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PRIVATE OPERATORS AND RURAL WATER SUPPLIES

A Desk Review of Experience

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ACRONYMS AND ABBREVIATIONS

DEM	<i>Direction de l'exploitation et de la maintenance</i>
AFD	<i>Agence Française de Développement</i>
AICD	Africa Infrastructure Country Diagnostic
APAUS	<i>L'Agence de Promotion de l'Accès Universel aux Services</i>
ARM	<i>L'Autorité de Régulation Multisectorielle</i>
ASUFOR	<i>Association des usagers des forages, Senegalese WUA</i>
BCCs	<i>Bureaux de Conseil et Contrôle</i>
BOTT	Build-Operate-Train-Transfer
BWSPP	Bangladesh Water Supply Program Project
DFID	Department for International Development
DNH	National Water Supply Directorate
DWAF	Department for Water Affairs and Forestry
EAP	East Asia and the Pacific
EMWF	East Meets West Foundation
ERSSAN	Regulatory agency in Paraguay
GPOBA	Global Partnership on Output-Based Aid
GRET	French NGO
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFC	International Finance Corporation
MDG(s)	Millennium Development Goal(s)
NGO(s)	Non-Governmental Organization(s)
NWDPII	Second National Water Development Project
OBA	Output-based Aid
ONEP	<i>Office Nationale l'Eau Potable</i>
PAEPEBA	Water supply project in Senegal

PAR	<i>Programme d'Application de la Réforme du système de gestion des infrastructures hydrauliques d'approvisionnement en eau potable en milieu rural et semi-urbain</i>
PEPAM	Senegalese Millennium Development Program for Water Supply and Sanitation
PIA	Project Implementing Authority
PMU	Project Management Unit
PPCs	Provincial People's Committees
PPIAF	Public Private Infrastructure Advisory Facility
PROSEA	National Water Supply and Sanitation Program (Mali)
PRSC	Poverty Reduction Support Credit
RDA	Rural Development Academy
RRESFMR	Belgian water project in Senegal
RURA	Rwanda Utility Regulatory Agency
RWSN	Rural Water Supply Network
RWSSE	Rural Water Supply and Sanitation Enterprise
RWSSP	Rural Water Supply and Sanitation Project
STeFi	<i>Le Suivi Technique et Financier</i>
USAID	United States Agency for International Development
WH India	Water Health India
WHI	Water Health International
WSP	Water and Sanitation Program
WUA	Water User Association

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EXECUTIVE SUMMARY

This study examines experiences with using the private sector to manage domestic water supplies serving dispersed populations or very small settlements in rural areas. The potential contribution from private operators is well-known for small towns. The unanswered question is whether private operators are an option for more remote rural areas with low population density. This review therefore focused on operations that:

- Serve dispersed populations or settlements with fewer than 5,000 inhabitants in rural areas,
- Have been undertaken on a significant scale, and
- Engage individuals or for-profit organizations to manage water supplies.

The rationale for examining rural private operator models is twofold: sustainability and expanded access. First, rural private operators may offer a solution to the high rates of non-functioning water points, especially in rural Africa. Second, private operator models may enable governments to leverage private capital and rationalize government subsidies for rural domestic water infrastructure. Those capacities would enable governments, in turn, to expand access to safe rural domestic water supplies.

Annex 1 describes the 25 initiatives reviewed in this study. They come from Sub-Saharan and North Africa, Latin America, the Caribbean, and South and Southeast Asia. Africa has spawned the most initiatives in response to a widespread problem with community management. Elsewhere, the initiatives are responses to more idiosyncratic local conditions.

Private operators managed the full range of rural water supply technologies, from protected springs to large and complex piped systems. The most common type of technology is a piped scheme with a pump or pumps, and some form of water treatment. Only three initiatives included handpump supplies. Of those, Rwanda also included a few protected springs.

The profiles of the operators vary widely, from multinational firms to respected village elders. At one extreme is Sodeci, a subsidiary of the multinational SAUR, which manages upwards of 100 rural schemes serving small settlements. At the other end are the Mauritanian elders managing piped schemes in their villages.

Some initiatives have faced series problems in attracting competent private operators. The following techniques and activities have helped attract acceptable bids:

- Grouping schemes into profitable clusters,
- Build-and-operate contracts, and
- Training and support in bid preparation.

Seven types of organizational design have emerged, based on the lead organization or group. These types can be grouped as decentralized or centralized, depending on whether the

lead organization or group operates at a national or sub-national level. Table 1 presents the seven types with examples.

Table 1: Seven Types of Lead Organizations or Groups in Rural Private Operator Initiatives

Decentralized			Centralized			
Rural Entrepreneur	Local Government	Utility	Ministry	Agency	Utility	NGO/Private
Cambodia	Benin	Malawi	Niger	Mauritania	Cote d'Ivoire	India (Naandi)
Vietnam (Tien Giang)	Burkina Faso	Vietnam (Red River)	Senegal	Paraguay	Gabon	
	Mali		Bangladesh (BWSPP)		Morocco	
	Rwanda					

Source: Annex 1

No common practice exists within or across organizational designs regarding community organizations. In Niger, Senegal, Burkina Faso, and Paraguay, water user associations (WUAs) are integral to the private operator management model, while Rwanda does not use these associations. Benin has two types of private operator contracts, one of which uses WUAs, and another that does not.

Evidence is scarce on the financial sustainability of supplies managed by rural private operators. The information available from the documents is as follows:

- **Niger and Senegal:** Many schemes are profitable, even under community management. The advantage of private operator management has been that it has been possible to improve maintenance and finance major repairs.
- **Burkina Faso:** One private operator has been able to realize a modest profit on seven schemes in the first year of operation.
- **Bangladesh:** The schemes constructed under the two initiatives are at best breaking even.

Some schemes cannot generate sufficient revenue, even after a private operator takes over. Options in addressing this challenge are as follows:

- Financial and technical diagnosis prior to tendering,
- Grouping schemes into profitable clusters,
- Metering, and
- Subsidized connections.

The principal conclusions are as follows:

1. Rural private operator initiatives are a promising option for addressing the problems of sustainable operation and maintenance.
2. Build-and-operate designs have improved several rural private operator initiatives.
3. Rural private operator initiatives are not an alternative to capable government institutions.
4. Analysis will be crucial in learning to judge when, where, and why to employ the rural private operator option.

The following recommendations, taken together, describe a program to ensure that the Bank carries out this crucial analysis. Governments and development partners will implement more rural private operator initiatives over the coming years because this model has shown results where other management models performed poorly. The initiatives will perform better if feedback is available on what is working and what is not. The studies and analyses listed below will inform this feedback:

1. Undertake a similar desk review of community management models.
2. Examine more closely the utility models for rural water supplies.
3. Bring into the Bank more information on the successful operations of other development partners.
4. Document and compare the processes by which successful or promising rural private operator initiatives have been put in place.
5. Encourage Bank operations to undertake more field survey evaluations.
6. Have the Bank lead an international community of practice on rural and small town private operators.

1. INTRODUCTION

This study examines experiences with using the private sector to manage domestic water supplies serving dispersed populations or very small settlements in rural areas. The purpose is to familiarize World Bank staff and others with how private operators have been used as an alternative to traditional community management, and with what success. The ultimate goal is to expand the range of management options that Bank staff discuss with clients, and thereby identify the one most likely to fit operations in a given context. This desk review is the first step in this direction.

One underlying issue is the sustainability of rural water supplies, particularly in Africa. Sustainability has numerous aspects, as past reviews of the literature have pointed out (Bakalian and Wakeman, 2009, p.8-9, Parry-Jones, et al., 2001, p. 6-24). For rural consumers, however, sustainability generally comes down to the functioning of the supply: does the infrastructure continue to provide them with water or not? As statistics presented in the next chapter will show, rural Africa has high numbers of water supplies that are not working. The question must be asked: does the problem lie in poor management, or elsewhere? If the problem is management, does private sector management offer a solution?

A second issue comes down to expanding access. For governments to maintain and expand access to safe rural domestic water, they will need to bring in more private financing and use public funds more effectively and efficiently. Rising standards for the level of service, from point sources to household connections, complicate these tasks further. Vietnam illustrates this challenge. The government now promotes rural piped schemes wherever possible. With the Bank's assistance, large and complex rural schemes are being built in the Red River Delta region. Meanwhile, as Vietnam transitions from IDA to IBRD loans, concessional finance has to be used more judiciously to leverage private capital rather than simply to pay for large public investment programs. Such changes will require a management model that goes beyond the simple form of community management that has been used elsewhere the country, especially given that community managed schemes in Vietnam already experience sustainability problems.

The potential for private operators is evident in rural small towns, but much less so in smaller rural centers and villages. As a rule of thumb, one assumes that potable water supply will be more profitable where population densities and incomes are higher, businesses are located, and communications are good. All these factors are associated with lower delivery costs and greater effective demand for water services. These factors also correlate with settlement size. Therefore, the truly unanswered question is whether private operators can successfully manage water supplies serving very small settlements and dispersed populations in rural areas, that is, where the preceding factors are less prevalent.

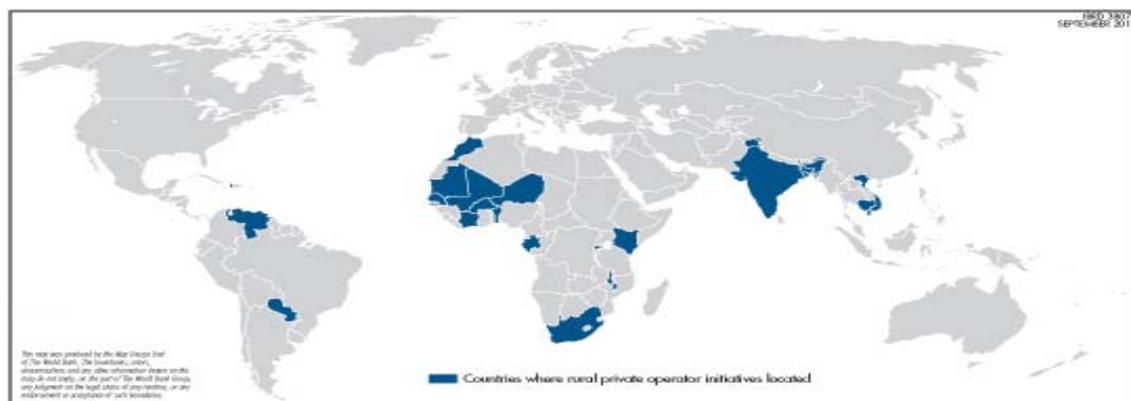
The preceding issues and concerns set the parameters for this study. This report represents a desk review of initiatives meeting the following criteria:

- **Serve a dispersed population or settlements under 5,000 inhabitants in rural areas:**¹ This criterion maintains the focus of the study on management models that can keep water supplies functioning under challenging rural conditions. A simple population criterion cannot pretend to capture all the nuances that distinguish rural and urban areas, especially as these vary across countries and regions. However, such a criterion is easily applied and at least filters out many clearly urban and peri-urban situations.
- **Initiatives have been undertaken on a significant scale:** The study is intended to provide Bank staff with information to help them in designing operations. It is difficult to apply lessons from isolated cases to programs on the scale at which the Bank implements.
- **Private individuals or for-profit organizations manage the operations:** “Manage” in this context refers to the responsibility for one or more functions such as maintenance, billing and payment collection, repair, and major replacement.

“Initiatives” is used as a broad term to encompass the various means—strategies, programs, projects, and grassroots actions—through which rural private operators have emerged. The initiative may have been a project, such as Régefor in Senegal. Alternatively, the initiative may have been a strategy or policy, such as the Small Towns Initiative that Benin instituted to release the trigger for the Bank’s third Poverty Reduction Support Credit. Sometimes the initiative comprises actions by the private sector, for example, the small piped schemes built and operated by entrepreneurs in Cambodia and Tien Giang Province in Vietnam.

The 25 initiatives reviewed in this study are described in Annex 1 and indicated in Figure 1. All the initiatives meet the criteria set out above in terms of population (under 5,000 inhabitants per settlement), scale, and operators from the private sector. These initiatives are located around the world, as Figure 1 indicates. The initiatives are drawn from both Bank and non-Bank sources.

Figure 1: Location of the 25 Rural Private Operator Initiatives, reviewed in this report



Note: Dark areas represent the countries where the rural private operators covered in this study are located.

¹ “Settlements” refers to the physical location of dwellings. For instance, rural people in a single administrative village or commune may in fact live in quite small settlements separated by agricultural lands. The supplies themselves may serve more than 5,000 persons, as is the case when large piped schemes link multiple small settlements.

World Bank-assisted investment operations are one source of rural private operator initiatives. Among the 25 initiatives are 11 Bank-assisted investment projects. In some cases, the project comprises the bulk of the initiative. For example, the Bank and the Vietnamese government agreed to pilot a radically different approach to managing rural and water supplies through the Red River Delta project. In Niger and Senegal, by contrast, the rural water components in the Bank projects take an approach that had already been developed through other projects and incorporated into sector policy.

Sometimes other types of World Bank Group instruments assisted the initiatives. For instance, International Finance Corporation (IFC) made equity investments in the K-Rep Bank and Water Health International, and these two organizations in turn supported rural private operator initiatives in Kenya and India respectively. The Public Private Infrastructure Advisory Facility (PPIAF) and Global Partnership on Output-Based Aid (GPOBA), two donor trust funds administered by the Bank, supported several of the 25 initiatives, including the Kenyan and Indian ones.² In Benin and Rwanda, Poverty Reduction Support Credits (PRSCs), a type of general budget support operation, promoted sector reforms that included a significant role for rural private operators. Rwanda illustrates how different instruments can complement each other: the Bank's rural water supply project identified the need to move sector policy toward rural private operators, and the PRSCs subsequently set targets for the number of rural schemes managed by private operators. The Water and Sanitation Program (WSP), another Bank-administered trust fund, provided technical assistance.

Some initiatives have little Bank involvement. Burkina Faso is a prime example, where the *Agence Française de Développement* (AFD) has been the main partner in shifting rural sectoral strategy toward private operators, with additional support from others such as Danida. A similar story can be told for Mali and Mauritania.

² PPIAF is the Public-Private Investment Advisory Facility. GPOBA is the Global Partnership on Output-Based Aid. Both are trust funds administered by the World Bank.

2. ISSUES UNDERLYING RURAL PRIVATE OPERATOR MODELS

The issues underlying this study are twofold: the sustainability of rural water supplies, and the cost-effective and sustainable expansion of rural water supply access. The study reviews information on whether and to what extent the private sector has successfully managed small rural water supplies. This chapter explains how that seemingly narrow focus relates to two key issues—challenges—facing the sector. Section 2.1 presents the issue of sustainability. Section 2.2 looks at expanding access.

2.1 Sustainability of Rural Water Supplies

The impetus for this study originated in the problem with non-functioning rural water supplies in Africa. Although sketchy, data indicates that an average 25-30 percent of rural water supplies in Africa appear not to be providing water. Section 2.1.1 presents the available statistics.

This problem raised the issue of whether the private sector could operate rural handpumps more effectively. The United Kingdom's Department for International Development (DFID) study of handpump sustainability in Africa concluded that simply handing over all responsibility for handpump maintenance to community organizations had not worked very well in practice, and that the alternative of using private individuals and organizations to manage the schemes should be explored. Section 2.1.2 briefly summarizes conclusions from the DFID study as well as subsequent work by some of its authors.

Studies by the World Bank and others suggested the need for more attention to private sector operation of all types of rural water supplies. Harvey and Reed, two researchers on the DFID study, argued that private sector alternatives to community management should be investigated for other types of rural water supply technologies. Several studies by the World Bank, WSP, and others had done precisely that. Section 2.1.3 presents these studies, along with the conclusion that private operators in rural areas outside of towns have been understudied. This provides the justification for the particular focus of this desk review on rural water supplies serving very small settlements or dispersed populations

2.1.1 Non-functioning Rural Water Supplies in Africa

The continued functioning of rural water supplies in Africa remains problematic, despite much progress over the past three decades. The recent Bank Africa Infrastructure Country Diagnostic (AICD) report states the following in regard to rural water supply:

...the big challenge, in addition to continuing to expand access, is the high breakdown rate due to lack of maintenance, threatening the sustainability of what has already been achieved (World Bank, 2009a, p. 159).

AICD and other reviews estimate a median 24-30 percent of rural water supplies are not functioning in Africa, with considerable variation among countries. The following table

presents the statistics from these sources. Some countries, such as Senegal and Madagascar, seem to be doing quite well, with only an estimated five to ten percent of supplies non-functioning. At the other extreme, countries such as Congo have 65 percent or more of their handpumps not functioning, although the situation for other types of supplies is not necessarily so bleak. Performance varies considerably by type of supply in Cameroon and Mali as well.

Table 2: Percentage of Non-Functioning Rural Water Supplies by Country, Source of Data, and Type of Supply

Source of Data	RWSN	PER	PER	AICD
Type of Supply	Handpumps	Handpumps	Mechanized Boreholes & Piped Schemes	Rural Water Points
Country				
Angola	30	--	--	--
Benin	22	15	5	25
Burkina Faso	25	23	33	38
Cameroon	25	35	75	
Chad	--	--	--	33
Congo, Democratic Republic of	67	--	--	41
Côte d'Ivoire	65	--	--	23
Ethiopia	35	--	--	--
Ghana	--	20-30	20-30	--
Guinea	20	--	--	--
Kenya	30	--	--	--
Lesotho	--	--	--	23
Liberia	31	--	--	--
Madagascar	10	--	--	15
Malawi	40	--	--	36
Mali	34	34	13	--
Mozambique	25	--	--	--
Niger	35	> 25	> 25	--

Source of Data	RWSN	PER	PER	AICD
Type of Supply	Handpumps	Handpumps	Mechanized Boreholes & Piped Schemes	Rural Water Points
Country				
Nigeria	65	--	--	--
Rwanda	--	--	--	30
Senegal	--	--	--	5
Sierra Leone	65	--	--	--
Sudan	--	--	--	17
Uganda	20	--	--	21
Zambia	32	--	--	--
Zimbabwe	30	--	--	--
Median	30	25	25	24

Sources: **RWSN:** Compiled for the Rural Water Supply Network from various sources (Harvey, 2009). **PER:** Data on Benin, Burkina Faso, Ghana, Mali, and Niger (World Bank, 2009g, p. 15). Data on Cameroon (World Bank, 2009c, pgs. 16-17). **AICD:** (World Bank, 2007a).

In-depth studies generally back up the picture given by AICD and other sources. WaterAid surveyed rural water points in 51 districts of Tanzania and found 46 percent of them not functioning. Of the ones that had been installed within the preceding two years, 25 percent were not working (WaterAid Tanzania, 2009, p. 2). Baumann and Danert found 20 percent of Malawi's rural handpumps and 51 percent of the taps on its rural piped schemes not functioning (Baumann and Danert, 2008, p. 21). A survey of 13 provinces in Burkina Faso in 2005 found 24 percent of handpumps and 65 percent of piped schemes not functioning (ANTEA, 2006, p. 10-23). Bakalian and Wakeman found 10 percent of the handpumps were not working in two hundred Ghanaian villages six years after installation (Bakalian and Wakeman, 2009, p. 79-81).

2.1.2 Handpumps

Statistics such as these led DFID to launch a major investigation of the factors influencing handpump sustainability (Harvey and Reed, 2004, Parry-Jones, et al.). Handpumps have long been promoted as the most appropriate technology for poor, small, and remote rural communities. Donors have consequently financed huge handpump projects over the last several decades, as a result of which "handpumps have become the principal technology for supplying water to over one billion people in rural areas in at least forty developing countries" (Harvey and Reed, 2004, p.5). Problems with handpump sustainability, however, belie the wisdom of the investment in certain countries and regions.

DFID researchers noted the following regional differences affecting handpump sustainability. In their analysis, these factors make it more difficult to establish sustainable handpump supplies in Africa compared to Central America and South Asia (Parry-Jones, et al., 2001, p. 4-5).

- **Government and private sector institutions:** African local governments have less capacity, experience, and authority to deliver services compared to South Asia. Also, South Asia and Central America have active and well-established small and medium-sized private enterprises to handle handpump installation and maintenance. India has a significant number of village mechanics. Africa, by contrast, has a weaker rural private sector capable of handling handpumps.
- **Market conditions:** High population densities in South Asia and Central America created better market conditions—more obvious demand, lower per capita costs of services—than in Africa. Furthermore, South Asia had more micro-finance credit schemes than in Africa, and consequently more widespread effective demand.
- **Mechanical pump tradition:** South Asia and Central America have a long tradition of using mechanized lifting devices for irrigation, drinking water, or both. This history has inculcated a tradition of pump maintenance that does not exist in Africa.

Related research found that handpump supply chains were commercially viable in Asia, but not in Africa. WSP examined the factors necessary for sustainable handpump spare parts supply chains (Robinson and Paul, 2000, Oyo, 2006, Robinson, 2000, Oyo, 2001). This work concluded that market-based supply chains succeeded in Pakistan and Bangladesh due to high population densities. Conversely, low population densities in Africa rendered commercial supply chains unviable (Oyo, 2006, p.11). Other researchers reached similar conclusions (Harvey and Reed, 2005).

These findings challenged the assumption that governments and donors could install handpumps and leave them to communities to manage. Community management means that a community organization has responsibility for the oversight, operation, and maintenance of the water supply, including financing these functions. Since the 1990s, this management model had been widely embraced for rural water supplies, particularly handpumps. There was a more or less standard approach as to how to put community management in place during the implementation phase of a project, at which point donors and the government were supposed to be able to withdraw from responsibility for the rural water supplies (Kleemeier, 2000, p. 932-933). The findings from the handpump sustainability research challenged this approach: community management would not keep the handpumps functioning in the absence of the right configuration of markets, government institutions, and tradition.

The DFID research concluded *inter alia* that private management or public-private management partnerships for handpumps should be explored. In this approach, the private sector would manage the water supply, and communities would pay for the service (Harvey and Reed, 2004, p. 42-46, 174-181, Harvey and Reed, 2006, p. 374-375, Parry-Jones, et al., 2001, p. 29-31). Harvey and Reed (Harvey and Reed, 2004, p. 370-372) reasoned that the critical factor in

sustainability was whether the users had a sense of responsibility for financing the upkeep of the water supply. There was no intrinsic link between this sense of responsibility and whether a community owned or managed the supply.³

Two possible models of private management for handpumps were cited, neither of which had yet proven itself. One model was for a small town utility to own and operate handpumps in surrounding villages, and charge a fee for this service. The other model was for a handpump distributor to sell an extended warranty for its products to the village water committees. The projects cited in the literature as piloting these models, however, have not produced good results. Annex 2 provides further information.

2.1.3 Other Rural Water Supplies

Harvey and Reed argued that community management of all rural water supplies in Africa—not just handpumps—required strong institutional support and adequate funding from government, NGOs, or both. When these requisites were absent or weak, the authors argued, too many communities failed to maintain their handpumps and other types of rural supplies. Community participation during construction was necessary for eventual sustainability, but no substitute for long-term institutional backup and government subsidies. The authors cited studies that showed sustainability of rural water supplies to be highest in specific districts of Uganda, Ghana, and Zambia where local government or NGO support was strongest. The authors' point was not that community management was a failure; obviously, it had delivered results in many cases. Rather, the authors had a more nuanced argument: community management in Africa was more widespread than the conditions for its success (Harvey and Reed, 2006, p. 372-373).

Research on Malawi's piped schemes supported this view of community management.

Malawi's rural piped scheme program won world-wide acclaim during the 1970s and 1980s as a model for using community participation to establish community managed rural water supplies. Research in the 1990s showed that successful community management had in fact depended on on-going financial and technical support from the government. That support was forthcoming as long as donors were financing huge rural water supply construction programs, and the political regime that had delivered piped schemes remained in power. When the Banda regime fell, and donors stopped rural piped scheme investments, the community management of the schemes slowly but steadily fell into disrepair due to the lack of government support (Kleemeier, 2000, Kleemeier, 2001).

Work on community-managed rural piped schemes in Latin America identified the need for long-term institutional support. Lockwood cited a number of studies and donor reports indicating that communities in Latin America required post-construction support. He summarized a number of models providing this support, based on United States Agency for International Development (USAID) experiences in Latin America (Lockwood, 2002).

³ In addition to private management, the DFID research also cited self-supply as an alternative to community management. See Annex 1 for additional information on this approach.

If the conditions for community management of rural water supplies are not present, the choice lies between seeking to establish those conditions, versus considering alternatives such as private operators. The former option has received most attention in the literature until recently. As just mentioned, this was the thrust of Lockwood's work. Bakalian and Wakeman explored the impact of different types of post-construction support programs on sustainability, starting with a review of this literature (Bakalian and Wakeman, 2009, p. 5). The latter options, alternatives to community management such as self-supply and private management, have received less attention in the secondary literature. Lockwood mentioned the potential for private sector operators in Latin America, without however pursuing the topic (Lockwood, 2002, p. 5). The conclusions of the DFID research on handpump sustainability, cited above, called for exploring private management alternatives. Harvey and Reed laid out several public-private or private maintenance models for rural water supplies in general (Harvey, 2005, p. 7-9, Harvey and Reed, 2004, p. 174-181). These two authors stressed that the need to tackle the sustainability problem makes it imperative to investigate multiple models, that is, revised versions of community management as well as alternatives.

Studies by the World Bank, WSP, PPIAF, and others lent weight to the idea that private operators could improve the sustainability of rural water supplies. Triche, Requena, and Kariuki examined six World Bank projects that had more or less successfully engaged the private sector to operate, or build and operate, piped schemes in small and medium-sized towns (Triche, et al., 2006). Baker, building on the work of Kariuki and Schwartz, identified successful examples of the private sector operating rural schemes in Cambodia (Baker, 2009, Kariuki and Schwartz, 2005). WSP found numerous examples in Francophone Africa where the government had successfully delegated the management of rural and small town schemes to private operators (WSP, 2010). A similar study of Ghana, Mali, Mauritania, and Mozambique by another group was also generally favorable (Valfrey-Visser, et al., 2006). One caveat to these findings, though, is that the studies did not have the opportunity to ascertain the long-term financial viability of the schemes.

The question remains as to whether private operators can improve the sustainability of piped schemes, handpumps, and other point sources in rural areas. The studies just cited looked at piped schemes in a range of types and sizes of settlements, including peri-urban and large rural towns. The study findings were generalized across this range. Consequently, it was not clear how well the private sector succeeded in managing piped supplies in rural areas outside small towns, that is, where the commercial prospects are most challenging. Handpumps and other point sources have generally not been considered, except for the WSP review that covered motorized boreholes in West Africa (WSP, 2010). In that case, the findings again were combined across rural and semi-urban areas.

2.2 Expansion of Rural Water Access

The World Bank has identified increased private investment and more cost-effective public investment as mechanisms to expand rural water access. The Bank, governments, and other donors have invested huge sums in the push to reach the Millennium Development Goal (MDG)

for rural water. Maintaining and expanding these coverage rates will be just as challenging, though, especially as rural people begin to demand higher service levels. One mechanism to meet the financing challenge is for public investment to leverage private investment. A second mechanism is more cost-effective use of public funds through output-based aid (OBA). Therefore, the Bank has introduced both mechanisms in its lending operations, including those for rural water supply.

The Bank has tested both mechanisms through contracts with private operators to build and operate rural water supply projects. These contracts engage the private sector to build, or design and build, the water schemes, and then to operate them for a certain number of years. Such contracts require the private sector partner to finance part of construction and then recover these costs from consumers' water payments during the operation phase. In this way, private investment—first by the private sector, and ultimately by the users—pays in part for expanding rural water access. In a number of these contracts, the Bank also has introduced an output-based aid element. Rather than disburse the Bank funds in advance of construction, the government reimburses the contractor-operator with fixed amounts of Bank funds as specified construction targets are met. This approach implies that public funds will be used more effectively, because they will no longer pay for cost overruns. OBA can also be designed to reduce the level of subsidies that the government provides to rural water supplies by having the private sector submit bids and then awarding the project to whomever can execute the works for the lowest subsidy.

For example, World Bank projects in Cambodia and Paraguay leveraged private investment for very small rural settlements. Triche, Requena, and Kariuki reviewed six Bank projects that had engaged local private operators (Triche, et al., 2006). Four of these projects had leveraged financing from the private operators through some form of a build and operate contract. Two of those four projects, in Paraguay and Cambodia, planned schemes in very small rural settlements.⁴ In the Cambodia project, the private operators had to provide ten percent of the long-term investment, to be recovered through the tariff. In Paraguay, the private operators also had to recoup a portion of the investment costs through the tariff and connection fees (Requena and Triche, 2006, p. 99,103).

The Paraguay project incorporated OBA in the contracts with private operators as a means to control the public share of construction costs. In the first phase of the project the rural development agency reimbursed the private operator with a fixed sum per connection after construction was completed and the connections were installed. In Phases 2 and 3, when more expensive schemes were being built, the operator was reimbursed in several tranches during construction, as specified outputs were met. The total amount of the reimbursement remained fixed, however, as a multiple of the number of connections.⁵ In their tenders, private firms bid against each other with the lowest required reimbursement being one of the deciding factors (Requena and Triche, 2006, p. 94, 95, 102, 105).

⁴ Population figures were not provided, but judging by the number of planned connections, the smallest settlements had no more than 5,000 inhabitants.

⁵ In all three phases, government paid only up to the planned number of connections.

The Bank's Morocco rural water supply and sanitation project incorporates OBA in an effort to make subsidies for operations and expansion more effective. The national utility, *Office National de l'Eau Potable* (ONEP), had found that costs were too high to operate piped schemes profitably in small towns and the surrounding rural areas. As a pilot, ONEP will select a private operator to take over the small piped networks in one area of the country. The operator will be remunerated from water sales, and from subsidies that the utility will provide against three outputs: increased number of household connections, increased water sales, and network expansion into the surrounding rural villages. Thus, the contract sets up a number of incentives for the operator to keep down operation and maintenance costs, and increase water sales and the customer base. These actions are key to turning schemes into a financially viable business, and to expanding service to larger and rural populations (Chauvot de Beauchene, 2009).

In short, another question concerns whether design-and-build contracts, OBA, and other design elements can deliver additional benefits from rural private operator initiatives. The last section discussed whether and why private operators might be better able to keep rural water supplies functioning. There may be other benefits such as more private financing, more efficient operations, and more transparent and lower public subsidies that can result as well from particular designs of private operator models.

3. OVERVIEW OF RURAL PRIVATE OPERATOR INITIATIVES

This chapter describes some general characteristics of the 25 initiatives, based on the information on each initiative presented in Annex 1.

3.1 Impetus and Objectives

Africa has spawned a large number of similar rural private operator initiatives in response to a common and widespread problem. In the other regions, the initiatives are more idiosyncratic responses to country or local conditions.

Africa

The impetus toward rural private operators in Africa stems principally from the poor maintenance of community-managed supplies. This finding comes as no surprise, given the Chapter 2 description of how poorly rural water supplies function in Africa. For example, a census in Burkina Faso found that 65 percent of the piped schemes in the project area were not functioning at the start up of PAR⁶, the AFD-assisted program to test rural private operator models. Malawi had a world-renown program of community-managed rural piped schemes, which deteriorated over time to the point where only about 50 percent of taps were functioning. Mauritania, Niger, Benin, and Rwanda have similar histories that caused the governments to turn to rural private operator models. By contrast, Kenya still relies largely on community organizations to manage rural piped schemes directly. However, a Bank Group-assisted microfinance project designed to help these organizations concluded that they must hire private operators for sustainable management.

In Gabon and Cote d'Ivoire, private operators took over rural piped schemes that had previously been managed by public utilities. These two countries are an exception to the trend just described. Traditional community management remains the norm for most rural water supplies in Gabon and Cote d'Ivoire. However, public utilities had responsibilities for numerous piped schemes serving small rural communities. When these utilities were let to private operators, on concession and lease contracts respectively, these rural schemes in fact became privately managed. The results have been quite positive, which is somewhat surprising given that community management evolved as a reaction to the failures of centralized operation and maintenance of rural water supplies.

As a result of the widespread problems with maintenance, and the efforts to address those projects, Africa has the most experience with rural private operator initiatives. This experience has several dimensions.

⁶ PAR stands for *Programme d'Application de la Réforme du système de gestion des infrastructures hydrauliques d'approvisionnement en eau potable en milieux rural et semi-urbain.*

- **The most countries where these initiatives have been tried:** Benin, Burkina Faso, Cote d'Ivoire, Gabon, Kenya, Malawi, Mali, Mauritania, Niger, Rwanda, Senegal, and South Africa have experimented with rural private operators in some form. (The list of countries would be much longer, except for the population criterion of 5,000 used as a cut-off in identifying initiatives for this review.)
- **The most countries where sector strategy emphasizes the role of rural private operators:** This is true of all the preceding countries except Kenya, Malawi, and South Africa.
- **The most initiatives of long date:** Mauritania, Niger, and Senegal began to experiment with rural private operators in the 1990s. So did Gabon and Cote d'Ivoire, although those two countries took a markedly different approach. Rwanda and Burkina Faso had started using rural private operators on a large scale by 2004.

East Asia and the Pacific

The rural private operator initiatives in East Asia and the Pacific (EAP) differ from each other, and those in Africa, because the EAP initiatives are responses to different situations. EAP offers examples of two markedly different types of initiatives: grassroots entrepreneurship versus a government initiative to consolidate ownership and management at the provincial level. Not surprisingly, these two categories of initiatives are responses to quite different situations.

Entrepreneurs in rural Cambodia and the Vietnamese province of Tien Giang stepped in to fill a gap in service provision left by limited public capacity. These owner-operators began to build and operate small piped schemes without outside support. A number of factors—high population density, easy access to water, the entrepreneurs' capacity largely to self-finance—created an unusual enabling environment. In Tien Giang, the provincial government's initial willingness to support these efforts through provincial policy was an additional factor. A Bank-assisted project in Cambodia and a GPOBA-backed initiative in Tien Giang and other provinces represent efforts to reinforce this trend through financing, build-and-operate contracts, and OBA.

The provincial water utilities in the Red River Delta region of Vietnam are a component in the effort to construct rural piped schemes that resemble urban and town supplies. The Red River Delta Rural Water Supply and Sanitation Project establishes provincial utility companies to own all rural piped schemes in their respective provinces. The objective is, first, to attract private capital into piped scheme construction and expansion. The second objective is to bring better technical expertise, equipment, and business principles through awarding management contracts to private companies. Both objectives stem from the nature of the infrastructure, which resembles urban water supplies in terms of cost, complexity, size, and level of service (see Annex 3).

Latin America and the Caribbean

Few countries in the Latin America and Caribbean region have experienced any push to introduce private operators for small rural supplies. The search for rural private operator initiatives revealed instead an enormous number of community-managed supplies. The

conclusion is that community management remains the norm for rural supplies. In some cases, these schemes were superbly managed, while in other cases management has been mediocre to poor (Nolasco, 2010, Nolasco and Associates, 2005, Nolasco and Associates, 2004). Poor management, though, has not generated a turn toward private operators, at least as far as the present study has been able to document.

Haiti and Columbia, however, have introduced rural private operator initiatives in response to the poor condition of existing schemes. The Bank is currently assisting the Haitian government to recruit local private operators to manage small rural schemes that have fallen into disrepair under community management. In Columbia, the Bank has long supported the government in its effort to introduce public-private partnerships for water services in cities. Since 2001, a Bank-assisted project focused on extending this approach to regional utilities and small municipalities, which included some small rural settlements.

A Paraguay initiative stemmed from an effort to minimize government investment costs, increase private financing, and improve consumer cost recovery. Community management of schemes was not the problem, apart from the *juntas'* unwillingness to collect sufficient user payments to repay loans. Using the private operator has addressed this problem. Competitively awarded build-and-operate contracts have also minimized the government subsidy required and introduced some private financing.

Middle East and North Africa

The Moroccan utility is experimenting with a rural private operator initiative in an effort to reduce the high costs of fulfilling its government mandate to serve rural areas. Since the mid-1990s, ONEP has served over 87 percent of the rural population, largely through standposts. ONEP has tested different models of private sector involvement, from established standpipe managers to more comprehensive performance-based service contracts (Chauvot de Beauchene, 2009, p.1). However, meeting the rising rural demand for household connections is a money-losing proposition for the utility. The initiative described in Chapter 2 and Annex 1 is an effort to use OBA to delegate a more comprehensive range of responsibilities—and risks—to rural private operators.

South Asia

The two Indian initiatives are different reactions to poor management of schemes, whether by government or communities. One model seeks to improve the management of multi-village schemes by handing production and transmission to a private operator, leaving distribution within each village to community management. A very different approach is to establish container sales of high-quality drinking water, and leave the poorly functioning government or community managed piped scheme to serve other domestic needs.

The two Bangladesh initiatives are efforts to promote piped schemes as a reaction to arsenic contamination in shallow ground water. Bangladesh has a wildly successful

handpump program. It provided a high level of service at an affordable price to the majority of the rural population, until arsenic was discovered in the shallow water table. The challenge now is to convince rural Bangladeshis to forsake their convenient and inexpensive shallow handpumps for safer rural piped schemes. The related challenge is how to construct and finance rural piped schemes on a large scale. The two Bangladesh initiatives propose different solutions. The Bank-assisted project uses a model quite similar to the Paraguay one. The other approach, developed by a national research institute, promotes schemes that provide both domestic use and irrigation water for a low investment and operating cost.

3.2 Technology

Private operators have taken responsibility for the full range of rural water supply technologies, from protected springs to large piped systems. Table 3 gives a general overview of the technologies involved in the 25 initiatives reviewed here. The most common type of technology is a piped scheme with a pump or pumps and some level of water treatment. Only three initiatives included handpumped sources. Of those, Rwanda also included a few protected springs.

The piped schemes are of vastly different size and complexity. WSP (WSP, 2010) provides an excellent description of the range of piped scheme technologies managed by private operators in Francophone Africa (see Table 4). Note that small rural settlements with populations of 5,000 or less (i.e., fitting the criterion used in this desk review) may be served through quite large multi-village schemes.⁷ Annex 3 compares the technical specifications for several piped schemes managed by rural private operators outside Africa. Again, the data illustrate the range in size of the piped schemes.

⁷ Niang Masse Niang, "The Development and Management of Rural Multi-Village Schemes: Main Findings of the Case Study in Senegal," (Dakar: Water and Sanitation Program, circa 2001)., p. 17 provides detailed population statistics for villages linked in 8 multi-village schemes.

Table 3: Rural Private Operator Initiatives by Technology

Country	Initiative	Handpumps		Piped Schemes — Power		Piped Schemes — Size		Other Supply	Water Treatment
		Shallow	Non-shallow	Gravity	Pumped	Large/ Multi-Village	Small/ Single Village		
AFRICA									
Benin	Sector Policy	✓	✓		✓	✓	✓		✓
Burkina Faso	PAR and Sector Policy		✓		✓		✓		
Cote d'Ivoire	SODECI <i>Affermage</i> Contract				✓	✓	✓		✓
Gabon	SEEG Concession				✓	✓	✓		✓?
Kenya	Microfinance for Water Services Project				✓		✓		✓
Malawi	National Water Development Program			✓	✓	✓	✓		✓
Mali	Sector Policy				✓		¶		✓
Mauritania	Sector Policy				✓		✓		✓?
Niger	Sector Policy				✓		✓		
Rwanda	Sector Policy	✓		✓	✓	✓	✓	✓	
Senegal	Régefor, PEPAM, and Sector Policy				✓	✓			✓
South Africa	BOTT				✓	✓			✓
EAST ASIA AND THE PACIFIC									
Cambodia	Rural Entrepreneurs in small centers				✓		✓		

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Country	Initiative	Handpumps		Piped Schemes — Power		Piped Schemes — Size		Other Supply	Water Treatment
		Shallow	Non-shallow	Gravity	Pumped	Large/ Multi-Village	Small/ Single Village		
Cambodia	Provincial and Peri-Urban Water and Sanitation Project				✓		✓		✓
Vietnam	Red River Delta RWSS Project				✓	✓			✓
Vietnam	EMWF Rural Water Supply Project				✓		✓		✓
Vietnam	Entrepreneurs in Tien Giang Province				✓		✓		✓
LATIN AMERICA AND THE CARIBBEAN									
Columbia	Water Sector Reform Assistance Project				✓		✓		✓
Haiti	RWSS Project			✓	✓		✓		
Paraguay	Fourth RWSS Project			✓		✓			✓
MIDDLE EAST AND NORTH AFRICA									
Morocco	ONEP Franchise System				✓	✓			✓
SOUTH ASIA									
Bangladesh	Water Supply Program Project				✓		✓		✓
Bangladesh	RDA Projects				✓		✓		
India	Bulk Water Supply to Multi-Village Schemes				✓	✓			✓
India	Naandi Foundation Water Treatment Plants							✓	✓

Source: Annex 1

Table 4: Typology of Piped Schemes for Domestic Water

Type	Description	Population Served	Length of pipeline (km)	Storage Capacity (m ³)	Production Capacity (m ³ /day)
Motorized point sources	Bank of taps and storage tank (ground level, or slightly elevated) next to borehole.	500-1,000	<0.1	2 - 10	5-10
Simple Piped Schemes	Small distribution network. Standpost connections only. Small, slightly elevated storage tank.	500 – 2,000	< 2	10 - 50	5-40
Standard Piped Schemes	Extended distribution network. Standpost and household connections. Large, elevated tanks.	2,000 – 10,000	2 - 10	50 - 150	20-300
Multi-village Piped Schemes	Extended transmission network connecting numerous villages.	5,000 – 200,000	10 - 250	100 – 1,000	100-2,000

Notes: The authors point out that motorized point sources and simple piped schemes comprise over 50 percent of the piped supplies in Burkina Faso, Benin, Mali, and Niger. The multi-village schemes are found primarily in Senegal and Rwanda (WSP, 2010). Malawi also has multi-village schemes that would fit the above description (Kleemeier, 2000).

Sources: (WSP, 2010, Adapted from Table 1)

The multipurpose schemes in Bangladesh stand out as unique compared to the piped scheme technology used in the other initiatives. The Rural Development Academy (RDA) developed this scheme design in an effort to improve the economics and efficiency of privately owned and managed irrigation. Domestic water supply was included initially as a way to make the schemes more profitable for their owners, by allowing them to sell water year-round.⁸ The domestic supply component turned out to be a possible solution to arsenic contamination in the shallow groundwater as well. The key technological innovations—in addition to being multipurpose—are as follows:

- **Buried pipeline:** By using a buried transmission pipe rather than an open channel to distribute irrigation water, a given tubewell (2 cusec capacity) can irrigate 67 hectares, as opposed to 16 hectares (Matin, et al., 2003).
- **Low-cost deep tubewell:** RDA lowered the construction cost for a deep tubewell by 30-40 percent. The power consumption is also reduced. The key to the lower costs are threefold: a particular manual drilling process; less expensive materials for the housing, blinds, and strainers; and a small and less expensive pump (Matin, et al., 2006a, Matin, et al., 2003).

The Naandi Foundation initiative deploys another unique technology. The foundation originally partnered with Water Health International, an American company that manufactures an ultraviolet process to kill water-borne pathogens. The treatment plant fits in a small building, about the size of a one-car garage, located next to a surface water source. Water is sold in reusable

⁸ Irrigation pump owners can typically only sell water during the three-month *boro* rice season.

plastic jerry cans from a distribution point at the plant, either directly to consumers or to water vendors who make home deliveries. The Naandi Foundation subsequently also partnered with Tata Projects Inc., which markets a reverse osmosis process to clean chemically contaminated water. With both types of projects, the idea is to supply drinking water at a price well below the cost of bottled water.

3.3 Rural Private Operators

The profiles of the operators vary widely, from multinational firms to respected elders living in a village served by the supply. Table 5 groups these operators by the scale of their commercial operations, and gives examples for each group.

Table 5: Profiles of Selected Rural Private Operators, Grouped by Scale of Commercial Operations

Country	Initiative	Profiles of Operators
International		
Cote d'Ivoire	Sodeci	Sodeci is a subsidiary of the multinational SAUR.
Gabon	SEEG	Vivendi (later Veolia) bought a controlling interest in SEEG, the state-owned national water and electricity provider, in 1997 when it was privatized.
Burkina Faso	PAR and Sector Policy	Vergent Hydro, a French company, and its affiliate, Faso Hydro, were awarded build-and-operate contracts for 7 piped schemes
India	Naandi	The Naandi Foundation, a large and successful Indian NGO, partnered with Water Health International, a U.S. manufacturing firm that sells its products in the U.S., Latin America, and Asia, and has entered into similar public-private partnerships in Ghana, the Philippines, and India.
National		
Paraguay	4 th RWSS Project	The build-and-operate contracts under this project were awarded to consortia, led by construction firms with the capacity to meet the formal bidding requirements and raise the capital necessary to bridge periods until payments are received. The first winning consortia hired <i>aguateros</i> , small independent providers found largely in urban areas, to manage the schemes. The final contract required that an <i>aguatero</i> be part of the consortium.

Country	Initiative	Profiles of Operators
Bangladesh	Water Supply Program Project	The project largely failed to attract genuine private sector operators, due to risk, low returns, and lack of financing. Operators are NGOs (which in Bangladesh operate for profit) and wealthy individuals who are interested for charitable reasons.
Benin	Sector Policy	Among the 80 operators in Benin, the majority (74 percent) are national enterprises and consulting firms. (The remaining operators are individuals, community associations, and small micro-enterprises)
Local		
Niger	Sector Policy	A 2009 survey interviewed 31 out of the 41 operators who manage 175 piped schemes (including motorized boreholes). In this sample, 50 percent of the operators were individuals, motivated either by profit or a sense of social responsibility. They generally did not have water supply skills. Many were illiterate; some had primary or secondary school. Another almost 45 percent of the sample were very small enterprises or NGOs. Together the individual and small groups manage 95 percent of the schemes that have been delegated to operators.
Mauritania	Sector Policy	100 percent of the operators are individuals. See Table 6 for profiles.
Cambodia	Rural Entrepreneurs	These are individuals who live in the area. The systems are built and slowly expanded with family savings. The family manages the schemes and possibly associated activities such as ice-making or vehicle washing. The entrepreneurs' motivations are providing family employment, a steady revenue, and assurance of a retirement income.
Bangladesh	RDA	The private operators are individuals, either farmers or commercial persons. (Other operators are NGOs or village cooperatives.)

Sources: See Annex 1.

Mauritania illustrates the range of professional expertise even among individual local operators. Valfrey-Visser and his co-authors developed the profiles for the various categories of operators managing small piped schemes in Mauritania, as shown in the following table (Valfrey-Visser, et al., 2006, p.10). Note that in Mauritania, contracts are only awarded to individuals, and

only for a single scheme.

Table 6: Profiles of Rural and Small Town Private Operators in Mauritania

Operator	Local Individual	Professional	Entrepreneur
Supply Area	Village	Small center	Small town
Background of Contract-holder	Locally respected. Older. Elementary or secondary school.	Management experience. Often retiree or soon-to-retire.	Graduate degrees in engineering or management
Staffing	One multi-purpose, part-time employee	Plumber, pump attendant, invoice clerk	3-10 full-time technical and commercial staff

Source: (Valfrey-Visser, et al., 2006, Table 3, p. 10)

Some initiatives faced serious problems in attracting competent private operators. Bank investment operations in Vietnam and Bangladesh illustrate these problems.

- **Vietnam:** The Bank-assisted Red River Delta project in Vietnam established provincial rural water companies to own the assets and provide corporate oversight. The original plan was for these companies to outsource operations to the private sector through five-year operation and maintenance contracts. However, no bids were submitted by the private sector. As a result, the provincial companies will manage operations and maintenance directly. The plan to introduce accountability through a contractual relationship between the asset owner and the operator has therefore slipped, at least for the time being.
- **Bangladesh:** The Bank-assisted project in Bangladesh had difficulty in attracting operators, in part due to the failure of the project to establish a credit market as planned. Without financing, the private sector could not or would not mobilize the required 40 percent investment. Furthermore, the 10 percent of investment financing that was supposed to come from consumers proved difficult for the operators to collect; the experience has been that consumers start to pay their connection fees only when a scheme is near completion or operating. For all these reasons, the project dropped the required investment from the private operator to 30 percent, including 10 percent from the community, when the project was restructured.

Some techniques and activities have emerged that help attract acceptable bids from the private sector. Three responses are as follows:

- **Grouping schemes into profitable clusters:** Niger, Rwanda, and Burkina Faso did this, and as a result attracted more qualified companies. Vergnet Hydro, the French firm working in Burkina, found that the ability to spread costs and revenue across several schemes was indispensable to the firm's entry into the market. In Paraguay, one bidder won the first four scheme contracts, tendered separately. When interviewed, the consortium said that winning all four was necessary in order to achieve economies of scale (Requena and Triche, 2006). In Benin, the profitability of scheme management for

operators has been limited by so many of them having only one scheme (Fichtner Water and Transportation GmbH, 2010, p. 7-46).

- **Build and operate contracts:** Burkina Faso and Paraguay had great success with this. The Vergnet Hydro Director cited four advantages: the firm will do quality construction of a system that the firm must subsequently operate; there can be no subsequent disputes about the state of the infrastructure; the operator will be completely familiar with the system; and time is saved in the contracting process. WSP-Africa compiled a similar list (WSP, 2010). The Haiti project is considering build-and-operate contracts as a way to deal with the lack of interest in operations alone.
- **Training and support in bid preparation:** Benin, Niger, Rwanda, and Mauritania have provided assistance to the pre-qualified bidders as a means to increase the number of acceptable bids. This support is focused on the bids, given the unfamiliarity of firms and entrepreneurs with this new market opportunity for private scheme management.

3.4 Organizational Design

Lead Agency or Organization

Seven types of institutional structures are defined below, based on the lead organization or group. These types are further grouped by whether the lead organization or group operates at a national or a sub-national level. Table 7 presents the 7 types, with examples of each.

Table 7: Seven Types of Lead Organizations or Groups in Rural Private Operator Initiatives

Decentralized			Centralized			
Rural Entrepreneur	Local Government	Utility	Ministry	Agency	Utility	NGO/Private
Cambodia	Benin	Malawi	Niger	Mauritania	Cote d'Ivoire	India (Naandi)
Vietnam (Tien Giang)	Burkina Faso	Vietnam (Red River)	Senegal	Paraguay	Gabon	
	Mali		Bangladesh (BWSPP)		Morocco	
	Rwanda					

Source: Annex 1

The following paragraphs briefly describe each type:

- **Rural entrepreneurs:** Local entrepreneurs responding to grassroots demand have become operators. In Cambodia and Tien Giang Province, Vietnam, families have become owner-operators. (These are the two cases where groups rather than organizations take the lead.) Another example (described in Annex 1) comes from Niger, where local business people formed SONEXIE to repair and operate six schemes that had broken down under community management. These three cases are all considered

- successful, but it would be difficult to duplicate the particular circumstances that gave rise to this type of initiative.
- **Local government:** Where national governments have decentralized responsibilities to local government, these organizations may play the lead. Benin, Burkina Faso, Mali, and Rwanda have used commune governments to solicit, negotiate, and sign rural private operator contracts. Note that, so far, the relevant ministries have remained heavily involved in the process, due to the weak capacity of the communes. The Rwanda initiative has had a good track record. The other ones are relatively recent initiatives, and have so far only proven themselves promising.
 - **Regional utilities:** Sub-national utility companies may have the responsibility to recruit and oversee rural private operators. In Malawi, three regional utilities responsible for town water supplies have been given the additional duty of rehabilitating selected rural and market center piped schemes, and finding local private operators to manage them. In Vietnam, the provincial rural water utilities are being created on a pilot basis, with the intention that each will eventually recruit a private operator to manage all rural piped water schemes within a province. None of the utilities in Malawi or Vietnam have yet succeeded in putting in place a private operator, but the Bank-assisted projects to support the initiatives are still on-going.
 - **Ministry:** In some countries, the ministry has taken the lead, because rural water provision remains a central government responsibility (e.g., Senegal) or decentralization has not yet become effective (e.g., Niger). The rural private operator initiatives in both these countries are well established and have shown good results. One reason that Senegal has succeeded with the centralized approach is that the relevant water department has an extensive field presence. The Bank's experience in Niger was that local government should be more involved, and the government is issuing new guidelines to that effect.
 - **Agency:** In some cases, the relevant ministry has delegated responsibility for rural water supply to a separate agency. In Paraguay, this agency, National Sanitation Service (SENSA) is a government organization. In Mauritania, a national NGO (ANEPA) was formed for this purpose. The rural private operator initiatives in both countries have largely met their objectives. However, a number of shortcomings in ANEPA have been noted: it is highly subsidized; there are high staff costs, which are passed on to operators as high repair fees; there is a shortage of technical staff; and a poor record on preventative maintenance.
 - **National Utilities:** In Cote d'Ivoire, Gabon, and Morocco, the responsibilities of the national utility have been extended to include at least some rural water supplies. In Cote d'Ivoire and Gabon, the private national operator manages the rural schemes directly. Trémolet documents that this approach has been successful, but she suggests that opening up competition between national and local operators would likely both expand service and make it more financially sustainable (Trémolet, 2002). ONEP, the Moroccan utility, has tried various ways to outsource this responsibility to the private sector, including the latest project to give all the responsibility in an area to a single private operator.
 - **NGO/Private:** National and international NGOs and at least one private firm have designed their own approaches to rural water supply and private operators. The most prominent example is the Naandi Foundation. It has worked with a private manufacturer or contractor, where the latter builds and operates the supply while Naandi handles the financial aspects of managing the schemes. Another example is East Meets West Foundation. This NGO is now introducing rural private operators into its schemes in central Vietnam, to see if this can improve the financial and technical sustainability of its schemes.

Community Organizations

No common practice exists regarding community organizations. In fact, practices vary widely. In Niger, Senegal, Burkina Faso, and Paraguay, WUAs are integral to the private operator management model. Rwanda, on the other hand, does not use such associations if the private operator has been awarded the contract. Benin has two types of contracts for rural private operators, one with a water user association, and the other without.

Table 8: Types of Community Organizations in Rural Private Operator Models

Initiative	WUA	Other	None	Lead Agency/Group	
Benin	✓		✓	Decentralized	Local Government
Burkina Faso	✓			Decentralized	Local Government
Rwanda			✓	Decentralized	Local Government
Niger	✓			Centralized	Ministry
Senegal	✓			Centralized	Ministry
Mauritania			✓	Centralized	Agency
Paraguay	✓			Centralized	Agency
Cote d'Ivoire			✓	Centralized	Utility
Morocco			✓	Centralized	Utility
India (Naandi)		✓		Centralized	NGO/private

Source: Annex 1

Professional Support

The least developed aspect of the various rural private operator designs is generally professional support to the local levels. The Town Water Initiative, a research program undertaken by the Bank's Water Unit, emphasizes that a good management model provides local authorities, operators, and community organizations with professional expertise and training as needed (Pilgrim, et al., 2007). Furthermore, good governance requires that the source of this external assistance be separated in order to avoid conflict of interest. That means, for example, that a consulting firm hired to assist local authorities in regulating private operators should not also provide technical support to those operators. None of the initiatives has reached this ideal.

The three principal designs for providing professional support are as follows:

- **Lead organization:** As sector reform was originally conceived, central ministries had responsibility for providing technical expertise and training. The Water Department in Senegal does this through its extensive hierarchy of offices and brigades. Maintenance

work, however, has been outsourced to a private national firm. ANEPA in Mauritania has similar responsibilities, but with only solar equipment repairs outsourced.

- **Public-private partnerships:** Some central ministries realized that they could not provide sufficient support, and contracted with private firms or other third parties to provide support to operators, WUAs, and local governments. “Le Suivi technique et Financier” (SteFi) in Mali and the BCC in Niger are the most prominent examples. BOTT in South Africa also falls roughly in this category, although the initiative was designed primarily to provide support to local governments during scheme design and construction. Note that some projects have taken this approach to providing professional support to community management systems, for example, Bank-assisted rural water operations in Ethiopia.
- **Utility:** SEEG and Sodeci, in Gabon and Cote d’Ivoire respectively, have sufficient technical expertise within their organizations for this not to be an issue. In Malawi, the regional utility companies have been given responsibility to identify and put in place local private operators to manage the rural and market center piped schemes. Although the project documents do not spell out this relationship after construction, one assumes that the local operators could still turn to the regional utilities for technical guidance.

3.5 Sustainability

Evidence is scarce on the financial sustainability of schemes managed by rural private operators. This section will present evidence from a few schemes in Senegal, Burkina Faso, and Bangladesh. The general scarcity of such data, though, reflects several constraints:

- **Information not available from the schemes:** A June 2010 evaluation of Benin’s schemes found that recording keeping was not sufficient to determine their financial sustainability (Fichtner Water and Transportation GmbH, 2010). Other researchers have mentioned operators’ not unreasonable reluctance to divulge financial information.
- **Evaluations have not been carried out to collect these data:** The desk review has uncovered few rigorous evaluations of the experiences with rural private operators. The evaluations in Benin (just mentioned) and in Niger appear to be the exception rather than the rule (CEH-SIDI, 2009, Groupement Egis BCEOM International and Cabinet THEC, 2009).
- **Analyses of financial sustainability are not widely disseminated:** All information on financial sustainability used in this report was obtained through personal contacts. There is surely more information available, e.g., SENSEA must have examined the financial sustainability of the Paraguay schemes. The challenge is capturing that information.

One private operator in Burkina Faso was able to realize a modest profit on seven schemes in the first year of operation. Four schemes operated at a profit, and their revenues covered the deficit on the three other schemes. Table 9 gives the summary figures:

Table 9: Overall Financial Situation of Seven Schemes Managed by Vergnet Hydro-Faso Hydro after One Year of Operation, Burkina Faso

Type of Transactions	Amount (USD)
Revenue	74,300
Costs	59,500
Financial provision for repairs and handpump maintenance	11,500
Balance	3,300

Notes: CFA BCEAO converted to USD using exchange rate on April 30, 2010. Costs include \$19,300 paid to Vergnet Hydro and Faso Hydro for their management costs.

Source: (Vergnet Hydro, 2010)

In Niger and Senegal, the issue is not profitability *per se*, but whether private operators can improve maintenance and finance major repairs. Data on community managed schemes suggest that they bring in substantial revenue. Indeed in Niger, this has created the problem that village committee members do not want to relinquish their hold on the schemes to a private operator (CEH-SIDI, 2009). Evaluators in these two countries have been more interested in the question of whether the private operators manage the schemes better. The conclusion in Senegal was that private operators became necessary as the schemes increased in size and level of service (i.e., more individual connections). Community managers did not have the technical expertise required to balance the schemes so that all consumers got sufficient water (Niang, circa 2001). One Niger evaluation found that private operators did a better job overall. However, community managed schemes had shorter breakdown periods, probably because the managers lived in the supply area (Groupement Egis BCEOM International and Cabinet THEC, 2009).

The Bangladesh schemes are at best breaking even. The following table provides data on revenue and expenditures for two RDA schemes and one scheme constructed under the World Bank-assisted project. The operators for the two RDA schemes see their main problem as an inability to raise tariffs. No mechanism for this was included in the contract, and consumers have resisted any changes. Note that two schemes manage to break even financially only because of the revenue from irrigation. The World Bank-financed scheme suffers from a low number of connection holders. The business plan anticipated 946 connections, based on a village survey. By January 2008, there were still fewer than 175 connections. While that is roughly the same number as for the RDA schemes, the Bank-assisted scheme is much larger, and more costly to build and operate.

Table 10: Expenditure and Revenue for Selected Schemes, Bangladesh Taka

Scheme	Revenue				Expenditure	Balance
	Domestic	Irrigation	Other	Total		
Perijhur -- RDA <i>Monthly average</i>	8,003	4,429	963	13,394	13,083	311
Garmahastan--RDA <i>Monthly average, 2007</i>	3,638	2,703	0	6,341	6,202	139
Duptara—World Bank <i>Est. monthly average, 2007</i>	14,575	0	0	14,575	26,000	(11,425)

Note: The revenue for Duptara scheme has reportedly improved considerably since 2007.

Sources: (Kleemeier, 2008, Table 10).

Some schemes cannot generate sufficient revenue, even after a private operator takes over.

Private operators are not a panacea that cures all problems. An evaluation of the World Bank-assisted project in Niger noted that some schemes were inherently unprofitable. Private operators abandoned these schemes unless they were bundled with profitable ones (CEH-SIDI, 2009). A mission to Rwanda made a similar observation based on anecdotal information (Hydroconseil, 2009c). Options in addressing this challenge are as follows:

- **Financial and technical diagnosis prior to tender:** Existing schemes may need rehabilitation, have low prospects for profit, or simply not be viable. That information can guide how the tender is packaged, and pre-requisites for tendering (WSP, 2010).
- **Grouping schemes into profitable clusters:** This has been discussed above. Grouping schemes is one possible action in response to a poor financial diagnosis.
- **Metering:** The profitability of certain Rwanda schemes and the World Bank-assisted scheme in Bangladesh suffered due to overconsumption through unmetered connections.
- **Subsidized connections:** Ironically, the profitability of Rwanda schemes in remote rural areas was undermined by under consumption, due to the limited number of individual connections. The Bank-assisted project in Cambodia had a similar experience. In both cases, the high cost to the household of taking out a connection was the limiting factor. The Paraguay project had good success with using an OBA approach to provide reasonable subsidies to household connections.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

- 1. Rural private operator initiatives are a promising option for addressing the problems of sustainable operation and maintenance.** This desk review has documented numerous initiatives in which private operators have taken over the operation and maintenance of rural water supplies. Several older initiatives—Niger, Senegal, and Rwanda—provide evidence that private operators have managed the schemes better than was the case under than community management. However, the sustainability of this approach is not yet proven.
- 2. Build-and-operate designs have improved several rural private operator initiatives.** Build-and-operate contracts turn out to be a good way to attract more competent private operators to the market, and have many other advantages as well. Less information is available on how OBA has improved the initiatives: OBA has been used in such a wide variety of ways that it is difficult to generalize about its role.
- 3. Rural private operator models are not an alternative to capable government institutions.** The secondary literature reviewed in Chapter 2 at times suggested that this was the case. Community management had too often failed to keep rural water supplies functioning, because government had not provided sufficient on-going support. Private operators were dangled in the literature as a tantalizing alternative, under which the institution of the market substituted for weak government. However, only a few cases—Cambodia and Tien Giang, Vietnam—fit this scenario. In the majority of cases, governments played a critical role not only at the outset, but also in the on-going functions of regulation, training, and professional support.
- 4. Analysis will be crucial in learning how to the judge when, where, and why private operator management can be successful and sustainable.** Governments and development partners will implement more rural private operator initiatives over the coming years, because this model has shown results in situations where other management models performed poorly. The planners and implementers behind these initiatives will do a better job, if feedback is available on what is working and what is not. This desk review represents a small step in that direction. This kind of effort needs to continue, and indeed expand. The recommendations outline the studies and analyses that should be undertaken.

4.2 Recommendations

- 1. Undertake a similar desk review of community management models.** This review has incidentally uncovered situations where the classic models of community management have failed, as well as instances where they are working well. Understanding when, where, and why community management works contributes to understanding the same thing for rural private operator models.

- 2. Examine more closely the utility models for rural water supplies.** Numerous cases among the 25 initiatives are national or regional utility companies providing water to small rural settlements. That was an unexpected finding, given the prevalence of decentralizing water provision to local government. Yet Cote d'Ivoire, Gabon, and Morocco have promising experiences, and Vietnam and Malawi have started experiments. These and similar cases need closer examination to understand when recentralization is the best option.
- 3. Bring into the Bank more information on the successful operations of other development partners.** The many rural private operator initiatives that have been assisted by AFD are outstanding examples of projects and programs from which the Bank could learn. The regional development banks and the big bilateral donors with major water programs are likely candidates as well.
- 4. Document and compare the process by which successful or promising rural private operator initiatives have been developed.** *Private Sector Participation in Water Service Provision: A Toolkit* lays out a model to put in place public-private partnerships for large utility companies. To do a similar exercise for rural partnerships will require several national case studies of how and why the various development partners and client institutions managed to put these initiatives in place.
- 5. Encourage operations to undertake more field survey evaluations.** The detailed field surveys carried out in Niger and Benin provided information useful to operations in each country, yet also advanced understanding of rural private operators more generally. These exercises will be particularly useful if they establish to what degree rural water supplies are financially viable with improved management. Promoting common terms of references across countries for field surveys will improve this approach.
- 6. Have the Bank lead an international community of practice on rural and small town private operators.** A community such as this can be created and linked through websites, newsletters, databases, conferences, and so forth. The Bank has the capacity, resources, and reputation to use these tools to make this idea a reality. Furthermore, the Bank can contribute knowledge along the lines outlined in the preceding recommendations. In return, Bank staff will profit from the contributions of others around the world, and take another concrete step toward becoming a Knowledge Bank.

ANNEX 1. RURAL PRIVATE OPERATOR INITIATIVES

This annex briefly describes the 25 individual initiatives. The short descriptions below provide basic information, with references to more complete information. The comparisons, analyses, and conclusions in the main report are based on these sources.

“Initiatives” refers to the various means—strategies, programs, projects, and grassroots actions—through which private operators have come to manage rural water supplies. The initiatives meet the criteria set out in the first chapter, namely that they:

- Serve a dispersed population or settlements under 5,000 inhabitants in rural areas;
- Engage rural private operators on a significant scale; and
- Operate the supplies using private individuals or for-profit organizations.

These criteria mean that several important innovations with respect to the private sector and rural water supplies are not examined here. For instance, private operator initiatives in Uganda, Ghana, and Tanzania are not described below, because they concern larger settlements. Ethiopia and Ecuador are not included because the private sector has been used to bolster community or local government capacity to manage supplies, rather than engaging the private sector directly as operators.

The initiatives were identified primarily through document review, and guidance from sector specialists within and outside the Bank. A search of the World Bank operations database, plus advice and suggestions from Bank staff identified the Bank-assisted initiatives. Looking at the grey literature of consultant reports, donor documents, project websites, and to a lesser extent traditional sources such as journal articles and conference proceedings identified other initiatives. Bank, WSP, Danida, and UNICEF staff provided invaluable help in recommending sources, as did several other experts.

An asterisk denotes those initiatives that received substantial World Bank assistance. Additional initiatives may have benefited from Bank assistance indirectly, for instance if the Bank provided assistance to an urban utility that also operated small rural piped schemes.

A1.1 Africa

***Benin Sector Policy**

Benin continues to revise its sectoral strategy to give more prominence to delegated management contracts, particularly between commune governments and the private sector. That approach has been fairly well developed over the past decade for piped schemes in small towns with populations between 2,000 and 25,000. Now, the strategy is being expanded to cover villages and handpumped water points.

The Bank, in its first Poverty Reduction Strategy Credit (PRSC), identified a problem with the management of the piped schemes. The Bank, other donors, and the government agreed during a joint annual review in 2004 to promote private operators for small town schemes. The Bank's second PRSC included support for an initiative along these lines, and made implementation a trigger for PRSC-3. As a result, the Small Towns Water Initiative was launched in 2006, assisted by a basket fund to which the Bank and other donors contributed. The triggers for PRSC-4 and PRSC-5 included targets for the number of small town schemes managed by private operators as a means to encourage steady progress in implementation. These targets were over-fulfilled. Whereas in 2001, a single town piped scheme had a private operator, by March 2010 some 90 private operators managed schemes, some with multiple contracts.

The change in strategy has been partly driven by the 1999 decentralization act that transferred responsibility for water provision to the communes, which own the assets. Under the new strategy, the communes have four contractual options for delegating the operation and maintenance of piped schemes, three of which involve a private operator, and a fourth type that delegates responsibility to a reformed water users association. The first two options are the most common. One hundred thirty-two piped schemes had delegated management as of March 2010. A more recent reform has been for the commune to delegate the maintenance of all handpumped water points wells within a given geographic area to a private operator, such as a group of former village handpump mechanics.

A June 2010 evaluation of 20 piped schemes under delegated management found that the record keeping was not sufficient to determine the financial viability of the schemes. The evaluation noted numerous positive results as well as weaknesses and challenges. For instance, well-defined tendering procedures have been developed, but one-third of the calls for tenders did not attract satisfactory candidates and proposals. The Water Department developed standardized contracts for the communes to use, but the provisions such as the responsibility of the operator to monitor water quality were often deleted. The schemes are generally functioning, but the repair time for pipe bursts can take longer than it did under community management.

Sources: (World Bank, 2004b, Netherlands Ministry of Foreign Affairs, 2009, Leroy-Themeze, et al., 2009, Prevost, 2009, Fichtner Water and Transportation GmbH, 2010). Personal communication with Sylvain Adkpo Migan and Karl Jorgensen.

Burkina Faso PAR (Management Reform Program) and Sector Policy

In 2000, the Burkinabè water ministry developed a new approach to managing rural handpumped water points and piped schemes, based on various options for delegating management to private operators. The new design reflected the greater responsibility for water services and water infrastructure maintenance that had passed to communes as a result of government decentralization. The options would later be revised to accommodate the even greater role given to the communes by 2004.

The two basic options are as follows:

HANDPUMP MAINTENANCE: The commune signs a maintenance agreement with a private individual or firm to handle preventative maintenance and repairs on all the handpumps within a given area, usually the commune.⁹ The contract requires the maintenance operator to pay inspection visits to all handpumps on a regular basis, and to make repairs based on a price list established in the contract. The repairs are paid for by a Water Users Association (WUA), which is responsible for all handpumps in a village. The WUA also has to pay an annual fee to the commune that covers the cost of the inspection visits. To collect the user fees to pay for maintenance, as well as save for eventual handpump replacement, the WUAs hire local handpump caretakers. Thus, most management responsibilities remain with the WUAs, but the functions of preventative maintenance and monitoring have been delegated to the private sector.

PIPED SCHEME AND OTHER WATER POINT MANAGEMENT: Communes request competitive bids from private firms for either *affermage* or management (i.e., no asset replacement responsibility) contracts. Under the *affermage* contracts, the operators are responsible for replacing assets with a design life of less than 15 years. All management responsibilities are delegated to the winning firm, and the role of the WUA is limited to informing the commune of how well the operator is performing, and generally representing the interests of the consumers. The private operator for piped schemes also has authority and responsibility for all public handpumps and open wells in the supply area.

AFD provided assistance to test the new management approach in 13 provinces through a program called PAR (*Programme d'Application de la Reforme de gestion des infrastructures hydrauliques d'approvisionnement en eau potable en milieu rural et semi-urbain*). The cooperation agreement was signed in 2002, the main construction period was 2005-2009, and a post-construction monitoring phase ended in July 2010. For handpumped water points, PAR provided 86 new and 345 rehabilitated points, and established a new style of private maintenance contracts in 33 communes. For piped schemes, PAR produced 12 new and 3 rehabilitated schemes through build-operate-transfer contracts under which the private firms will manage operations for 7 years.

Vergnet Hydro, a French firm, in partnership with its local affiliate Faso Hydro, won the contract to build and operate 7 of the PAR piped schemes. The experience from the first year of operations was that 3 schemes did not earn enough revenue to meet running costs, while the other 4 schemes covered operational costs and set aside funds for handpump maintenance and piped scheme replacement. The aggregate operations balance for the 7 schemes was about US\$14,000, and \$3,000 after provisions for replacement and handpump maintenance had been deducted. Vergnet Hydro's Director attributed the ability to achieve a profit to (1) grouping several schemes in a single contract, (2) remunerating staff based on performance and benchmarks, (3)

⁹ Under PAR, 33 communes signed 39 maintenance contracts, which suggests that most communes select one maintenance operator per commune. A large commune, or one with several different types of handpumps, will require more operators (www.reforme-aep.org).

using the latest technology for financial and technical management, and (4) creating incentives for good quality construction by having the contractor subsequently responsible for operation.

According to the original plan, water from standposts and handpumps was to be sold for the same price. However, Vergnet did not find a reliable method to enforce this tariff policy, given the absence on meters on handpumps. Finally, Vergnet received permission from the communes to close handpumps within 500 meters of standposts. The operator had the obligation to keep the handpumps operable, and put them into service if the piped schemes failed to deliver sufficient water.

Sources: (Vergnet Hydro, 2010, Diallo, 2009, ANTEA, 2006, Direction Générale des Ressources en Eau, undated). Personal communication with Thierry Barbotte, Peter Jorgensen, and Seydou Traore.

Cote d'Ivoire SODECI *Affermage* Contract for Piped Water Services

SODECI, a subsidiary of the multinational SAUR, has an *affermage* contract to provide water services. When the company renegotiated its contract in 1987, rural water supply was handed over to villages under community management. However, SODECI retains responsibility for rural centers down to 3,000 inhabitants, and consequently its rural service provision responsibilities have continuously expanded. In 2000, SODECI had 174 rural systems serving fewer than 10,000 users. These systems served 257 settlements. About 40 of the systems served multiple settlements.

Almost all of these small systems are unprofitable for SODECI. Abidjan and other urban centers subsidize rural water supply via uniform national tariffs set as part of SODECI's contract.

Each system has a chief. SODECI also employs villagers as agents to report leaks, distribute bills, and collect payments. In three multi-village schemes reviewed by WSP, bill collection was 91-98 percent, leakages were 2-7 percent, and consumer satisfaction was high. All three schemes supplemented community managed handpumps, or in one case a piped scheme, for which maintenance and payments had been irregular.

Sources: (WSP, 2001, Trémolet, et al., 2002, Trémolet, 2002)

Gabon SEEG Water and Electricity Concession

In 1997, SEEG, a national private operator, took over from the government the responsibility for providing piped water services and electricity in two cities and 32 rural areas, some with populations of just over 1,000. In the rural centers, service has improved, tariffs decreased, and coverage expanded.

Sources: (Trémolet and Neale, 2002, Trémolet, 2002)

***Kenya Microfinance for Rural Piped Water Services Project**

K-Rep Bank is a commercial microfinance bank that the IFC has supported since 1999 with advisory services and \$1.4 million in equity. K-Rep Bank and WSP designed the Microfinance for Rural Piped Water Services as a pilot project to demonstrate the role that microfinance can play in increasing the sustainability of small community managed piped schemes in rural and peri-urban areas.

The project supports K-Rep's program for loans to community organizations to build, expand, or improve piped water schemes. The pilot project received \$1.2 million from GPOBA for 2006-2010 to fund 21 schemes, later reduced to 13. The project subsequently received grants from the European Union water facility and PPIAF, and purchased a partial credit guarantee from USAID's Development Credit Authority. This assistance will allow the project to scale up to 60 schemes and extend activities to 2011.

In addition to financing, the K-Rep program introduces more rigorous loan preparation (e.g., business plan prepared) and appraisal procedures. Also, communities are required to engage private sector professionals to prepare the loans and manage implementation. OBA grants reimburse communities for part of the cost of loan preparation and construction, provided targets (such as the loan being approved or construction completed on time) are met.

During the pilot project, both communities and K-Rep Bank became concerned about the capacity of communities to manage the completed schemes. As a result, K-Rep has modified the loan process to require new loan recipients to engage a private operator on a management contract until the loan has been repaid. This requirement can only be waived if the community has a track record of good management.

The community can either engage the private firm that handled the loan preparation and implementation, or award a competitive tender to another operator approved by K-Rep. The payment method—fixed management fee or percentage of revenue—is set as part of the tender. The operator has responsibility for operation and maintenance, commercial functions, and financial analysis and investment planning.

The pilot experience also suggests that design-build-operate contracts may reduce costs and provide incentives to the project manager to ensure high quality construction.

The IFC continues to investigate the options for commercially viable rural piped schemes in Kenya. One avenue seems to be to bundle the rural schemes with more profitable small town or peri-urban schemes, as means to make the management contracts profitable for the operator and allow cross-subsidization.

Sources: (K-Rep Bank, undated, Mehta and Virjee, 2003, Virjee, 2009, Mehta, et al., 2007, Mehta and Virjee, 2007, World Bank, 2009f, World Bank, 2009e, GPOBA, 2010, IFC, 2010a, IFC, undated). Personal communication with William Davies and Rajesh Advani.

***Malawi National Water Development Program**

Malawi mounted a world-renowned program to construct rural piped schemes and have communities subsequently manage the schemes with government backing. The management system eventually deteriorated, however, with the consequence that 50 percent of the taps stopped working.

The government has now adopted a new approach to rural piped schemes management, based on establishing WUAs that will contract operation and maintenance to private operators. Rural point sources will continue under traditional community management, although with more use of the private sector to build community planning and management capacity.

Both approaches are embedded in the National Water Development Program (2007-2012), which receives parallel financing from numerous donors, including \$50 million from the Bank's Second National Water Development Project (NWDPII). In addition, a Bank-administered trust fund will contribute \$25 million, to be used by three regional water utilities to support rural piped schemes.

District Assemblies have the responsibility and authority for rural water supply provision, as a result of government decentralization. In the new rural piped scheme approach, the District Assemblies should delegate this responsibility to the Ministry of Irrigation and Water Development, which will call upon the appropriate regional water utility to implement the series of steps leading to construction or rehabilitation. Only those communities that complete each step are supposed to be eligible for assistance under the national program. The first step includes establishing a WUA, and hiring a local private operator and core operational staff. Subsequent steps include preparing a business plan and an operator performance agreement, training for the WUA and local operator, and introducing improved financial management, billing and collection, operation, and monitoring procedures into existing schemes. Civil works tenders will be prepared for schemes where the communities have successfully completed these steps.

The NWDPII will finance schemes for 9 market centers, and the Bank-administered trust fund will finance 7 rural piped schemes. The former are in various stages of design, bidding, and construction, while some of the rural schemes are nearly complete. WUAs for the rural schemes have been established and trained, but have not yet begun to collect user payments from those who have functioning connections. No private operators have yet been engaged.

Sources: (Kleemeier, 2001, Kleemeier, 2000, World Bank, 2007e, p. 50-56, World Bank, 2010d).

***Mali Sector Policy**

The 1995 law on government decentralization established rural communes and communal councils to take over certain responsibilities from the central government. A 2002 decree spelled out the details of this transfer of responsibilities in regard to water supply. The Regional Government must issue a decision transferring the responsibilities to a commune, accompanied by an inventory of the transferred assets and various documents spelling out the commune's new

role. By 2005, water provision responsibilities had been transferred to somewhat less than half the communes.

The legislation obliges the communes to delegate service provision to a service provider, which could be a WUA or a private operator. Initially, the communes only delegated to WUAs.

The National Water Supply Directorate (DNH) established, with German assistance, a unit to provide financial and technical backstopping to WUAs. The unit (STeFi) was privatized after 1998 by contracting two firms to provide this backstopping in their assigned geographic service zones. The support functions consist of carrying out a twice-yearly financial audit of each system, and offering advice by radio on technical problems, repairs, and spare parts. As of March 2006, about 30 percent of the 271 piped schemes were covered by the STeFi. The structure was supposed to pay for itself through a fee paid by the service provider based on the volume of water produced. However, as of 2006, STeFi had not been able to collect the full amount, which in any case was not sufficient to cover costs.

The 2006 National Water Supply and Sanitation Program (PROSEA) planned the introduction of public-private partnerships to manage piped schemes. The Bank's Second PRSC in 2007 included actions to promote these partnerships, and set targets for the number of rural piped systems to be managed by private operators. With assistance from the Bank and other donors, DNH prepared model documents and procedures for communes to use (e.g., technical assessments of schemes, tender solicitation, different types of contracts). DNH together with its regional offices then assisted some communes to solicit bids and award contracts. By 2008, 15 rural piped schemes were managed by private operators.¹⁰ DNH has drawn up an action plan with its development partners to support an additional 20 communes to establish public-private partnerships, and to strengthen the regulatory framework.

The main challenges to date have been (1) the inexperience of private firms and communes in tendering delegated contracts, and the inability of the regional water departments to provide the necessary support, (2) the difficulty in getting accurate evaluations of the technical status and problems of the schemes, (3) the need for funds to rehabilitate the schemes before they can be operated, (4) the need for good mentoring systems in order to provide regulation, and (5) the need to adapt and strengthen STeFi to handle private operators. As part of the effort to address the last two challenges, DNH has contracted a Senegalese firm to provide cell phone-to-web services as a pilot program to improve the communication between operators and STeFi.

Sources: (Ministère de l'Energie, 2009, World Bank, 2007d, World Bank, 2009d, WSP, 2009a, WSP, 2009b, WSP, 2006a).

¹⁰ The sizes of the populations served by these schemes were not available, but a significant number produce less than 10 cubic meters of water per day. Some of the schemes therefore seem likely to serve populations of under 5,000.

Mauritania Sector Policy

The government established communes in 1986 and transferred the responsibility for water supply provision to them, except where an urban utility had been delegated this task. Commune management quickly encountered problems. In response, the government made its first effort at introducing private operators to manage rural piped schemes in 1993.¹¹ However, this system did not work well as the operators had too few skills, and the maintenance remained in practice a highly centralized government responsibility.

In 1995, Mauritania, with AFD assistance, mounted a rural water supply program (Ashyr, 1995-2000) that included a component to develop the capacity of rural piped scheme operators and disengage the government from maintenance. The president mandated that recent university graduates should be employed as operators. They went to the larger schemes, while the operators for the small rural schemes remained locally respected older individuals. Ashyr assisted with recruitment and training.

In 2001, a non-profit organization, ANEPA, was formed to take over from the government its responsibility for managing and maintaining piped schemes. In line with this, the government transferred the offices, materials, equipments, and so forth that the Ministry of Water had previously used for this purpose to ANEPA. ANEPA rapidly signed contracts with private operators. As of 2006, almost 90 percent of the small piped schemes were under a delegated management contract between ANEPA and a private operator. ANEPA remains responsible for major repairs and maintenance against a volume-sold fee paid by the operators. They are responsible for operation, billing, collection, and maintenance and repair on the distribution network. Although it is not in the contract, in practice operators finance expansion of the schemes through charging users the full cost of installing new connections.

The system does not provide for WUAs. Instead, communes are expected to defend consumer interests, although communes do not have a formal role in the delegation from ANEPA to private operators. In principle, two regulatory bodies monitor the contracts. ARM (*L'Autorité de Régulation Multisectorielle*) has oversight over the contract between the water ministry and ANEPA, and its offshoot APAUS (*L'Agence de Promotion de l'Accès Universel aux Services*) regulates the contracts with the private operators. In practice, this regulation has not functioned.

The system has been successful in rapidly expanding the number of household connections (35,000 in 10 years), through the twin approach of (1) allowing users to pay for the connections and (2) flexible construction standards to keep costs down. The process has been aided by a strong tradition of paying for water in Mauritania. The drawback to the system has been heavy state subsidies, with two-thirds of ANEPA's costs paid by the government. In part this reflects overstaffing—ANEPA employs 150 persons for 349 boreholes—and in part government's unwillingness to let tariffs rise to cover costs. Another concern is how well the maintenance

¹¹ These schemes serve settlements with anywhere from less than 500 to more than 20,000 inhabitants. Some settlements are truly rural, while others have mixed immigrant populations and a more commercial economy.

actually works: almost 50 percent of the pumps were replaced in a period of less than 4 years. ANEPA essentially performs no preventative maintenance, only repairs, and the operators have little incentive on a three year management contract to care for pumps that the government replaces for free. The following table summarizes the successes as well as the challenges facing the system in Mauritania.

Table 11: Successes and Challenges in Mauritanian System of Delegated Management

Successes	Challenges
ANEPA within 2 years put in place a national program. Most piped schemes (89% or 361 schemes) managed by private operators	ANEPA is not regulated or audited, due to weak regulatory body.
Piped schemes are functioning (98%). Rapid expansion of private connections.	Performance statistics do not take into account problems with distribution systems and tanks that disrupt service
ANEPA provides technical and repair services	ANEPA has high staff costs, but shortage of technical staff.
Technically competent operators have been recruited.	ANEPA weak in providing training for operators
Tariff comparable to other countries in region	Tariff is not keeping up with rising costs, e.g., for fuel
Fee is paid to ANEPA	Two-thirds of budget from government
Cross-subsidization from semi-urban to rural areas	Operators of more successful schemes resent costly repair services from ANEPA, and would prefer to handle on their own
Local government <i>de facto</i> plays regulatory role (tariff adjustment, conflict resolution, operator selection)	

Note: These results are for ANEPA schemes in general, and not limited to those serving small settlements or dispersed rural populations.

Sources: (Carlier, 2001, Valfrey-Visser, et al., 2006, WSP, 2006c, Fichtner Water and Transportation GmbH, 2010).

*Niger Sector Policy

Niger established local government in 1996, and nominally pushed responsibility for water supply to the communes through laws passed in 2001 and 2002. However, the central government did not follow through on actually transferring the assets and specific responsibilities to the

communes. As of 2009, a water law that would accomplish this transfer was under discussion in the legislature.

In reality, the government long relied on communities to manage their supplies. In the 1980s, the government set up rather informal village water committees that did not prove equal to the task, especially for piped schemes.

A grassroots initiative eventually led to a different approach. A chief in one northern village asked a local businessman to repair the broken piped scheme, which he did in collaboration with other local businesspeople. The business expanded to other schemes, and so the company SONEXIE was formed with a capital of about \$6,500. Local communities were made token shareholders, so as to entitle them to certify the annual financial report. The ministry devised a tripartite contract among the ministry, local government, and the company to set the tariff. The government retained ownership of the assets, with the company getting a five to six year contract in compensation for financing rehabilitation.

The 1997 master plan for water resource development advocated delegated management by private operators, but still talked in terms of village water committees. A *Conseil d'Entente* (Phase 3) project promoted WUAs to replace village water committees, the difference being that WUAs are legal bodies which can open bank accounts, take out loans, be sued, and so forth. In its 2001 Sector Policy Letter for rural water supplies, the government specified that communes should delegate the responsibility for water supply provision to WUAs, who in turn would be encouraged to delegate piped scheme management to private operators. Donor projects, including the Bank's Water Sector Project (2001-2009), adopted this approach.

In summary, a system has evolved in Niger in which the central ministry's water department solicits bids on behalf of WUAs for private operators to manage piped schemes. The selected operators then sign a contract for each scheme with its WUA. In addition, projects in four regions have established *Bureaux de Conseil et Contrôle* (BCCs) through competitive bidding open to the private sector, NGOs, and other third parties. The details vary by project, but generally the BCCs provide technical and financial support, auditing, and monitoring similar to the SteFi system in Mali.

The Bank had a positive experience with the rural water component in its Water Sector Project. The lessons learned included the need to involve commune governments more, and group schemes into profitable bundles for tendering. The urban component found that rehabilitation was critical to successful private operator management, and rehabilitate-and-operate contracts were a good means to achieve this. The private operator ensured timely execution, and did not press for large-scale investments. These lessons appear applicable to rural operators as well.

The strengths and challenges in the Nigerien general experience with delegated management for rural and small town piped schemes are summarized in the following table:

Table 12: Successes and Challenges in Nigerien System of Delegated Management

Successes	Challenges
Forty-three percent of rural piped schemes managed by private operators	Communes weak, cannot play local regulation function. Some communes show no interest in operator supervision. Administrative and legal constraints prevent interested firms from investing in rural piped schemes.
Delegated schemes function more reliably than community managed ones. Record-keeping and savings much better on delegated schemes	No national benchmarking
BCCs: Competitively selected private firms provide audit, support, and regulation for fee paid by WUAs	Support function not a profitable business; WUAs will not contract services unless obliged. Only half country covered
Multiple schemes grouped in a contract so that profitable for operator	Some operators did not take up contracts once awarded, or left without notice
Well-written, standard contracts provide a range of options, management to concession	Some WUAs kick out operators so WUA members can control funds
Training for operators and WUA members	Illegal connections, water overconsumption, refusal to accept higher tariffs by consumers. Poor record-keeping, non-payment of fee, delay in repairs by operators

Sources: (Vézina, 2002, CEH-SIDI, 2009, Groupement Egis BCEOM International and Cabinet THEC, 2009, Hydroconseil, 2009a, Fichtner Water and Transportation GmbH, 2010). Personal communication with Chaibou Tankari.

*Rwanda Sector Policy

The government decentralized responsibilities for water services, and transferred asset ownership, to the districts in 1987. National regulations established several possible management models, including direct operation by the district, operation by a water user group, or third-party operation. Community or commune management was used exclusively until 2002, when district authorities in Byumba Province experimented with delegating the management of three rural gravity schemes to third parties.

The Bank-assisted Rural Water Supply and Sanitation Project (2000-2007) initially adopted community management, but in 2004 carried out a detailed review of the experience with this

model versus the approach taken in Byumba. The review found that more than 50 percent of the WUAs were no longer operational for reasons such as no payment for work, the unwillingness of users to pay for water, funds mismanagement, and technical shortcomings. By contrast, the three operators from Byumba had managed to maintain the systems and finance scheme rehabilitation out of revenue.

Consequently, the government and donors began to shift toward third-party operators. The Bank-assisted project made this change, and a prior action for the Second Poverty Reduction Strategy Credit was that such management contracts would have been signed in at least one district of each of four pilot provinces. The government's Poverty Reduction Strategy Paper included the goal of assisting districts to move toward a private operator model, with the target that 10 percent of rural water supplies would be managed privately by 2007.

As of 2008, approximately 140 schemes, out of a total of roughly 850 rural piped schemes, were managed through delegated contracts. A little over half of these contracts went to the private sector (individuals or companies) and the remainder went to other types of third-party organizations (cooperatives, associations, and so forth). Most of the contracts state that the operator should manage the other improved sources in the supply areas. These are predominantly protected springs, except for handpumps in the East Province. However, most protected springs and small piped schemes are still managed by WUAs.

Data on the financial and technical performance of the schemes are not available. A consultant, Hydroconseil, calculated that an average operator manages three to four separate schemes, and brings in about \$20,000 to \$26,000 per year from a total of 30 to 40 standposts. In Hydroconseil's view, that should be sufficient revenue to attract professional operators, but not investors.

The district decides which management model to use for the water supplies under its jurisdiction. If the district decides to use an operator model, the district prepares the tender and negotiates the contracts, with technical assistance from the central ministry. The type of contract varies among districts, but generally, they remain responsible for planning and funding the expansion of the water systems. Contracts are awarded through transparent bidding.

The Rwanda Utility Regulation Agency (RURA) was established in 2001 to regulate water, electricity, and telecommunications. It is supposed to monitor the contracts and the bidding process, protect consumers, and arbitrate in conflicts between the operators and the districts. In practice, RURA is just beginning to extend operations outside urban areas. The districts generally lack the capacity to monitor contracts, although this varies. Some districts have put in place a District Water Board charged with this task.

Expanding access to rural people still seems problematic. Private connections are the profitable ones for operators. Consequently, the number of private connections has grown while the number of standposts has stagnated. A small survey of seven schemes found that between 2006 and 2008 the number of private connections had gone from 86 to 467, while the number of standposts had gone from 60 to 126. Furthermore, private connections are largely confined to institutions and

commercial areas, rather than rural villages. Only two percent of the private connections serve village households; one reason being that households have to pay about \$180 for a connection.

The consensus in Rwanda is that the operator model is an improvement over community management. An evaluation due in September 2010 will provide data as to whether this perception is correct. The challenges facing the Rwanda initiative are as follows:

- The contracts in some districts are imprecise; for example, district versus operator responsibilities not well defined, use of lease fee not specified and well-controlled, supply standards not included. Other improvements include having longer lease periods, and providing incentives to the operators to make scheme repairs.
- The districts need more support and training to be able to monitor the contracts.
- The national regulatory agency needs to expand its services outside urban areas.
- Some schemes need rehabilitation and meters before they can be profitably operated.
- Schemes may not be profitable in remote rural areas, where consumption is low and people are not willing to take out private connections, or unable to afford the high connection costs.

Sources: (World Bank, 2004a, World Bank, 2005, World Bank, 2006a, World Bank, 2008a, World Bank, 2008b, World Bank, 2008c, Hydroconseil, 2009c, Hydroconseil, 2009b). Personal communication with Bruno Mwanfunzi and Pierre François-Xavier Boulenger.

***Senegal Régefor, PEPAM , and Sector Policy**

Although Senegal has decentralized some functions to local government, rural water supply provision remains a responsibility of the central ministry, specifically *Direction de l'exploitation et de la maintenance* (DEM), which owns the assets. DEM has a large field staff that originally had full responsibility for maintaining rural water supplies and supplying water free of charge. The DEM structure comprises three sub-department offices, a division in each region, and one to three brigades under each division with the exception of Dakar.

Since 1984, the rising cost and burden of rural water supply led the government to introduce village management committees and fixed water payments for the rural piped schemes. Since 1996, the government gradually introduced more changes into rural piped scheme management: legally constituted WUAs (called ASUFORs); user payments based on volume (metering), ASUFOR bank accounts; an option to delegate maintenance to a private company; and an option to delegate operations to a private operator.

These reforms were tested through donor-assisted projects such as RRESFMR and PARPEBA (Belgian Cooperation) and Régefor (AFD). Under Régefor (1999-2004), DEM selected a Senegalese company (Equip Plus) to provide maintenance—one preventative visit a year, plus breakdown repairs as needed. Each ASUFOR then signed a performance agreement with Equip Plus. ASUFORs also had to hire local operators to handle water pumping, distribution, billing, and payment collection. The operator in turn managed pump attendants, standpost operators, meter

readers, and plumbers. By its completion in 2004, Régefor had 80 boreholes serving 240,000 people, and was declared successful. The Régefor boreholes functioned 98 percent of the time compared to a national average of 80 percent; borehole repair averaged 48 hours compared to four days nationally; and the Régefor ASUFORs had \$10,000 in savings, compared to a national average for ASUFORs and water committees of \$5,000.

The approach has now been adopted as sector strategy in 2005. In addition to the options described above, the strategy provided for the option to delegate management directly to a private operator rather than an ASUFOR, especially for larger schemes. The possibility was also left open that communes rather than the central government might eventually become the body that delegates responsibility to either ASUFORs or private operators.

That sector strategy lies at the heart of PEPAM, the program for meeting the MDGs. The Bank contributed to the development of PEPAM through its two urban sector projects, Long-Term Water Sector Project (2001-2009) and the Water Sector Project (1995-2004). The PEPAM Coordination Unit evolved out of the coordination unit for these two projects.

The Bank has recently approved the Water and Sanitation Millennium Project (2010-2015). The rural water component will construct 29 multi-village water supplies, and extend or rehabilitate additional supplies. The component will follow the new sector strategy, but with the intention of ultimately going a step further and delegating management directly to a private operator. The project will finance a study to propose the arrangements for this. The schemes will be managed by user associations in line with the current strategy, but with the goal of fully delegating management to the private sector.

A review of selected RRESFMR schemes circa 2001 found that schemes had to sell at least 35 cubic meters of water per day—which means serving 1,500-2,500 persons—to be viable. (These schemes linked numerous villages, most of which had under 500 inhabitants.) At 70 cubic meters per day—meaning the schemes served between 2,500-3,400 people in six to eight villages—the schemes were financially viable with a very affordable tariff. At 100 cubic meters per day, the schemes were profitable and with enough revenue to contribute toward expansion and replacement costs.

This review also noted that ASUFORs needed more technical skills and support as schemes expanded and added household connections, so that the systems remained in balance. DEM had become too overextended, with the increased number of schemes, to provide this support.

Sources: (Fall, undated, Republic of Senegal, 2005, Blanc and Ghesquière, 2006, WSP, 2006b, World Bank, 2010c)

South Africa BOTT

Up until 1997, the Department for Water Affairs and Forestry (DWAF) implemented and managed water supply and sanitation services. In that year, the Water Services Act transferred

responsibility for those services to local governments. The latter, however, lacked the capacity to handle the new responsibilities. DWAF developed BOTT (Build-Operate-Train-Transfer) as a means to construct new infrastructure, train local governments and communities in the management of it, and then transfer the facilities to the local governments. After the transfer, it was up to local governments to decide whether to operate the services themselves or contract them to the private sector.

BOTT was a type of framework contract that gave the responsibility for implementing the construction of publicly-funded infrastructure within a province to a Project Implementing Authority (PIA). DWAF solicited bids from the private sector to act as PIAs, encouraging private firms to team with NGOs. Including such organizations was a move in part to alleviate the suspicion and hostility that private sector participation was generating in South Africa at the time. Two of the winning consortia, for Northern and Eastern Cape Provinces respectively, included Mvula Trust, a local NGO specializing in the delivery of water and sanitation to the poor, in their groups.

For each particular project that DWAF considered for funding, the PIA submitted a business plan evaluating the needs of the local population and proposing technical and institutional solutions. As its name suggests, the PIA then had implementation responsibility for approved projects. During implementation, the PIA provided various types of operation and maintenance support to local governments, such as advice on tariff rates (although these must respect DWAF policy). During BOTT, each local government had to approve an "Operation and Transfer Agreement," under which the fully operational facilities were to be transferred to local authority.

BOTT proved successful as a means to allow central government to quickly build and transfer water supplies to local governments that were not themselves in a position to plan the investments and manage construction. Information is not readily available on how the schemes have functioned since their transfer to local government.

Sources: (Waddell, 2000b, Komives, 2000, Waddell, 2000a).

A1.2 East Asia and the Pacific

Cambodia Small Entrepreneurs in Rural Centers

Cambodian rural centers have populations between 1,000 and 10,000 clustered around a market or along a road. Some of these centers may have sizeable commercial activities and urban conveniences such as electricity, while others are more traditional peasant villages.

In the denser parts of these centers, entrepreneurs have constructed small piped schemes serving 20-60 households with untreated water from boreholes, rivers, or ponds. These schemes cost anywhere from US\$1,000 to \$8,000 (circa 2000).

GRET, a French NGO, implemented a project 2000-20005 to assist these entrepreneurs to expand their schemes to serve all 250-900 households in a center. The project, MIREP, did this through

developing various types of build-and-operate packages for local authorities to engage these entrepreneurs as investors and operators. MIREP also provided technical and financial assistance to the entrepreneurs. The project helped to construct 14 schemes. GRET has had a similar type of project in Laos.

Sources: (Salter, 2003, Mahe, 2010).

***Cambodia Provincial and Peri-Urban Water and Sanitation Project**

The project planned to engage private operatives to design, build, and lease water schemes for 23 small towns, of which six had populations under 5,000. The project succeeded in engaging private operators to invest their own funds and to operate 11 schemes (population unknown); funds for the remaining schemes were reallocated to other components due to mis-procurement problems. Revenues were only sufficient to cover operation and maintenance due to high operating costs, low household consumption, and lack of sufficient connections. High connection fees inhibited households from joining schemes.

Sources: (World Bank, 2003, World Bank, 2009b, Triche, et al., 2006).

***Vietnam Red River Delta Rural Water Supply and Sanitation Project**

The Red River Delta Rural Water Supply and Sanitation Project illustrates an effort to introduce private operators that has not so far succeeded.

The 2006 World Bank Water and Sanitation Strategy for Vietnam pointed out that soon Vietnam would move from IDA to IBRD financing. That would make less viable the current model of financing rural water supply through loans to the government. Also, the government would not have the financial capacity to continue to pay the major share of rural water supply investment, especially since the both the government and consumers wanted higher service levels. The Bank country partnership strategy for 2007-2011 echoed the water strategy on a number of these points, most notably the need to reduce concessional and public financing for infrastructure in favor of private capital, and to increase cost recovery. The Red River Delta Rural Water Supply and Sanitation Project was designed to test a model for making this transition.

The Red River Delta project is the first phase of a two-phase Adaptable Program Loan. The first phase covers 120 communes in four provinces in the Red River Delta in northern Vietnam. A second phase project, yet to be designed, will cover a further eight provinces in the same region. The original IDA Credit was for US\$45.87 million. Due to the significant inflation in 2007/8, the Bank's Board agreed to additional financing of US\$65.27 million in April 2010.

The project constructs only piped schemes, despite an initial plan to serve about twenty percent of the consumers through point sources. Six schemes have been completed under the project to-date, with an additional 74 schemes that are under construction, procurement, or detailed design. All schemes serve multiple small settlements (hamlets) in a commune. The six completed

schemes each serve one commune. Elsewhere, though, the provinces have elected to construct large schemes serving multiple communes, when warranted on the grounds of technical efficiency and economies of scale. In Nam Dinh Province, for example, only three schemes will serve single communes, and the remaining schemes will serve anywhere from three to seven communes. Provincial rural water companies called Rural Water Supply and Sanitation Enterprises (RWSSes) are the centerpiece of the management model. The RWSSes were created through the project, with the intention that they will assume responsibility for the project-financed schemes constructed and eventually all other piped schemes managed by the provincial water departments.

RWSSes are joint stock companies established under commercial law. The major shareholders are Provincial People's Committees (PPCs), which "purchased" their shares through transferring ownership of the project schemes to the RWSSes. In exchange for this asset transfer, the PPCs are assigned 81.8 percent of the shares of the RWSSes. (Thus, RWSSes are also state-owned enterprises.) The remaining 18.2 percent of shares are assigned to selected cooperatives in the scheme supply areas, in recognition of the community contribution to scheme investment. The provincial water departments have initially supplied most of the RWSSe staff, supplemented to varying extent in the different provinces by direct hire staff. At present, the provincial water departments continue to pay part or all of the salaries for their staff.

The RWSSes manage operations and maintenance, as well as asset ownership and corporate oversight. The original plan was to outsource operations to a private sector third party through a performance contract. The tender was initiated for five year operation and maintenance contracts, but no bids were submitted by the private sector in response. Consequently, the RWSSes have assumed responsibility for operations.

Sources: (World Bank, 2009h, Boucher, 2005)

***Vietnam East Meets West Foundation Rural Water Supply Project**

East Meets West Foundation (EMWF), an American NGO, and its Vietnamese subsidiary have worked on water supply in Vietnam since 1996. Up to 2007, the management of EMWF-funded schemes was turned over to the local authorities, who became the owners of the systems. These authorities were at either the hamlet level or the Commune People's Committee. Schemes were operated by Water Managers, either elected from the hamlet or proposed by the commune authorities. Sometimes water managers emerged quite naturally during preparatory activities to form the user committee. The water managers were responsible for operation and payment collection.

A 2006 external review of the program found that major repair works and replacement of significant items has too often involved the owner of the scheme simply returning to EMWF for financial and technical assistance. The same review found a number of cases where the scheme management had decided to lease the operation and maintenance to a third party.

In 2007, GPOBA provided funds for 75 new piped water schemes to be built in low income rural communities with an average of 500 households each. EMWF planned to explore the opportunities to introduce private operators, selected through competitive bidding, to manage these schemes. To make the market more attractive to the private sector, EMWF would also investigate aggregating the contracts for villages. As of the 2009 Mid-Term Review, EMWF was gearing up for a pilot component to test build-and-operate contracts.

Sources: (World Bank, 2009i, World Bank, 2007c).

Vietnam Entrepreneurs in Tien Giang Province

Households in the Mekong Delta of Vietnam traditionally get their water from ponds, canals, community handpumps, and informal vendors who deliver water from the same sources.

In the early 1990s, entrepreneurs began constructing piped schemes based on tubewells and simple treatment. The investment financing came from consumers, who paid an upfront connection fee of US\$60-\$100. The assets belonged to the entrepreneur. In 1998, the provincial government decreed that investment could no longer come from consumers. However, some entrepreneurs switched to a system whereby consumers still made an initial contribution, but were eventually repaid through a reduced tariff.

For example, Mr. Nha in Long Vinh Commune used \$14,000 of his own savings in 2000 to build a piped scheme serving 120 households with treated surface water. He next extended the pipeline to serve 480 households in total. This expansion was financed by each household contributing \$20 and paying 60 percent of the water tariff until its contribution was reimbursed. Eventually Mr. Nha borrowed \$9,000 from a bank to increase the capacity of the transmission line, with the intention of connection all 600 households in the six square-kilometer commune by the end of 2003.

Community groups and the government also have built and managed rural piped schemes. Of the 415 schemes in operation in 2002—serving 65 percent of the 1.6 million provincial population—80 were owned by private investors, 258 by commune-backed user groups, and the remainder by state enterprises and cooperatives.

Sources: (Salter, 2004, Salter, 2003).

A1.3 Latin America and the Caribbean

Columbia Water Sector Reform Assistance Project

The Bank-assisted Water Sector Reform Assistance Project (2001-2010) was designed to promote private operators in regional utilities (serving up to 300,000) and in small municipalities (up to 12,000 inhabitants). Sector policy and legislation already favored competition and private sector

participation as means to promote efficiency in service delivery. However, private operators had only been used to a limited extent in smaller utilities and municipalities.

Nataga, a small community of 2,500 people in Huila Department, benefited from the project. Previously, the Nataga piped schemes had provided 79 percent coverage but supplied water only about two hours per day. The private operator received a build-and-operate contract that included expanding and improving the schemes. As a result, coverage increased to 100 percent and provided water continuously. The scheme operated at a slight deficit (US\$500 in 2008), but the operator received central government subsidies, channeled through the municipality.

Sources: (World Bank, 2001, Triche, et al., 2006, Requena and Triche, 2006). Research by Daniel Nolesco.

***Haiti Rural Water and Sanitation Project**

It is the intention of the Haitian government to decentralize responsibility for water supply and sanitation to those local authorities capable of handling the tasks. The authorities will have the option to delegate management to private operators, municipal water companies, or community organizations. The project will construct or rehabilitate rural schemes, and test a private operator management model. This is in a context in which many rural community water committees have done a poor job of maintaining supplies and collecting funds. Due to some difficulty in attracting well-qualified private operators, the project is exploring the possibility of having the contractors act as operators.

Sources: (World Bank, 2010b, World Bank, 2006b)

***Paraguay Fourth Rural Water Supply and Sanitation Project**

SENSA, a central government agency, has the responsibility for providing water services in towns and settlements with populations below 10,000. SENSA has promoted WUAs (*Juntas Administradoras de Agua Potable*) to manage the completed schemes as well as collaborate in planning and implementation. The *juntas* have five to nine members, chosen by a community assembly, and a representative of the local government. Law No. 1614 gave *juntas* the right to outsource operations. A separate regulatory agency (ERSSAN) sets tariffs, connection policies, and technical standards.

SENSA financially supports the rural water sector with loans and grants for 40 to 80 percent of investment costs. The specific percentage depends on the size and resources of the target community. In practice, the actual subsidies end up being far larger, since communities often fail to make agreed cash contributions or to service their debt. The basic problem lies in the reluctance of the *juntas* to collect user payments.

The Bank-assisted Fourth Rural Water Supply and Sanitation Project (1997-2007) included a component to test build-and-operate contracts and an OBA approach as means to limit subsidies-through-non-payment. In their bids, private firms competed on the size of the subsidy that they would require from the government in order to build technically specified schemes. To win, firms in

effect had to invest some of their own capital, to be recovered from scheme revenue. The firms signed a construction contract with the supervising government agency, SENSA, and a ten-year concession contract with each water user association. The private operator would assume full commercial risk for operating and maintaining the system, and has complete managerial control over operations during the ten-year contract period. The government paid out the subsidies as the firms achieved various construction and connection milestones. The concession agreements spelled out tariffs, connection fees, and service levels, so that firms could not realize profits at the expense of consumers, but only through controlling costs and collecting payments.

The project assisted four rural communities that had populations around or below 5,000 (a total population of 9,600 and a median population of 1,500). As the communities were located within a 10-kilometer radius of each other, they received a single piped scheme. This scheme cost approximately \$700,000.

The winning bidder provided half the investment financing. It would recover 40 percent of this from SENASA after achieving output targets, and the rest from connection charges, and if necessary tariff revenues. The subsidy in the winning bid was US\$196 per connection. As of May 2010, it had risen to \$250. Tariffs cover operational costs, but not expansion. As the treatment plants has already reached its capacity, the operator is currently studying how to increase its capacity without raising tariffs.

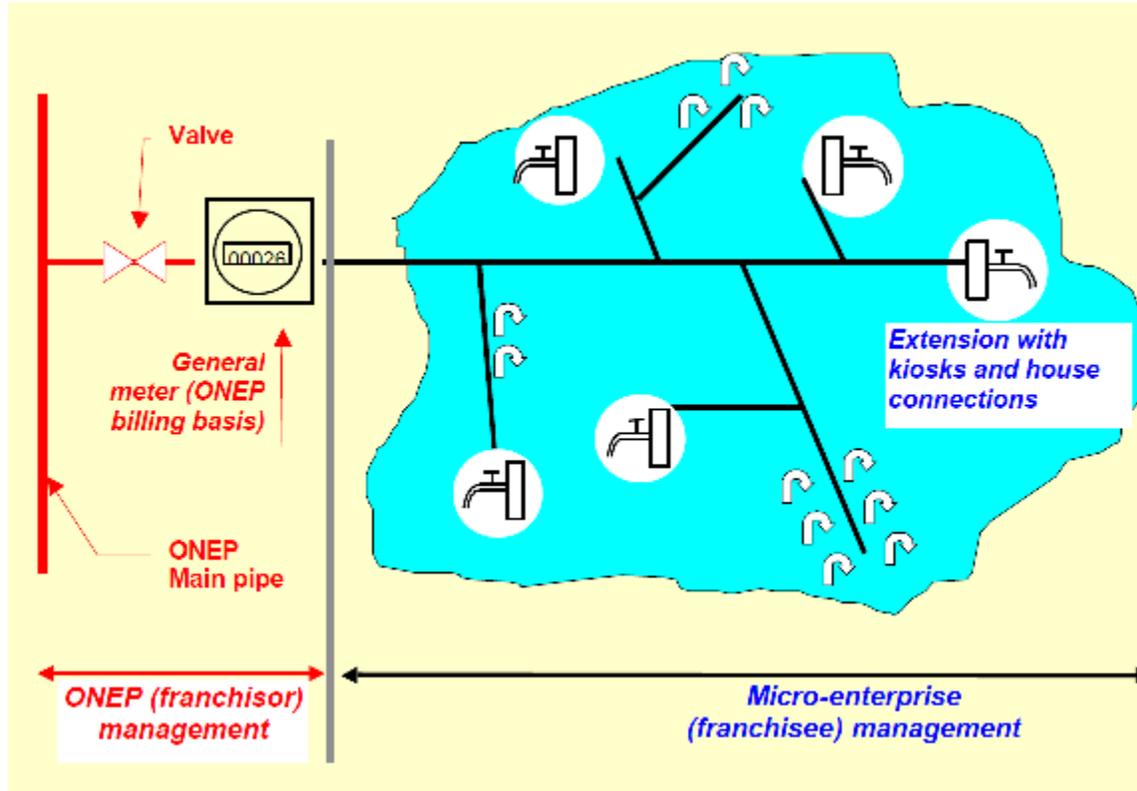
Sources: (World Bank, 1997, Triche, et al., 2006, Requena and Triche, 2006, Drees-Gross, et al., 2005)

A1.4 Middle East and North Africa

***Morocco ONEP Franchise System**

ONEP, the national utility, has used franchising to cut its very substantial operating losses in small towns and villages: ONEP delivers water to bulk meters, and contracts local companies to handle all downstream operations, as illustrated in Figure 2.

Figure 2: Graphic Presentation of ONEP Franchise System in Rural Morocco



Source: Collignon, 2002.

The Bank-assisted Rural Water Supply and Sanitation Project is currently helping ONEP to test an output-based aid version of this, which will improve the incentives to make the franchise financially viable and to expand service in rural areas. As a pilot, ONEP will select a private operator to take over the small piped networks in one area of the country. The operator will be remunerated from water sales and from subsidies that the utility will provide against three outputs: increased number of household connections; increased water sales; and network expansion into the surrounding rural villages. Thus, the contract sets up a number of incentives for the operator to keep down operation and maintenance costs, and increase water sales and the customer base. These actions are key to turning schemes into a financially viable business, and to expanding service to larger and rural populations

Source: (Collignon, 2002, Chauvot de Beauchene, 2009).

A1.5 South Asia

Bangladesh Bangladesh Water Supply Program Project

The rural component of the Bank-assisted BWSPP was designed primarily as a scalable response to arsenic groundwater contamination. By the early 1990s, more than ninety percent of rural Bangladeshis had access to safe water, primarily due to handpumps on shallow boreholes. However, by 1997 it became clear that arsenic contaminated groundwater down to depths of two hundred to two hundred fifty meters across large parts of the country. Shallow handpump sources had reached other limits as well, such as falling water tables and largely unserved areas where this technology was not feasible. Meanwhile, research by WSP had indicated an overwhelming preference by rural consumers for piped water compared to other arsenic mitigation technologies, and a willingness to pay for such services. In addition, the Bank had pilot tested a rural private operator model for piped schemes in several other projects. BWSPP drew on these findings and experiences.

BWSPP received an IDA grant of \$40 million for 2005-2009, extended to December 2010. The credit was reduced to \$18.5 million, when the project was restructured in 2008, and funds transferred to flood and hurricane relief assistance. The original target for the rural component was 300 piped schemes, reduced to 21 after the mid-term restructuring.

The BWSPP concept was to award design-build-operate contracts on a competitive and O&M basis to NGOs or private firms. As originally envisioned, a NGO or private sector partner would have the scheme designed, oversee construction, provide a major share of the capital financing, and operate the completed scheme for at least 15 years. The project would provide 50 percent of the investment costs, and the private operator would mobilize 50 percent, of which 10 percent would be collected from consumers. The operator would raise its share from its own funds and possibly bank loans. The project was supposed to facilitate the latter through establishing a credit market through a national bank. The private operators would be reimbursed as construction milestones were achieved.

The inability of private operators to raise financing became a major impediment to attracting operators and to managing cash flow during construction. BWSPP did not attract private companies as originally envisioned. Instead, interest has come from larger NGOs, and wealthy individuals who appear to be more philanthropists interested in helping villages than entrepreneurs interested in developing a business. The private sector's lack of interest stems in part from the failure of BWSPP to establish a credit market. Without financing, the private sector could not or would not mobilize the required 40 percent investment. Furthermore, the 10 percent of investment financing that was supposed to come from consumers proved difficult for the operators to collect. The experience on the 21 schemes has been that consumers start to pay their connection fees only when the scheme is near completion or operating. For all these reasons, the required investment from the private operator was dropped to 30 percent, including 10 percent from the community, when BWSPP was restructured.

Closely related to the financing problem was the capital cost of the schemes. The first BWSP scheme cost \$140,000 compared to under \$30,000 for village piped schemes built under the government's RDA projects. The higher cost of the schemes stemmed from their size: bigger and higher overhead tanks; more distribution lines, expensive water treatment, and a large number of household connections included in the contractor's costs.

The core of the management model is an agreement between the private operator and the community. Prior to scheme construction, the operator forms a community committee. The operator signs service agreements with each connection holder, and agrees with the committee on the business plan.

The first BWSP scheme (Duptara) did not generate sufficient revenue in its first year of operation to cover operation and maintenance, due to an insufficient number of connections. Revenue collection was somewhat less than US\$214 per month due to the inevitable non-payment by some connection holders. Meanwhile, routine monthly operation costs were about US\$382. As a result of the revenue shortfall, in 2008 the scheme only supplied water three times a day for a total of six hours.

Sources: (Ahmad, et al., 2003, World Bank, 2004c, Kleemeier, 2010).

Bangladesh Rural Development Academy Multipurpose Schemes

The Rural Development Academy (RDA), a government research and training institute, has developed combined drinking water and irrigation supply schemes based on large diameter tubewells with submersible pumps. RDA will design, construct, and provide 90 percent of financing for individuals or groups who agree to provide a 10 percent down payment, operate the scheme, and repay the financing within ten years. Along with the schemes, RDA also provides microcredit and training to bolster villagers' ability to pay for water. As of January 2008, RDA had completed 73 schemes with another 56 planned or under construction. However, RDA has not yet succeeded in recouping any of its investment costs beyond the down payment.

Sources: (Matin, et al., 2006a, Matin, et al., 2006b, Fontein, 2007, Kleemeier, 2010).

India Bulk Water Supply to Multi-Village Schemes

An emerging model in India leaves bill collection, operation, and maintenance within the villages to local government (*gram panchayats*) but contracts private operators for the common infrastructure that delivers water to the villages in a multi-village scheme.

An example is the Songaon-Mekhali regional scheme, which served four villages in Pune District, Maharashtra State. The *zilla parishad* (equivalent of a district) is the asset owner, and had operated the scheme for one year, before deciding to solicit tenders from private companies to take over water treatment and transmission to each village's overhead tank. An open bid process was used to invite bids for one-year renewable contracts. The contract itself was based on a

standard state document. The Zilla Water Management Unit, originally established for a proposed KfW-assisted project, manages the contract. Block (lower level of government) officials do the actual supervision.

This example is a relatively minor case, and so does not quite fit the study criterion of large-scale implementation. However, it represents an emerging trend. Using private operators to handle bulk supply to villages is under consideration in at least one Bank-assisted project.

Sources: (Srivastava and Sharma, 2004).

***India Naandi Foundation Water Treatment Plants**

The Naandi Foundation describes itself as “one of the largest and fastest growing social sector organizations in India working to make poverty history.” Started by an extremely successful businessman, the foundation bases its approach to poverty on using public-private partnerships to create sustainable models for delivering critical services. Safe drinking water is a core program.

Naandi formed a relationship with Water Health India (WH India), a subsidiary of Water Health International (WHI), an American company that markets ultra-violet water treatment plants. IFC provided WHI with a \$90,000 grant to improve the company's business plan, followed by a \$1.2 million equity investment in the company. As a result, WHI was able to launch its business in India and elsewhere. Naandi also works with Tata Projects, which markets a reverse osmosis plant.

The idea behind the treatment plants is to provide safe drinking water (only) at a price well below bottled water. Consumers will continue to rely on other sources, such as government-run rural piped schemes, for other domestic water uses. A WHI plant fits in a small building, about the size of a one-car garage, located next to a surface water source. Water is sold from a distribution point at the plant in reusable plastic jerry cans, either directly to consumers or to water vendors who make home deliveries.

As of 2010, the Naandi Foundation had 300 plants (WH India and Tata combined) serving 393,000 households in 13 districts in Andhra Pradesh and Punjab.

Naandi acts as program manager, once agreement has been reached with the community and local government that a village will receive a WHI plant.¹² The foundation secures financing, signs a build-and-operate agreement with WH India, hires a community worker to promote safe water, and eventually collects the user fees.

WH India builds the plant and is responsible for its operation and maintenance for eight years. The company hires and trains villagers to do this work. At the end of the period, the assets transfer to the village, which has the option to continue to contract WH India as operator.

¹² Little information is available on whether and how the business model may differ when Tata Projects Ltd. is the build-and-operate contract holder.

Financing comes partly from a 20 percent cash contribution from the villages, made by villagers, philanthropists, the local government, or some combination. The village also agrees to provide the water source, the land where the plant will be located, and a subsidized electricity tariff. Naandi raises the remainder through long-term loans from commercial banks in India, partly underwritten by philanthropic organizations such as the Acumen Fund and The Bill and Melinda Gates Foundation. In 2007, GPOBA agreed to reimburse up to \$850,000 of investments costs in 25 villages, as certain sequential targets were met: plants constructed; 500 poverty-level households registered as users; and three months of payments by these users.

Sources: (Mandri-Perrott, 2008, IFC, 2010b, World Bank, 2007b, Kumar, 2009, Naandi Foundation, 2010, World Bank, 2010a).

ANNEX 2. MODELS AND PROJECTS CITED IN DFID RESEARCH

This annex provides additional information on models and projects that were cited in DFID-financed research as possible alternatives to community managed handpumps and other rural water supplies. Chapter 2, and particularly Section 2.1, refers to this DFID study on handpump sustainability and the resulting publications (Harvey and Reed, 2004, Parry-Jones, et al., 2001)

Self-supply or the household-centered approach

“Self-supply” refers to simple improvements to water supplies that households or groups of households can finance and execute by using very affordable technologies. These technologies include rainwater harvesting, deepening and lining wells, inexpensive water-lifting devices such as rope pumps, simple household water treatment, and so forth. The concept is to avoid management and financing issues by putting the household or a small group of households in charge (Sutton, 2004b, Sutton, 2004a, Sutton, 2009).

Handpump leasing

One private management model suggested by the DFID research was for a local company to own and operate the handpumps, and to lease them to the villages where they were located (Harvey and Reed, 2004, p. 180, Parry-Jones, et al., 2001, p. 29-30). The practical example of this approach was a small town water utility in Angola that maintained handpumps in surrounding villages for a fee. Under a Dutch-financed project in Lubango, Angola, the company had maintained handpumps in the rural and peri-urban areas surrounding the town since 1990. Each family paid US\$0.40 per month to the pump caretaker, half of which was for the caretaker’s salary and the rest to the company. The estimated annual revenue per handpump was \$240 versus annual costs of \$150 for salary, spare parts, unforeseen repairs, and future investment (Van Beers, 2001).

Intrigued by the example, WSP sent a mission to Lubango and other municipalities in southern Angola where the leasing concept was being tested (Zuin, 2006). The mission found that mobile Water Brigades were responsible for the repairs and maintenance of the handpumps. However, only three out of 14 brigades operated in rural areas. These brigades had begun rather recently, and only one had managed to collect monthly payments from some of the households using the twenty handpumps under the brigade. Due to lack of funds and the high costs of reaching the more distant rural pumps, the brigades were not doing the envisioned maintenance. More generally, out of the 14 brigades, only the Lubango Brigade was covering costs, because it had 125 handpumps in a relatively densely populated area.

The handpump leasing concept was also tested in Kenya through a Catholic Dioceses’ program aided by several donors, and implemented by the same manager who had worked previously on

the Lubango project (Erpf, 2006). In this case, though, the leases (maintenance contracts) were issued by the project. The whole system collapsed when the project came to an abrupt end.

Vergnet Basic and Total Warranty

This approach differed from handpump leasing only in that the village would own the handpumps, but pay for a warranty to cover either preventative maintenance and labor for repair. For a higher fee, all maintenance and repairs would be covered (Harvey and Reed, 2004, p. 176, Parry-Jones, et al., 2001, p. 31).

Vergnet Hydro, a French manufacturer, piloted two versions of this model on some of its pumps in West Africa. In the basic warranty system, water committees paid a fixed annual sum for the vendor-operator to do preventative maintenance, and make repairs. The committees, however, paid for repair parts. In the total warranty system, the vendor-operator paid for all maintenance, including parts, against an annual fee (Diallo, 2009).

Vergnet's assessment was that neither system worked well because the water committees had difficulties in collecting user payments, managing funds, and controlling disputes within the community. In short, the village water committees were so weak that they could not hold up their end of the warranty agreement (Bouzerma, 2007).

ANNEX 3. TECHNICAL SPECIFICATIONS FOR SELECTED PIPED SCHEMES

Country	Vietnam	Bangladesh	Bangladesh	Paraguay
Initiative	Red River Delta RWSSP	BWSPP	RDA Multipurpose Schemes	Fourth RWSSP
Type of Scheme:	Piped schemes serving most to all the settlements within a commune. Some schemes will serve multiple communes.	Single village piped scheme in Duptara Village. .	Single village scheme in Garamahstan for domestic and irrigation supply	Multi-village scheme connecting four villages in one Department
Cost	\$200,000 - \$520,000 (USD 2008) per scheme, for the six schemes completed in 2007	\$140,000 (USD 2006)	\$13,000 (USD 2006)	\$700,000 (USD 2004)
Source	Rivers, irrigation canals	Medium deep borehole	Medium deep borehole	River
Power	Electric	Electric	Electric	Not available
Treatment	Plant with conventional treatment system for coagulation and mixing, flocculation, sedimentation, filtration, and disinfection. Small sludge lagoon.	Filtration, chemical	none	Addition of lime and aluminum sulfate. Fast mixing and mechanical flocculator. High rate settler. Fast filter. Addition of sodium hypochlorite.
Storage	No schemes have storage tanks in the sense of providing emergency supplies. Some schemes have elevated concrete tanks for balancing and with intention to use gravity distribution (which is generally not done).	60 m ³ overhead tank	30 m ³ overhead tank	Three reservoirs, three elevated tanks. total capacity of 610 m ³

Country	Vietnam	Bangladesh	Bangladesh	Paraguay
Initiative	Red River Delta RWSSP	BWSPP	RDA Multipurpose Schemes	Fourth RWSSP
Connections type	Individual connections only	Individual (yard connections shared by several households, and individual household connections)	Individual (household and commercial)	One standpost. Remaining ones are individual (household and commercial)
Metering	All connections are metered.	No	No	All connections metered
Filtration Plant capacity	25 m ³ per hour (example from 1 scheme)	30 m ³ per hour	No filtration plant. Pump discharge is 125 m ³ per hour	60 m ³ per hour
Per capita design	80 liters per capita per day, assumption of 100% connection rate	Not available	Not available	130 liters per capita per day
Transmission pipe	20 - 75 each for the first 6 schemes	9.9 km	1.6 km	37 km.
Distribution pipe				60 km
Number of connections	1,200 – 3,100 per scheme, for the six completed schemes. Up to 18,000 per scheme, for the schemes in preparation	175 actual, January 2008. 946 planned at time of construction	170	1,940
Population served	3,000 – 13,500 per scheme, for the six completed schemes. Up to 58,000 per scheme, for the schemes in preparation	Not available	Not available	8,800

Country	Vietnam	Bangladesh	Bangladesh	Paraguay
Initiative	Red River Delta RWSSP	BWSPP	RDA Multipurpose Schemes	Fourth RWSSP
Age of schemes	6 schemes completed in 2007 74 schemes in preparation	Scheme largely completed in 2007	2005	2005

Sources: See references given in Annex 1 for the respective initiatives.

REFERENCES

- Ahmad, Junaid, B.N. Goldar, S. Misra, and M. Jakariya. 2003. *Willingness to Pay for Arsenic-free, Safe Drinking Water in Bangladesh*, WSP South Asia Series, Delhi: Water and Sanitation Program.
- ANTEA. 2006. *Mise en oeuvre du programme : Programme d'application de la réforme du système de gestion des infrastructures hydrauliques d'alimentation en eau potable en milieu rural et semi urbain*, Cotonou: Ministère de l'Agriculture, de l'Hydraulique et des Ressources Halieutiques.
- Bakalian, Alexander, and Wendy Wakeman. 2009. *Post-Construction Support and Sustainability in Community-Managed Rural Water Supply: Case Studies in Peru, Bolivia, and Ghana*, Water Sector Board Discussion Paper series, Washington, DC: World Bank.
- Baker, Judy. 2009. *Opportunities and Challenges for Small Scale Private Service Providers in Electricity and Water Supply: Evidence from Bangladesh, Cambodia, Kenya, and the Philippines*, Washington, DC: World Bank.
- Baumann, Erich, and Kerstin Danert. 2008. *Operation and Maintenance of Rural Water Supplies in Malawi: Study Findings*, St.Gallen, Switzerland: SKAT.
- Blanc, Aymeric, and Cedric Ghesquières. 2006. "Secteur de l'eau au Senegal : un partenariat équilibre entre acteurs publics et privés pour servir les plus démunis?" Paper presented at Les PPP : de l'eau pour les plus démunis?, June 15.
- Boucher, Chanel. 2005. *The Rural Water Supply and Sanitation Initiative: An initiative of the African Development Bank for building a partnership for poverty reduction in Africa*, New York: African Development Bank Group and United Nations.
- Bouzerma, Dominique. 2007. Personal Communication, April.
- Carlier, Rodolphe. 2001. "Concessionnaires de réseaux d'adduction d'eau potable, naissance d'un métier." *Traverses*. no. 9. April.
- CEH-SIDI. 2009. *Evaluation de l'expérience de la réforme de l'Hydraulique Rurale (Cas du Projet Sectoreil Eau - PSE)*, Niamey: Ministère de l'Hydraulique.
- Chauvot de Beauchene, Xavier. 2009. "Output-Based Aid in Morocco (Part 2): Expanding Water Supply Service in Rural Areas." *OBApproaches, GPOBA* (26) (June).
- Collignon, Bernard. 2002. "Outsourcing and Franchising: How ONEP (Morocco) Mobilizes Small Scale Local Enterprises to Cut Down Running Costs" Paper presented at Water and Sanitation Services in Small Towns and Multi-Village Schemes, Addis Ababa, June 11-15.
- Diallo, Mamadou. 2009. *La Pérennisation du service d'accès à l'eau potable et à l'assainissement: Le cas du Burkina Faso*, pS-Eau.

- Direction Générale des Ressources en Eau. undated. "Programme d'Application de la Reform dy système de gestion des infrastructures hydrauliques d'approvisionnement en eau potable en miliuex rural et semi-urbain au Burkina Faso." accessed January - August 2010.
- Drees-Gross, Franz, Jordan Schwartz, Maria Angelica Sotomayor, and Alexander Bakalian. 2005. "Output-Based Aid in Water: Lessons in Implementation from a Pilot in Paraguay." *OBApproaches: GPOBA (7)* (May).
- Erpf, Karl. 2006. *The Lease Concept Introduced in the Rural Water Development Programme in Catholic Dioceses of Homa Bay, Kisii, and Ngong, Kenya*, St. Gallen, Switzerland: SKAT - RWSN.
- Fall, Madio. undated. "Public-Private Partnership in the Rural Water Supply Sector, The Senegalese Experience." Presentation.
- Fichtner Water and Transportation GmbH. 2010. *Evaluation du processus de professionnalisation de la gestion des AEV -- Benin*, Cotonou: Water and Sanitation Program.
- Fontein, Maarten. 2007. "An Evaluation of a Multiple-Use Water Supply System Developed by the Rural Development Academy, Bangladesh." Cranfield University.
- GPOBA. 2010. *Micro-Finance for Small Piped Water Schemes - Kenya*, Semi-Annual Status Report, GPOBA, Washington, DC: World Bank.
- Groupement Egis BCEOM International, and Cabinet THEC. 2009. *Projet d'elaboration du guide des services d'aep dans le domaine de l'hydraulique rurale: Rapport de L'Etat des lieux*, Niamey: Ministry of Hydraulics.
- Harvey, P.A., and R.A. Reed. 2004. *Rural Water Supply in Africa: Building Blocks for Handpump Sustainability*, Leicestershire, UK: WEDC, Loughborough University.
- . 2005. "Sustainable Supply Chains for Rural Water Supplies in Africa." *Engineering Sustainability* 159 (ESI): 31-39.
- Harvey, Peter. 2005. *Operation and Maintenance for Rural Water Services: Sustainable Solutions*, WELL Briefing Note, Leicestershire, UK: Loughborough University.
- . 2009. *Handpump Data, Selected Countries in Sub-Saharan Africa*, St. Gallen, Switzerland: RWSN.
- Harvey, Peter A., and Robert A. Reed. 2006. "Community Managed Water Supplies in Africa: Sustainable or Dispensible?" *Community Development Journal* 42 (3): 365-78 (July).
- Hydroconseil. 2009a. *Detailed Case Studies of Experiences in PPP or PSP in the Construction and Subsequent Management of WSS in Disperse Rural Areas- Country Report: Niger*, Nairobi: Water and Sanitation Program.
- . 2009b. *Detailed Case Studies of Experiences in PPP or PSPP in the Construction and Subsequent Management of WSS in Disperse Rural Areas - FRUGAL: Rwanda Case Study*, Nairobi: Water and Sanitation Program.

- . 2009c. *Mission to analyze and document the delegated management of rural water supply systems: Final Report - Tome 1*, Nairobi: Water and Sanitation Program.
- IFC. 2010a. "IFC Financing to Micro, Small, and Medium Enterprises (MSMEs): Sub-Saharan Africa." accessed August 2010. IFC Website.
- . 2010b. "IFC Paves Way for Client to Deliver Clean, Affordable Water to Poorest." accessed August 2010. IFC Website.
- . undated. *There's Nothing "Micro" about Poverty: The World Bank Group and Microfinance*, Brochure, Washington, DC: World Bank, CGAP and IFC.
- K-Rep Bank. undated. *Maji ni Maisha: Financing Investment in Water*, Nairobi: K-Rep Bank.
- Kariuki, Mukami, and Jordan Schwartz. 2005. *Small-Scale Private Service Providers of Water Supply and Electricity: A Review of Incidence, Structure, Pricing, and Operating Characteristics*, Policy Research Working Paper, Washington, DC: World Bank.
- Kleemeier, Elizabeth. 2000. "The Impact of Participation on Sustainability: An Analysis of the Malawi Rural Piped Scheme Program." *World Development* 28 (5): 929-44 (May).
- . 2001. "The Role of Government in Maintaining Rural Water Supplies: Caveats from Malawi's Gravity Schemes." *Public Administration and Development* 21 (3): 245-57 (August).
- . 2008. *An Assessment of Rural Piped Water Schemes in Bangladesh*, Dhaka: Water and Sanitation Program.
- . 2010. *The Impetus to Experiment: Private Provision of Rural Piped Water in Bangladesh*, Dhaka: Water and Sanitation Program.
- Komives, Kristin. 2000. "South Africa's BoTT Program in the Northern Province and Eastern Cape." *Crystal Clear: The BPD Water and Sanitation Cluster Newsletter*. no. 4.
- Kumar, Anjali Ravi. 2009. *Private Initiatives in Water Quality Management in Andhra Pradesh, India*, Delhi: Water and Sanitation Program.
- Leroy-Themeze, Claude, Christophe Prevost, and Sylvestre Bea. 2009. "Scaling Up Rural Water Supply Service in Benin: A Programmatic Approach and Budget Support." accessed June 2010. IFC Website.
- Lockwood, Harold. 2002. *Institutional Support Mechanisms for Community-Managed Rural Water Supply and Sanitation Systems in Latin America*, Washington, DC: Environmental Health Program, USAID.
- Mahe, Jean-Pierre. 2010. *Building Water Utilities with Local Private Entrepreneurs: The Example of the MIREP Program in Cambodia*, Washington, DC: Water and Sanitation Program and GRET.
- Mandri-Perrott, Cledan. 2008. "Output-Based Aid in India: Community Water Project in Andhra Pradesh." *OBApproaches, GPOBA* (21) (October).

- Matin, M.A., Mahmoud Hossain Khan, and Md. Nazrul Islam Khan. 2003. "Key Note Paper on Mitigating Arsenic Problem through RDA-developed Multipurpose Low-cost DTW" Paper presented at Proceedings of the National Seminar on Mitigating Arsenic Problem through RDA-Developed Multipurpose Low-cost DTW, September 10.
- . 2006a. *RDA-Developed Low-Cost DTW Technology for Multipurpose Uses: Performance Evaluation*, Bogra: Rural Development Academy.
- . 2006b. *Safe Drinking Water Supply through RDA-Developed Low-Cost Deep Tubewell*, Bogra: Rural Development Academy.
- Mehta, Meera, and Kameel Virjee. 2003. *Financing Small Water Supply and Sanitation Service Providers: Exploring the Microfinance Option in Sub-Saharan Africa*, Nairobi: Water and Sanitation Program.
- . 2007. *Microfinance for Rural Piped Water Services in Kenya: Using an Output-Based Aid Approach for Leveraging and Increasing Sustainability*, Nairobi: Water and Sanitation Program.
- Mehta, Meera, Kameel Virjee, Barbara Evans, and King'ori Wathobio. 2007. *Business Development Services for Community-managed Small Water Enterprises: From Post-Construction Support to Business Development Services in Kenya*, Nairobi: Water and Sanitation Program.
- Ministère de l'Energie, des Mines et de l'Eau. 2009. *Plan d'action pour le développement de la délégation de l'exploitation du service de l'eau à des opérateurs privés dans les Centre AEP en milieu rural et semi-urbain*, Bamako: Direction Nationale de l'Hydraulique.
- Naandi Foundation. 2010. "Safe Drinking Water." accessed September 2010. Naandi Foundation Website.
- Netherlands Ministry of Foreign Affairs. 2009. *Etude d'impact des programmes d'approvisionnement en eau potable et d'assainissement au Bénin : Rapport de la mission d'évaluation institutionnelle*, Cotonou: Government of the Netherlands.
- Niang, Masse. circa 2001. *The Development and Management of Rural Multi-Village Schemes: Main Findings of the Case Study in Senegal*, Dakar: Water and Sanitation Program.
- Nolasco and Associates, Inc. 2004. *Estudio sobre Sostenibilidad de Servicios de Agua y Saneamiento Rural en Ecuador*, Lima: Water and Sanitation Program.
- . 2005. *Lecciones aprendidas sobre los factores que contribuyen a la sostenibilidad de los servicios de agua y saneamiento en América Latina*, Lima: Water and Sanitation Program.
- Nolasco, Daniel. 2010. *Case Study of Inter-American Development Bank-assisted rural water schemes in Cordoba-Santa Fe Provinces, Argentina*, Buenos Aires: Nolasco and Associates, Inc.
- Oyo, Anthony. 2001. *Creating Successful Private Sector Supply Chains: A Resource Guide*, Washington, DC: Water and Sanitation Program.

- . 2006. *Spare Part Supplies for Handpumps in Africa: Success Factors for Sustainability*, Nairobi: Water and Sanitation Program.
- Parry-Jones, S., R. Reed, and B.H. Skinner. 2001. *Sustainable Handpump Projects in Africa: A Literature Review*, Leicestershire, UK: WEDC, Loughborough University.
- Pilgrim, Nick, Bob Roche, John Klabermatten, Cathy Revels, and Mukami Kariuki. 2007. *Principles of Town Water Supply and Sanitation, Part 1: Water Supply*, Water Working Notes, Washington, DC: World Bank.
- Prevost, Christophe. 2009. *Benin PRSCs: Assessment of Budget Support Effectiveness in RWSS*, Nairobi: Water and Sanitation Program.
- Republic of Senegal. 2005. *Lettre de politique sectorielle de l'hydraulique et de l'assainissement en milieu urbain et rural*, Dakar: Ministry of Agriculture and Water. Ministry of Public Health, Hygiene, and Sanitation. Ministry of Planning and Sustainable Development. Ministry of Economy and Finance.
- Requena, Sixto, and Thelma Triche. 2006. *Engaging Local Private Operators in Water Supply and Sanitation Services-Emerging Experiences in Five Countries. Volume II: Case Studies*, Washington, DC: World Bank.
- Robinson, Andy. 2000. *The Demand or Dependency?: AfriDevs in Pakistan*, Delhi: Water and Sanitation Program.
- Robinson, Andy, and Ajay Paul. 2000. *The Growth of Private Sector Participation and Rural Water Supply and Sanitation in Bangladesh*, Delhi: Water and Sanitation Program.
- Salter, Dan. 2003. *Private Sector Financing of Rural Water Supply in Vietnam and Cambodia*, Jakarta: Water and Sanitation Program.
- . 2004. *Private Sector Engagement in Rural Water Supply in the Mekong Delta: Tapping the Market*, Jakarta: Water and Sanitation Program.
- Srivastava, Vivek, and Pooja Sharma. 2004. *Alternative Management Approaches for Village Water Supply Systems*, Delhi: Water and Sanitation Program.
- Sutton, Sally. 2004a. *Preliminary Desk Study of Potential for Self Supply in Sub-Saharan Africa*, SWL Consultants UK.
- . 2004b. *Self Supply: A Fresh Approach to Water for Rural Populations*, Nairobi: Water and Sanitation Program.
- . 2009. *An Introduction to Self Supply: Putting the User First: Incremental improvements and private investment in rural water supply*, Washington, DC: Water and Sanitation Program.
- Trémolet, Sophie. 2002. "Rural Water Service: Is a Private National Operator a Viable Business Model?" *Viewpoint: PPIAF* (249) (June).

- Trémolet, Sophie, Sara Browning, and Charlotte Howard. 2002. *Water Services in Cote d'Ivoire and Senegal*, PPIAF, London: Environmental Resources Management.
- Trémolet, Sophie, and Joanna Neale. 2002. *Water and Electricity Services in Gabon*, PPIAF, London: Environmental Resources Management.
- Triche, Thelma, Sixto Requena, and Mukami Kariuki. 2006. *Engaging Local Private Operators in Water Supply and Sanitation Services: Initial Lessons from Emerging Experience in Cambodia, Columbia, Paraguay, the Philippines, and Uganda*, Washington, DC: World Bank.
- Valfrey-Visser, Bruno, David Schaub-Jones, Bernard Collignon, and Emmanuel Chaponnière. 2006. *Access through Innovation: Expanding Water Service Delivery through Independent Network Providers; Considerations for Practitioners and Policymakers*, London: Building Partnerships for Development in Water and Sanitation.
- Van Beers, Paul. 2001. "Leasing, a New Handpump O&M Concept" Paper presented at the 27th WEDC Conference: People and Systems for Water, Sanitation, and Health, Lusaka, Zambia, August 20-24.
- Vergnet Hydro. 2010. "Retour d'expérience sur l'exploitation de petits réseaux d'adduction d'eau potable au Burkina Faso." Presentation, Vergnet Hydro.
- Vézina, Marc. 2002. *Water Services in Small Towns in Africa: The Role of Small and Medium-Sized Organizations*, Nairobi: Water and Sanitation Program.
- Virjee, Kameel. 2009. "Leveraging Private Sector Finance for Rural Piped Water Infrastructure: The Use of Output-Based Aid." *OBA Approaches, GPOBA* (30) (October).
- Waddell, Steve. 2000a. *Emerging Models for Developing Water Systems for the Rural Poor: From Contracts to Co-Production*, Research and Surveys Series, London: Building Partnerships for Development in Water and Sanitation.
- . 2000b. "Emerging Models for Developing Water Systems for the Rural Poor: From Contracts to Co-Production." *Crystal Clear: The BPD Water and Sanitation Cluster Newsletter*. no. 5.
- WaterAid Tanzania. 2009. *Management for Sustainability: Practical lessons from three studies on the management of rural water supply schemes*, Dar es Salaam: WaterAid Tanzania.
- World Bank. 1997. *Project Appraisal Document on Two Proposed Loans in the Amounts of US\$20.0 Million equivalent and US\$20 Million to the Republic of Paraguay for the Fourth Rural Water Supply and Sanitation Project*, Washington, DC: World Bank.
- . 2001. *Project Appraisal Document on a Proposed Loan in the Amount of US\$40 million to the Republic of Columbia for a Water Sector Reform Assistance Project*, Washington, DC: World Bank.
- . 2003. *Project Appraisal Document on a Proposed Credit in the Amount of US\$16.9 million and a Proposed Grant in the Amount of US\$3.1 million to the Kingdom of Cambodia for a Provincial and Peri-Urban Water and Sanitation Project*, Washington, DC: World Bank.

- . 2004a. *International Development Association Program Document for a Proposed Credit in the Amount of SDR 10.3 Million (US \$15 Million Equivalent) and a Proposed Grant in the Amount of SDR 34.3 Million (US \$50 Million Equivalent) to the Republic of Rwanda for a Poverty Reduction Support Credit and Grant*, Washington, DC: World Bank.
- . 2004b. *International Development Association Program Document for a Proposed Credit in the Amount of SDR 13.4 million (US\$20 million equivalent) to the Republic of Benin for a Poverty Reduction Support Credit*, Washington, DC: World Bank.
- . 2004c. *Project Appraisal Document on a Proposed Grant in the Amount of SDR 27.6 million (US\$40.0 million equivalent) to the People's Republic of Bangladesh for a Water Supply Program Project*, Washington, DC: World Bank.
- . 2005. *International Development Association Program Document for a Proposed Grant in the Amount of SDR 37.6 Million (US\$55 Million Equivalent) to the Republic of Rwanda for a Second Poverty Reduction Support Grant*, Washington, DC: World Bank.
- . 2006a. *International Development Association Program Document for a Proposed Grant in the Amount of SDR 33.8 Million (US \$50 Million Equivalent) to the Republic of Rwanda for a Third Poverty Reduction Support Grant*, Washington, DC: World Bank.
- . 2006b. *Project Appraisal Document on a proposed grant in the amount of SDR 3.4 Million (US\$5 Million equivalent) to the Republic of Haiti for a Rural Water and Sanitation Project*, Washington, DC: World Bank.
- . 2007a. *Africa Infrastructure Country Diagnostic Water Supply and Sanitation Survey Database*, Washington, DC: World Bank.
- . 2007b. *GPOBA Commitment Paper: Naandi - India Foundation*, Washington, DC: World Bank.
- . 2007c. *GPOBA Commitment Paper: Vietnam EMWF GPOBA Rural Water Supply Development Project*, Washington, DC: World Bank.
- . 2007d. *International Development Association Program Document for a Proposed Second Poverty Reduction Support Credit (PRSC-II) in the Amount of SDR 26.5 Million (US\$42 million equivalent) to the Republic of Mali*, Washington, DC: World Bank.
- . 2007e. *Project Appraisal Document on a Proposed Credit in the Amount of SDR 18.4 million (US\$27.5 million equivalent) and a Proposed Grant in the Amount of SDR 15.0 Million (US\$22.5 million equivalent) to the Republic of Malawi for a Second National Water Development Project*, Washington D.C.:
- . 2008a. *Implementation Completion and Results Report (Credit No. 3994-RW and Grant No's. H130-RW, H189-RW, H260-RW) on Credits/ Grants in the amount of SDR116 Million (US\$170 Million equivalent) to the Republic of Rwanda for the First Poverty Reduction Support Credit/Grant, Second Poverty Reduction Support Grant, and Third Poverty Reduction Support Grant*, Washington, DC: World Bank.

- . 2008b. *Implementation Completion and Results Report (IDA-33680 IDA-3368A) on a credit in the amount of SDR 15.1 Million (US\$20.0 Million equivalent) to the Republic of Rwanda for a Rural Water Supply and Sanitation Project*, Washington, DC: World Bank.
- . 2008c. *Implementation Completion and Results Report on a Credit in the Amount of SDR 15.1 million (US\$20.0 million equivalent) to the Republic of Rwanda for a Rural Water Supply and Sanitation Project*, Washington, DC: World Bank.
- . 2009a. *Africa Infrastructure Country Diagnostic: Africa's Infrastructure: A Time for Transformation: Overview*, Washington, DC: World Bank.
- . 2009b. "Cambodia: Provincial and Peri-urban Water and Sanitation Project (PPUWSP) - World Bank Supervision Mission December 1-5, 2009." Aide Memoire, World Bank.
- . 2009c. *Cameroun : Revue des Dépenses Publiques, Secteur de l'Eau et de l'Assainissement en Milieu Rural*, Washington, DC: World Bank.
- . 2009d. *Implementation Completion and Results Report (Credit No 4268-ML and Credit No. 4388-ML) on a Credit in the Amount of SDR (US\$92 million equivalent) to the Republic of Mali for First Poverty Reduction Support Credit (PRSC I) and Second Poverty Reduction Support Credit (PRSC II)* Washington, DC: World Bank.
- . 2009e. "Kenya Microfinance for Water Projects (P104075) Second Supervision Mission Aide Memoire." Aide Memoire, World Bank.
- . 2009f. "Microfinance for Water Projects First Supervision Mission Aide Memoire." Aide Memoire, World Bank.
- . 2009g. *Niger : Revue des Dépenses Publiques, Secteur de l'Eau et de l'Assainissement en Milieu Rural (2002-2007)*, Washington, DC: World Bank and Agence Française de Développement.
- . 2009h. "Red River Delta Rural Water Supply and Sanitation Project - Mid term and implementation review mission." Aide Memoire, World Bank.
- . 2009i. *Semi-Annual Status Report: Vietnam EMWF GPOBA Rural Water Supply Development Project*, Washington, DC: World Bank.
- . 2010a. "Dr. Water Changes Lives in Andra Pradesh." *WSP Media Monitoring*. September 17.
- . 2010b. "Haiti Projet Eau Potable et Assainissement en Mileu Rural (EPAR), Mission de Supervision technique du 4 au 9 mars 2010, Aide-mémoire." Aide Memoire, World Bank.
- . 2010c. *Project Appraisal Document on a Proposed Credit in the Amount of SDR 34.2 million (US\$55 million equivalent) to the Republic of Senegal for the Water and Sanitation Millennium Project*, Washington, DC: World Bank.
- . 2010d. "Second National Water Development Project Mid Term Review and Fifth Implementation Review Mission." Aide Memoire, World Bank.

- WSP. 2001. *Multi-Village Rural Water Supply Schemes: An Emerging Challenge*, Washington, DC: Water and Sanitation Program.
- . 2006a. *Analyse comparative des systèmes de délégation de gestion de réseaux d'adductionj d'eau potable en milieu rural: Mali*, Dakar: Water and Sanitation Program.
- . 2006b. *Analyse comparative des systemes de delegation de gestion de reseaux d'adductionj d'eau potable en milieu rural: Rapport intermediaire par pays- Senegal*, Dakar: Water and Sanitation Program.
- . 2006c. *Analyse comparative des systemes de delegation de gestion de reseaux d'adductionj d'eau potable en milieu rural: Rapport intermediaire par pays - Mauritanie*, Dakar: Water and Sanitation Program.
- . 2009a. "Mali Professionalizes Rural Water Supply management." *Access Newsletter*. December.
- . 2009b. "Mali Water Sector Embraces Public-Private Partnerships." *Access Newsletter*. August.
- . 2010. *Bilan et perspectives de la délégation de gestion sur les réseaux d'adduction d'eau en milieu rural et semi-urbain au Bénin, Burkina Faso, Mali, Mauritanie, Niger, Rwanda, et Sénégal*, Dakar: Water and Sanitation Program.
- Zuin, Valentina. 2006. *Are Water Brigades an Alternative Post-Construction Management Model for Rural Water Supply? An Overview of the Experience of the Huila Province, Angola*, Back to Office Report, Washington, DC: Water and Sanitation Program.