.00	8.63	8.66	4.58	0.00	5.23	4.00	2.67	5.01
UG	RUWASA	hpb	6.88	9.33	8.58	8.80	8.01	8.43	4.27	5.00	4.69	7.00	6.33	4.55
BO	YRWSS	gsp	3.96	8.00	8.36	10.00	8.38	8.28	6.89	5.00	7.76	9.00	7.67	7.47
PA	NRSP	hpd	5.00	6.67	9.33	10.00	7.50	8.21	7.33	5.00	8.18	8.00	7.00	7.90
HO	PROPAR	gsp	6.25	8.00	7.27	8.80	9.38	8.19	8.44	10.00	5.58	6.00	7.33	6.53
UG	RUWASA	hpb	5.42	10.00	8.72	8.00	7.54	8.11	5.63	5.00	4.69	5.00	5.00	5.00
UG	RUWASA	hpb	6.46	9.33	8.89	7.60	7.73	8.10	3.75	0.00	4.52	4.00	2.67	4.26
BO	SIF	ghc	8.75	6.33	7.73	8.67	8.13	7.95	5.33	7.50	3.64	2.00	3.83	4.20
BE	CFD	sol	5.83	7.00	7.61	10.00	7.54	7.92	4.00	2.50	2.61	4.00	3.50	3.07
UG	RUWASA	hpb	6.04	7.33	8.04	8.80	7.89	7.89	4.69	0.00	4.60	6.00	4.00	4.63
UG	RUWASA	hpb	5.00	9.33	8.75	8.80	6.09	7.81	4.58	5.00	4.49	3.00	3.67	4.52
BO	YRWSS	gm	5.83	6.00	8.52	7.67	9.08	7.80	8.67	5.00	7.27	7.00	6.33	7.74
UG	RUWASA	hpb	5.83	9.67	6.76	8.80	7.19	7.72	5.42	7.50	3.92	5.00	5.83	4.42
BE	CFD	hpb	4.58	8.67	5.76	10.00	7.96	7.69	3.44	2.50	2.00	3.00	2.83	2.48
BO	SIF	ghc	7.29	7.67	7.79	7.80	7.58	7.67	8.44	5.00	7.70	7.00	6.33	7.95
BE	CFD	sol	6.46	7.33	6.73	10.00	6.88	7.65	5.33	2.50	3.48	9.00	6.83	4.10
UG	RUWASA	hpb	6.46	8.33	7.73	7.60	7.50	7.60	4.48	5.00	4.09	6.00	5.67	4.22
BO	SIF	gm	3.96	7.00	7.64	10.00	6.83	7.56	6.44	5.00	5.03	5.00	5.00	5.50
BO	YRWSS	gsp	3.96	7.00	7.45	8.80	8.08	7.53	8.44	10.00	7.64	8.00	8.67	7.91
UG	RUWASA	hpb	5.63	6.67	6.88	10.00	6.52	7.41	3.65	5.00	3.32	4.00	4.33	3.43
BO	SIF	gm	6.25	6.00	6.70	10.00	6.58	7.35	2.78	5.00	2.73	3.50	4.00	2.74
BE	CFD	sol	5.21	7.33	6.94	8.00	7.88	7.32	3.56	0.00	3.30	7.00	4.67	3.39
BO	SIF	ghc	7.29	8.00	6.18	8.80	6.21	7.23	6.44	5.00	5.39	8.50	7.33	5.74
BO	SIF	ghc	6.04	7.67	7.55	7.60	6.67	7.21	6.22	5.00	6.30	7.50	6.67	6.28
	Average		5.86	7.83	7.66	8.94	7.57	7.80	5.53	4.48	4.92	5.77	5.34	5.13
	Std		1.137	1.192	0.902	0.942	0.849	0.386	1.778	2.756	1.767	2.048	1.730	1.710

Country	PROJECT	Pump (g)ravity, (s)lsctric, (d)isssl, (s)olar	SFI	SOM	SCS	SPC	SWL	SST	SHPI	SCPI	SHIC	SCIC	DRCJ	DRHJ
BE	CFD	hpb	2.50	3.67	0.00	0.00	0.00	0.80	1.56	2.50	2.06	4.00	3.50	1.89
BE	CFD	hpb	5.00	3.00	0.00	0.00	0.00	0.95	2.11	0.00	2.39	6.00	4.00	2.30
BE	CFD	hpb	3.33	7.00	0.00	0.00	0.00	1.38	2.00	2.50	1.15	3.00	2.83	1.43
IN	VIP	hpd	0.00	4.33	3.73	1.40	2.25	2.49	1.78	5.00	2.00	2.00	3.00	1.93
BO	SIF	ghc	1.88	3.67	2.70	0.00	4.42	2.52	3.22	5.00	2.21	3.00	3.67	2.55
IN	WSSLIC	hpd	0.00	6.33	3.21	-0.20	3.79	2.65	3.11	5.00	1.94	6.00	5.67	2.33
PA	LGRD	gm	0.00	2.67	6.67	0.00	3.58	2.96	3.78	5.00	3.61	1.50	2.67	3.66
IN	WSSLIC	hpd	0.00	4.00	3.15	2.40	4.04	3.00	3.67	5.00	4.24	3.00	3.67	4.05
BO	SIF	gsp	0.00	3.00	2.82	5.27	2.63	3.13	3.56	5.00	2.24	4.00	4.33	2.68
PA	LGRD	gsp	0.00	2.00	7.12	0.00	4.83	3.29	4.67	5.00	3.55	2.00	3.00	3.92
IN	VIP	gsp	0.00	5.00	5.64	0.53	4.67	3.46	3.44	5.00	3.33	3.50	4.00	3.37
BO	SIF	ghc	3.54	2.33	1.73	2.73	6.79	3.52	4.89	5.00	4.67	9.00	7.67	4.74
UG	RUWASA	rtw	0.83	2.67	5.80	2.20	4.34	3.57	3.54	5.00	4.32	5.50	5.33	4.06
PA	LGRD	ghc	0.00	2.33	6.91	1.73	4.63	3.67	3.89	10.00	4.61	3.00	5.33	4.37
PA	NRSP	shc	0.00	4.33	2.97	4.20	4.96	3.68	5.33	5.00	4.24	8.50	7.33	4.61
UG	RUWASA	hpb	5.42	1.67	3.01	4.60	4.26	3.76	2.60	5.00	2.73	4.00	4.33	2.69
PA	NRSP	sub	0.00	2.00	5.64	3.40	4.88	3.78	5.56	10.00	4.97	5.50	7.00	5.16
PA	LGRD	ghc	0.00	3.00	7.42	1.13	4.96	3.83	6.22	5.00	4.91	2.00	3.00	5.35
PA	LGRD	gsp	0.00	3.33	8.06	1.40	4.33	3.95	5.44	5.00	4.00	3.00	3.67	4.48
IN	VIP	gsp	0.00	3.33	6.30	2.93	5.21	4.11	3.00	2.50	2.24	5.00	4.17	2.49
IN	VIP	gsp	0.00	4.00	4.82	4.27	5.29	4.19	3.00	5.00	3.15	5.00	5.00	3.10
PA	NRSP	ghc	0.00	2.67	3.45	8.00	3.83	4.22	6.22	5.00	3.76	6.00	5.67	4.58
IN	VIP	gsp	0.00	4.00	4.12	5.27	5.63	4.35	4.11	5.00	2.48	7.00	6.33	3.03
BO	YRWSS	gm	1.04	5.67	7.15	0.00	6.50	4.37	5.00	5.00	8.12	7.50	6.67	7.08
	Average		0.98	3.58	4.27	2.14	3.99	3.23	3.82	4.90	3.46	4.54	4.66	3.58
	Std		1.700	1.363	2.435	2.224	1.837	1.008	1.357	2.016	1.478	2.100	1.514	1.337
	t-value		11.688	11.500	6.400	13.800	8.673	20.738	3.752	-0.598	3.122	2.053	1.450	3.498
	Average		3.02	5.55	6.18	5.90	6.21	5.71	5.46	5.40	4.26	5.50	5.47	4.66
	Std		2.571	1.945	1.879	2.861	1.819	1.624	1.930	2.587	1.768	2.227	1.782	1.598
	t-value		5.300	5.535	3.773	5.143	3.588	6.278	0.185	-1.580	1.689	0.552	-0.320	1.304
	t-value		-3.727	-4.742	-4.338	-6.089	-5.468	-7.186	-3.960	-0.903	-2.086	-1.948	-2.077	-3.105

ANNEX E: Analytical Framework

I. Indicator Category

Indicators of Demand Responsiveness

1. Project Initiation - Household (HPI)
2. Project Initiation - Water Committee (CPI)
3. Informed Choice - Household (HIC)
4. Informed Choice - Water Committee (CIC)
5. Contribution -- Cash and Labor (COC and COL)

Other Project Indicators

1. Training of the Water Committee (TC)
2. Training at the Household level (TH)
3. Contracting
4. Legal Ownership

Indicators of Sustainability

1. Physical Condition (PC)
2. Consumer Satisfaction (CS)
3. Operations and Maintenance (OM)
4. Financial Management (FI)
5. Willingness to Sustain the System (WL)
6. Overall Rankings of Sustainability (ST)

II. Scoring Methods

There are four types of questions in the survey. Most questions have maximum 2 points. Scores of the indicators are calculated to fit 10-scale that the sum of scores of the sub-indicators be divided by the number of sub-indicators and multiplied by 5. Overall sustainability score was calculated by averaging the 5 sustainability indicators' scores.

Type I: Yes/No Questions

Scoring:

If the answer given contributed positively towards that indicator category, it was given a score of +2. If the answer did not contribute positively, it was given a score of 0.

Example:

H30. Were you offered a choice of different levels of service?

Yes = +2, No=0.

Type II: Ordinal (Ranking) Questions

Scoring:

If the answer given indicated positive performance in that indicator category, it was given a score of +2. If the answer indicated neither positive nor negative performance, it was given a score of +1. If the answer did not contribute, it was given a score of zero.

Example:

H68. In general, how would you rate the service provided by your water system?

Good = +2, Fair = +1, Poor = 0

Type III: Multiple Choice Questions

In some cases, multiple choice questions were used in place of multiple yes/no questions, but using the same scoring principle.

Example:

H18 Whose idea was it to built the project?

The purpose of this question is to find out whether people perceived the sub-project as being initiated inside the community (and thus based on demand), or outside the community.

The answers were scored as follows:

+2 water committee, neighbor, or community leaders
+1 local government
0 project, national government, or don't know

Type IV: Open Questions

Some questions ask numerical answers.

Example:

C41. How many members of the water committee were trained?

The answer was scored as follows:

0 = 0, 1 = 1, 2 = 1, 3 = 2, 4 = 2, 5 = 2

III. Indicator Codes

SPI	Score of Project Initiation
SIC	Score of Informed Choice
SCOC	Score of Cash Contribution
SCOL	Score of Labor Contribution
STC	Score of Training, Water Committee
STH	Score of Training, Household
SCN	Score of Contracting
SLO	Score of Legal Ownership
SFI	Score of Financial Management
SOM	Score of Operations and Maintenance
SCS	Score of Consumer Satisfaction
SPC	Score of Physical Condition
SWL	Score of Willingness to Sustain the System
SST	Score of Overall Sustainability

IV. Scores of the Secondary Indicators

1. DEMAND RESPONSIVENESS

A. Project Initiation, Household (HPI)

Perceptions on whether the community played a role in project initiation

Q-ID	Question text	Answers	code	Weight
H18	**source of project initiative**			
		inside community	a	2
		project	b	0
		local govt	c	1
		others	d	0
		don't know	e	0
H19	**knowledge of assistance**			
		yes	a	2
		no	b	0
H26	**participation in decision**			
		yes	a	2
		no	b	0
		don't know	c	0

B. Project Initiation, Water Committee (CPI)

Perceptions on whether the community played a role in project initiation

Q-ID	Question text	Answers	code	Weight
C16	**source of project initiative**			
		inside community	a	2
		project	b	0
		local govt	c	1
		others	d	0
		don't know	e	0
C18	**can identify fund source**			
		yes	a	2
		no	b	0

C. Informed Choice, Household (HIC):

Did people make decisions based on understanding of costs?

Q-ID	Question text	Answers	code	Weight
H21	**other priorities besides water**			
		preferred something else	a	0
		water first priority	b	2
		two priorities	c	2
		don't know	d	0
H23	**offered multi-sectoral choice**			
		yes	a	2
		no	b	0

H27 knowledge of requirements			
	name 50%	a	2
	can't name	b	0
H28 Choice of Source			
	yes	a	2
	no	b	0
	don't know	c	0
H29 choice of technology			
	yes	a	2
	no	b	0
	don't know	c	0
H30 LOS options offered to individuals			
	yes	a	2
	no	b	0
	don't know	c	0
H31 facility options	yes	a	2
	no	b	0
	don't know	c	0
H34 costs of options presented	yes	a	2
	no	b	0
	don't know	c	0
H35 O & M responsibility	yes	a	2
	no	b	0
	don't know	c	0
H36 LOS selected by HH			
	yes	a	2
	no	b	0
	don't know	c	0
H37 final decision on LOS			
	community	a	2
	water committee/comm leaders	b	1
	local govt	c	0
	don't know	d	0
	joint decision	e	1
	other	f	1

D. Informed Choice, Water Comittee (CIC):

Did people make decisions based on understanding of costs?

C12 other priorities besides water			
	yes	a	0
	no	b	2
	don't know	c	0

C19 knowledge of requirements			
	name 50%	a	2
	can't name	b	0
C20 Choice of source			
	yes	a	2
	not applicable	b	2
	no	c	0
C21 choice of technology			
	yes	a	2
	not applicable	b	2
	no	c	0
C22 LOS options offered to individuals			
	yes	a	2
	no	b	0
C23 facility options			
	yes	a	2
	not applicable	b	2
	no	c	0
C24 costs of options presented			
	yes	a	2
	not applicable	b	2
	no	c	0
C27 final decision on LOS			
	water committee/comm leaders	a	1
	community leaders	b	2
	project/local govt	c	0
	other/don't know	d	0
C28 Alternative selected the one wanted by community			
	yes	a	2
	no	b	0
C32 O & M responsibility			
	yes	a	2
	partially aware	b	0
	no	c	0

E. Contribution by Cash (COC)

How much money and labor did people actually contribute?

C33/T03 cash contribution per household

c33/t03 = 0	0
0<c33/t03<= 30	1
30<c33/t03<= 60	2
60<c33/t03	3

F. Contribution by Labor (COL)

H41 labor contribution per household

1-7 days	a	1
8-14	b	2
15-30	c	3
more than 30	d	4
0	e	0
don’t know/other	f	0

2. Other Project Rules

A. Training of Water Committee (TC)

Did the water committee receive training?

C40 Training of committee

yes	a	2
no	b	0

B. Training of Community Members (TH)

Did households receive training

C48 Training of community members

yes	a	2
no	b	0

C. Contracting (CN)

C38 WC participation in contractor supervision

yes	a	2
no	b	0

C39 Contractor paid by W.C.

yes	a	2
no	b	0

D. Legal Ownership

T44 water source ownership			
	community	a	2
	unknown	b	0
	private, permiss required	c	0
	private, no permiss required	d	2
T45 land ownership			
	community	a	2
	unknown	b	0
	private, permiss required	c	0
	private, no permiss required	d	2
T46 water system ownership			
	community	a	2
	other/don't know	b	0

3. SUSTAINABILITY

A. Financial Management (FI)

How well is the system being managed financially?

Q-ID	Question text	Answers	code	weight
T58	**criteria for tariff setting**			
		operational cost	a	2
		other	b	0
T59	**differential tariff structure**			
		yes	a	2
		no	b	0
T60	**tariff adj. to meet costs**			
		yes	a	2
		no	b	0
		not required	c	2
T61	**costs covered by tariff**			
		O&M + replace	a	2
		O&M + repair	b	2
		O&M, no savings	c	1
		operations only	d	0
		no tariff	e	0
		does not cover operations	f	0
T62	**service cut-off for non-payment**			
		yes	a	2
		no	b	0

T63	**connection fee charged**		
	yes	a	2
	no	b	0
T64	**existence of treasurer/bookkeep**		
	yes	a	2
	no	b	0
T66	**capacity of treasurer**		
	yes	a	2
	no	b	0
T67	**community bank account**		
	yes	a	2
	no	b	0
T71	**% current in payment**		
	More than 90%	a	2
	50-90%	b	1
	Less than 50%	c	0
T72	**tariff covers O&M**		
	yes	a	2
	no	b	0
T75	**can community replace system**		
	yes	a	2
	no	b	0

B. Operations and Maintenance (OM)

Ability to maintain the system

C59	**system operator**		
	yes	a	2
	no	b	0
C66	**# of breakdowns/year**		
	0	a	2
	1-3	b	1
	4 +	c	0
C67	**community could do all repairs**		
	yes	a	2
	no	b	0
	none have been required	c	2
C68	**days to repair**		
	1	a	2
	2-5	b	1
	6 or more	c	0

C72	**quantity decrease**		
	yes	a	0
	no	b	2
C73	**quantity sufficient**		
	yes	a	2
	no	b	0
T48	**employ. hired based on ability**		
	yes	a	2
	no	b	0
T49	**employ. trained in operation**		
	yes	a	2
	no	b	0
T50	**operators have capacity to op.**		
	yes	a	2
	somewhat	b	1
	no	c	0
T51	**operator has access to tools & spares**		
	yes	a	1
	no	b	0
T52	**if not, operator knows where to get tools**		
	yes	a	1
	no	b	0
T53	**operator has done major repair**		
	yes	a	2
	no	b	0
T54	**operator can get help**		
	yes	a	2
	no	b	0
T55	**op. has plans/blueprints**		
	yes	a	2
	no	b	0
T56	**operator has manuals**		
	yes	a	2
	no	b	0

C. Consumer Satisfaction (CS)

H57	**water use**		
	more	a	2
	less	b	0
	same	c	1

H58	**continued use of alternative sources**		
	1 or more, regularly	a	0
	1 or more, seasonally	b	0
	no	c	2
H60	**satisfied with your water pressure**		
	very	a	2
	somewhat	b	1
	no	c	0
H63	**satisfied with # of hours avail**		
	very	a	2
	somewhat	b	1
	no	c	0
H64	**satisfied with quantity**		
	yes	a	2
	no	b	0
	depends on the season	c	0
H65	**perception of color**		
	good	a	2
	fair	b	1
	poor	c	0
	depends on the season	d	0
H66	**perception of taste**		
	good	a	2
	fair	b	1
	poor	c	0
	depends on the season	d	0
H68	**overall satisfaction with service**		
	good	a	2
	fair	b	1
	bad	c	0
H69	**new water use**		
	yes	a	2
	no	b	0
H82	**stand in line a long time**		
	yes	a	2
	no	b	0

D. Physical Condition (PC)

T26	**contamination possibility**		
	yes	a	0
	no	b	2

T27	**protection of source**			
		yes	a	2
		no	b	0
T30	**possibility of animal contamination**			
		yes	a	0
		no	b	2
T33	**quality of construction**			
		good	a	2
		fair	b	1
		bad	c	0
T34	**system functioning**			
		yes	a	2
		no	b	0
T35	**being repaired**			
		yes	a	2
		no	b	0
T36	**defects in catchment or wells**			
		yes	a	0
		no	b	2
T37	**defects in masonry (tanks, etc.)**			
		yes	a	0
		no	b	2
T38	**leaks from exposed pipe**			
		yes	a	0
		no	b	2
T39	**many leaking standpipes**			
		yes	a	0
		no	b	2
T41	**sufficient pressure in all parts**			
		yes	a	2
		no	b	0
T42	**water flows at the first pump (hand pumps only)**			
		yes, all pumps/wells/tanks	a	2
		yes, majority pumps/wells/tanks	b	1
		no	c	0
T43	**abundant flow of water (hand pumps only)**			
		yes, all pumps/wells/tanks	a	2
		yes, majority pumps/wells/tanks	b	1
		no	c	0

E. Willingness to Sustain the System (WL)

H12	**satisfaction w/ WC**			
		yes	a	2
		no	b	0
H71	**perceptions on tariff level**			
		expensive	a	0
		fair	b	1
		inexpensive	c	2
H72	**problems in paying tariff (ability to pay)**			
		yes	a	0
		no	b	2
		sometimes	c	1
H75	**perception where to obtain money for repairs**			
		tariff	a	2
		additional contribution	b	2
		local govt	c	1
		outside community	d	0
		more than	e	0
		others	text	
H76	**perception: could replacement be done with funds in community**			
		yes	a	2
		no	b	0
		don't know	c	0
H77	**perception: does community have financial capacity to sustain**			
		yes	a	2
		no	b	0
		don't know	c	0
H78	**perception of ownership**			
		community	a	2
		local govt	b	1
		natl. govt,	c	0
		others	d	0
		don't know	e	0
		other (UG)	f	0
		other (UG)	f	0
H81	**willingness to pay for desired improvements**			
		yes	a	2
		no	b	0
		don't know	c	0
H85	**do you think your health is better since water system**			
		yes	a	2
		no	b	0
		don't know	c	0

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