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POVERTY REDUCTION AND ENVIRONMENT AND ENERGY

COMMERCIALIZING COMMUNITIES: TRANSITIONS IN WATER MANAGEMENT IN RURAL SENEGAL

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Commercializing Communities: Transitions in Water Management in Rural Senegal

February 2013

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Acknowledgments

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Excellent research assistance was provided by the following doctoral students at LAREM, University of Dakar (UCAD): Kandioura Dramé, Amadou Soumaré, Ibrahima Diouf, Modou Dieng, Seydina Omar Sèye, Mamadou Dione, Cheikh Ahmed Bamba Diagne. This research would not have been possible without the valuable contributions from the staff of government departments, international agencies, private sector firms and NGOs in Dakar who were extremely generous in providing advice, information and data.

The authors would like to thank the residents of the communities that took part in the study for giving up their time to answer our questions and share their experiences. Without the cooperation of community water managers and households, this research would not have been possible.

The paper is copy edited by Emily Schabacker, and the final proofreading by Shams Banihani of UNDP.

Cover Photo

Kate Bayliss/Senegal.

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CONTENTS

ACRONYMS AND ABBREVIATIONS

AFD	*Agence Française de Développement* (French Development Agency)
AG	*Assemblée Générale* (General Assembly)
ASUFOR	*Association des Usagers des Forages* (Association of borehole users)
BE	*Bureau Exécutif* (Executive Board)
CD	*Comité Directeur* (Management Committee)
CdG	*Comités de Gestion* (Management Committee)
DEM	*Direction de l'Exploitation et de la Maintenance* (Office of Operations and Maintenance)
DGRE	*Direction Générale des Ressources en eau*
DHR	*Direction de l'Hydraulique Rurale* (Office of Rural Water)
FCFA	*Franc Communauté Financière Africaine* (CFA Franc)
GNI	Gross National Income
HDI	Human Development Index
MAH	*Ministère de l'agriculture et de l'hydraulique* (Ministry of Agriculture and Water)
MDG	Millennium Development Goal
MHA	*Ministère de l'Hydraulique et de l'Assainissement* (Ministry for Water and Sanitation)
NNP	Notto-Ndiosmone-Palmarin
OECD	Organisation for Economic Co-operation and Development
PEPAM	*Programme d'eau potable et d'assainissement du Millenaire* (Water and Sanitation Millennium Project)
PPP	Public Private Partnership
REGEFOR	*Réforme du système de gestion des forages ruraux motorisés* (Reform of the management system for motorized rural boreholes)
SSA	Sub-Saharan Africa
WSP	Water and Sanitation Program
WHO	World Health Organization

SUMMARY OF MAIN FINDINGS AND POLICY RECOMMENDATIONS

This study found that financial management of rural water at the community level in Senegal has been strengthened by recent reforms. The Senegal experience shows the benefits of operating water systems at scale. A key element to the success of the rural water model in Senegal is the use of multi-village schemes rather than the village-level pump. These schemes mean that several villages and significant populations have a stake in ensuring their sustainability. In addition, it is cheaper per capita to operate a well serving several villages.

However, some households classified as having access to water often find it difficult to pay. In addition, poor households that cannot afford a household connection are forced to pay a higher tariff for water from stand-posts. There seemed to be more emphasis on cost recovery than affordability or equity when it came to financing water. Prices were high with a regressive tariff structure.

In all case study locations where comparison was possible, the standpipe tariff was considerably higher than the cost of water from a household connection. Water is charged at the same price to all connections for domestic use, whether a standpipe or a household connection. However, the price at a standpipe is higher for end users because there is an additional charge to cover the fee paid to the standpipe operator. This situation has a regressive result: standpipe users — the poorer community members who cannot afford a household connection — are charged more for their water.

Connection costs are not subsidized. In all cases, the full cost of connection was paid by the household. Overall, the average connection cost was US$116. Most residents paid the full cost themselves. These costs are high for many residents. In some surveyed villages, there is very little economic activity. With the average Gross National Income per capita at US$1,050 — and over 60 percent of the rural population living in poverty — a piped connection is out of reach for many households.

The study indicates that minimum needs are mostly met, with the majority of residents within close reach of a stand-post. However the averages mask some low consumption estimates. For some households,, the length of collection time may mean that consumption levels fall to dangerous levels. The majority of standpipe users interviewed indicated that they would like to consume more water (54 percent) compared with 46 percent who said that they consumed a sufficient quantity for their household.

Households reported that they adopted various coping strategies when they had difficulty paying their water bill. Several households reported that they reduced consumption when they were in financial difficulties. While most households used water from wells or from neighbours, some reported using unsafe sources such as rivers and creeks when they could not pay for water. This suggests that the number of disconnections is a blunt instrument for measuring affordability as this is an extreme measure and end users go to considerable lengths to avoid reaching this stage. More research is required to determine how poor households pay their water bills and the extent to which meeting water expenses requires them to reduce other expenditures.

This study found variability in the extent to which households participate in water management. Most households interviewed had not been involved with their water management authority. The majority of those interviewed had not been involved in the selection of their representative nor had they contacted them, although the majority were able to name their representative.

Households with a piped connection reported that their supply is interrupted several times a week, although about half reported interruptions less than monthly. The top three reasons for a break in supply are equipment breakdown, power failure and a leak, with these accounting for 96 percent of supply interruptions.

Finally, the Millennium Development Goals (MDGs) fail to capture some core aspects of water usage. The MDGs measure access to safe water in terms of use of 'improved' water sources, without considering the quality of the water. But in some areas, households that use improved sources actually lack access to water that meets the World Health Organization (WHO) quality standards. Similarly, while the data indicate relatively high rates of access, the survey shows that in poor rural areas, the water system is precarious. Households that are classified as having access to safe water often must adopt coping strategies to keep their water bills down.

Policy recommendations

The main lesson from the Senegal experience is that water management can be transferred to communities successfully in some cases to some degree, but more research is needed to determine the circumstances under which community management thrives. The system works better in locations with good infrastructure and where incomes are higher. Recommendations to improve policy outcomes include:

Affordability: Rural water management should be more pro-poor. While financial sustainability is vital, the system should be structured to ensure that the needs of the poorest households are met. Households that cannot afford to pay should receive assistance. Policy options include income-based subsidies, free water up to the WHO minimum level, stand-post subsidies and connection-cost subsidies.

Clustering: Decentralization has eroded the scope for redistribution. The experience in Senegal shows the benefits of operating at scale. The multi-village approach provides economies of scale and ensures buy-in from a large number of end users. More collective operations of local water systems through clustering mechanisms could support risk pooling and facilitate cross-subsidy across areas of varying economic activity.

Role of the state and limits of privatization: Government support remains important. Much of the success of rural water systems in Senegal is due to state involvement. Infrastructure is mostly financed by the state and maintenance has been supported. Private sector input has been marginal so far and has failed to improve maintenance due to low profitability and contracts that are often not honoured. In addition, private interest is skewed towards high-income areas where water quality and infrastructure are good. The focus on cost recovery, which has biased outcomes away from poor households, is likely to be accentuated with a private operator in place. There is considerable scope for exploitation without strong regulation.

MDGs have limited value as indicators of water access: According to the MDG indicators, most of the households interviewed would classify as having access to safe water. However, there are two aspects of water consumption that considerably affect water safety but are overlooked by the MDG measurement. First, the quality of tap water may be poor and in some cases, households only use tap water for washing and cleaning. Second, many households financially struggle to access water, which affects consumption levels. Access indicators should be refined if they are to genuinely reflect household welfare.

1. INTRODUCTION

In the past three decades, there has been a transformation in approaches to water delivery in rural sub-Saharan Africa (SSA). State provision, widespread until the 1980s, has to varying degrees been replaced by community management, which in turn is shifting towards provision systems based on marketization, decentralization and private sector delivery. Although rural water access rates have increased in SSA (see table 1), infrastructure sustainability remains low. Wells are often quickly obsolete and many are not functional. Increasing access depends on increasing the life span of infrastructure as much as increasing investment. This requires attention to the governance of water infrastructure and service delivery.

Table 1: Proportion of the population with access to safe drinking water[1]

	Urban			Rural			National		
	1990	2000	2010	1990	2000	2010	1990	2000	2010
Senegal	*88*	*90*	*93*	*43*	*49*	*56*	*61*	*66*	*72*
SSA	83	82	83	36	42	49	49	55	61
Developing regions	96	94	95	59	69	79	70	79	86
World	95	96	96	62	72	81	76	83	89

Source: UNICEF/WHO 2012.

The approach to rural water delivery in Senegal is considered successful compared with community management elsewhere (WSP 2010). Although only around 56 percent of Senegal's rural population has access to safe water, this exceeds the regional average of 49 percent. Rural water management in Senegal has evolved substantially since the mid-1980s as management responsibilities have shifted from the central government towards local communities.

This study examines the impact of water management policy reforms in rural areas of Senegal, drawing on interviews with key stakeholders, community representatives and households. Section 2 sets out the conceptual framework and research methodology. Section 3 explores the context for the research, starting with an overview of rural water supply in SSA before moving to Senegal. An analysis of the research findings is provided in section 4, and conclusions and policy implications are set out in section 5.

Overall, the research demonstrates that there are indeed relatively high rates of access in some areas of the country and compared with the rest of the region, the level of functionality is high. In addition, the new system of community management has led to an accumulation of savings at the local level. However, the cost of water is high. There has been an emphasis on improving financial efficiency rather than access. With a shift towards more private sector involvement, the focus on revenue maximization is likely to be accentuated. Poor households pay more for water from standpipes than users with a private connection yet many are excluded from networked services because of the high cost of a connection. Some households that are classified as having access to safe water nevertheless find that water is barely affordable. While progress has been made in strengthening rural institutions, greater support is needed for those who are struggling to pay for water.

1 Indicators of access to water are based on households' reported use of water sources. These are classified into improved and unimproved. Where a household reports that they use an improved source for drinking water, they are classified as having access to safe water. The definitions of 'improved' as opposed to 'unimproved' water sources are provided in Annex A.

2. CONCEPTUAL FRAMEWORK AND METHODOLOGY

This study investigates the impact of water reforms in Senegal, specifically, the commercialized approach to water management in rural areas. Given its relatively high rates of access and sustainability in rural areas, Senegal can offer valuable lessons to other countries in the region. As in the rest of SSA, Senegal began shifting towards community water management in the 1980s (Harvey and Reed 2006). The new community organizations are not private enterprises, but there has been a major shift towards commercialization. The ground is prepared for private sector involvement. Indeed, the private sector is already engaged in some locations and private sector engagement is high on the national policy agenda.

At the outset, this study aimed to determine the extent to which Senegal's community management system met typical indicators of delivery performance, such as efficiency, sustainability and accountability. However, as the study began to reveal key issues, the research questions were revised. One of the biggest concerns for rural communities — and particularly, lower income households — is the affordability of water. As a result, equity is a key focus of this study, which also addresses water governance, service quality and the role of the private sector.

The authors collected information through desk research, structured interviews with key stakeholders and a survey of households in selected villages. In January and March 2012, the authors met with the managers of EquipPlus (a private maintenance company) and key government stakeholders in the Office of Rural Water (DHR), the Office of Operations and Maintenance (DEM) and the Water and Sanitation Millennium Project (PEPAM — Programme d'eau potable et d'assainissement du Milenaire).[2] The authors also met with donors and non-governmental organizations (NGOs). During this period, the research team conducted meetings and interviews in six rural locations.

The survey began with identifying the population and selecting a sample. The population was identified as the PEPAM website list of 'infrastructures'.[3] This is a comprehensive list of the motorized wells in the country and includes data on the number of villages that each well serves and the population. The sample was biased towards the larger wells that served substantial populations and those that had subcontracted maintenance to the private sector. A search of the PEPAM database in January 2012 for infrastructures that served more than 3,000 people and that had subcontracted management of maintenance[4] generated a list of 12 'infrastructures'. The authors selected six from five regions and identified a target number of households to interview from each area, based on population size. The focal unit in the selection process is the infrastructure — the motorized well. A single well often serves several villages. Interviews with members and manager of the local Association of Borehole Users (ASUFOR) were conducted at the well, and the end users interviewed were selected from a village served by the well.

Annex B provides information about the survey locations, drawn from the PEPAM website. The target sample of 180 households was allocated pro rata across these villages according to population size. The surveys covered an average of 16.3 percent of the households in each village and survey questions were answered to varying degrees. This case study refers to the study locations by the name of the village that was the focus of research (Column 5 of Annex B).

2 Section 3.3 details the roles and responsibilities of these institutions.

3 *www.pepam.gouv.sn/infrastructure*

4 On the PEPAM website there are two companies to which firms have contracted maintenance — Equip Plus and SEEE. However, SEEE supports sustainable energy, not water maintenance, and is therefore not included in this study.

Research in each village took place over two days between January and March 2012.[5] The researchers held meetings with:

- The ASUFOR president and one or two ASUFOR members in five villages: Nganda, Ndioukeme, Toucar, Sandiara and Fimela. In Ndioum, a meeting was held with the president of the management committee.
- The manager of the water supply in the four locations with separate management.
- Households in each location. Household selection was not random. Rather, it was based on housing type (permanent structures and those with straw roofs), which was used as a proxy for socio-economic status.

A total 182 households were interviewed across the six locations. Full details of the allocation of the sample across the selected infrastructures are provided in Annex B. In each location, the number of standposts[6] and households according to the ASUFOR was different from the number recorded on the PEPAM website, probably reflecting a time lag. The sample included about 55 percent women and 45 percent men. The average age of interviewees was 44 years old. More than half of those interviewed (52.6 percent) could not read or write. Around 40 percent of those interviewed were casually or self-employed. Less than 6 percent were in paid employment. Table 2 summarizes the total number of households interviewed according to their location and their drinking water source. Some households had more than one source; they may have had a household connection but used well-water for drinking.

Table 2: Overview of survey sample

	Ndioum	Fimela	Toucar	Ndioukeme	Nganda	Sandiara	Total
Household connection — metered	20	10	43	0	26	8	107
Household connection — unmetered	0	1	1	0	0	0	2
Neighbour's connection	0	1	0	0	7	0	8
Standpost	0	6	9	22	5	1	43
Bottle/sachet	0	1	0	0	0	0	1
Protected wells	0	5	0	0	0	16	21
Total	20	24	53	22	38	25	182

5 Mansour Diop, co-author of this case study, conducted the interviews in five locations, and a local researcher conducted the interviews in the sixth (Nganda). Research students provided additional support. Interviews with households were conducted in Wolof and Serer, local languages.

6 A standpost is a public distribution point for a water supply.

3. BACKGROUND

3.1 Rural water in sub-Saharan Africa

This section provides a stylized overview of water delivery in SSA, highlighting the issues that are most relevant to this study. The authors acknowledge that SSA is a vast region with diverse experiences. The proportion of the population with access to safe drinking water is lower in rural than urban areas.[7] While the average national rate of access is around 61 percent for the region as a whole, in rural areas, less than half the population has access to safe water (49 percent), although this has increased from 36 percent since 1990 (see table 1). Notwithstanding the improvements over the past 20 years, long collection times and frequent breakdowns in water facilities are common features of rural water supplies in SSA.

In some parts of rural Africa, water collection times of more than 30 minutes are common. Those spending more than half an hour per round trip progressively collect less water so that consumption rates fall below levels required to maintain basic health (Cairncross and Feachem 1993; Hutton and Haller 2004; cited in UNICEF/WHO 2011, p. 28). Women and girls bear primary responsibility for water collection, which has a negative impact on their welfare and education (UNICEF/WHO 2012, p. 31). In these circumstances, equipment breakdowns can be devastating, yet there are many accounts of failing water infrastructure in SSA (for example, Harvey and Reed 2007; Lockwood and Smits 2011; IIED 2009).[8]

Improving access in rural areas, then, is as much about increasing the lifespan of investments as installing new water systems. The main reason for the short life of equipment is lack of maintenance, which in turn results from weak governance. In many countries, the state provided water without charge beginning soon after independence. However, the combined pressures of increasing costs and shrinking budgets, in a climate of structural adjustment policies, led to a shift in the 1980s towards community management, where rural water delivery became the responsibility of local villages.

Communities varied greatly in their capacity to manage services. There were challenges in transparency, citizen accountability, cost recovery and implementation capacity (WSP 2010). Many schemes failed or were abandoned as a result. According to Harvey and Reed (2003, p.116), communities often failed to fully understand what was required in the long term to sustain services. Consequently, many facilities fell into disrepair soon after installation or as soon as anything went wrong with the pump.[9]

Increasing access to water requires increasing the lifespan of investments, which in turn requires improved maintenance systems. To accomplish this, the overall governance of rural water systems must be strengthened. Policy options include improving institutional support to communities (for example, Lockwood 2002; Harvey

7 See Annex A for details on measurement of access.

8 The World Bank (2011) cites evidence that in Ghana, 70 percent of rural water point sources functioned at a substandard level. A study in Tanzania found that 46 percent of public improved water points were non-functional (Wateraid Tanzania, 2009). Another study reports that in many countries, more than a third of rural water systems were not working at any given time and in some (Democratic Republic of Congo, Madagascar and Malawi) more than half the rural water facilities were in need of rehabilitation (Banerjee and Morella, 2011). Sometimes very new water points are not sustained. Despite increases in investment, rural infrastructure often falls into disrepair within five to eight years (IIED, 2009, p.3). In Tanzania, 25 percent of 2-year old Water Points were already non-functional (Wateraid Tanzania, 2009).

9 For further analysis, see Harvey and Reed (2003).

and Reed 2007); operating on a larger scale (Schouten 2006; the triple-S initiative led by IRC International Water and Sanitation Centre[10]); and bringing in the private sector. Privatization is intended to improve governance by distancing village governments from water management, particularly revenue collection. It is intended to improve maintenance by providing a financial incentive for reliable water systems because a break in supply will result in lost revenue. Privatization is also considered to be a way to 'professionalize' the management of water (AGUASAN 2008, p. iv).

Privatization of public services is more prevalent in francophone Africa because of the civil law systems in place in those countries. Private sector involvement in rural water is much less common in countries with common law systems, such as the British Commonwealth (Kleemier and Lockwood 2012). According to a seven-country study by the Water and Sanitation Program (WSP), Mauritania and Niger have the highest penetration rates of public-private-partnerships (PPPs) in rural areas. The coverage of PPPs in Benin, Mali and Rwanda is expected to grow rapidly due to national action plans that are being implemented to accelerate this process (WSP 2010). There are two modes of private sector engagement in rural water delivery. First, equipment maintenance can be subcontracted to the private sector and second, management of water systems can be delegated to private enterprises.

Often the PPP arrangements for rural water are similar to traditional affermage-lease contracts, with the ownership of the assets separated from the management function. The nature of private sector entities varies but the largest group according to the WSP study is self-employed entrepreneurs. There are fewer large operators and they are more likely to participate when a number of schemes are clustered under one tender (as in Burkina Faso, Mauritania and Rwanda), or if an operator wins several successive tenders in one area (as in Niger) (WSP 2010).

There are challenges to involving the private sector in rural water delivery. First, it is often not profitable without special measures to enhance attractiveness (Aguasan 2008). Low population density and incomes in rural areas may be an impediment to successful private sector intervention in maintenance services (Banerjee and Morella 2011).

Second, even with private sector involvement, government support will be needed for technical support, regulation and finance (WSUP 2011, p.9; Lockwood and Smits, 2011). Regulation is often weak or absent in rural areas. A study by Wateraid of private involvement in the United Republic of Tanzania found evidence that private operators were making extremely large profits but were transferring very small proportions of their revenue to a water fund for future investment. However, villagers had little interest in regulation and were only interested in whether water flowed: 'if the village system yielded water then users were satisfied and seemingly disinterested in the matters of water management' (WaterAid Tanzania 2009, p.13).

Third, a vibrant market with a choice of operators and competitive pricing and/or effective regulation are required in order to benefit from private sector engagement. However, efforts to subcontract maintenance services to the private sector in rural areas can encounter difficulties due the scarcity of trained mechanics with spare parts within reach of village communities (IIED 2009, p.2).

Finally, water access is not simply a case of contractual processes but emerges from the underlying social and power relations that are the fundamental determinants of water allocation (UNDP 2006; Boelens 2008). Social relations can override contractual obligations.

10 *www.waterservicesthatlast.org*.

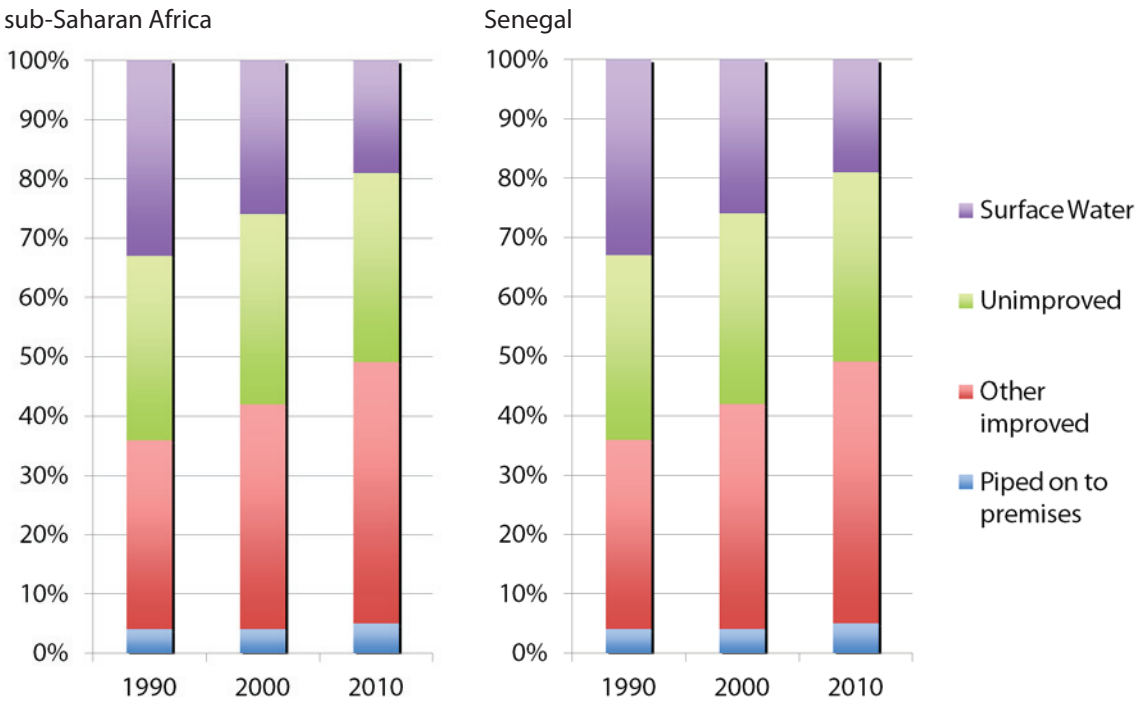
3.2 The institutional evolution of water in Senegal

3.2.1 Overview

Groundwater in Senegal is unevenly distributed and mostly extracted from deep aquifers. Quality varies greatly, with saline intrusion in the coastal areas and excessive levels of fluoride in the central part of the country. The distribution of groundwater is such that deep boreholes with motorized pumps were required to access water, and these are now widely used to supply water to Senegalese villages.

Levels of access to water in Senegal have increased substantially in the past two decades and are higher than average in the region for both rural and urban areas (see table 1). Connection rates are considerably higher in the Dakar area than the rest of the country, although the proportion of the rural population using piped water sources has increased substantially and is considerably higher than in other countries in the region (WSP 2010) (see figure1). There is relatively little use of surface water.

Figure 1: Rural water sources

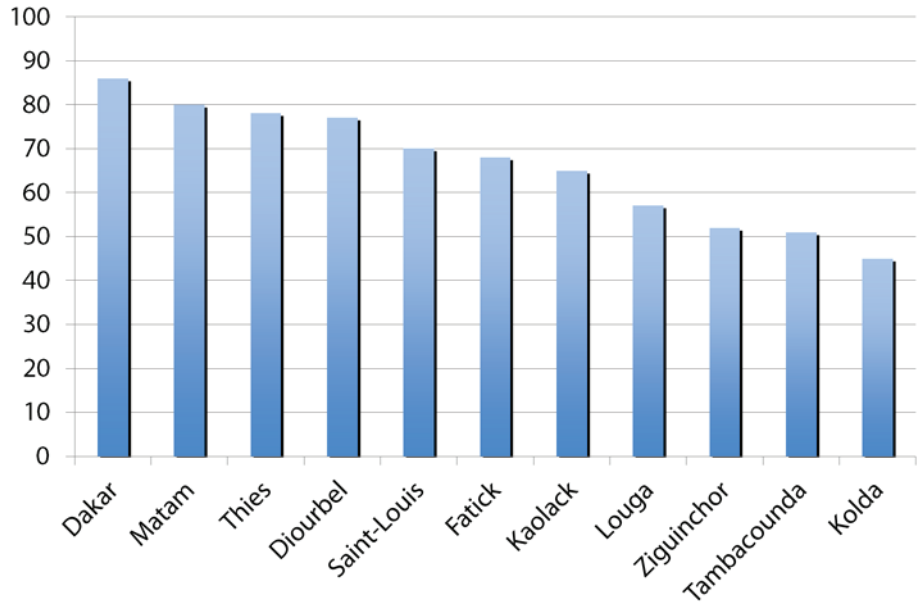


Source: Adapted from data in UNICEF/WHO 2012.

While access rates are relatively high at the national level, there is considerable diversity across regions in Senegal. Figure 2 shows rate of access for each region. Rates are highest in the Dakar region and lowest in Kolda.

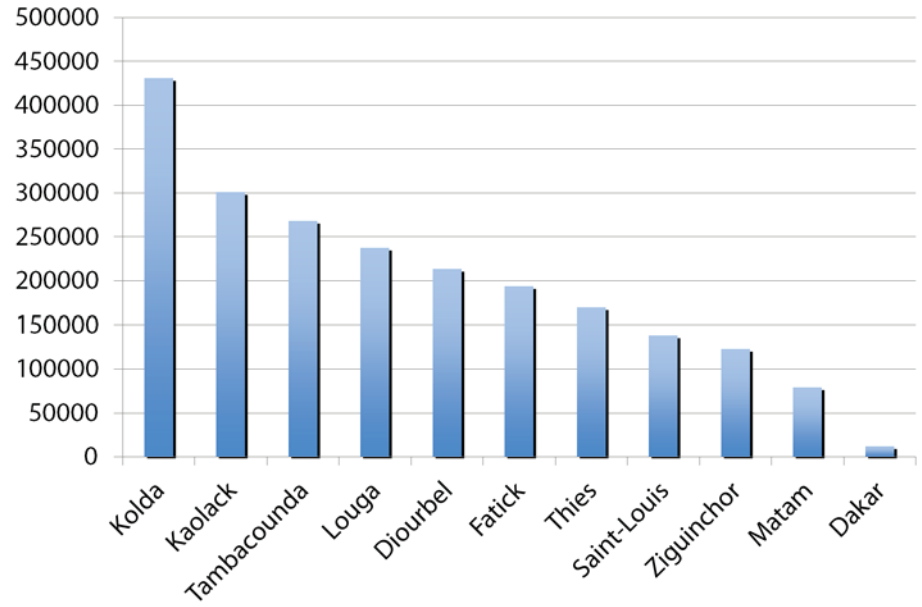
However, when these access rates are translated to absolute numbers, the discrepancies between regions are starker. The largest rural population without access to safe water is in Kolda, where the number of people without access is more than 36 times that of the highest access rate region, Dakar (see figure 3).

Figure 2: Proportion (percent) of the rural population with access to safe water (2010)



Source: Authors' calculations using data from PEPAM (2011).

Figure 3: Rural population without access to safe water (numbers)



Source: Authors' calculations using data from PEPAM (2011).

Water quality is a concern in large parts of the Central zone — Fatick, Kaolack, Kaffrine and Diourbel. In these areas, the high levels of fluoride, chloride and iron in the water often exceeds the standard set by the World Health Organization (WHO). Data from PEPAM suggest that around 21 percent of the population is served by wells where the levels of flouride and chloride exceed those specified in the Millennium Development Goals (MDGs). If water quality were taken into account, the rate of access for drinking water would fall considerably (AMCOW 2010).

The proportion of the population served by rural networks which are supplied by deep motorized wells is particularly high in Senegal compared with other countries in the region (WSP 2010). This provides economies of scale and risk-pooling that brings down costs (MAH 2004). Senegal has a multi-village approach where small piped networks serve several villages. These are generally small villages that are connected to a slightly bigger central village. Around 68 percent of the connected villages have fewer than 500 inhabitants and 14 percent have from 500 to 1,000 inhabitants. The number of villages supplied from the same borehole is 7.5 on average — a sample of 900 villages were supplied by 119 small piped networks (Aguaconsult 2008). In contrast with other countries in the Sahel, the use of hand pumps is marginal in Senegal (MAH 2004, World Bank 2010).

3.2.2 Institutional evolution

Since the change of government in 2012, water falls under the auspices of the *Ministère de l'Hydraulique et de l'Assainissement* (MHA — the Ministry for Water and Sanitation). Previously the *Ministere de l'Habitat, de la Construction et de l'Hydraulique* (Ministry for Housing, Construction and Water) managed rural water. Within the MHA, there are several departments. The *Office National de l'Assainissement du Sénégal* is responsible for sanitation. Urban water is the responsibility of the *Société Nationale des Eaux du Senegal*, which is a state-owned asset-holding company. Management of urban service has been contracted to *Senegalaise des Eaux* since 1996.

Within the MHA, rural water falls under the control of the *Direction de l'Exploitation et de la Maintenance* (Directorate for Operations and Maintenance, or DEM) and *Direction de l'Hydraulique Rurale* (Directorate for Rural Water, or DHR). DEM is responsible for the management of rural water, including regulating the sector, allocating operating licences, approving managers and controlling operators. DHR is responsible for the infrastructure and the investment.

Water delivery in rural areas was originally entirely controlled by the state. The first deep well in Senegal was constructed in Saint-Louis in 1904 and by 1942, there were 12 such wells. Starting in the 1940s, the state managed the construction of additional deep wells in rural areas. Until the 1980s, water was provided by a national state-owned and managed utility and the government covered all costs, including, fuel, repairs and staff. Water was provided free of charge. By the early 1980s, there were more than 180 deep motorized wells.

Until the early 1980s, end users were largely uninvolved in water management. By the early 1980s, however, it was clear that the state alone could not finance operation of the motorized wells and a strategy to recover some costs was gradually introduced (MAH 2004). In 1984 reforms were introduced to transfer control of water to the local community and allow the progressive withdrawal of the state from day-to-day involvement in the sector (except for maintenance). Across the country, water management committees (*Comites de Gestion*, or CdGs) were established to manage rural water systems. These committees assumed responsibility for the running costs of the motorized wells (the well operator and fuel costs). At this stage, the national government established DEM and made it responsible for major maintenance (Paldrup and Sy 2010; World Bank 2010).

Over time, it became clear that the capacity of the water management committees was not adequate to manage the water supply although performance was varied (MAH 2004; World Bank 2010, p.3). Some committees succeeded in functioning independently of the state, generating their own resources and taking control of repairs. Other committees failed to generate adequate resources and continued to rely on state interventions. By the mid-1990s, in many communities, revenue from the sale of water was not sufficient to cover costs. In addition, there was a sharp increase in the number of motorized wells, and DEM did not have the capacity to maintain the increased infrastructure. Cost recovery was low and there was little provision for repairs and renewal. In addition, the community organizations were not well organized (Paldrup and Sy 2010).

Sector reform began anew in 1996 with a project supported by the French Government through *Agence Française de Développement* (AFD). The AFD-sponsored programme, known as REGEFOR (*Réforme du système de gestion des forages ruraux motorisés*), addressed the weak capacity of the CdGs (MAH 2004, p.5). Under REGEFOR, the CdGs were converted to more formal associations, known as ASUFORs (*Association des Usagers des Forages*, or Association of Borehole Users). The first ASUFORs were established in a pilot phase in the central region in Diourbel, Fatick, Thies and Kaolack.

There were three main elements of the 1996 reforms (Paldrup and Sy 2010). First, the management committees became more formal. The ASUFORs had an independent legal status and were encouraged to engage with the financial system so that they could better manage their own finances. Each ASUFOR established a current account sustained by receipts from the sale of water and a savings account sustained by transfers from the current account. The ASUFORs were encouraged to access credit to finance investment such as pumps, generators and network extensions. Within the committees, user representation was functionally separated from the operation of water production and distribution.

Second, water meters were widely introduced and water began to be sold by volume, rather than at a flat rate. According to a World Bank assessment of the financial viability of ASUFORs, they were expected to cover their operating expenditures and the cost of renewed pumping equipment at an average tariff of FCFA 200/ cubic metre (m^3) for systems supplied by groundwater and FCFA 400/m^3 for systems supplied by water treatment plants (World Bank 2010, p.18).

Third, the reforms aimed to increase private sector involvement. Unlike the CdGs that preceded them, ASUFORs are able to enter into contracts. They can outsource maintenance to licensed private providers and can subcontract, or delegate, management of water delivery to a private sector entity. The aim of this change was to bring in the private sector to take over both management and maintenance of the wells. DEM supports 19 decentralized maintenance organizations (Brigades) and supervises 11 regional water divisions. However, DEM's maintenance activities have increasingly been curative rather than preventative, as its resources are insufficient to cope with the increasing number of boreholes (Paldrup and Sy 2010). The transfer of maintenance to the private sector was also intended to boost the technical capacity of local providers. With the private sector managing and maintaining wells, the idea was that DEM would redirect activities towards monitoring regulation and training (AMCOW 2010), supported by the World Bank (World Bank 2010, p.15). However, DEM would continue to retain a supportive role through its regional divisions. DEM, for example, approves the candidates for private managers and is involved in mediation if there is a dispute between manager and ASUFOR.

Typically, an ASUFOR has the following institutional structure (MdH 2007):

- A General Assembly (Assemblée Générale, or AG) that includes all users of the motorized well who have paid a subscription fee (FCFA 100 minimum).
- A Management Committee (*Comité Directeur*, or CD) that includes delegates elected from the AG. The CD may also include an elected delegate for each standpost with more than 200 users, one for each water trough in remote unconnected villages, one for farmers, one for market gardeners, one for sports and cultural associations, and one for every 20 private connections. Every village member should have a representative.
- An Executive Board (*Bureau Exécutif*, or BE) comprising nine members (including a president, two vice-presidents, a treasurer and a secretary) elected from the CD to carry out day-to-day management of the well. One of the vice president posts should be filled by a woman. The BE manages the accounts, implements decisions made by the AG and has the legal authority to sign maintenance and management contracts.
- A Control Commission that provides monitoring and support for the ASUFOR. The Commission includes the Chief of the local DEM Brigade or a representative from the Ministry, a representative of the *sous préfet* and the president of the local community or their representative.[11]

Each motorized well has an operator who is chosen by the ASUFOR and trained by DEM, and who is responsible for the well's upkeep. ASUFORs have the authority to appoint a private manager for the well with responsibility for all aspects of water service management, including billing end users, collecting revenues and paying expenses. The ASUFOR appoints stand post attendants who are paid from the receipts of water sales. This framework is intended to serve as a kind of hierarchical regulatory system: the CD monitors the BE, and the AG monitors the CD. Important decisions must be approved by the AG.

The cost of water includes investment costs, fixed operating costs (personnel, management expenses, maintenance) and variable operating costs (fuel, treatment products etc). The water tariff is intended to cover operating costs and maintenance and to make some provision, through the savings account, for the renewal of equipment (MdH 2007).

At the end of 2010, ASUFORs were operating 912 wells out of a total of 1,273. In other words, around 70 percent of wells were under ASUFOR management. The proportion is much higher in Kaolack, Fatick, Diourbel and Louga than in other regions because the ASUFOR system began in the central part of the country and is being rolled out in other areas over time (see table 3).

In some regions, some ASUFORs have banded together to form federations of ASUFORs. These federations are encouraged as a platform for dialogue with the government. Some federations have established mutual revolving funds where each ASUFOR pays a fee and can access the fund in the case of a breakdown. In Kaolack and Caritas, some federations even manage a technical advisory service and a maintenance centre (Aguasan 2008).

Table 3 shows the number and percentage of wells that were inactive due to breakdown at the end of 2010. Out of the total of 1,273 wells, 121 (or 9.5 percent) were not functioning. However, there are large regional disparities in breakdowns. For example, 47 percent in Kedougou and 30 percent in Kolda were not functioning. These regions also have the lowest proportions of wells managed by ASUFORs, but there may be many reasons for differing functionality rates.

11 Senegal is divided into133 *arrondissments* or districts each of which is managed by *a sous préfet*.

Table 3: ASUFORs in Senegal

Region	Total number of wells	Number managed by ASUFOR	Percent of wells managed by ASUFOR	Number of wells not functioning	Percent of wells not functioning
Kaolack	83	78	94	3	4
Fatick	75	66	88	5	7
Kaffrine	150	117	78	8	5
Diourbel	115	96	83	8	7
Saint-Louis	118	88	75	14	12
Ziguinchor	51	27	53	7	14
Sedhiou	42	33	79	6	14
Matam	118	75	64	4	3
Kolda	60	27	45	18	30
Kedougou	17	5	29	8	47
Tambacounda	128	61	48	28	22
Louga	205	164	80	5	2
Thies	111	75	68	7	6
Total/average	**1,273**	**912**	**68**	**121**	**13**

Source: adapted from PEPAM (2011).

Rural water facilities last longer in Senegal than elsewhere in the region. In line with the data presented in table 3, Bannejee and Morella (2011) find that Senegal has a rate of rural well functionality of 85 percent, which is the highest in a study of water supply in 12 SSA countries.

The large variation in the proportion of water schemes run by ASUFORs across Senegal reflects the fact that the REGEFOR project began in the central part of the country and has been slowly expanding to the north and south. According to a study by the French NGO *Groupe de Recherche et d'Echanges Technologique* (GRET), implementation of the REGEFOR reforms has been patchy and largely left to the initiative of the villagers with support from expatriate and émigré communities (Paldrup and Sy 2010, p.9). The eventual goal, however, is for all rural water to be managed by ASUFORs (Interview DEM, March 2012).

The policy reforms in rural water in the 1990s reflect a wider shift towards a more market-oriented framework in the Senegalese water sector. REGEFOR coincided with the privatization of urban water across the country. In 1996, the Government of Senegal awarded a concession contract to a French company, Bouygues, for the management of the national urban water utility, Senegalaise des Eaux. The delegated management of the national urban water utility in Senegal (and other Francophone countries) is some ways parallels the ASUFOR system of management for rural water. Under the ASUFOR system, local representatives have ultimate responsibility for water delivery but the day-to-day management is subcontracted to the private sector. In both cases, there is a shift towards establishing market relations between the private provider and the water end users based on the principle of full cost pricing (Diop and Hamath 2011).

In 2004, the Ministry of Agriculture and Water (*Ministère de l'agriculture et de l'hydraulique*, or MAH) commissioned an extensive review of Senegal's water and sanitation sector (MAH 2004). The review led to the establishment of the PEPAM in 2005, with the aim of achieving Senegal's water and sanitation MDG targets by 2015. PEPAM was created by Interministerial Order N° 5773 of 20 October 2005 and is designed to coordinate interventions in water and sanitation in both rural and urban areas (World Bank 2010). PEPAM's rural water objectives are to ensure the sustainable supply of water to 2.3 million more people and increase the level of rural households' access to drinking water to 82 percent by 2015.

PEPAM is the focal point for donor activity in water and sanitation. The organization's portfolio managed projects with a total value of FCFA 352bn between 2005 and 2009. These were predominantly funded by loans (65 percent), donations (28 percent) and state funding (7 percent). In rural areas, PEPAM has been instrumental in coordinating financing, which came to FCFA 93bn covering 15 programmes, between 2005 and 2009. Of this, 57 percent was in the form of loans and 43 percent in the form of grants (PEPAM 2010). In 2008 the government passed a new law (Service Public de l'eau potable et de l'assainissement, or the Public Service of Water and Sanitation law) to formalize and institutionalize the changes in delegated management and contractualization in place since 1994.

The World Bank has strongly supported water and sanitation reforms in Senegal for the past 15 years. In 2010 the proposed US$56.56m World Bank Water and Sanitation Millennium Project was approved. In rural areas, US$24.61m of International Development Association[12] funding was set aside for water system construction and rehabilitation and to support the further establishment and operation of ASUFORs. The World Bank loan also supports the transfer of the maintenance of motorized boreholes to the private sector and a study of the full delegation of the management of water supply systems in rural areas to the private sector (World Bank 2010).

12 The International Development Association is a dedicated World Bank fund that provides loans and grants to the world's poorest countries.

4. SURVEY FINDINGS

This section presents findings from the survey of households and ASUFOR members, and information from interviews with key stakeholders. The study included fieldwork in six locations, selected according to the methodology described in section 2. Annex C provides a brief overview of the infrastructure and management arrangements in each location to enhance understanding of the analysis of survey findings.

In five of the villages studied (Nganda, Toucar, Fimela, Sandiara and Ndioukeme), an ASUFOR was in place. The sixth village — Ndioum — had a management committee. In Ndioukeme, Nganda and Toucar, management was subcontracted to a private operator on an affermage basis, where the manager keeps the revenue from sales and pays a proportion of funds collected to the ASUFOR (although the contract in Toucar was cancelled and management had reverted to the ASUFOR). In Ndioum, management had been subcontracted on a flat rate basis, where the ASUFOR keeps the revenue from sales and pays the subcontractor a fixed sum.

In Sandiara and Fimela, the ASUFOR was responsible for water management. Both villages had struggled with water quality and were recently connected to a major new water source provided by the Notto-Ndiosmone-Palmarin project, which was due to come on stream at the time of this research. The Notto-Ndiosmone-Palmarin project was expected to greatly improve household water quality but at the time of the household interviews, many had not yet seen the benefits. In both Sandiara and Fimela it was reported that some households with connections to the motorized well used alternative water sources for drinking because of the poor quality of the tap water.

Table 2 notes the source of drinking water for households interviewed in each village. Most households (59 percent) have a metered household connection. Around 24 percent of households were using standposts. In Sandiara and Fimela, some households were using private wells for drinking water and a small proportion of households (4 percent), mainly in Nganda, used water from a neighbour's tap. Table 2 shows the diversity of water sources in the areas covered.

4.1 Affordability and the right to water

Access to a minimum amount of water to meet basic needs is a human right, and this right is threatened when households are denied access to water based on income. According to the United Nations (UN):

> The right to water requires water services to be affordable for all and nobody to be deprived of access because of an inability to pay. . . All direct and indirect costs related to water and sanitation should not prevent anyone from accessing these services and should not compromise their ability to enjoy other human rights, such as the rights to food, education, adequate housing or health. The affordability requirement also underlines that cost recovery should not become a barrier to access to safe drinking water and sanitation, notably by the poor.
>
> *(OHCHR 2010, p.11)*

Access indicators are usually based on household surveys that ask respondents about their water sources. However, these methods may mask some underlying constraints to access, such as affordability. This section demonstrates that some households classified as having access to water often find it difficult to pay. In addition, poor households that cannot afford a household connection are forced to pay a higher tariff for water from stand-posts. There

seemed to be more emphasis on cost recovery than affordability or equity when it came to financing water. Prices were high with a regressive tariff structure.

4.1.1 Consumption price

According to interviews with key stakeholders, in all the survey locations tariffs were determined by the ASUFOR (or the management committee in the case of Ndioum), usually in partnership with the manager and in some cases with the DHR. In Nganda, price is determined by agreement between the ASUFOR, manager and representative of DHR. In Sandiara, the ASUFOR and residents have reached a consensus to determine the price of water. In Toucar and Ndioukeme, price is determined by the ASUFOR and the manager. Of the six villages, only Ndioukeme and Ndioum had stable prices for the past five years. The others villages experienced price changes. Table 4 presents price information for standpipes and household connections for each of the survey areas based on interviews with households, ASUFOR members and managers of the wells.

Table 4: Average price paid for water in survey locations

	Standpipes				Piped connection		Standpipe mark-up (percent)
	Container size (litres)	Cost (FCFA)	Equivalent cost: FCFA/m³	US$/m³	FCFA/m³	US$/m³	
Toucar	25	11.5	450	0.90	300	0.60	50
Nganda	25	9	360	0.72	300	0.60	20
Ndioukeme	20	7.5	375	0.75	*	—	—
Fimela	30	10	333	0.67	300	0.60	11
Sandiara	30	10	333	0.67	200	0.40	67
Ndioum	**	—	—	—	185	0.37	—

Source: Survey interviews
** No piped connections in sample*
*** No standpipes in sample.*

As shown in table 4, the most expensive water in the study came from standpipes in Toucar. Some households in this village reported that they paid as much as FCFA 25 for two 25 litre Jerri cans of water which amounts to a cost per m³ of FCFA 500, or about US$1. The average standpipe water price was FCFA 460 (US$0.90) per m³.

Generally, water is expensive in SSA compared with other developing regions, but the tariff in Toucar is high even by African standards. Analysis by the Africa Infrastructure Country Diagnostic found the average tariff for SSA was US$0.67/m³. In comparison, the average tariff in middle-income countries is US$0.35/m³ and the average in South Asia is US$0.10/m³. The Organisation for Economic Co-operation and Development (OECD) average tariff was reported to be around US$1/m³ (Foster and Briceño-Garmendia 2010). The price of water from a standpipe in Toucar is not far off the average tariff in the far wealthier OECD countries.

Tariffs are lower in urban areas even though the incidence of poverty is much higher among rural communities. Table 5 provides details of water tariffs in Dakar, where water is charged with a progressive block tariff. The same tariff has been in place since 2003. For stand-post users, the cost of water is cheaper in urban areas, including Dakar.

Table 5: Urban water tariff, Senegalaise des Eaux

	Consumption per month	Tariff (FCFA)	Tariff
Social/lifeline tariff (< 10 m^3/month)	<10 m^3	191.32	0.38
Regular tariff (from 10 to 20 m^3/month)	11-20 m^3	629.88	1.26
Deterrent tariff (> 20 m^3/month)	> 20 m^3	788.67	1.58
Standposts		322.31	0.64

Source: www.sde.sn/h2otarif.htm and Diagne (2011).

In all case study locations where comparison was possible, the standpipe tariff was considerably higher than the cost of water from a household connection. Water is charged at the same price to all connections for domestic use, whether a standpipe or a household connection. However, the price at a standpipe is higher for end users because there is an additional charge to cover the fee paid to the standpipe operator. This situation has a regressive result: standpipe users — the poorer community members who cannot afford a household connection — are charged more for their water.

Almost all users of the piped network were charged the same price but some villages practiced price discrimination. In Ndioum, households, mosques and agricultural producers were charged different prices. In Nganda, there is a lower tariff for water provided to animal troughs — FCFA 200 rather than the FCFA 300 paid by users of household connections; standpipe users pay an even higher price.

In Sandiara and Fimela, some of the households interviewed obtained water from private wells — their own or a neighbour's. This was often the water that the household used for drinking, while water from the household connection was used for other purposes. In these cases, water was charged at FCFA 200/ m^3 (or in some cases was free), making it considerably cheaper than water from other sources.

4.1.2 Connection price

Connection costs are not subsidized. In all cases, the full cost of connection was paid by the household. Although costs are high, ASUFOR members reported that demand for connections was increasing.

There was a large range in the price for a connection to networked water. The highest recorded connection cost was in Fimela, at FCFA 150,000 (US$300) and the lowest in Toucar, at FCFA 1,000 (US$2). Table 6 shows the average connection cost paid by households in each village. The cheapest connection charges on average are in Ndioum, where the average cost is about a quarter of that in the most expensive village, Fimela.

Table 6: Average price paid for a household connection

	FCFA	US$
Toucar	60,425	121
Nganda	54,593	109
Fimela	104,864	209
Sandiara	54,000	108
Ndioum	27,447	55
Average	**57,834**	**116**

Source: Survey data.

Overall, the average connection cost was US$116. Most residents paid the full cost themselves. Only 3 percent reported that they had paid in instalments and 14 percent reported that they had borrowed money to pay for their connection. Most residents had been connected for several years (table 7).

Table 7: How long have you had your connection (months)?

	Number of households	Percent
Less than 30	18	15
From 30 to 60	26	22
From 60 to 90	26	22
From 90 to 120	26	22
From 120 to 150	14	11
From 150 to 180	4	3
More than 180	6	5
Total	**120**	**100.0**

Source: Survey data.

These costs are high for many residents. In some surveyed villages, there is very little economic activity. With the average Gross National Income (GNI) per capita at US$1,050 — and over 60 percent of the rural population living in poverty — a piped connection is out of reach for many households.

When asked why they did not have a household connection for drinking water, some standpipe users cited convenience. One household in Toucar said it took just one minute to fetch water from a standpipe near the house so there was no need for a household connection. However, the most common reason for not having a household connection was that the cost of connection was too high. Responses are listed in Table 8.

Table 8: Why do you not have a household connection for drinking water?

	Number of households	Percent
The cost of the connection is too high	32	59.3
The cost of water is too expensive	4	7.4
I do not want to pay a monthly bill	2	3.7
Water is not available	1	1.9
The service is unreliable	1	1.9
Other (including convenience)	14	25.9
Total	**54**	**100.0**

Source: Survey data.

4.1.3 Consumption levels

Households were asked how much water they consumed but estimates varied substantially, suggesting either human error in recall or misunderstanding of the question. As a result, the reliability of the reported information was questionable. Consumption estimates for users with a household connection are, therefore, based on the monthly household bill and the number of 'adult equivalents' in the household (two children were counted as one equivalent adult) to roughly estimate daily individual consumption in litres. The results, which only include those with a piped connection, are shown in Table 9.

Table 9: Average consumption — litres per capita per day

	Average consumption in litres per person per day	Number of observations
Toucar	49	23
Nganda	59	18
Fimela	129	9
Sandiara	156	16
Ndioum	84	16

Source: Calculations from survey data.

According to the UN, the right to water does not entitle individuals to an unlimited amount of water but to a water supply that is sufficient and continuous to cover personal and domestic uses (drinking, washing clothes, food preparation, personal and household hygiene). To meet basic needs with few health concerns the recommended consumption is between 50 and 100 litres per person per day (OCHCR 2010). Most households in the sample with a piped connection consumed enough water to meet their basic needs. However the averages mask some low consumption estimates. In Toucar, 15 out of 23 households consumed less than 50 litres per person per day and in Nganda, 7 out of 18 households consumed less than 50 litres per person per day.

For standpost users, likely consumption is probably lower. While responses were unclear on the volume of water consumed, standpost users were asked about the length of time taken to collect water. Research indicates that those spending more than half an hour per round trip to collect water progressively collect less water and eventually fail to meet their families' minimum daily consumption needs (JMP 2011, p.28). Most residents reported that the standpipe was near and they did not have to wait long in a queue, but some reported waiting for an hour or more.

On average, water was available to standpost users for about five hours a day although in some cases it was only available for one hour. There was wide variation in the reported number of trips each week to get water. Some said the trips numbered into the hundreds and some less than 10, suggesting there was confusion in the interpretation of this question and possibly some human error in the recall.

As with the analysis of households with a piped connection, the study indicates that minimum needs are mostly met, with the majority of residents within close reach of a standpost. However, for some, the length of collection time may mean that consumption levels fall to dangerous levels. The majority of standpipe users interviewed indicated that they would like to consume more water (54 percent) compared with 46 percent who said that they consumed a sufficient quantity for their household.

Under the UN Convention on the Elimination of all Forms of Discrimination against Women, parties are committed to taking all appropriate measures to eliminate discrimination against women in rural areas. However, failings in the water delivery system in the villages surveyed disproportionately penalize women and girls. Of the 49 households that responded to the question 'Who is responsible for obtaining water?' all replied 'women or girls'. Three out of the 49 indicated that men also obtained water but this was in addition to women. All the other respondents indicated that fetching water was the responsibility of female household members only. In other words, the burden of water collection falls almost entirely on women and girls.

4.1.4 Payment for water

Almost all households with a water connection had a meter, which was usually read monthly. Re-selling of water was rare and was reported in less than 4 percent of the surveyed households, although several households in Sandiara reported that they obtained water from a neighbour's connection. Bills are issued monthly. Eighty two percent (of 112 households that responded) indicated that they were satisfied with monthly billing. Less than 2 percent reported that they would rather be billed weekly. Some households are required to pay their bills in a short time-frame, with several reporting that they had to pay on the day that they received their bill. Virtually all that responded indicated that they would be disconnected if they did not pay their bill.

All ASUFOR members interviewed confirmed that households that failed to pay their bills were disconnected. In two cases, households had to pay to be reconnected. Being disconnected can be a severe penalty since some households are located far from a standpipe and have no other water sources. Out of 111 households that responded, around 10 percent reported that they had been disconnected for non-payment. About half were reconnected in less than two days, but for two households the duration of disconnection was longer than six days. During the period of disconnection, households obtained water from standpipes, wells and neighbours.

Disconnection is an extreme indicator of lack of affordability. Just because a household is not disconnected does not mean that water is affordable. Households were asked if — aside from disconnections — they ever had difficulty paying their water bill and if they had taken measures to reduce expenditure on water in the previous

month. Eighteen percent reported that they had been required to use lower quality water in the previous month because they did not have sufficient funds to pay their water bills. These responses are in addition to those that said they had been disconnected at some stage. Others had not been disconnected but had taken measures to reduce water consumption because of affordability. Almost a quarter reported that they sometimes had difficulty paying, although not all had been disconnected (see table 10 for responses on affordability).

Table 10: Affordability responses

	Survey response	Number	Percent
Have you ever been disconnected for non-payment?	Yes	12	12.24
	No	86	87.76
Total		98	100.00
Have you had to use lower quality water in the past month because of affordability?	Yes	19	17.92
	No	87	82.08
Total		106	100.00
Have you ever had difficulty paying your water bill?	Yes	26	23.42
	No	85	76.58
Total		111	100.00

Source: Survey data.

Households reported that they adopted various coping strategies when they had difficulty paying their water bill. Several households reported that they reduced consumption when they were in financial difficulties. While most households used water from wells or from neighbours, some reported using unsafe sources such as rivers and creeks when they could not pay for water.

This suggests that the number of disconnections is a blunt instrument for measuring affordability as this is an extreme measure and end users go to considerable lengths to avoid reaching this stage. More research is required to determine how poor households pay their water bills and the extent to which meeting water expenses requires them to reduce other expenditures.

There is a danger that already low consumption levels will be pushed even lower if prices increase. In addition, high prices may damage the already precarious financial position of local management if users turn to alternative water sources. According to the manager in Nganda, late payments are a major problem in the village. Without sufficient revenue, there is not enough money to pay for fuel to power the generator that keeps the supply running.

Similarly in Ndioukème Ndiaye, late payments are a major threat to the functioning of the well, according to the manager. The local residents, who mostly earn their livings by selling crops and trading with surrounding areas, considered the price of water to be high relative to incomes. Costs are high in part because of the high costs of electricity. In addition, aging infrastructure means that leaks and supply disruptions are common but repairing the infrastructure would require an even higher tariff.

When asked if water was affordable for households in their village, the response from all ASUFOR members and directors was unanimous. All believed that the price of water was not affordable for their community. Ndioum was

the only village in which one of the community managers believed that water was affordable for local residents. This may be related to the amount of price discrimination as well as to the fact that tariff in considerably lower than in the other study locations (see table 4).

There are considerable challenges in extracting payment from households that cannot afford to pay, particularly where the manager is a member of the local community. Even though, in theory, households are disconnected if they do not pay their bills, ASUFOR members from Toucar explained that their community is small and they know when households are suffering financial hardship. They try to avoid disconnecting these households and allow considerable leeway on late payments. At the time of the research many villagers were suffering financially due to a poor harvest season, which made revenue collection extremely challenging as affordability was constrained for many.

It is not easy to disconnect households in the village context, where everyone knows each other and incomes are low. The ASUFOR members in Toucar explained their difficult situation. People cannot afford to pay their water bill and those collecting the revenue know this, and the rest of the community knows that they know this. The social framework means that the whole village is aware of financial hardships. The ASUFOR members said that they would be criticized by the community if they disconnected people who everyone knew could not afford to pay.

However, if households are allowed not to pay their bills they set a bad precedence for other households and without subsidies from elsewhere, the water system will eventually become unsustainable and water will not be available. In Toucar and in other locations (Ndioukeme, for example), very high rates of late payments were tolerated but households were not exempt. This is effectively an informal subsidy from those that pay their bills on time.

These findings are similar to those by Diop and Hamath (2011), who studied the impact of the REGEFOR scheme on the community of Ndiass in the Thies region of Senegal, where the ASUFOR contracted a private manager to run the water distribution system. This was heralded as a success in a report by WSP (2010, p.15) because of a large increase in household connections and accumulated savings of FCFA 14m. A key part of the reforms in Ndiass was the doubling of the price of water. As a result of the logic of cost recovery, poor households paid a higher price as long distances and weak population density mean that water provision is more expensive.

The ASUFOR system increases formality with a network of contracts, but the system is built on a long-standing social framework that can make it difficult for the manager to enforce payments. Diop and Hamath (2011) found that non-payments levels were high in Ndiass and that the manager sometimes covered deficits when people had not paid with his own money. The sanction of disconnection for non-payment was rarely applied. The shift to economic and financial priorities means effectively that the manager is left with the discretion to apply social policy. There is no scope for support for those who cannot pay their bills apart from at the discretion of the manager (Diop and Hamath 2011, p. 16-17). The contractual framework is overridden by social and kinship relationships.

Under the UN General Comment 15, the disconnection of water supplies where households fail to pay on account of affordability is a contravention of human rights. In cases where individuals are unable to pay for water, the authorities might have to provide it for free (OHCHR 2010, p. 35). In Senegal, it is the community managers of the water associations — rather than the local authority or the state — that are responsible for ensuring that the human rights of the poorest are not breached.

4.2 Governance and social relations

The ASUFOR is intended to be a transparent and democratic governance system (MAH 2004, p. 126). This study found variability in the extent to which households participate in water management. Most households interviewed had not been involved with their ASUFOR. The majority of those interviewed had not been involved in the selection of their representative nor had they contacted them, although the majority were able to name their representative.

Typically the ASUFOR consists of a committee in which all communities in a geographic area are represented. For example, in some locations, users for each standpipe will elect a representative, or there will be a delegate for every 20 houses. This large group then elects a smaller committee or 'bureau' of usually nine members who make decisions about water management in the area. In this study, the average committee size was 36 members. The smallest was Ndioukeme with nine members while Nganda had 55 members.

Most respondents stated that the ASUFOR representatives were selected by election. However in Ndioukeme, most respondents said that their ASUFOR member was appointed by the local village chief or leader. The majority of respondents indicated that they were not involved in the selection of their ASUFOR member (114 out of 151). ASUFOR members came from diverse backgrounds. Three worked in agriculture, one as a plumber, another a retired banker and another worked with small children. Most reported that they had not received training. The number of hours devoted to working for the ASUFOR was not reliably reported with some not recording a response while others said they worked 24 hours a day. Although women were responsible for obtaining water in all of the households interviewed, they are in the minority in the decision-making bodies. In most ASUFOR's three out of nine members (of the bureau) were female and in one case there were only two female members.

ASUFOR members are volunteers although some reported that they receive some compensation for participation. In Toucar ASUFOR members are paid FCFA 10,000 (US$19) a month and in Ndioukeme they receive between 5,000 and FCFA 6,000 (US$10-11) a month. In Sandiara, the ASUFOR treasurer reported receiving FCFA 44,100 a month (US$84). In Nganda, the members share an expenses allocation equivalent to 12 percent of total receipts from water bills. However, these sums are intended to compensate for time and expenses; the essence of the arrangement is that participation in the ASUFOR is voluntary. According to interviews, the ultimate sanction for non-performance by an ASUFOR member is to be removed from the ASUFOR. This was reported in Sandiara, Ndioukeme and Toucar, although it has rarely happened.

The role of the ASUFOR member is to communicate between community residents and the decision-makers of the committee. The precise roles vary. In Toucar, where there was not a separate manager, the ASUFOR members were responsible for revenue collection. In other locations, the ASUFOR members have more of a regulatory function, monitoring the manager and controlling finances. The methods of communication between end users and the ASUFOR members varied, split roughly between a third that held formal meetings, a third that held informal meetings and a third that stated their means of communication as 'other'. In most cases formal meetings were held monthly (57percent of responses).

About 89 percent of standpipe users surveyed were able to name their ASUFOR representative, compared with 71 percent of those with household connections. This may reflect the system in which each standpipe has a representative and may also be due to the fact that those who use standpipes have more concerns about their water than those with a piped connection. Around 60 percent of all respondents said that they had never contacted their representative while 14.5 percent had contacted their representative in the previous month. Of those who

had contacted their ASUFOR representative, 63.3 percent judged their treatment to be effective while 20.5 percent believed that their problem had not been resolved and 16.3 percent believed the system to be ineffective. On the whole, most users felt that their interests are represented by their local ASUFOR member, although a quarter of the sample indicated that their interests were not well represented or were badly represented.

There can be scale advantages from working with other ASUFORs. Three out of five ASUFORs in this study are members of a confederation of ASUFORs. In Toucar, the ASUFOR chief reported that the federation members were able to support each other in the case of a breakdown and provide financial support. In Nganda, participation in the federation facilitated intermediation between their ASUFOR and the Ministry (DHR) and an NGO for easier access to replacement equipment.

4.3 Service quality and perception of water services

The performance of the water service varies from village to village. Around 39 of those with a piped connection reported that their supply is interrupted several times a week, although about half reported interruptions less than monthly. The responses that indicated that breakdowns occurred at least once a day were mainly in Sandiara and Fimela. The areas where breakdowns were less frequent than once a month were mainly in Toucar, Nganda and Ndioum.

The top three reasons for a break in supply are equipment breakdown, power failure and a leak, with these accounting for 96 percent of supply interruptions. Nearly half of interruptions are the result of equipment breakdown. Responses were divided 50:50 between those who were informed about the reasons for breakdown (sometimes or always) and those that were not (rarely or never).

Table 11: How often is your water supply interrupted for reasons other than non-payment (household connections)?

Number of incidents	Number of respondents	Percent
Several times a day	2	2.11
Once a day	8	8.42
A few times a week	27	28.42
Once a week	2	2.11
A few times a month	4	4.21
Once a month	4	4.21
Less often than once a month	48	50.53
Total	**95**	**100.00**

Source: Survey data.

Standpipe users were also asked about the frequency of supply interruptions (table 12). For standpipe users, the most reliable service seems to be in Ndioukeme, which accounted for most of the 'rarely' (15 out of 21) and 'never' (four out of six) responses and none of the 'frequently'. Fimela, on the other hand, accounted for all four of the 'frequently' responses. When there is a break in service delivery from the standpipe, most households reported that they obtained water from a non-motorized well.

Table 12: How often is there a break in services from the standpipe?

	Number of respondents	Percent
Frequent	4	8
Often	5	11
Sometimes	12	25
Rarely	21	44
Never	6	12
Total	**48**	**100**

Source: Survey data.

In terms of quality, responses for those with a household connection were evenly grouped from 'excellent' to 'very bad' with 68 percent in the 'acceptable' and above range (table 13). In Fimela and Sandiara, it was reported that in some cases water quality from a piped connection was so poor that households used this water only for cleaning and washing and used well water for drinking. In Sandiara, users reporting poor water quality were those who did not obtain water through the Notto-Ndiosmone-Palmarin project. Similarly, in Fimela, users who received good quality water through Notto-Ndiosmone-Palmarin had a long history of poor quality water. Users with piped connections were asked to rate the quality of their water. Those that said the quality of their water was very bad were predominantly from Toucar and Sandiara, where there have been major problems with water quality. No one from these two areas reported that their water was excellent. About a quarter of those with household connections treated their water, mostly (over 85 percent) by adding bleach or chlorine. However, the majority of respondents did not treat their water.

For standpipe users there was also a clear regional demarcation in perceptions of water quality. Respondents who said that quality was excellent were all from Nganda and Fimela. It seems then that the water from standposts is regarded as a superior quality to piped water in Fimela. Those that said the water quality was bad were mainly from Ndioukeme and Sandiara. The two 'very bad' responses were in Sandiara.

Table 13: How would you rate the quality of water from your household connection?

	Household connections		Standposts	
	Number	Percent	Number	Percent
Excellent	16	15	10	20
Good	25	23	3	6
Acceptable	33	30	27	54
Bad	23	21	8	16
Very bad	12	11	2	4
Total	**109**	**100**	**50**	**100**

Source: Survey data.

All users were asked to provide an overall rating of the water distribution system. Of users with household connections, 21 percent rated the system as 'good' or 'excellent', 63 percent found it 'acceptable' and 17 percent found it 'bad' or 'very bad'. Of standpost users, 24 percent rated the system as 'good', 59 percent as 'acceptable' and 17percent as 'bad' or 'very bad'. A higher proportion of standpipe users that opted for the 'very bad' category were in Fimela and Sandiara. No standpipe users in these villages considered their service to be 'excellent'.

All households were asked what would improve their water delivery service. Cost was by far the most important issue for both users of standpipes and those with connections. Cost was mentioned in 65 percent of responses from those with a connection and over 80 percent of respondents who used standpipes (table 14). This was the case in all areas except Ndioum. In Ndioum, all households cited quality as the main concern with their water except one that cited supply security. None in Ndioum mentioned cost. This may be because the cost of water in Ndioum is FCFA 185 / m^3, which is lower than all the other villages in the study.

Table 14: What would be the best improvement that could be made to your water supply?

	Household connections		Standposts	
	Number	Percent	Number	Percent
Cost	32	30	10	24
Cost and quality	31	29	21	50
Quality	32	30	6	14
Cost and regular supply	7	7	2	5
Regular supply	5	5	2	5
Cost and access to a connection	-	-	1	2
Total	**107**	**100**	**42**	**100**

Source: Survey data.

To determine where water fitted in the wider picture of deprivation in rural areas, households were asked to list the services or items that would best improve their quality of life. Households were permitted to list more than one answer. Responses appear in table 15.

In a list of 12 choices, and over 1,200 responses, water comes in ninth, far behind sanitation and health services. This may be due to progress in water delivery, selection bias (we spoke to people with access to water) or because the other services on the list are very poor.

4.4 Financial sustainability

A key factor in the transition from management committee to ASUFOR was an increase in the financial autonomy of water management at the village level. ASUFORs receive funds from user fees and the state. The ASUFOR chiefs in Nganda and Ndioum reported that they also received financial support from residents living abroad. The price of water is determined by the ASUFOR in conjunction with DEM. User fees are intended to cover the costs of fuel, staff, maintenance and renewal of the system of drainage, piping and secondary distribution points. The state is responsible for financing the renewal of drilling, reservoir or water towers, and water mains (MAH 2004, p. 131).

Table 15: What would best improve your quality of life?

		Number of respondents	Percent
1	Access to sanitation	159	13.1
2	Access to health services	143	11.8
3	Better job	137	11.3
4	More land	132	10.9
5	Access to electricity	124	10.2
6	Access to education for children	118	9.7
7	Better roads to reach larger towns	115	9.5
8	Property ownership	100	8.2
9	Better access to water	81	6.7
10	Modern cooking facilities (gas / carbon)	76	6.3
11	Motorcycle	20	1.6
12	Other	8	0.7
	Total	**1,213**	**100**

Source: Survey data.

Despite the challenges reported in interviews, the aggregate data show that some ASUFORs have accumulated significant savings. The sector reforms have gone a considerable way to generating financial reserves for the communities. These reserves are retained within the ASUFOR and can be used to finance investment as well as operations and maintenance.

These developments suggest that financial sustainability has been considerably improved under the ASUFOR system. In survey interviews, some ASUFORs indicated that they had established savings and others that they were investing in equipment. Although they did not offer financial details, it was clear that in most cases, the ASUFORs are positioned to consider small-scale investments. Table 16 provides data on ASUFOR savings for the regions where the case study villages are located.

Table 16: ASUFOR savings for selected regions

	Number of Forages	Number of ASUFORs	Total savings (FCFA)	Average savings (FCFA)	Total savings (US$)	Average savings (US$)
Fatick (Toucar and Fimela)	75	66	241,270,709	3,655,616	482,541	7,311
Kaffrine (Nganda)	150	117	534,059,775	4,525,930	1,068,120	9,052
Saint Louis (Ndioum)	133	88	221,025,000	2,511,648	442,050	5,023
Thies (Sandiara)	111	75	383,624,749	5,114,997	767,249	10,230
Diourbel (Ndioukeme)	115	96	490,033,453	5,104,515	980,067	10,209

Source: Series of presentations by DEM for Regional Review, November 2010.

There are, however, considerable investment needs that are beyond the capacity of the ASUFOR. Some ASUFOR interviewees reported that considerable investment was required in their village to address poor water quality. These investments are beyond the capacity of the ASUFOR and some ASUFORs did not have enough money for maintenance. There is also diversity in the financial capacity of the ASUFORs. For example, Fatick, had the average amount of savings, while Soumbel Keur Latyr had the greatest (FCFA 18,000,000, or US$34,000) and Patar Sine had the least (FCFA 97,572, or US$187) (see table 16).

While financial reserves have been established under the ASUFOR system, the state still plays an important role in investment and technical support. Increased independence may work well for ASUFORs where there is a robust local economy. For ASUFORs in locations where incomes are low, there is potentially less revenue, which may threaten financial sustainability. The study shows that many households are struggling to pay their water bills and infrastructure is fragile. Such a fragmented system has the potential to exacerbate regional inequality, which could be further accentuated with a move to increase the role of the private sector when some areas are more profitable than others.

4.5 Role of the private sector

As noted above, until the 1980s, water was provided by a national state-owned and -managed utility and water was provided free of charge. In the 1980s reforms began to shift the control of water to the local community, allowing the state's progressive withdrawal from day-to-day involvement in the sector. This shift was further consolidated by donor-sponsored reforms in the 1990s. More recently there has been a shift towards greater private sector involvement in the delivery of rural water, which was a component of the 2008 Public Service of Water and Sanitation law. There are two main avenues for private sector involvement in rural water delivery in Senegal: water distribution management and infrastructure maintenance.

4.5.1 Private sector management

The separation of the functions of user representation and operation is a key element of the ASUFOR's institutional framework. This arrangement is similar to large utility privatizations. ASUFORs are encouraged to be financially independent, with a financial plan and structure. The legal status of ASUFORs means that they can subcontract management of their water delivery to the private sector, either an individual or a company. The manager is supposed to be paid according to the volume distributed and to be autonomous with a written contract with the ASUFOR. Contractual arrangements fall into two main categories (MdH 2007):

- Risks and Benefits Management (la gérance aux risques et benefices) where the manager receives all the sales revenue, pays a fixed amount to the ASUFOR per m^3 and is responsible for expenses.
- Controlled management (la gérance en régie) where the manager pays all the revenue received to the ASUFOR and is paid a fixed rate fee.

When selecting a private manager, the ASUFOR sends details of all applicants to DEM, who evaluates them and informs the ASUFOR which candidates are approved. The ASUFOR selects the manager from the list of those that have been approved.

In Toucar, Nganda and Ndioukeme, the ASUFOR had appointed a local individual as a private manager under a risks and benefits contract that employed others, while in Ndioum the manager was a subcontractor that paid a flat rate. In Fimela, the ASUFOR members were responsible for billing and collecting revenue, which was then paid to the managers of the Notto-Ndiosmone-Palmarin (NNP) project. In Sandiara on the other hand, the ASUFOR manages the motorized well and has engaged an accountant but there is no private manager contracted under affermage contracts.

The private managers in Nganda and Ndioukeme have been in place for several years and the system has run smoothly, although in both cases, the managers report delays in receiving payments as well as problems with the aging infrastructure. In Toucar the well eventually broke down and has not been repaired. The private manager is no longer in the post because it was cheaper for the ASUFOR members to manage the water system than to have delegated management.

In our sample, the impact of delegation to the private sector is difficult to assess. Where private managers were in place, they struggled to secure payment and maintaining infrastructure. These privatizations are slightly different from the approach adopted in eastern Senegal, where the French NGO GRET has supported an innovative programme of support for private sector management of rural water. Under the GRET project, water management in three towns has been transferred to a private company, GIE, under a five-year affermage contract. The company is run by a retired ex-employee of Senegalaise des Eaux. In contrast to the case study locations for this study, the GRET project with GIE has brought in management from outside the community with skills and experience in the sector. This may account for the relative public support for the GRET programme. More research is needed to determine the impact of the delegation of private management in different locations. The GRET projects have been implemented in relatively wealthy locations and it is unclear how successful this approach would be in poorer communities.

4.5.2 Private sector maintenance

ASUFORs have been encouraged to subcontract maintenance to licensed private sector firms largely because the Ministry, via DEM, does not have the means to support the maintenance brigades that were responsible for maintaining rural infrastructure (MAH 2004). Since 2004, a Dakar-based company, EquipPlus, has carried out maintenance under contracts with some ASUFORs in the pilot central region covering Diourbel, Thies, Fatick, Kaffrine and Kaolack, with the goal of expanding to other regions. This subsection is based on an interview at the Head Office of EquipPlus in March 2012[13] and interviews with ASUFOR members.

There are different types of maintenance contracts between EquipPlus and ASUFORs, including a preventative contract and a repair maintenance contract. The maintenance contract is considerably detailed. EquipPlus established a maintenance centre in Diourbel to support activity in the region. Its bid was based on the assumption of 300 contracts because that is how many ASUFORs initially expressed interest. However only about 80 ASUFORs actually signed contracts with EquipPlus and that number has since fallen; at the time of this research, only 43 contracts were operational (March 2012).

According to EquipPlus, the reason for the decline is that rural communities that do not contract with EquipPlus can obtain free maintenance support from the local 'Brigade' that is part of DEM. When ASUFORs saw that their neighbours were getting free maintenance from the Brigade, they stopped using EquipPlus. In addition, ASUFORs used local artisans

13 The authors met with the Technical Manager and the Assistant General Director of EquipPlus.

to carry out repairs because they were cheaper than EquipPlus, even when there was a contract between EquipPlus and the ASUFOR. In addition, some ASUFORs do not have money and do not pay regardless of the terms of the contract.

The project has not been profitable for EquipPlus. It is an insignificant proportion of their business activity but the objective of their involvement was more strategic and they had not expected to make short-term profits. The operation would have been profitable if there was a critical mass but there was not enough business to make a profit.

Three of the villages covered in this study had a contract with EquipPlus: Fimela, Nganda and Sandiara. Nganda cancelled its contract in 2009. Fimela and Sandiara's contracts are still in place but the terms are not observed. For the ASUFORs, their involvement with EquipPlus was not a positive experience. EquipPlus was very expensive and local people could be used more cheaply.

The experience with delegated maintenance in Senegal suggests that, while it might be intuitively appealing to engage a private firm in order to alleviate the strains on DEM, this is not straightforward. Simply signing a contract does not guarantee that the terms will be observed. Financial constraints in poor communities limit the scope of private sector profitability.

5 CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Conclusion

This study found that financial management of rural water at the community level has been strengthened by recent reforms. Although introduced relatively recently, paying for water by volume has become an accepted practice for households and community managers. A strong ethos of revenue collection has been instilled in the communities. Even when managers and ASUFOR members know that households are suffering from financial hardship, they ensure that water bills are paid. Communities understand that they need to pay for water or risk losing their supply.

Although there were complaints about difficulties in securing payment and challenges with aging infrastructure, the system seems to be reasonably robust. Bills are collected monthly and the water generally flows regularly. Water is now relatively low on the list of household concerns compared with health and sanitation services, and most households report that their services are at least acceptable if not better. Savings have accumulated and functionality rates are high compared with other countries in the region, according to aggregate data, although there were some concerns at the community level.

Despite the shift to local management, there was evidence that the state is still considerably involved in rural water. For example, the problems with water quality reported in Fimela and Sandiara could not be overcome at the local level. To resolve the problem, the Ministry, together with donors, has constructed new wells to serve several villages, such as the Notto-Ndiosmone-Palmarin project. Maintenance is still provided by the Ministry Brigades through DEM and DEM is also involved in the approval of private managers for the ASUFORS. Thus, while the emphasis is on decentralization of management to villages, state involvement continues to be significant. Also PEPAM, a state institution, has ensured that timely data is collated for monitoring outcomes, which means that donor support is coordinated and targeted effectively.

The Senegal experience shows the benefits of operating water systems at scale. A key element to the success of the rural water model in Senegal is the use of multi-village schemes rather than the village-level pump. These schemes mean that several villages and significant populations have a stake in ensuring their sustainability. In addition, it is cheaper per capita to operate a well serving several villages.

There are, however, concerns. First, the price of water is very high and some rural households face a tariff that is approaching OECD levels, despite a high incidence of poverty. Moreover, pricing is regressive. A tariff structure based on cost recovery means that stand-post users — who are poorer than those with a household connection — are charged a higher price for water. This may make for good business practice but water is not like other commodities. Water is essential and communities must somehow obtain access. The high cost of water has considerable knock-on effects and the burden is particularly severe for women and girls. Longer time spent collecting water affects consumption, which in turn has health effects, and girls may miss out on education. Penalizing poor households, for whom the cost of delivery is more expensive, can further entrench inequality.

The fact that a household pays its water bill does not necessarily mean that water is affordable. Some of the households interviewed had never had their water supply disconnected but still had difficulty paying their bills. More research is needed to determine how bills are paid by poor families and the degree to which making these payments requires reductions in other essential expenditures. Although the ASUFOR governance structure is

intended to be democratic and inclusive, the evidence suggests that the interests of the poorest households are not well represented.

Second, decentralization to the village or the infrastructure level risks exacerbating inequality and deepening poverty in areas where economic activity is weak. Making each infrastructure an autonomous independent cost unit creates a fragmented structure and removes the scope for cross subsidy across regions and villages with different levels of economic development. This can increase vulnerability. In the remote village of Toucar, we were told that a poor harvest had weakened household incomes in the past year, making water payments a major strain on households. Meanwhile in Sandiara, located not far from Dakar on the main road, the ASUFOR was doing well and reported no problems with payments.

Third, this study suggests patchy results from private sector involvement. The experiment with EquipPlus was not successful for the communities or EquipPlus. Private sector managers have experienced mixed results. The GRET project in eastern Senegal has reportedly realized considerable improvements from working with a private partner with sector expertise and experience. Nevertheless, the private managers interviewed for this study faced challenges with aging infrastructure and poverty among residents. The provision of safe drinking water is an absolute necessity and a state responsibility and should not depend on who is managing it.

The private sector cannot substitute for the state, which has played an important role in shaping the reformed water sector to date. PEPAM has been instrumental in coordinating donor investments. The high rate of functionality in rural infrastructure in Senegal, compared with elsewhere in the region, is thanks to the support provided by DEM as attempts to outsource maintenance have had a negligible impact. While there have been some positive outcomes from commercialization, this study highlights the importance of state involvement and support for infrastructure.

Finally, the MDGs fail to capture some core aspects of water usage. The MDGs measure access to safe water in terms of use of 'improved' water sources, without considering the quality of the water. But in some areas, households that use improved sources actually lack access to water that meets WHO quality standards. Similarly, while the data indicates relatively high rates of access, the survey shows that in poor rural areas, the water system is precarious. Households that are classified as having access to safe water often must adopt coping strategies to keep their water bills down.

5.2 Policy recommendations

The main lesson from the Senegal experience is that water management can be transferred to communities successfully in some cases to some degree, but more research is needed to determine the circumstances under which community management thrives. The introduction of ASUFORs in Senegal has been successful in many respects but the impression is that the system works better in locations with good infrastructure and where incomes are higher. Recommendations to improve policy outcomes include:

Affordability: Rural water management should be more pro-poor. The ASUFOR system operates in the interests of those who can pay for water and are wealthy enough to have piped connections; the poorest of the poor, and those living in the poorest villages, are among the disadvantaged. While financial sustainability is vital, it should be structured to ensure that the needs of the poorest households are met. Households that cannot afford to pay should receive assistance. Policy options include income-based subsidies, free water up to the WHO minimum level, standpost and connection-cost subsidies.

Clustering: Decentralization has eroded the scope for redistribution. The experience in Senegal shows the benefits of operating at scale. The multi-village approach provides economies of scale and ensures buy-in from a large number of end users. More collective operations of local water systems through clustering mechanisms could support risk pooling and facilitate cross-subsidy across areas of varying economic activity.

Role of the state and limits of privatization: Government support remains important. Much of the success of rural water systems in Senegal is due to state involvement. Infrastructure is mostly financed by the state and maintenance has been supported by DEM. Private sector input has been marginal so far and has failed to improve maintenance due to low profitability and contracts that are often not honoured. In addition, private interest is skewed towards high-income areas where water quality and infrastructure are good. The focus on cost recovery, which has biased outcomes away from poor households, is likely to be accentuated with a private operator in place. There is considerable scope for exploitation without strong regulation.

MDGs have limited value as indicators of water access: According to the MDG indicators, most of the households interviewed would classify as having access to safe water. However, there are two aspects of water consumption that considerably affect water safety but are overlooked by the MDG measurement. First, the quality of tap water may be poor and in some cases, households only use tap water for washing and cleaning. Second, many households financially struggle to access water, which affects consumption levels. Access indicators should be refined if they are to genuinely reflect household welfare.

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ANNEX A: DEFINITION OF 'ACCESS'

According to the WHO/UNICEF Joint Monitoring Programme (*www.wssinfo.org*), access to safe drinking-water is measured by the proportion of the population using an improved drinking-water source.

Improved sources of drinking water include:

- **Piped water into dwelling (also called a household connection):** a water service pipe connected with in-house plumbing to one or more taps (e.g. in the kitchen and bathroom).
- **Piped water to yard/plot:** a piped water connection to a tap placed in the yard or plot outside the house.
- **Public tap or standpipe:** a public water point from which people can collect water. A standpipe is also known as a public fountain or public tap. Public standpipes can have one or more taps and are typically made of brickwork, masonry or concrete.
- **Tubewell or borehole:** a deep hole that has been driven, bored or drilled, with the purpose of reaching groundwater supplies. Tubewells/boreholes are constructed with casing, or pipes, which prevents the small diameter hole from caving in and protects the water source from infiltration by run-off water. Water is delivered from a tubewell or borehole through a pump, which may be powered by human, animal, wind, electric, diesel or solar means. Tubewells/boreholes are usually protected by a platform around the well, which leads spilled water away from the borehole and prevents infiltration of runoff water at the wellhead.
- **Protected dug well:** a dug well that is protected from runoff water by a well lining or casing that is raised above ground level and a platform that diverts spilled water away from the well. A protected dug well is also covered, so that bird faeces and animals cannot fall into the well.
- **Protected spring:** typically protected from runoff, bird faeces and animals by a 'spring box', which is constructed of brick, masonry or concrete and is built around the spring so that water flows directly out of the box into a pipe or cistern, without being exposed to outside pollution.
- **Rainwater:** refers to rain that is collected or harvested from surfaces (by roof or ground catchment) and stored in a container, tank or cistern until used.

Unimproved sources of drinking water include:

- **Unprotected spring:** a spring that is subject to runoff, bird faeces, or the entry of animals.
- **Unprotected dug well:** a dug well that is unprotected from either runoff water, or bird faeces and animals.
- **Cart with small tank/drum:** water sold by a provider who transports water into a community. The types of transportation used include donkey carts, motorized vehicles and other means.
- **Tanker truck:** water trucked into a community and sold from the water truck.

- **Surface water:** water located above ground, such as rivers, dams, lakes, ponds, streams, canals and irrigation channels.
- **Bottled water:** considered to be improved only when the household uses drinking water from an improved source for cooking and personal hygiene; where this information is lacking, bottled water is classified on a case-by-case basis.

ANNEX B: SAMPLE INFRASTRUCTURES, BASIC DATA

1	2	3	4	5	6	7
Infrastructure by location*	Region	Population served	Number of villages served	Village of interview	Village population	Village households
MBOLO BIRANE	St Louis	3,421	1	Ndioum	3,421	398
NDANGANE FIMELA	Fatick	3,485	3	Ndangane Fimela	2,162	245
TOUCAR	Fatick	8,530	6	Toucar	3,612	409
TOURE MBONDE	Diourbel	3,505	8	Ndioukeme Ndiaye	646	62
NGANDA	Kaffrine	6,077	5	Nganda	1,597	149
SANDIARA	Thiès	4,074	2	Sandiara	2,493	285

1	8	9	10	11	12
Infrastructure by location*	Number of standposts connections		Number of household		Number of interviews of Sample target
	(database)	(survey)*	(database)	(survey)*	
MBOLO BIRANE	0	4	X	100	20
NDANGANE FIMELA	X	3	X	—	24
TOUCAR	35	16	53	176	53
TOURE MBONDE	39	2	0	25	22
NGANDA	400	10	91	—	38
SANDIARA		17	158	—	25

**Based on interviews with ASUFOR managers*

X = no data on PEPAM website

Source: www.pepam.gouv.sn, interviews and authors' calculations. To access infrastructure information, click on a location listed in column 1.

ANNEX C: SUMMARY OF CASE STUDY LOCATIONS

Toucar

Overview: Toucar is situated 18 kilometres (km) from National Route 1 (RN 1), and is accessed by dirt and sand roads. The residents depend on small-scale subsistence agriculture and low-level commercial activity (shops and market stalls) for their living. Incomes are vulnerable to weather changes, which affect crop yields. At the time of the research, residents reported considerable financial hardship following a weak harvest.

Infrastructure: A motorized well was established in Toucar in 1992 but in 2010 it fell into disrepair. There was a maintenance contract with EquipPlus but this had expired and, as the quality of the well water was deemed so poor, the well was not considered worth repairing. Now the village is served by a piped connection from a well in another village. There is a meter at the point where the water arrives in Toucar.

Management: Toucar has an ASUFOR and until recently, a private manager. Since the breakdown of the well two years ago, costs have risen substantially as the ASUFOR has to pay the neighbouring village for all water consumed. The ASUFOR decided not to continue with the private manager in order to save money. The ASUFOR members themselves are responsible for billing and for revenue collection. When he was in post, the private manager had a kind of affermage contract and was paid a fixed amount for each unit of water sold (FCFA 41 from a private connection and FCFA 91 from a standpost).

Ndioukème Ndiaye

Overview: Ndioukème Ndiaye is located 9km from the RN3 and is difficult to reach due to poor roads. According to a local leader and founder of the village, 10 neighbouring settlements have been abandoned because of the poor quality and salty taste of the water. At the time of this research, there was clear evidence of abandoned houses in the area. The residents surveyed earn a living from the sale of crops and trade with the surrounding areas. Water prices are high relative to incomes and according to the manager, late payment of bills is a major threat to the functioning of the well.

Infrastructure: Water comes from a motorized well at Toure Mbonde, 4km away. The well was constructed with financial support from Saudi Arabian donors in 1986/7. The well — like many in rural Senegal — serves several villages. It has two water towers and a generator. The infrastructure is old, leading to frequent breaks in supply. When there is a problem with the well, villagers travel to a neighbouring village to obtain water, which can take all day.

Management: There is a private (female) manager under an 'affermage' contract. The manager collects all revenue and pays the ASUFOR FCFA 90 for each m^3 sold. The manager pays for small repairs. Households pay for their own connection costs and the ASUFOR pays for larger repairs. The ASUFOR bought the generator. Prices vary according to the type of usage (for example, domestic, cattle watering) and are agreed upon by the ASUFOR and the manager. There are just two standposts. One is managed in turn by the women of the village and the other was constructed with financial support from by several households that contributed to the cost of installation in order to improve their access.

Nganda Village

Overview: Nganda village is located 37km from RN1 and access is difficult. Economic activities revolve around livestock and rain-fed agriculture. Nganda hosts a market every Saturday, which is attended by residents of neighbouring villages. Incomes are mainly derived from sales of agricultural products, livestock and retail. Water quality (judged simply on taste) is regarded as high.

Infrastructure: There is one motorized well, established in 1978, with a water tower and two generators. The well was established with financing from the state. Infrastructure is old and leakage rates are high. Residents complained of major breaks in service, which required frequent trips and often long trips to obtain water. There is a high proportion of household connections. In addition to state funding, the infrastructure in maintained with financing from former residents who are living abroad.

Management: There is a private manager under an affermage-type contract with the ASUFOR.

Ndioum, Mbolo Birane

Overview: Mbolo Birane is located in the rural community of Guamadji Saré (department of Podor, Saint Louis region) in northern Senegal on the border with Mauritania, some 443km from Dakar. Mbolo Birane is one of a number of villages that make up Ndioum and residents are mainly Toucouleur (halpulaar) like much of the North. The economy of the region is not well developed and is limited to local business (weekly markets, for example) and cattle management. The area receives considerable revenue from immigrant communities established in Europe.

Infrastructure: There is one motorized well constructed in 1994 with financial support from former residents now living overseas. There are no standposts because of the high level of household connections.

Management: Instead of an ASUFOR, there is a Management Committee with a manager subcontracted by the Committee who is paid a flat rate regardless of the amount sold.

Sandiara

Overview: Sandiara is situated some 87km from Dakar alongside RN 1. Its location benefits the local economy. There is substantial economic activity around the production and sale of fruits and vegetables.

Infrastructure: Part of the village is connected to the Notto-Ndiosmone-Palmarin (NNP) water network for bulk water while the rest of the village is served by a motorized well. The distribution system consists of a well with a water tower. The area served by the well suffers from poor quality water with a high salt content. Many buy water from private vendors.

Management: There is an ASUFOR but management has not been delegated to a private manager. The ASUFOR appears to be operating more effectively than the others in the study. The members are mainly retired people from the community who have relevant experience. They have an accountant and an office with a computer. The local people have income and normally pay their bills. The ASUFOR has a maintenance contract with EquipPlus.

Ndangane Fimela

Overview: Ndangane Fimela lies nearly 40km from the RN1 and is accessed by an asphalt road in very poor condition. This is a new residential area with hotels and houses that are permanent structures. Tourism contributes significantly to the local economy.

Infrastructure: Ndangane Fimela had a well but it is no longer used because of the water's high salt content. Now the region is served through the multi-village NNP project. Households consider the quality of the water provided through the project good, but the price is considered relatively high. Cuts in supply are rare (although there was a two-day cut at the time of this study, causing anger among hoteliers).

Management: There is an ASUFOR but management has not been delegated to the private sector. The ASUFOR only pays for minor repairs; major repairs are financed by the state through the multi-village NNP project. The ASUFOR is effectively the link between the villagers and the managers of the NNP project. They carry out the billing and revenue collection and pay the money to NNP managers. The ASUFOR is a member of a federation of ASUFORs.

ANNEX D: SENEGAL BACKGROUND

Senegal, in West Africa, has a population of around 13 million. The economy is dominated by a few strategic sectors, including groundnuts, fisheries and services. The role of the agricultural sector and especially of groundnuts has declined over time as the country's location on the edge of the Sahel has led to frequent droughts. Gross nation income per capita in 2011 was US$1,050.[1] In 2011, Senegal was ranked 155 in the UNDP Human Development Index (HDI) out of 187 countries. The HDI value of 0.459 was below the average for SSA (0.463).[2] There are entrenched inequalities between the capital, Dakar, and the rest of the country. Dakar accounts for 0.3 percent of the country's land area but is home to one-quarter of its population and accounts for over 60 percent of economic activity (World Bank Senegal Country Brief 2011).[3]

Unlike many countries in West Africa, Senegal is politically stable. In February 2012, democratic elections led to a change in government for the first time in 12 years. The country belongs to several regional organisations including the Economic Community of West African States; the West African Economic and Monetary Union; the Senegal River Basin Development Authority (an organization of Guinea, Mali, Mauritania and Senegal to manage the Senegal River and its drainage basin); and the Gambia River Basin Organisation.

Poverty is widespread and more acute in rural areas. According to the IMF (2010, p.63) the incidence of urban poverty in 2009 (outside Dakar) was 38.1 percent (in Dakar the figure is 30.7 percent) compared with 63.2 percent in rural areas. Although the incidence of poverty decreased by 16 points between 1994 and 2004, inequalities have deepened (OECD 2007). High rural poverty and limited access to infrastructure and basic services have stimulated migration to urban areas (World Bank Senegal Country Brief 2011). Foreign remittances are an important funding source in Senegal and in 2010 these accounted for as much as 10 percent of Gross Domestic Product.[4]

Since 2006, Senegal has faced a series of internal and external shocks, including unfavourable rains, followed by the international food and oil price rises, the global financial crisis and floods in the Dakar region. Senegal's economic activity slowed in 2009 as a result of the global economic downturn and domestic shocks including temporary electricity shortages. A rebound in 2010 was followed by a slight downturn in the first half of 2011 due to persistent power outages. Growth has been slowed by lower external demand and downward pressure on remittances, tourism receipts and foreign investment (IMF 2011).

1 *rru.worldbank.org/besnapshots/BecpProfilePDF.aspx?economy=senegal*
2 *hdrstats.undp.org/images/explanations/SEN.pdf*
3 *www.tinyurl.com/WB-Senegal-CBrief*
4 *www.bloomberg.com/news/2011-04-29/senegal-s-remittances-in-2010-were-worth-10-of-gdp-bank-says.html*

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