The Role of Private Entrepreneurs in Enhancing Impact and Ensuring Sustainability of Rural Water Supply in Vietnam

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By Emilio Batzella & Per Ljung

GPOBA Australian Aid east meets west

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The Clean Water Program analyzed in this report was implemented under the direction of Minh Chau Nguyen and Hoang Thi Hang Tam. The field surveys and data entry were supervised by Nguyen Thu Ha of East Meets West. Valuable comments on various drafts were received from Leslie Villegas and Carmen Nonay of GPOBA.

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Acronyms

ADB	Asian Development Bank
AUD	Australian dollar
AusAID	Australian Agency for International Development
CPC	Commune People's Committee
CSS	customer satisfaction survey
EMW	East Meets West
GPOBA	Global Partnership for Output-Based Aid
NTP	National Target Program
O&M	operation and maintenance
OBA	output-based aid
OS	operator survey
PPC	Province People's Committee (Vietnam)
PPP	public-private partnership
VND	Vietnamese dong
WTP	willingness to pay

Note: All dollar amounts are in U.S. dollars, unless otherwise noted.

EXECUTIVE SUMMARY

In November 2007, the Global Partnership for Output-Based Aid (GPOBA), a trust fund managed by the World Bank, awarded the East Meets West Foundation (EMW) a $3.0 million grant for implementation of the Rural Water Supply Development Project (the "Project") in the Central Region of Vietnam. This grant was subsequently increased to a total of $4.5 million in 2009 and the scope was expanded to include the Mekong Delta, where EMW established an innovative partnership with the private sector to build, own, and operate village water supply systems.

EMW surpassed the revised target of 32,700 households by 10 percent, bringing access to affordable clean water for about 35,900 households (about 180,000 people). Altogether, 82 subprojects were completed under the GPOBA grant. A customer satisfaction survey (CSS) was conducted at completion of the Project to assess the impact on project beneficiaries.

The initial objective of this study was to get further insights into the sustainability of Project operations and benefits some two to four years after completion of the individual village water supply schemes. To this end, EMW obtained a small grant from GPOBA to conduct another beneficiary assessment. However, the 2011 CSS had some intriguing results that seemed to indicate that the private operators in the Mekong Delta not only provided better service to their customers but that their operations might also be more sustainable. To examine these issues further, EMW undertook two distinct but complementary surveys: a customer satisfaction survey (CSS) and an operator survey (OS).

The OS examined how well each scheme's owner/operator performed with respect to technical and financial criteria; in essence, much of the data collected through the OS was very similar to that used for the benchmarking of urban utilities. The CSS, on the other hand, aimed at finding out how well the owners/operators met the needs of their customers: that is, the quality of service. The water users' experiences and opinions were broken down into three broad categories: water availability and accessibility; reliability and quality of service; and quality of the piped water itself. Data for both the OS and CSS were collected between August and September 2013 from 66 GPOBA-funded rural water supply schemes in the Mekong Delta and the Central Region of Vietnam; a total of 65 system operators and 890 connected households were interviewed. The focus of the analysis was on three management types: private owners/operators, cooperatives, and Commune People's Committees (CPCs, the local governments).

Although the average tariffs were basically the same for the three groups of operators, the private sector managed their finances in a much more prudent way than either the cooperatives or CPCs. Revenues not only covered operating costs, but significant amounts were set aside for future repairs, their customers paid in a timely manner, and labor productivity was higher. Their technical operations were also done with greater care: water losses were lower; production volumes were monitored more regularly; and fewer breakdowns and technical problems were experienced (no doubt, due to better routine maintenance). The table below summarizes some of the key findings of the operator survey.

Operator Survey: Key Indicators

	Private	Cooperative	CPC
Read production meter at least monthly	81%	43%	18%
Monthly tariff collection	100%	64%	59%
Water losses	22%	23%	31%
Percent of schemes where revenues do not cover operating and maintenance costs	4%	7%	35%
Water distributed per worker (m^3)	1,794 m^3	706 m^3	688 m^3
Revenues per worker (Vietnamese dong)	7.8 million	2.5 million	2.8 million

Note: O&M=operating and maintenance; m^3 = cubic meters; VND=Vietnamese dong

This leads to the inevitable question: do private owners/operators achieve better profitability in the short run at the expense of the quality of service to water users or the sustainability of the schemes? The CSS convincingly showed that this was not the case. The private operators were more likely to provide water 24 hours per day than cooperatives and CPCs. They had fewer system breakdowns and attended to repairs more quickly than the others. The users felt that the system managers were more responsive and they rated water quality higher. The table below summarizes the overall satisfaction of consumers with water availability, water quality and management performance.

Consumer Satisfaction Survey: Key Indicators

	Private	Cooperative	CPC
Water availability (average user satisfaction) score)[a]	4.30	3.49	3.42
Water quality (average user satisfaction score)[a]	4.28	3.34	3.58
Management (average user satisfaction score)[a]	4.30	3.61	3.61
System breakdowns 3 or more times per month	12%	45%	55%
Repairs take longer than 1 day	3%	30%	46%
24-hour supply	75%	65%	50%

a. Rating scale is 1-5, where 1 = Very Bad and 5 = Very Good.

The quality of service provided by cooperatives was generally at the same level as that found in CPC-managed systems. However, there are some clear indications that the cooperatives manage their finances more soundly than the CPCs, and thus their operations are more likely to be sustainable. Although some geographical and socioeconomic factors might have influenced the results, the clear conclusion of this study is that the private entrepreneurs provide better service and operate their systems—technically and financially—in a more sustainable manner than either cooperatives or CPCs.

The output-based aid (OBA) grant from GPOBA was instrumental in mobilizing the private entrepreneurs, and thus enhancing sustainability. The positive experiences gained from the Project are providing an input to the governments expected policy and regulatory reforms aimed at enabling greater private sector participation and enhancing the efficiency and sustainability of investments in rural water supply.

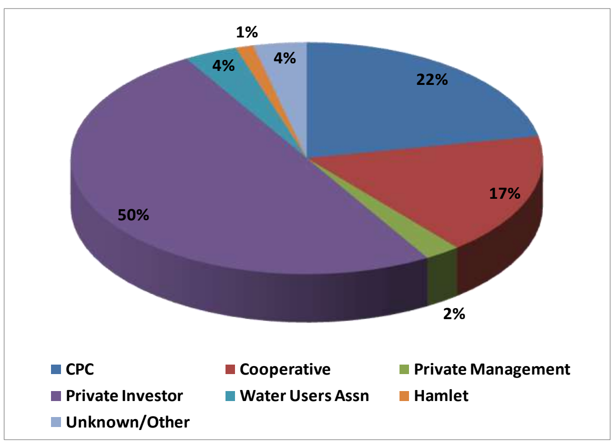
1 INTRODUCTION

1.1 PROJECT OVERVIEW

In November 2007, the Global Partnership on Output-Based Aid (GPOBA), a trust fund managed by the World Bank, awarded the East Meets West Foundation (EMW) a $3 million grant for implementation of the Rural Water Supply Development Project (the "Project") in the Central Region of Vietnam. In 2009, this grant was subsequently increased to a total of $4.5 million and the scope was expanded to include the Mekong Delta, reaching a targeted total of 32,700 households. EMW surpassed this target number by 10 percent, bringing access to affordable clean water for about 35,900 households (about 180,000 people). Altogether, 82 subprojects were completed under the GPOBA grant.[1,2]

In the Central Region, covered by the original Project, EMW built 41 village water schemes, servicing 22,900 households (approximately 115,000 people). GPOBA provided $3 million and the Project beneficiaries provided about $300,000 in connection charges and an estimated $380,000 in kind (labor for installation of the household connection). The value of land provided by local governments (communes) is estimated at $50,000. Upon completion, these schemes were handed over to the local government. In turn, the Commune People's Committees (CPCs) often entered into agreements with cooperatives or private individuals for the schemes' operation and maintenance (fFigure 1. Management Types for EMW's Rural Water Supply

Figure 1. Management Types for EMW's Rural Water Supply Project



Project

Figure 1. Management Types for EMW's Rural Water Supply Project

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[1] For further details about how the GPOBA Project was implemented, see East Meets West (2014).

[2] The overall results of the Project and the key lessons learned are presented in East Meets West (2014).

Figure 1. Management Types for EMW's Rural Water Supply Project

Figure 1).

An innovative feature of the Project—introduced in the Mekong Delta after the revision of the Project in 2009—was the use of partnerships with local entrepreneurs. These entrepreneurs mobilized financing for, built, and operated 41 piped village water supply systems, and ultimately provided clean water to about 13,000 households (around 65,000 people). In total, the private investors in the Mekong Delta mobilized about $550,000 from their own funding sources in addition to the $1.5 million provided by GPOBA (and around $250,000 in connection fees paid by Project beneficiaries). This enabled EMW to expand the scope of the Project. As testament to the Project's increasing success, the Australian Agency for International Development (AusAID) in 2010 awarded EMW an additional AUD 1.5 million to extend its private-public partnership (PPP) approach to output-based rural clean water supply in the Mekong Delta. The AusAID program was implemented in parallel with the GPOBA-funded Project, following the same basic procedures.

In the Central Region, EMW built the water systems and installed the main distribution pipelines; although supervised by EMW, the local communities themselves for the most part lay the household connection pipes. After the implementation process and following a final joint inspection by relevant stakeholders to ensure quality standards had been met, ownership of the facilities was then transferred to the Commune People's Committees (CPCs). In turn, the CPCs either managed the system directly or delegated the responsibility to a cooperative, private individual(s) (under a short-term contract), the village/hamlet, or a quasi-formal water users group. In contrast, schemes in the southern provinces were driven almost entirely by the private sector; water systems and pipelines are financed, built, operated, and maintained by carefully selected private enterprises.

The output-based aid (OBA) approach adopted for the Project proved to be very cost-effective. Although built to basically the same technical standards, the cost per household connected under the Project was significantly lower than in comparable public sector rural water supply schemes under the National Target Program (NTP) supported by AusAID, the Danish aid agency (Danida), and the UK Department of International Development (DFID), as well as projects financed by the World Bank and the Asian Development Bank (ADB). The results of the PPP systems in the Mekong Delta were especially encouraging. Not only did the Project's private partners implement the subprojects efficiently, but they also directly contributed approximately 40–50 percent of the initial capital investment.[3]

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[3] In public schemes financed by donors and government(s), e the capital subsidy for village water system construction is usually $300 or more per household. In the private sector schemes in the Mekong Delta, the subsidy was only $103 per household. Still, as discussed later, the tariff charged in the private sector schemes is essentially the same as the one charged in schemes handed over ("free of charge") to the CPCs in the Central Region.

1.2 RESEARCH CONTEXT AND OBJECTIVES

Toward the end of the Project's funding cycle in 2011, EMW conducted a consumer satisfaction survey (CSS) by gathering direct feedback from serviced households themselves. The 2011 CSS attempted to assess the overall impact of the Project. In broad terms, respondents of the 2011 CSS expressed a high degree of consumer satisfaction[4] with the standard of facilities and services provided by the Project. Beyond this encouraging tendency, the survey seemed to indicate that the water users' perception of service quality was significantly better in the Mekong Delta, where the PPP model was first introduced.

In the last few years, more questions have been raised about the sustainability of rural water supply schemes, not only in Vietnam but around the world. In order to examine this issue in greater detail, EMW obtained a small grant from GPOBA for a new beneficiary assessment. Given the tentative results of the 2011 CSS, EMW concluded that the management model adopted for the water schemes seemed to be an important factor in determining not only the quality of service but also the sustainable benefits of the village water supply systems.

Consequently, the main research objectives of this study are to:

- Assess the overall impact of the Project some two to four years after the individual village water supply schemes have been completed and the euphoria over getting clean water delivered into the house has passed, and the real quality and reliability of the supply have become clear.
- Examine in greater detail consumers' perception of the quality of water service provided by different types of water managers.
- Study how different types of managers operate and maintain the village water systems and analyze the impact of these practices on consumer satisfaction, as well as the likelihood that the operation will be sustainable over the long run.

1.3 FOCUS ON THE OPERATING PHASE

Consistent with its main objectives, this study looks at the operation of the individual subprojects two or more years after GPOBA funding has ceased. Thus the Project no longer has any direct influence on how managers operate their systems. However, the GPOBA grant agreement not only enabled EMW to experiment with different management models, but enabled the private sector to expand its participation in rural water supply. Indeed, the OBA approach was instrumental in mobilizing the private sector in the Mekong Delta and potentially influencing government policy, leading to a more sustainable development path for rural water supply. This topic will be explored in the concluding chapter.

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[4] The feedback from Project scheme users in the 2011 CSS was resoundingly positive in both the Central Regions and Mekong Delta, with overall customer satisfaction at nearly 90 percent.

1.4 OUTLINE OF THE REPORT

The report is organized as follows:

- Chapter 2 describes the methodology for the field surveys.
- Chapter 3 assesses the overall impact of the project on the water users.
- Chapter 4 presents the main results of the customer satisfaction survey.
- Chapter 5 analyzes how different types of managers run their systems, using a number of simple financial, technical, and administrative performance indicators.
- Chapter 6 provides the general conclusions and recommendations. This chapter also includes a section on how the OBA approach enabled the private sector to participate, and thus promoted sustainability.

2 METHODOLOGY

2.1 ASSESSMENT FRAMEWORK AND KEY CONCEPTS

Table 1 summarizes some of the key indicators collected via the CSS and OS surveys.

Table 1. Key Indicators

Water availability	Water quality	Management practice	System operation
System up-time (hours per day)	Water color, smell, and taste	Notification before system repairs	Tariffs, revenues, and costs
Breakdowns per month	Seasonal changes	Availability of water manager	Water losses (%)
Duration of breakdowns	Change since start of project	Systematic tariff collection	Water distributed per worker
Severity of breakdowns	Improvement on previous source	Revenue set aside for future repairs	Revenues per worker

As suggested in chapter 1, this study aims to use these data to provide:

- A general impact assessment of project clean water systems on serviced communities—the extent to which users' water supply situations have been improved as a direct result of the Project.
- Insight into water user perceptions regarding the water service: that is, how "satisfied" water users are with the Project.
- An analysis of how different management models and practices may influence the sustainability of the water service over the long term.

Although these objectives seem to be fairly straightforward, it is still useful to elaborate on some of the study's underlying concepts and premises. To begin with, what exactly is meant by *water service*? In many sectors, the concept of service refers to the provision of a public benefit through a continuous flow of activities and resources. A water service therefore consists of a flow of water with certain characteristics, such as quantity, quality, and continuity. A water service can be delivered through a variety of different means and management models. Such differences, however, are relevant only insofar as they affect the water service itself. In the simplest of terms, then, the water service should be thought of in terms of what providers are able to supply and what end-users actually receive.

The term *sustainability* also requires clarification. In the specific context of the rural water sector, many organizations define sustainability as the maintenance of the perceived benefit of investment projects after the end of the active period of implementation. A sustainable rural water service can thus be understood as the maintenance (or even improvement) of a flow of water with certain characteristics over time.

Aside from the physical quality of the infrastructure itself, the effectiveness and sustainability of a water service beyond the initial construction period depends largely on how well the system and its various components are operated and maintained. This, in turn, is a function of:

- The general competence of the operator, not only in the technical aspects of system operations and maintenance (O&M) but also in financial management
- Whether or not the scheme is able to generate enough revenue to cover routine O&M costs, as well as unexpected expenditures for major repairs, and
- The strength of the incentive mechanisms which drive the system operators' actual performance.

2.2 SURVEY QUESTIONNAIRES

EMW conducted two distinct but complementary surveys for the post-completion study: a customer satisfaction survey (CSS) and an operator survey (OS) (see appendixes A and B for a full text of the questionnaires).

The CSS aims to highlight the impressions, opinions, and experiences of Project water users. The questionnaire itself was kept as close to the original 2011 CSS questionnaire as possible so as to facilitate comparison of water user responses over time. In keeping with the 2011 questionnaire, the current CSS was broken down into three broad sections: water availability and accessibility; reliability and quality of service; and quality of the piped water itself.

The OS, on the other hand, examines how well the owner/operator performed with respect to their given scheme's technical and financial operation. This is the first time that the Project's system operators have been interviewed in such a structured way. It is hoped that the OS will provide context to the CSS, while also allowing for "harder" analysis through the use of more objective/quantitative data. Much of the data collected through the OS is very similar to that used for the benchmarking of urban utilities. [5]

2.3 DATA SAMPLE

The surveys were carried out in two phases. In August, the OS and CSS were carried out for 27 schemes in the Mekong Delta and 18 schemes in the Central Region. In September, another 19 schemes in the Central Region were surveyed. Taken together, then, a total of 65 system

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[5] "Benchmarking" involves systematic collection and comparative analysis of various performance indicators for water supply and/or sewerage enterprises. The indicators reflect different aspects of utility operations such as water production and consumption, water losses, revenues, operating costs, tariffs, etc. The data is typically provided by the enterprises themselves. For a a more detailed discussion of benchmarking, see the website of the International Benchmarking Network for Water and Sanitation Utilities (www.ib-net.org; accessed June 12, 2014).

operators were interviewed for the OS and 890 serviced households were interviewed for the CSS from the 66 selected schemes. Table 2 breaks down the CSS sample by location. An average of 14 households was interviewed per scheme.

Table 2. CSS Sample by Location

Region	Province	Schemes	Households
Central	Hue	2	30
	Quang Binh	9	166
	Quang Nam	22	304
	Quang Tri	6	93
Mekong	Tien Giang	27	297
Total	-	**66**	**890**

More specifically, households for the CSS were selected using a random assignment technique based on geographical clustering.[6] First, clusters of between five and eight households were formed and categorized on the basis of distance from main roads and distance from the system itself. Subproject samples were then randomly selected among clusters so as to be representative of the spatial distribution of project beneficiaries. Given the number of clusters covered and the large overall sample size, these measures were considered sufficient to mitigate the risk of many design effects and selection bias while also reducing operation costs.

As discussed, completed Project schemes have been operated and maintained under a variety of different management models. The surveys broke down scheme management type into six categories (tTable 3):

Table 3. CSS Sample by Commune and Management Type

	Private enterprise	Cooperative	CPC	Community management	Private contractor	Other	Total
Hue	0	1	0	0	0	1	2
Quang Binh	0	1	6	1	1	1	10
Quang Nam	0	11	7	1	1	2	22
Quang Tri	0	1	4	0	0	0	5
Tien Giang	27	0	0	0	0	0	27
Total	**27**	**14**	**17**	**2**	**2**	**4**	**66**

The remainder of the study is primarily concerned with the first three management types: private investor, cooperative, and CPC (bBox 1. Three Main Management Types

Figure 2. Main Source of Drinking Water before the ProjectBox 1. Three Main Management Types

[6] The same sampling technique was also used for the 2011 CSS.

Figure 2. Main Source of Drinking Water before the Project

Figure 3. Time Spent Collecting WaterFigure 2. Main Source of Drinking Water before the ProjectBox 1. Three Main Management Types

Figure 2. Main Source of Drinking Water before the ProjectBox 1).

Box 5. Three Main Management Types

Private investor. A private enterprise or individual has invested funds in the system, and owns and operates it under a formal agreement with the Provincial People's Committee (PPC).

Cooperative. This is a multipurpose cooperative that might be handling electricity distribution, supply of agricultural inputs, and the like. The system is managed by cooperative employees. The cooperative receives the revenues from the water charges, paying for operational expenditures from its own accounts in accordance with the cooperative's internal regulations.

CPC. The CPC owns the system, which is operated by employees of the CPC. Collected water charges are counted as revenues of the CPC, which is also responsible for covering the system's operating costs (electricity, wages, and so on).

The study limits its scope to these three management models mainly because the other three management categories are not adequately represented in the sample. Taken together, they make up only about 10 percent of the total sample size for the CSS. There are not enough observations to allow for meaningful and unbiased analysis of all six management categories. This is to be expected as, taken together, all the project schemes that are *not* managed by private investors, cooperatives, or CPCs make up only 11 percent of total Project systems (see fFigure 1. Management Types for EMW's Rural Water Supply Project

Figure 1. Management Types for EMW's Rural Water Supply Project

Figure 1. Management Types for EMW's Rural Water Supply Project

Figure 1). Therefore, the authors believe this exclusion is perfectly justified.

2.4 Data Collection

Two separate teams were assembled for data collection in each region. These teams were led by EMW staff and consisted of volunteers who had prior experience with data collection for the Project in selected areas. This was crucial to ensure that each enumerator had extensive knowledge of the core issues related to clean water provision, as well as a working familiarity with the local communities. To further guarantee the consistency and quality of data collected, survey enumerators took the time to reassure each beneficiary household of the survey's purpose and confidentiality.

2.5 Data Limitations

All the surveyed schemes were implemented by EMW between 2008 and 2011. They represent only a small sample of projects in two regions of the country. Consequently, the picture that is presented here is at best a snapshot, and should not be taken as a complete representation of how well or poorly various management models function throughout Vietnam. Still, as the study illustrates, the results are sufficiently striking to warrant a serious discussion about the potential for expansion of the public-private partnership model for rural water supply in the country. This is especially the case since a number of other studies have shown that the performance of many water supply systems managed by the public sector have failed to meet expectations.

3 REGIONAL ASSESSMENT OF PROJECT IMPACTS

3.1 THE PROJECT AREAS

The Project is located in two areas of Vietnam: the Mekong Delta in the south and the Central Coastal Region around the city of Danang. Natural, climatic and socioeconomic conditions vary significantly between the two regions.

The Mekong Delta is the most productive farming area in the country, typically producing three crops a year. It is heavily populated, with rural densities of 400 to 500 persons per square kilometer. Most of the area is intersected by numerous river branches, streams, and canals. Large parts of the delta are subject to regular flooding during the rainy season each year (May to October). The quality of surface water and shallow groundwater is affected by industrial pollution, aquaculture, and salt water intrusion. Away from the coast, the quality of the deep aquifer is generally good. Annual rainfall is usually around 2,000 mm. Outside of the big cities (Ho Chi Minh City and Hanoi), the Mekong Delta is the most dynamic economy in Vietnam.

The Central Region essentially consists of a relatively narrow coastal plain bordered by hills and mountains to the west. Annual rainfall on the coastal plain, where the great majority of people in the area live—and where almost all of the subprojects are located—is similar to that in the Mekong Delta (roughly 2,000 mm). The rainy season extends from August to December, with the heaviest rainfall in October to November. The numerous rivers are quite short, with relatively large seasonal variations in flow. The groundwater in the Central Region (especially in Quang Nam and Quang Binh) is often quite poor. It tends to have high levels of sedimentation, iron, and hydrogen sulfide (which makes the water smell like "rotten eggs"). The quantity and quality of groundwater tends to decline during the dry season. Rural incomes in the Central Region are about four-fifths of those in the Mekong Delta.

3.2 WATER SOURCE, COLLECTION, AND TIME-SAVINGS

To provide some context to the survey results, water users were first asked what their primary source of clean water was before the water project was implemented. Broadly speaking, households' main water source is determined by geographical factors. As depicted in fFigure 2. Main Source of Drinking Water before the Project

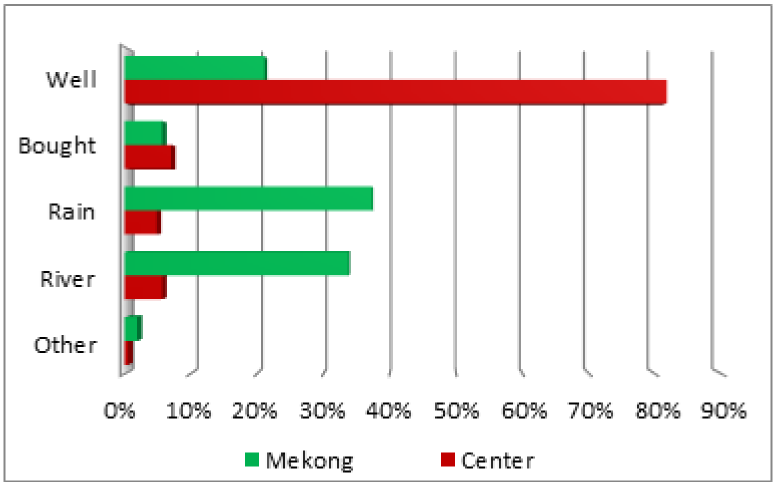
Figure 3. Time Spent Collecting WaterFigure 2. Main Source of Drinking Water before the Project

Figure 3. Time Spent Collecting Water

Figure 3. Time Spent Collecting WaterFigure 2. Main Source of Drinking Water before the Project

Figure 3. Time Spent Collecting WaterFigure 2, the overwhelming majority of households in the Central Region tended to rely on wells for their clean water. In the Mekong Delta, rain and

Figure 11. Main Source of Drinking Water before the Project



river water were the most common responses.

Very few households in either geographical region regularly bought bottled drinking water. This is indicative of the fact that the project targets poor communities whose residents generally cannot afford such luxuries. Despite the fact that there are substantial differences in the previous source of water across the regions, the amount of time that surveyed households from the Mekong Delta and the Central Region usually spent collecting their water each day is strikingly similar across all categories (fFigure 3. Time Spent Collecting Water

Figure 19. Time Spent Collecting Water

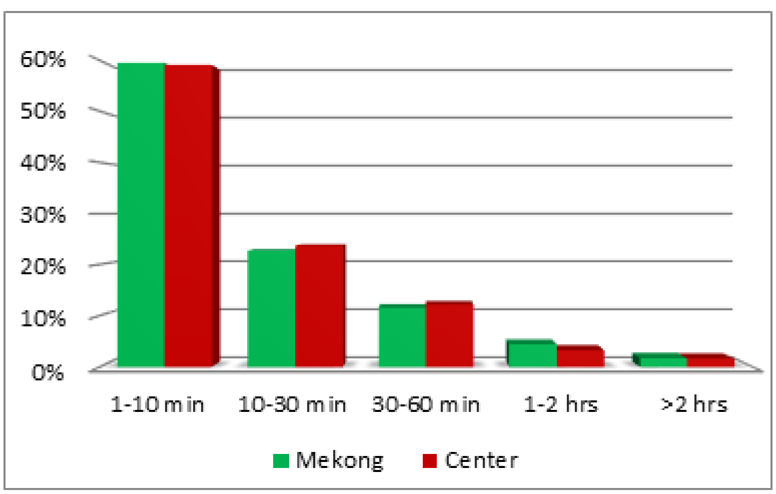


Figure 3. Time Spent Collecting Water

Figure 3. Time Spent Collecting Water

Figure 3).

About 60 percent of surveyed households reported that collecting their water took less than 10 minutes each day and only 5 percent of all respondents stated that water collection from their previous source took longer than an hour. The relatively limited time needed to collect water is due to the fact that many families in the Central Region own their own shallow well, and that in the Mekong Delta, a river or stream is never far away. In broad terms, the average time spent collecting water is slightly higher in the Mekong Delta (8.8 hours per month) than in the Central Region (8.5 hours per month). These figures beg the question of how these time-savings might be valued in monetary terms (see bBox 2. Estimating the Value of Time-Savings

Figure 4. Who Collects Household WaterBox 2. Estimating the Value of Time-Savings

Figure 4. Who Collects Household Water

Figure 5. Water Treatment in the Central RegionFigure 4. Who Collects Household WaterBox 2. Estimating the Value of Time-Savings

Box 13. Estimating the Value of Time-Savings

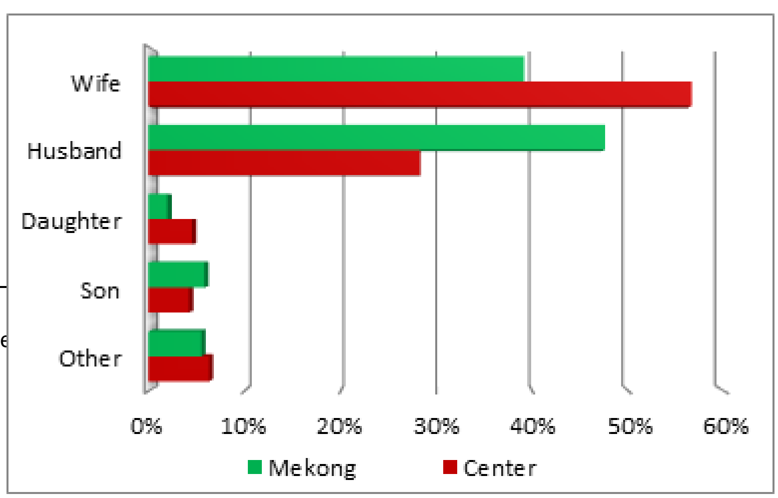
The median income in Tien Giang province (Mekong Delta) was VND 1,003,000 per person per month and around VND 800,000 in the four central provinces, according to the Vietnam Living Standard Survey 2010. A family of 4 had on average 2.4 working members. This implies a median monthly income of VND 1.67 million in the Mekong Delta and 1.33 million in the Central Region. Inflation between 2010 and 2013 was close to 40 percent. In addition, there was an increase in real income during these years. GDP per capita increased a little over 5 percent annually. Assuming that not all of this trickled down to rural areas, a 4–4.5 percent increase in annual real income can be assumed.

Thus income for the median household would have increased by about 60 percent in nominal terms between 2010 and 2013. Further assuming 180 working hours per month, it is estimated that the hourly income at the time of the survey was VND 15,000 in the Mekong Delta and VND 12,000 in the Central Region. Valuing the time for collecting water at half the hourly income, this study uses VND 7,500 in the Mekong Delta and VND 6,000 in the Central region. Given average time-savings of 8.8 and 8.5 hours per month, it follows that the total value of time-savings are around VND 66,000 and VND 51,000 per month in the Mekong Delta and the Central region, respectively.

Figure 4. Who Collects Household WaterBox 2 for an estimation).

Much of the literature on rural water supply in developing countries advises that statistics regarding water collection times often cannot be taken at face value, particularly when the respondent is not the person who is directly responsible for collecting the household's water. This happens frequently as questionnaires and surveys are most often addressed to the "head of household"—usually a man—and water collection is a task which in many parts of the world is considered the responsibility of women and children.[7] This does not appear to be a major

Figure 29. Who Collects Household Water



[7] For example, see

concern for this study, however, especially in light of the fact that 49 percent of the survey respondents are female. Furthermore, men and women gave virtually identical answers to the questions on how much time was spent on collecting water.

In any case, the CSS also explicitly asked water users which member of their households is usually responsible for water collection (fFigure 4. Who Collects Household Water

Figure 5. Water Treatment in the Central RegionFigure 4. Who Collects Household Water

Figure 5. Water Treatment in the Central Region

Figure 6. Water Treatment in the Mekong DeltaFigure 5. Water Treatment in the Central RegionFigure 4. Who Collects Household Water

Figure 5. Water Treatment in the Central RegionFigure 4). For the Central Region, the majority of households (56 percent) stated that the "Wife" does the water collecting. This is about two times higher than the figure for "Husband," and is in keeping with the conventional wisdom on the subject. For the Mekong Delta sample, however, "Husbands" were actually more likely to collect their family's water than "Wives" (47 percent versus 38 percent). This regional contrast is indicative of the fact that the Mekong Delta is more developed and economically dynamic, implying that women have higher opportunity costs (more employment opportunities) than their counterparts in the Central Region.

3.3 Water Treatment and Quality

As far as water treatment is concerned, the only difference across regions worth mentioning is that a slightly higher proportion of beneficiaries in the Mekong Delta buy bottled drinking water. Again, this is likely due to relatively better economic conditions in the South. In this case, it is much more interesting to compare household water treatment within the same region over time (fFigure 5. Water Treatment in the Central Region

Figure 38. Water Treatment in the Central Region

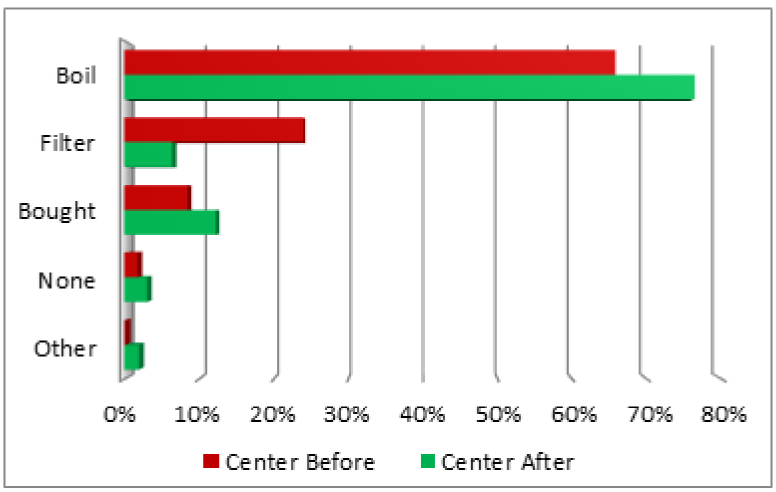


Figure 6. Water Treatment in the Mekong DeltaFigure 5. Water Treatment in the Central Region

Figure 6. Water Treatment in the Mekong Delta

Figure 7. Major Improvement over Previous SourceFigure 6. Water Treatment in the Mekong DeltaFigure 5. Water Treatment in the Central Region

Figure 6. Water Treatment in the Mekong DeltaFigure 5 and fFigure 6. Water Treatment in the Mekong Delta

Figure 7. Major Improvement over Previous SourceFigure 6. Water Treatment in the Mekong Delta

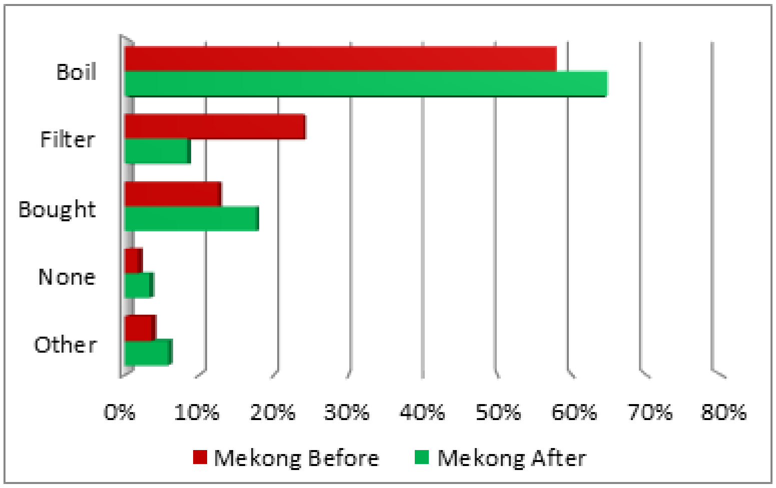
Figure 7. Major Improvement over Previous Source

Figure 8. Seasonal Changes to Water QualityFigure 7. Major Improvement over Previous SourceFigure 6. Water Treatment in the Mekong Delta

Figure 7. Major Improvement over Previous SourceFigure 6).

Broadly speaking, the same general tendencies can be found in both the Central Region and the Mekong Delta. For instance, there is a distinct drop in the number of households that filter their water after the Project had been implemented. This is because all systems include a filtering process that reduces water turbidity and sedimentation, making filtration by the households largely unnecessary.

Figure 47. Water Treatment in the Mekong Delta



Boiling remains the most common treatment method in both regions, even after households are connected to the clean water systems. Boiling is recommended, as many bacteria are too small to be caught in the traditional filtration process; to purify the water at the system level would require chemical treatments such as chlorination. However, if polluted ground water leaks into the underground distribution pipelines, even use of appropriate chemicals cannot guarantee that the water is safe to drink. Besides, it is important to note that Vietnamese people are not accustomed to such treatments. They often complain about the taste of chlorinated water, preferring to simply boil it themselves.

As shown in fFigure 7. Major Improvement over Previous Source

Figure 8. Seasonal Changes to Water QualityFigure 7. Major Improvement over Previous Source

Figure 8. Seasonal Changes to Water Quality

Figure 56. Major Improvement over Previous Source

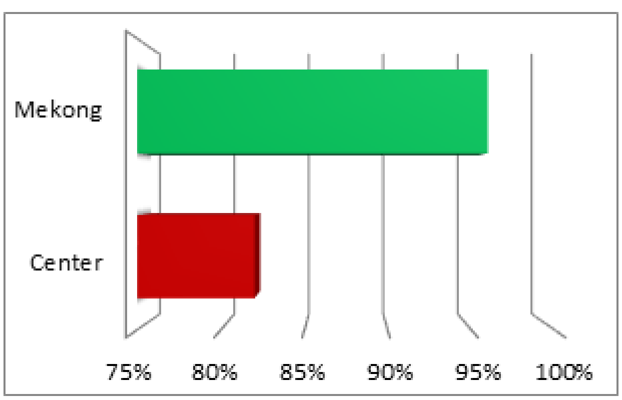


Figure 9. User Satisfaction with AvailabilityFigure 8. Seasonal Changes to Water QualityFigure 7. Major Improvement over Previous Source

Figure 8. Seasonal Changes to Water QualityFigure 7, when asked whether the quality of their system water was a "major" improvement over their previous water source, the overwhelming majority of respondents answered affirmatively (96 percent and 82 percent in the Mekong and Central Region, respectively). Still, the margin between the Mekong and Central systems is significant. This is largely a result of the geology and water resources of the two regions. Thus in the Mekong Delta, wells constructed under the project were generally 250–400 meters deep, as opposed to 10–40 meters in the Central Region. The latter wells are more susceptible to seasonal variations in quality and quantity.

When considering seasonal changes to water quality (fFigure 8. Seasonal Changes to Water Quality

Figure 9. User Satisfaction with AvailabilityFigure 8. Seasonal Changes to Water Quality

Figure 9. User Satisfaction with Availability

Figure 65. Seasonal Changes to Water Quality

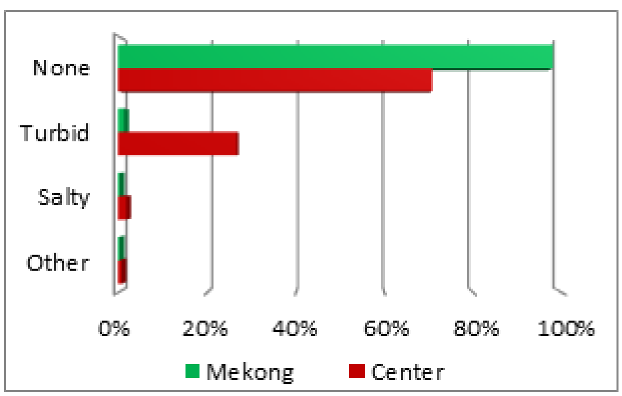


Figure 10. User Satisfaction with Water QualityFigure 9. User Satisfaction with AvailabilityFigure 8. Seasonal Changes to Water Quality

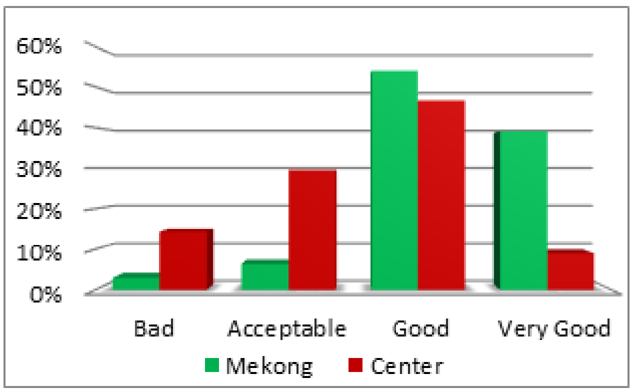
Figure 9. User Satisfaction with AvailabilityFigure 8), there are significant differences across the regions; 98 percent of the respondents from the Mekong Delta found that there were no seasonal changes in terms of quality, compared to 70 percent from the Central Region. More

specifically, about 27 percent of respondents from Central schemes experienced a drop in water quality due to increased turbidity. This is most likely because underground water sources in the Central provinces tend to be relatively shallow, making them vulnerable to seasonal variation as sediment and other particles are stirred up during the flood season. In contrast, systems in the Mekong Delta have access to a very deep aquifer, ensuring a stable supply of consistently high quality ground water.

3.4 USER SATISFACTION

Figure 9. User Satisfaction with Availability

Figure 74. User Satisfaction with Availability **Figure 83. User Satisfaction with Water Quality**



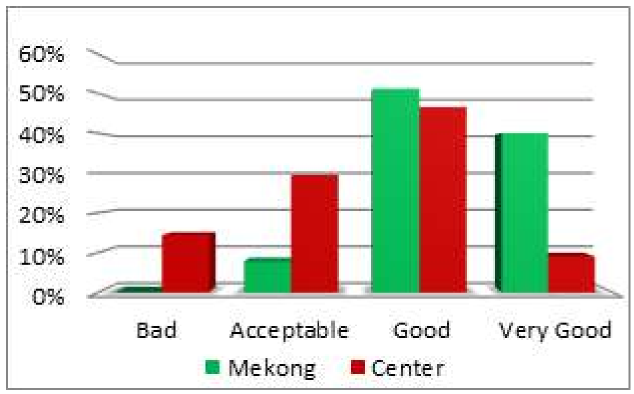


Figure 10. User Satisfaction with Water QualityFigure 9. User Satisfaction with Availability

Figure 10. User Satisfaction with Water Quality

Figure 11. What People Value about Piped WaterFigure 10. User Satisfaction with Water QualityFigure 9. User Satisfaction with Availability

Figure 10. User Satisfaction with Water QualityFigure 9 and Figure 10. User Satisfaction with Water Quality

Figure 11. What People Value about Piped WaterFigure 10. User Satisfaction with Water Quality

Figure 11. What People Value about Piped Water

Figure 11. What People Value about Piped WaterFigure 10. User Satisfaction with Water Quality

Figure 11. What People Value about Piped WaterFigure 10 present a basic summary of how water users perceive the quality of the service they are being provided with respect to water availability and water quality.

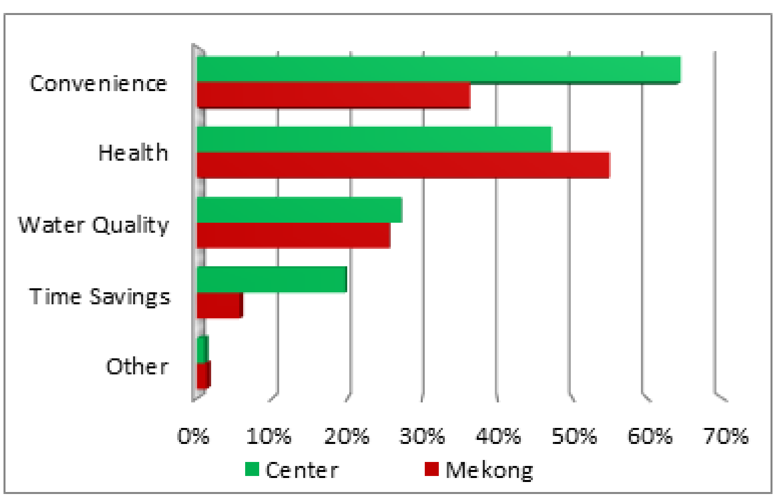
Broadly speaking, it is clear that water users in the Mekong Delta are substantially more satisfied with their water systems on both accounts when compared with those in the Central provinces. The preceding subsections have discussed some regional and geographical explanations for these differences. However, this line of analysis seems to raise more questions than it answers. What, then, can account for the striking disparity in performance across project regions?

3.5 Overall Assessment of Project Impact

The previous sections of this chapter analyzed how the access to piped water supply has impacted the lives of the project beneficiaries. They benefited from increased availability and improved quality of the water (although they experienced some problems with reduced availability and increased turbidity in the dry season in the Central Region). While time-savings were relatively modest, the economic value was estimated at VND 66,000 and VND 51,000 in the Mekong Delta and the Central Region, respectively. These amounts exceed the average monthly water bills of VND 47,000 and VND 36,000 in the Delta and the Central, respectively.

However, time-savings are regarded by the households as significantly less important than convenience and health benefits (figure 11). An independent research study assessed the drinking water quality and health impacts of seven of EMW's systems built in the Central Region under the GPOBA program. The study found that the risk of diarrheal disease decreased by about one third when households used water from the water supply system rather than from "improved" water sources (protected wells and rainwater harvesting). For a more complete description of the study's conclusions, see b 3. Appendix C presents a more detailed explanation of the study's methodology and results.

Figure 91. What People Value about Piped Water



Box 21. Health Impact of GPOBA/EMW Water Systems in Central Region

In their 2010 study, *Relative Benefits of Piped Water Supply over Other "Improved" Sources: A Case Study from Rural Vietnam,* J. Brown, H. Vo Thi, and M. Sobsey note:

"This longitudinal, prospective cohort study included 300 households in seven project areas in [the Central Region of] Vietnam: 224 randomly selected households who paid to connect to one of seven piped water systems and 76 control households from the same areas relying primarily on "improved" water sources outside the home. The four-month study was intended to specifically measure the impact of the NGO-led water programs on households' drinking water quality and health and to evaluate system performance. Other observed water use and handling practices, including point-of-use water treatment by boiling, were also examined for possible associations with household drinking water quality and health. We found that: (i) households connected to a piped water supply had consistently improved drinking water quality over those relying on other, non-piped sources, despite inadequate centralized treatment; (ii) individuals in households with access to a piped water connection were at reduced risk of diarrheal diseases compared with households without a piped water connection (RR: 0.65, 95% CI 0.46 – 0.90); (iii) households paid less per month for water and reported greater satisfaction with the service over available alternatives…"

The authors presented their results at the Singapore International Water Week, June 29, 2010.

Note: A "prospective cohort study" is a research study that follows over time groups of individuals who are alike in many ways but differ by a certain characteristic (in this case, the water source) and compares them for a particular outcome (such as experiencing diarrhea). Longitudinal implies that the same individuals were followed over time (in this case, the households were interviewed every month for four months. RR stands for "relative risk." In simple terms, the RR of 65% reported in the study implies that the probability of getting diarrhea is reduced by 35%. CI stands for "confidence interval" as the term is commonly used in statistical analyses.

The World Bank Water and Sanitation Program (WSP) has estimated the health costs of diarrhea and other water-related diseases in Vietnam.[8] The total cost of these diseases was estimated at $192 million for rural areas in 2005. Using the percentage reduction in diarrhea reported by Brown, Thi, and Sobsey (2010) and adjusting the WSP figure for inflation and economic growth, this study estimates that the health benefits of clean, piped water are about $3.0 per capita per year, or $12 per family per year. Thus, of the quantifiable benefits, time-

[8] Water and Sanitation Program. (2008). *Economic Impacts of Sanitation in Vietnam*. Research Report February.

savings make up 70–75 percent of the total, and health benefits make up 25–30 percent, which is consistent with estimates of the World Health Organization (2012) for Southeast Asia.

No attempts were made in the customer satisfaction surveys to measure the consumers' willingness to pay. Taking the time-savings and health benefits as a lower bound for the overall benefits and using the implicit O&M costs from the operator surveys as well as actual investment costs (less beneficiary contributions, table 4), this study estimates the economic internal rate of return at 17 percent in the Mekong Delta and 14 percent in the Central Region. Given the partial assessment of benefits, these estimates are lower bounds, and would have been significantly higher if this study had been able to fully estimate the consumers' willingness to pay.

Table 4. Investment Costs in the Central Region and the Mekong Delta

	EMW/CPC	**Private**
	($ per household)	
Construction cost charged to donors	93.99	64.11
Beneficiary contributions in cash	13.01	18.47
Beneficiary contributions in-kind	16.55	0.00
Local government contribution (land, etc.)	2.02	0.00
Private enterprise investment	0.00	53.55
Total construction cost	**125.58**	**136.12**
EMW design, supervision, training, etc.	35.83	39.01
Total cost per household	**161.41**	**175.13**

Brown, Thi, and Sobset (2010) also concluded: "Although a connection to a piped water supply offers measurable benefits to households at relatively low cost, maintaining water quality and ensuring consistent operation and maintenance represent ongoing challenges to local service providers."

How well local service providers—especially private entrepreneurs, cooperatives, and Commune People's Committees—perform in terms of providing high quality water in a reliable and sustainable manner is the topic explored in the next two chapters.

4 CONSUMER SATISFACTION SURVEY RESULTS

4.1 SYSTEM WATER SUPPLY

The most basic indication of whether a particular subproject has been successful is to ask water users whether or not they currently have enough clean water for their household's needs. The 2011 CSS provides a useful point of reference. Only about 10 percent of respondents were able to acquire enough drinking water before the introduction of the Project's piped water systems. After Project implementation, in 2011, 89 percent of beneficiary households stated that they had sufficient clean water for drinking.

Figure 12. Households Have Enough Clean Water

Figure 13. Household Access to Piped WaterFigure 12. Households Have Enough Clean Water

Figure 101. Households Have Enough Clean

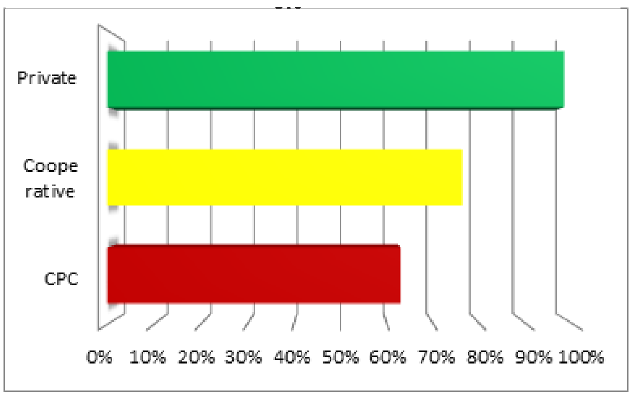


Figure 110. Household Access to Piped Water

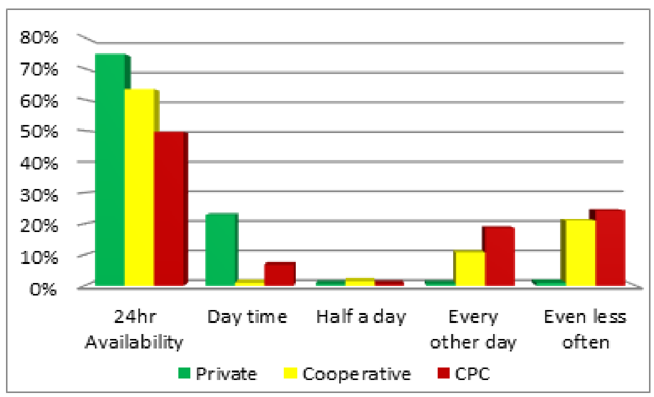


Figure 13. Household Access to Piped Water

Figure 14. User Satisfaction by Management Type: AvailabilityFigure 13. Household Access to Piped WaterFigure 12. Households Have Enough Clean Water

Figure 13. Household Access to Piped WaterFigure 12 illustrates the responses of the current CSS broken down by management type. In sum, 98 percent of users from privately managed schemes reported that they have enough clean water—significantly higher than the figures for users of cooperative and CPC managed systems (76 percent and 62 percent, respectively). Perhaps this discrepancy can be at least partially explained by the consistency of the water service provided.

Households were also asked how frequently they had access to clean water through the system under normal circumstances (fFigure 13. Household Access to Piped Water

Figure 14. User Satisfaction by Management Type: AvailabilityFigure 13. Household Access to Piped Water

Figure 14. User Satisfaction by Management Type: Availability

Figure 15. Frequency of System Breakdowns (monthly)Figure 14. User Satisfaction by Management Type: AvailabilityFigure 13. Household Access to Piped Water

Figure 14. User Satisfaction by Management Type: AvailabilityFigure 13). As expected, the users of privately managed systems recorded much better results—98 percent of respondents stated that they had at least daytime access to their system's clean water. In contrast, many of the cooperative and CPC managed systems provide their users with clean water only every other day—or even less often (32 percent and 43 percent, respectively).

In sum, it is not surprising privately operated system users tended to be more satisfied with the availability of system water—about 94 percent reported a satisfaction rating of "Good" or "Very Good" (fFigure 14. User Satisfaction by Management Type: Availability

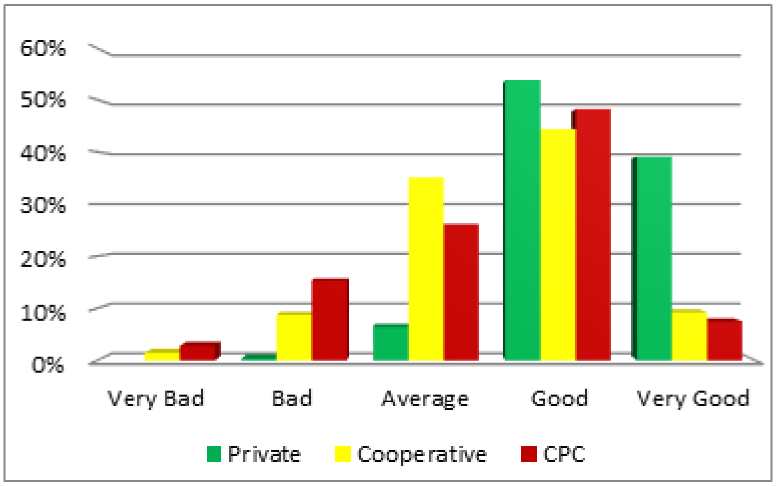
Figure 15. Frequency of System Breakdowns (monthly)Figure 14. User Satisfaction by Management Type: Availability

Figure 15. Frequency of System Breakdowns (monthly)

Figure 16. Main Causes of System BreakdownsFigure 15. Frequency of System Breakdowns (monthly)Figure 14. User Satisfaction by Management Type: Availability

Figure 15. Frequency of System Breakdowns (monthly)Figure 14). Although the difference is significant, the cooperative and CPC systems still performed satisfactorily, with more than 80 percent of households scoring availability at "Average" or better. This discussion begs the obvious question of whether the private systems' impressive results are due to better operator knowledge and management practices or for other reasons.

Figure 119. User Satisfaction by Management Type: Availability



4.2 MANAGEMENT QUALITY AND SYSTEM BREAKDOWNS

The preceding subsection shed some light on how the systems perform when operating as usual—but what about when problems arise? Consistent with the previous findings regarding water availability, privately operated systems also tend to break down much less often. When asked, nearly 90 percent of private system users stated that their system breaks down at most one to two times per month (fFigure 15. Frequency of System Breakdowns (monthly)

Figure 128. Frequency of System Breakdowns (monthly)

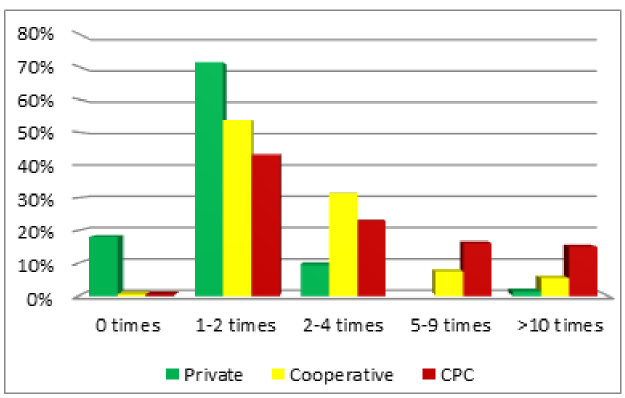


Figure 16. Main Causes of System BreakdownsFigure 15. Frequency of System Breakdowns (monthly)

Figure 16. Main Causes of System Breakdowns

Figure 17. Usual Time for System RepairsFigure 16. Main Causes of System BreakdownsFigure 15. Frequency of System Breakdowns (monthly)

Figure 16. Main Causes of System BreakdownsFigure 15).

The key question, then, is whether this result is due to private system operator's superior performance incentives, technical knowledge, or for other less apparent reasons. However, the private systems were built to the same technical standards as used by EMW in the Central Region. Thus there are no design-related or construction-related reasons why there would be any significant difference in the occurrence in system breakdowns. One possible exception is that the secondary household connection pipelines for cooperative and CPC schemes are not reliable, as they are usually laid by the water users themselves.

The data presented in fFigure 16. Main Causes of System Breakdowns

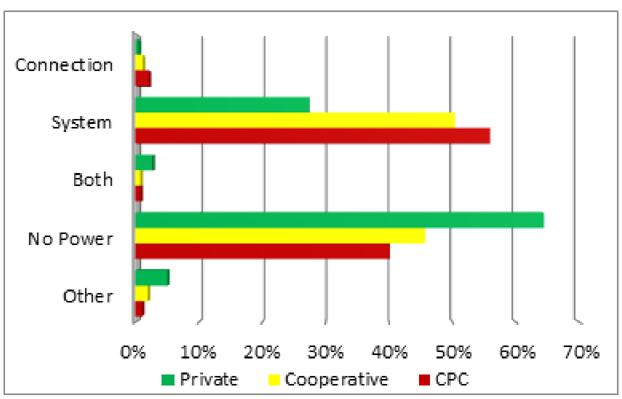
Figure 17. Usual Time for System RepairsFigure 16. Main Causes of System Breakdowns

Figure 17. Usual Time for System Repairs

Figure 18. Users Informed about System DowntimesFigure 17. Usual Time for System RepairsFigure 16. Main Causes of System Breakdowns

Figure 17. Usual Time for System RepairsFigure 16, however, illustrates that this is not the case. The overwhelming majority of water users from all management types reported that the main causes of breakdowns are power outages and technical problems with the system mains, as opposed to issues with household connections.

Figure 137. Main Causes of System Breakdowns



Not only do CPC and cooperative systems experience more frequent supply interruptions than the private systems, but these problems are generally caused by technical system failures rather than power outages. While service providers have little or no control over the reliability of the electricity supply, they largely can prevent technical breakdowns through good routine maintenance. As discussed in section 5.2, private operators allocate much greater amounts for repairs and maintenance than cooperatives or CPCs. This is a strong indication that the frequent breakdowns in cooperative and CPC systems are due to poor maintenance.

The root causes of breakdowns also have important implications with respect to how long it usually takes to fix these "broken" systems. For instance, the power situation in Vietnam is fairly reasonable in that power outages tend to last only a few hours and only rarely longer than a day—notwithstanding exceptional circumstances like natural disasters. To repair technical problems with the system mains can take a much longer time. Usually spare parts must be purchased, for instance. Since such technical problems are on about twice as common for systems managed by cooperatives and CPCs, , one would expect that it would take the cooperatives and CPCs somewhat longer to restore service.

However, technical problems cause around 30 percent of the service interruptions in the private schemes. Still, as shown in fFigure 17. Usual Time for System Repairs

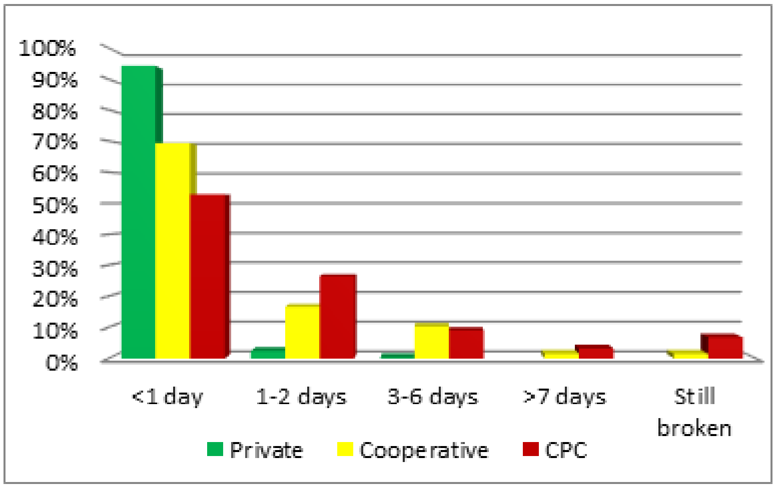
Figure 18. Users Informed about System DowntimesFigure 17. Usual Time for System Repairs

Figure 18. Users Informed about System Downtimes

Figure 19. User Satisfaction by Management Type: ManagementFigure 18. Users Informed about System DowntimesFigure 17. Usual Time for System Repairs

Figure 18. Users Informed about System DowntimesFigure 17, some 96 percent of private system breakdowns are solved within a day's time, compared to just 69 percent and 53 percent for cooperative and CPC systems, respectively. This implies that in the great majority of cases, the private operators manage to repair the system in less than one day, while this frequently takes one to two days in the CPC and cooperative systems. From the perspective of these water users, the difference between having the clean water supply restored within the same day and having to wait one to two days is significant.

Figure 146. Usual Time for System Repairs



Looking at the other end of the spectrum, however, provides a more worrying perspective on the “usual” duration of breakdowns. This is especially so for CPC systems. A total of 10 percent of CPC system users reported that repairs usually take more than a week to repair (6.8 percent stated that the system was still broken after a week), compared to just 3 percent for cooperative systems and 0 percent for private systems. The CPCs’ relatively poor performance with respect to system breakdowns and repair times is not acceptable, implying that these water users cannot rely on their CPC-managed systems as their primary source of clean water.

Another possible indication of management quality is whether or not the water users are informed when the system is brought down for maintenance ahead of time. Only 27 percent of private system users responded affirmatively. It must be borne in mind, however, that this is more than double the result for either cooperative or CPC systems (fFigure 18. Users Informed about System Downtimes

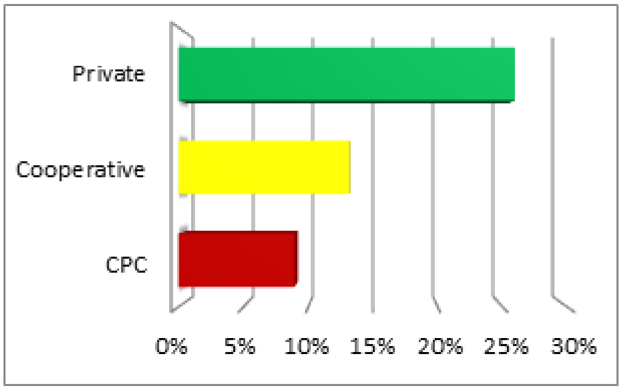
Figure 19. User Satisfaction by Management Type: ManagementFigure 18. Users Informed about System Downtimes

Figure 19. User Satisfaction by Management Type: Management

Figure 20. Project Water Quality Is an ImprovementFigure 19. User Satisfaction by Management Type: ManagementFigure 18. Users Informed about System Downtimes

Figure 19. User Satisfaction by Management Type: ManagementFigure 18).

Figure 155. Users Informed about System Downtimes



Regardless, when asked directly it is clear that water users of private systems tend to be more satisfied with the quality of their system managers when compared with the other management types (fFigure 19. User Satisfaction by Management Type: Management

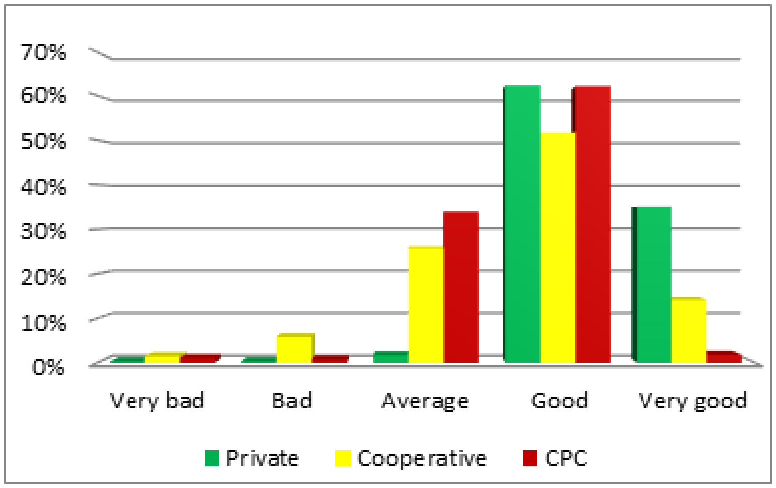
Figure 20. Project Water Quality Is an ImprovementFigure 19. User Satisfaction by Management Type: Management

Figure 20. Project Water Quality Is an Improvement

Figure 21. Quality Has Become WorseFigure 20. Project Water Quality Is an ImprovementFigure 19. User Satisfaction by Management Type: Management

Figure 20. Project Water Quality Is an ImprovementFigure 19).

Figure 164. User Satisfaction by Management Type: Management



4.3 WATER QUALITY

In terms of water quality, the most fundamental question is whether or not water users consider the piped system water to be an improvement on their previous source of drinking water (fFigure 20. Project Water Quality Is an Improvement

Figure 21. Quality Has Become WorseFigure 20. Project Water Quality Is an Improvement

Figure 21. Quality Has Become Worse

Figure 22. User Satisfaction by Management Type: Water QualityFigure 21. Quality Has Become WorseFigure 20. Project Water Quality Is an Improvement

Figure 21. Quality Has Become WorseFigure 20). The overwhelming majority of users responded affirmatively and, as usual, the private water systems recorded the most impressive result. However, this might at least partly be due to geographical factors, as described in section 3.1. Most water users also reported that the quality of their system's water had not changed since it was first constructed (fFigure 21. Quality Has Become Worse

Figure 22. User Satisfaction by Management Type: Water QualityFigure 21. Quality Has Become Worse

Figure 22. User Satisfaction by Management Type: Water Quality

Figure 23. Water Tariff Is UnreasonableFigure 22. User Satisfaction by Management Type: Water QualityFigure 21. Quality Has Become Worse

Figure 22. User Satisfaction by Management Type: Water QualityFigure 21). From a sustainability perspective, this certainly is an encouraging sign, indicating that the majority of scheme operators are able to effectively maintain their systems.

Figure 173. Project Water Quality Is an Improvement

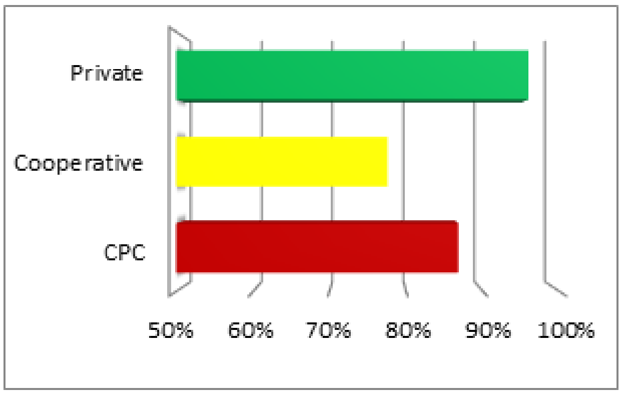
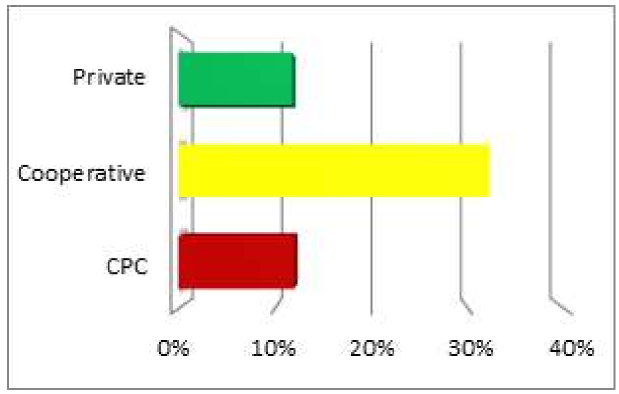


Figure 182. Quality Has Become Worse



Finally, respondents were asked to rate the taste, smell, and color of their system's water. The results of these questions are not worth illustrating graphically, especially as they are consistent with the water users' general satisfaction ratings with their system's water quality (fFigure 22. User Satisfaction by Management Type: Water Quality

Figure 23. Water Tariff Is UnreasonableFigure 22. User Satisfaction by Management Type: Water Quality

Figure 191. User Satisfaction by Management Type: Water

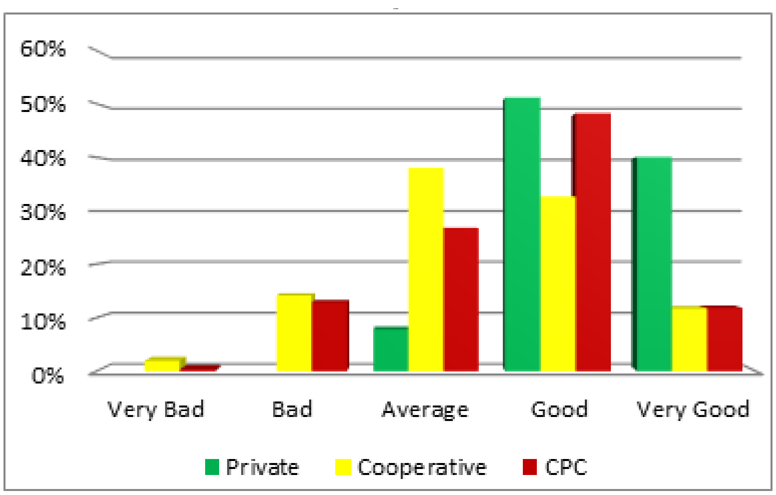


Figure 23. Water Tariff Is Unreasonable

Figure 24. Water Price per Cubic MeterFigure 23. Water Tariff Is UnreasonableFigure 22. User Satisfaction by Management Type: Water Quality

Figure 23. Water Tariff Is UnreasonableFigure 22). Suffice to say that, once again, private system users were the most satisfied. However, again, this might be due to the higher quality of the raw water pumped from the deep aquifer in the Mekong Delta as compared to the water from surface sources or the more shallow aquifer in the Central Region (see section 3.1).

4.4 Water Pricing and Consumption

So far, the findings discussed support the notion that the private systems' better and more consistent performance is largely a result of the quality of their operators. One plausible explanatory factor might be the private operators' profit/performance incentives—or, alternatively, the CPC and cooperative system operators' lack of them. This line of reasoning suggests that the users of private systems may be forced to pay higher water tariffs compared to their CPC and cooperative system using counterparts.

Figure 23. Water Tariff Is Unreasonable

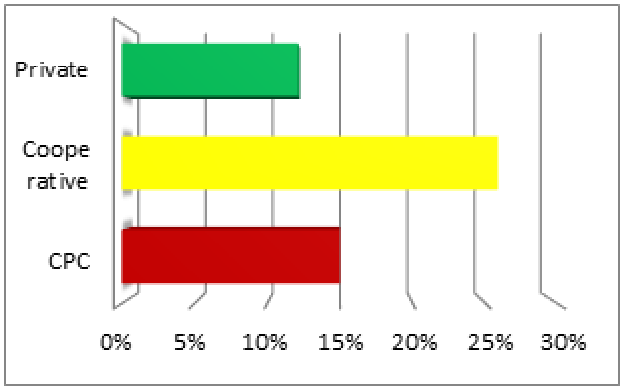
Figure 24. Water Price per Cubic MeterFigure 23. Water Tariff Is Unreasonable

Figure 24. Water Price per Cubic Meter

Figure 25. Percent of Households That Consider the Tariff "Unfair" Tariff by User Quality PerceptionsFigure 24. Water Price per Cubic MeterFigure 23. Water Tariff Is Unreasonable

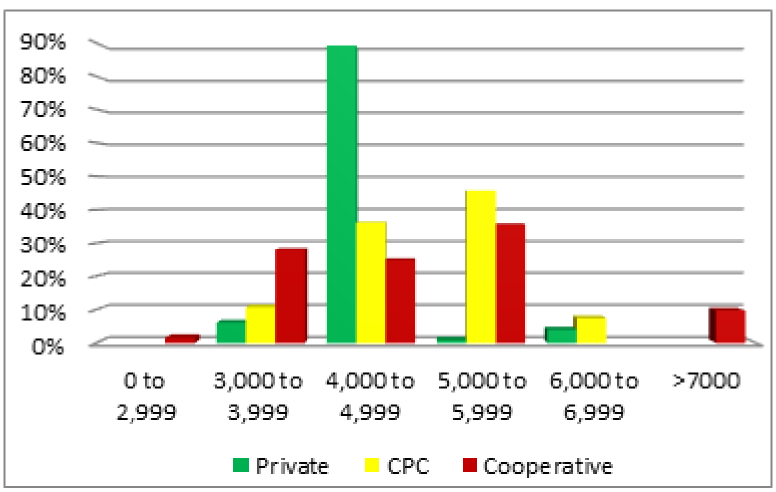
Figure 24. Water Price per Cubic MeterFigure 23 shows that regardless of such speculations, out of the three system types, the private water users are still the most content with their price rates. Still, it may be instructive to examine water tariffs, household water expenditure, and consumption.

Figure 200. Water Tariff Is Unreasonable



At first glance, there seems to be very little difference between water tariffs across management types. On average, private systems require VND 4,520 per cubic meter, compared with VND 4,424 and VND 4,560 for cooperative- and CPC-managed systems, respectively. As illustrated in figure 24, the main difference between the management types in terms of water pricing appears to be the *range* of tariffs. About 90 percent of private systems charge between VND 4,000–5,000 per cubic meter, whereas the spread for CPC and cooperative systems is much more varied.

Figure 209. Water Price per Cubic Meter



There is no correlation between a given scheme's *actual* water tariff and whether or not its water users consider the price to be fair or not. Rather, what is important in this regard is the users' satisfaction with the quality of the water scheme and service. Figure 25. Percent of Households That Consider the Tariff

“Unfair” Tariff by User Quality Perceptions

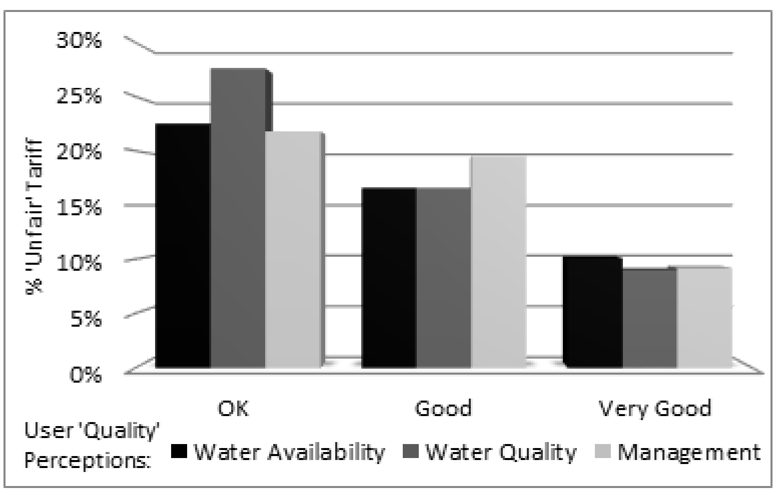
Figure 26. Household Water Expenditure (Monthly)Figure 25. Percent of Households That Consider the Tariff
“Unfair” Tariff by User Quality Perceptions

Figure 26. Household Water Expenditure (Monthly)

Figure 28. How Can the Water Service Be Improved?Figure 26. Household Water Expenditure (Monthly)Figure 25. Percent of Households That Consider the Tariff
“Unfair” Tariff by User Quality Perceptions

Figure 26. Household Water Expenditure (Monthly)Figure 25 illustrates a strong, linear correlation between all three proxies of general water user satisfaction and user perception of whether the tariff is “unfair.” In short, water users who perceive service quality to be higher

Figure 218. Percent of Households That Consider the Tariff
“Unfair” Tariff by User Quality Perceptions



tend to be more satisfied with the water tariff they are offered.

Although the average tariff is very similar across management types, there are significant differences in the amount of water consumed and the monthly expenditures on clean water (fFigure 26. Household Water Expenditure (Monthly)

Figure 28. How Can the Water Service Be Improved?Figure 26. Household Water Expenditure (Monthly)

Figure 28. How Can the Water Service Be Improved?

Figure 29. What Consumers Dislike Most about their SystemsFigure 28. How Can the Water Service Be Improved?Figure 26. Household Water Expenditure (Monthly)

Figure 28. How Can the Water Service Be Improved?Figure 26): water users of privately managed systems *do* tend to consume more water than those from other system types (table 5). There are three possible explanations for this result. The first is that these households simply have a higher demand for water. The second is that consumers in CPC and cooperative systems might be constrained in how much water they can practically consume. As seen in figure 13, households in CPC and cooperative systems have "normal" or "regular" water supply fewer days and hours per week than those served by private operators. In addition, consumers in CPC and cooperative systems experience more frequent and longer service interruptions (section 4.2). A third possible explanation is that consumers regard "water service" as a simple uniform good, but with several different characteristics such as taste, color, and reliability. The analysis in this chapter indicates that households regard the quality of the water service provided by private operators as higher than the service provided by CPCs and cooperatives. Since the price is virtually the same under the three management models, people would tend to consume more of the "high quality" water service than the "low quality" service.

Figure 227. Household Water Expenditure

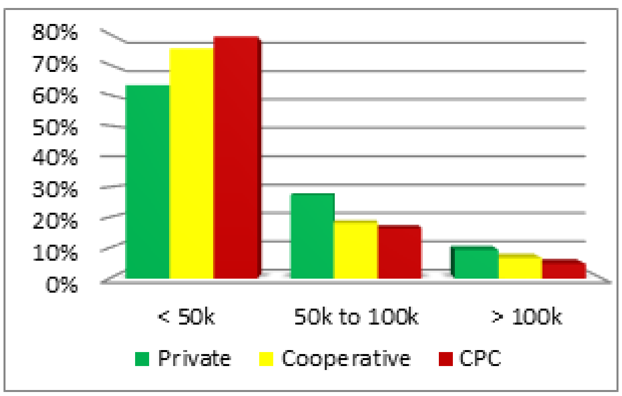


Table 5. Average Water Pricing, Expenditure, and Consumption

	Cost per M^3	Monthly expenditure	M^3 per Month
Private	VND 4,512.9	VND 46,958.3	10.40 M^3
Cooperative	VND 4,424.3	VND 37,958.7	8.58 M^3
CPC	VND 4,560.5	VND 24,324.8	5.33 M^3

On average, private system water users spend approximately VND 47,000 per month—about 20 percent more than cooperative users and almost double the average expenditure of households serviced by CPC-managed systems. In other words, private system users consume roughly 10.4 cubic meters of system water per month, compared to 8.6 and 5.3 cubic meters for cooperative and CPC systems, respectively. This difference is most likely accounted for by the reliability, consistency, and overall better performance of the privately managed systems. Similarly, the cooperative system water users consume more water than users of CPC systems, presumably for the same reasons.

There is also some divergence between the sales volumes reported by the operators in the OS and the consumers in the CSS. The private operators quote sales values that are about 15 percent lower than what consumers say they are. This can be explained by a tendency of consumers to overestimate how much water they use and how much they pay. More puzzling is the fact that the cooperatives and CPCs report sales per household that are only two-thirds of the water consumption quoted by households. One possible explanation is that cooperatives and CPCs overstate the number of households they actually serve.

4.5 SUMMARY

The CSS questionnaire finished with some overarching questions that summarize water users' feelings about their systems and the Project in general (figures 27–29). It is worth noting a few striking results. First, when the respondents were asked what they dislike about the system, an impressive 88 percent of private system users said they were completely satisfied and had nothing to complain about. This is nearly three times the number of "satisfied" cooperative and CPC system users. Consistent with this finding, when asked how the system might best be improved, 78 percent of private system users had no recommendations to make, compared with just 22 percent and 26 percent of cooperative and CPC users, respectively.

In sum, then, all of the evidence from the CSS supports the following conclusions:

- Privately managed systems perform better than their cooperative and CPC counterparts on all accounts (water supply, system management, water quality and pricing).
- These impressive results are likely due to the quality of the private operators' management practices.

Figure 27. What Consumers Value Most about Their Systems

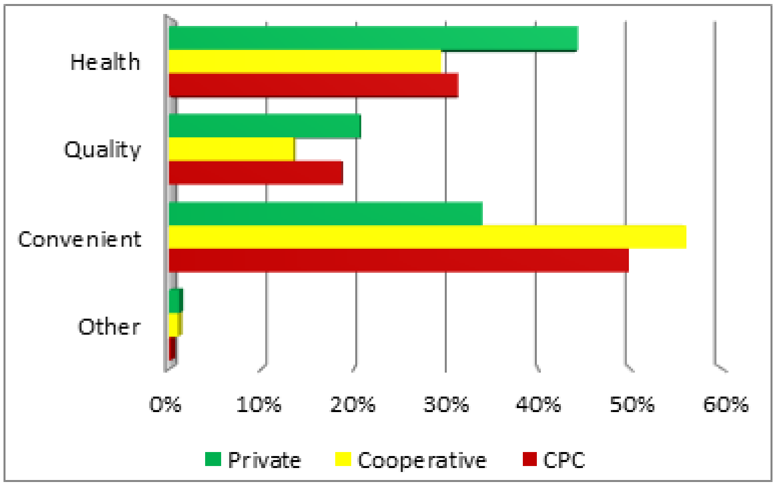


Figure 236. How Can the Water Service Be Improved?

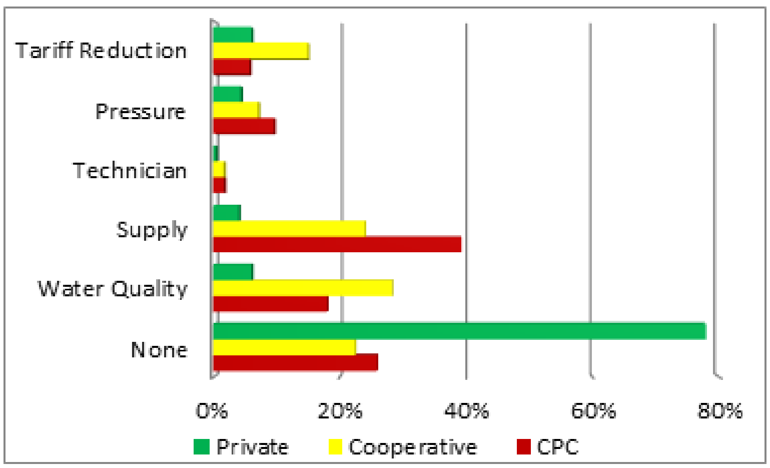
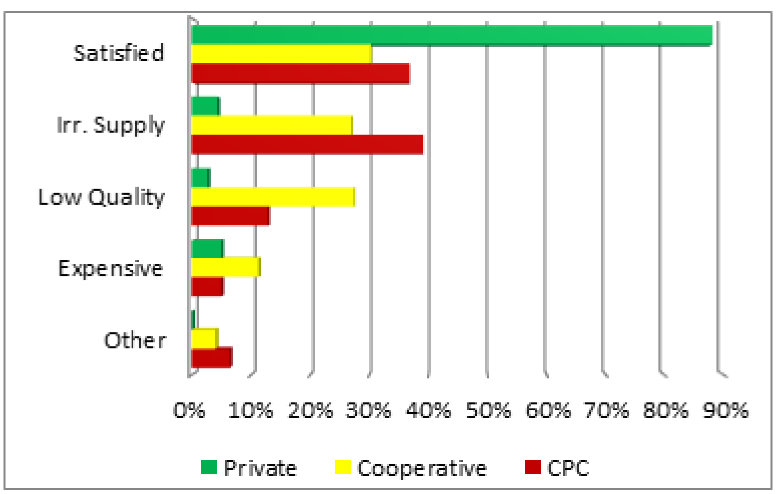


Figure 244. What Consumers Dislike Most about their



5 OPERATOR'S SURVEY RESULTS

It is important to keep the findings of the CSS in mind when considering the results of the Operator's Survey presented below. Where relevant, the following analysis will reflect on some basic similarities between the data sets. However, a detailed cross-survey analysis will be reserved for the next subsection.

The results of the CSS reflect to some extent the regional differences discussed in chapter 3. For example, electricity supply is generally more reliable in the Mekong Delta than in the Central Region. Thus consumers in the South are somewhat less likely to service interruptions due to power outages. The deep tubewells used in the Mekong Delta tend to produce better quality water than the shallow wells in the Central provinces.

This chapter focuses on management practices that are not location-specific. For example, to regularly record the volume of water produced is a good management practice. So is having a special fund for repairs.

5.1 SYSTEM SPECS AND OPERATION

Perhaps the most basic responsibility of any operator is to know and understand how much water their system actually produces and distributes. Table 6 summarizes this information according to management type.

Consistent with the CSS, it is apparent that privately managed systems tend to produce and distribute a significantly higher volume of piped clean water than those under different management schemes. However looking at overall production values is not sufficient. The efficiency of water distribution—that is, the proportion of water produced that actually reaches the connected households—is of crucial importance. Private systems also recorded the lowest water loss ratio: 21.8 percent. This is marginally lower than that of cooperative systems, while CPC-managed systems have the highest water loss ratio; on average, 30.8 percent of their clean water is lost to leakages in the piped distribution network.

Table 6. Average Monthly Water Production, Consumption, and Loss (per scheme)

	Production (M^3)	Consumption (M^3)	Difference (M^3)	Water loss (%)
Private	391	293	98	22%
Cooperative	207	176	46	23%
CPC	234	163	71	31%
Average	277	210	72	25%

The production and consumption for cooperative and CPC systems should be taken with a (big) grain of salt, as more than 40 percent of their production meters were broken. Thus for these two categories of operators, the production and consumption measures are not much better than "guestimates."

After having examined how efficiently the schemes distribute clean water, it is appropriate to consider labor productivity (tTable 7). The most basic measure of labor productivity is to see how many staff each scheme employs relative to the number of households it services. There is little difference between management types in terms of staff per connection. Although this is a common yardstick used in comparing the performance of water supply systems, it is a poor indicator of real labor productivity. The previous chapter indicated that the staff of private operators tended to provide a superior service quality. The next section indicates that the staff in private systems seems to be doing a better job in terms of billing and collection. Thus from a financial and economic point of view, it is more relevant to measure labor productivity in terms of volume of water sold per employee and revenues per staff member. When considering such more appropriate performance measures, however, it is apparent that the operators of privately managed systems (including technical, financial, and managerial staff) are the most productive by a substantial margin. Indeed, when measured in terms of water distributed per staff and monthly revenue per staff, labor productivity in private schemes is more than double that found in cooperative and CPC schemes.

Table 7. Labor Productivity by Management Type

	Staff per 1,000 HH connections	Water distributed/sold per staff (M^3/month)	Revenue generated per staff (monthly)
Private	7.5	1,794 M^3	7.8 million VND
Cooperative	8.8	706 M^3	2.5 million VND
CPC	7.3	688 M^3	2.8 million VND

The full effect of these differences in operational efficiency and productivity is best demonstrated by comparing revenues against operational costs. To this end, system operators were asked whether or not their revenues were sufficient to cover their operating costs. As shown in fFigure 30. Revenues Do Not Cover Operating Costs

Figure 254. Revenues Do Not Cover Operating Costs

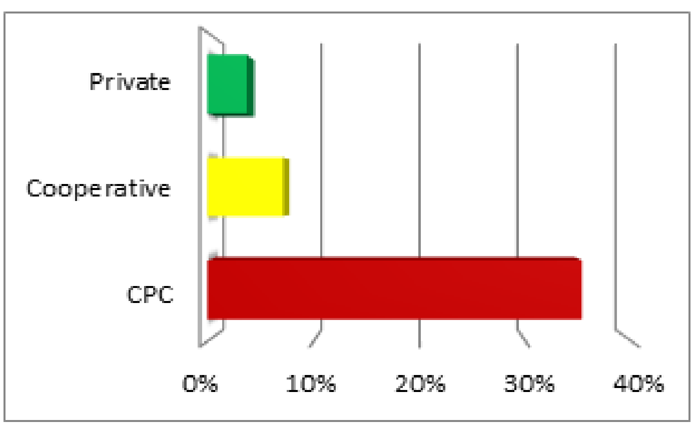


Figure 31. Frequency of Reading Production MeterFigure 30. Revenues Do Not Cover Operating Costs

Figure 31. Frequency of Reading Production Meter

Figure 32. Frequency of Collecting User Fees Figure 31. Frequency of Reading Production MeterFigure 30. Revenues Do Not Cover Operating Costs

Figure 263. Frequency of Reading Production Meter

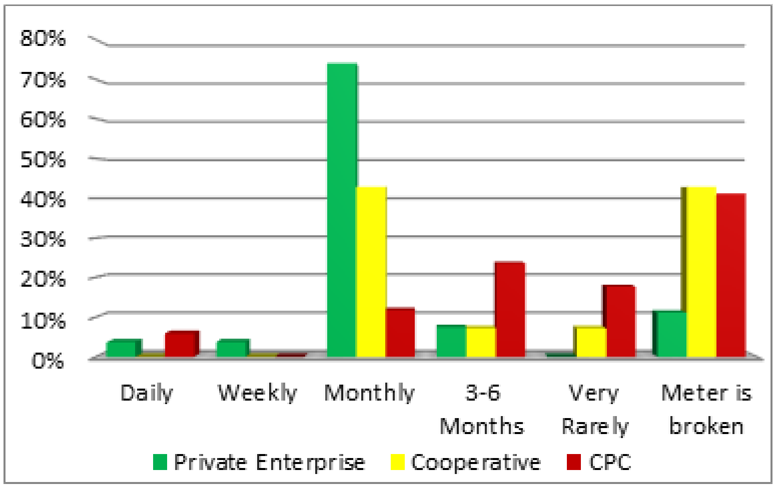


Figure 31. Frequency of Reading Production MeterFigure 30, CPC-managed systems perform particularly poorly when compared to the other management types; 35 percent of their systems are not financially viable, let alone sustainable.

5.2 Management Practices

The purpose of this portion of the operator's survey is to determine how adequately water managers perform their day-to-day responsibilities—this should provide an additional perspective on the quality of system management across the various scheme types.

The most routine task of any system operator is to check and make note of the main production meter readings. As in fFigure 31. Frequency of Reading Production Meter

Figure 32. Frequency of Collecting User Fees Figure 31. Frequency of Reading Production Meter

Figure 32. Frequency of Collecting User Fees

Figure 33. Percentage of Users Who Are Late in Paying

(Or Don't Pay)Figure 32. Frequency of Collecting User Fees Figure 31. Frequency of Reading Production Meter

Figure 32. Frequency of Collecting User Fees Figure 31, private operators tend to read their system's main production meter most frequently. Roughly 80 percent of them check it at least once a month. In stark contrast, the most common response of cooperative and CPC operators is that their systems do not actually have a functional production meter at the system mains.

Scheme managers were then asked how frequently they collect their user fees.[9] Here again, the private operators outshone the rest; 100 percent of them collected user fees on a monthly basis, compared to just 64.3 percent and 58.8 percent of cooperative and CPC operators, respectively (figure 32). This difference is undoubtedly due to the private operators' need to maintain a regular cash flow.

Private system water users also tend to pay on a significantly more consistent basis when compared to the other system types (fFigure 33. Percentage of Users Who Are Late in Paying

(Or Don't Pay)

Figure 34. Schemes with a Dedicated Repair FundFigure 33. Percentage of Users Who Are Late in Paying

(Or Don't Pay)

Figure 34. Schemes with a Dedicated Repair Fund

Figure 35. Percent of Revenue Set Aside for Future RepairsFigure 34. Schemes with a Dedicated Repair FundFigure 33. Percentage of Users Who Are Late in Paying

(Or Don't Pay)

Figure 34. Schemes with a Dedicated Repair FundFigure 33). When asked, most private operators (80 percent) responded that less than 10 percent of their customers are late with their payments.

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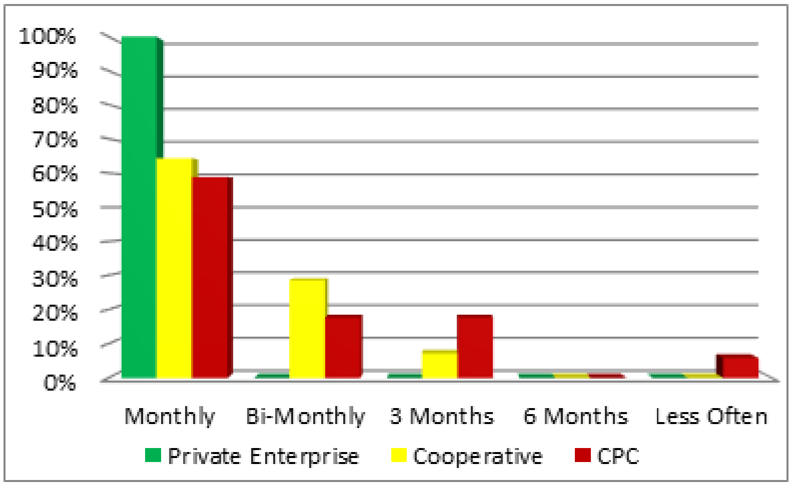
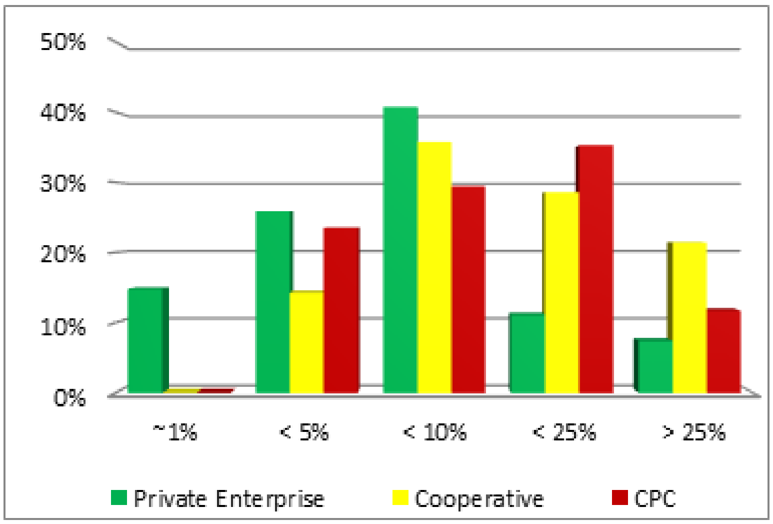
[9] Most water managers visit each serviced household to read their water meter and collect fees directly. A very small minority of households make their payments via bank transfer or by visiting the system operator's offices.

Figure 272. Frequency of Collecting User Fees



The majority of cooperative and CPC operators, on the other hand, reported that approximately 25 percent of their users fail to pay their bills when they are due. One might speculate that this is because cooperative and CPC system users are poorer or are less satisfied with the quality of water service they are being provided with. It seems most likely, however, that the reason for this discrepancy is once again the lack of performance incentives for cooperatives and CPC operators. In the case of cooperatives, there is also a tradition of collecting payments based on the seasonal cropping cycle and of being lenient in case of natural calamities (which are frequent in the Central Region).

Figure 281. Percentage of Users Who Are Late in Paying (Or Don't Pay)



In the CSS, one of the most substantial differences revealed between the management types was how often systems break down and, once broken, how long it usually takes to get them back up and running. There are a number of possible reasons that may explain why private systems recorded significantly lower downtimes than cooperative and CPC systems. For example, it might be that the private operators have more knowledge and expertise. CPC and cooperative operators may simply not be capable to address the cause of their systems' breakdowns. The results of the operator survey, however, suggest a different explanation: namely, that cooperative and CPC operators simply do not have the money to carry out the necessary repairs. Only about one-third of CPC systems have a dedicated fund that is used solely for repairs, while almost nine-tenth of the private schemes have a repair fund. (FFigure 34. Schemes with a Dedicated Repair Fund

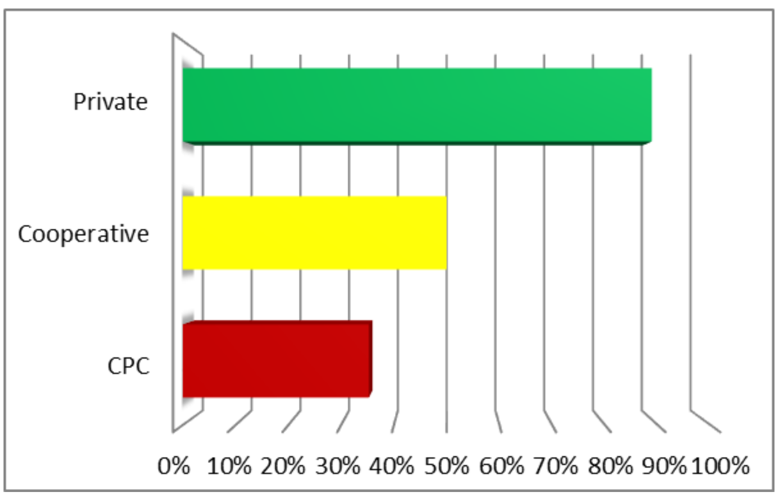
Figure 35. Percent of Revenue Set Aside for Future RepairsFigure 34. Schemes with a Dedicated Repair Fund

Figure 35. Percent of Revenue Set Aside for Future Repairs

Figure 36. Frequency of Severe BreakdownsFigure 35. Percent of Revenue Set Aside for Future RepairsFigure 34. Schemes with a Dedicated Repair Fund

Figure 35. Percent of Revenue Set Aside for Future RepairsFigure 34).

Figure 290. Schemes with a Dedicated Repair Fund



As shown in fFigure 35. Percent of Revenue Set Aside for Future Repairs

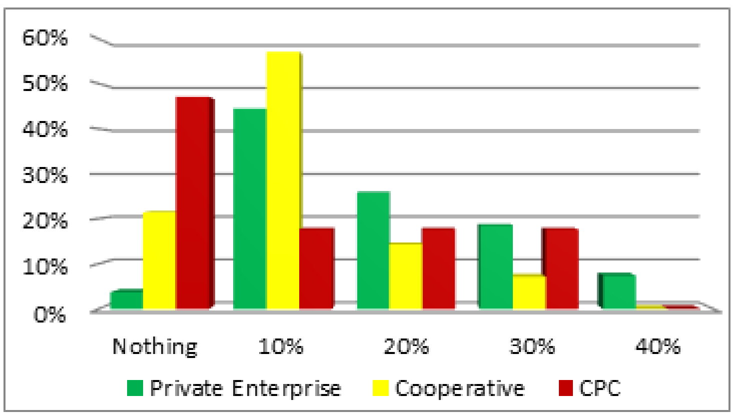
Figure 36. Frequency of Severe BreakdownsFigure 35. Percent of Revenue Set Aside for Future Repairs

Figure 36. Frequency of Severe Breakdowns

Figure 37. Main Problems with Distribution NetworkFigure 36. Frequency of Severe BreakdownsFigure 35. Percent of Revenue Set Aside for Future Repairs

Figure 36. Frequency of Severe BreakdownsFigure 35, perhaps most worrying is the fact that many cooperative and CPC operators explicitly stated that *none* of their system's revenue is routinely set aside to cover future maintenance costs (21.4 percent and 47.1 percent, respectively).

Figure 299. Percent of Revenue Set Aside for Future



5.3 PROBLEMS AND BREAKDOWNS

Given their lack of funding, it is no surprise that cooperative and CPC systems tend to suffer from many more serious breakdowns—indicating that the problems cannot be easily addressed—when compared to private systems (fFigure 36. Frequency of Severe Breakdowns

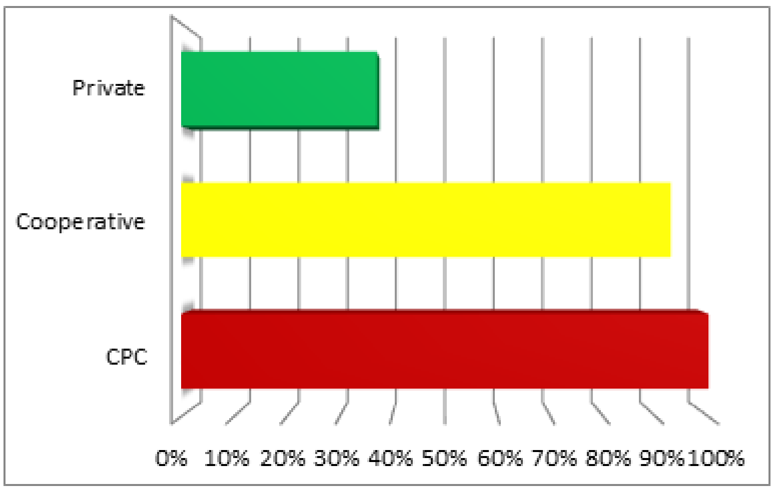
Figure 37. Main Problems with Distribution NetworkFigure 36. Frequency of Severe Breakdowns

Figure 37. Main Problems with Distribution Network

Figure 38. Main Problems with Water SystemFigure 37. Main Problems with Distribution NetworkFigure 36. Frequency of Severe Breakdowns

Figure 37. Main Problems with Distribution NetworkFigure 36). In fact, 100 percent of interviewed CPC operators reported that there have been "severe" system breakdowns in the past. Cooperative operators do not fare much better, at 94 percent. In contrast, only 38 percent of private operators reported that they have had to deal with severe breakdowns. This lower number is probably the result of two complementary factors. First and most obviously, their systems simply do not break down as badly or as often. Second, when something does go wrong, the problem is not as "severe" because the operators have the financial backing to properly address the problem as soon as it surfaces.

Figure 308. Frequency of Severe Breakdowns



Operators were then asked directly about the root causes of specific problems they have with the distribution network and system mains (fFigure 37. Main Problems with Distribution Network

Figure 38. Main Problems with Water SystemFigure 37. Main Problems with Distribution Network

Figure 38. Main Problems with Water System

Figure 39. Technical Problems Users Complain about Most mostFigure 38. Main Problems with Water SystemFigure 37. Main Problems with Distribution Network

Figure 38. Main Problems with Water SystemFigure 37 and fFigure 38. Main Problems with Water System

Figure 39. Technical Problems Users Complain about Most mostFigure 38. Main Problems with Water System

Figure 39. Technical Problems Users Complain about Most most

Figure 40. Financial and Service Problems Users Complain about MostFigure 39. Technical Problems Users Complain about Most mostFigure 38. Main Problems with Water System

Figure 39. Technical Problems Users Complain about Most mostFigure 38). Naturally, private operators are apparently faced with substantially fewer problems than operators from the other management types; 45 percent of them stated that they faced no problems with respect to the distribution network and 47 percent said there were no "common" reasons for main system repairs. With respect to the distribution network, "damaged pump" was the most commonly recorded response for both cooperative and CPC operators, at 31 percent and 38 percent, respectively. Faulty main meter and broken pump were the most frequently reported reason underlying the need for main system repairs for both cooperative and CPC operators. Of these, the pump is the most worrying issue, as in many cases, the only way to address this problem is to purchase a new pump. As noted, this requires money; these operators often lack timely access to funding.

Figure 317. Main Problems with Distribution Network

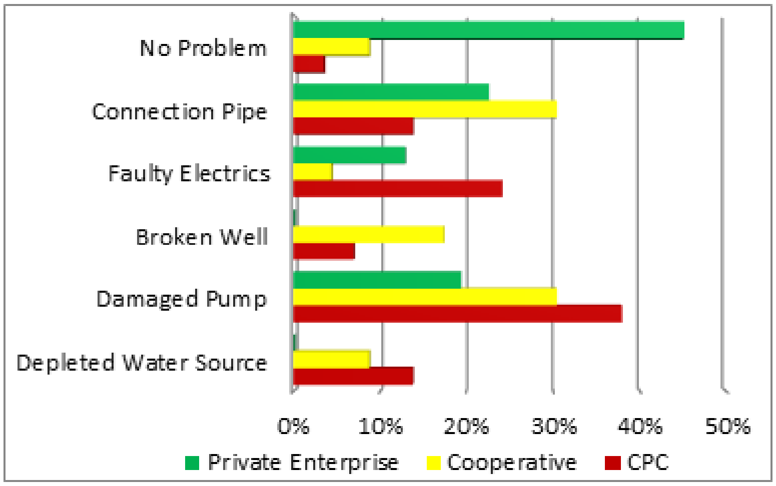
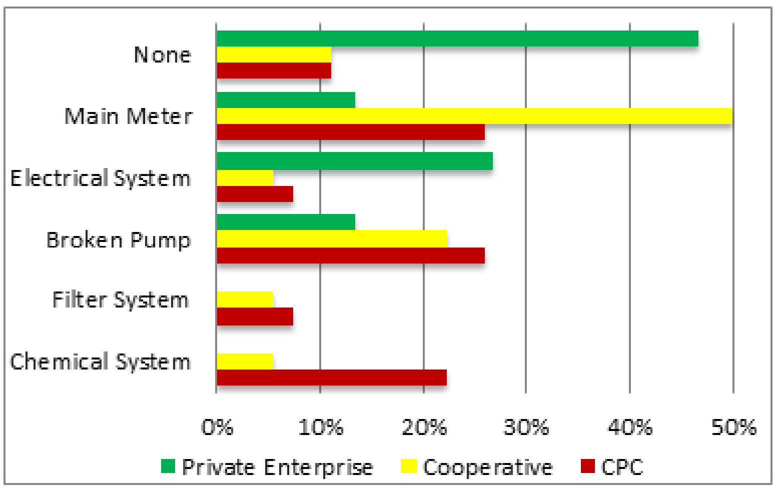


Figure 326. Main Problems with Water System



5.4 Feedback and Summary

In keeping with the CSS results, operators of private systems reported that they receive substantially fewer complaints regarding technical problems than those from the other system types (fFigure 39. Technical Problems Users Complain about Most most

Figure 40. Financial and Service Problems Users Complain about MostFigure 39. Technical Problems Users Complain about Most most

Figure 40. Financial and Service Problems Users Complain about Most

Figure 41. General User Satisfaction by Management TypeFigure 40. Financial and Service Problems Users Complain about MostFigure 39. Technical Problems Users Complain about Most most

Figure 40. Financial and Service Problems Users Complain about MostFigure 39). In sum, 74 percent stated that they do not receive any complaints from their users in this regard, compared to just 17 percent and 12 percent for cooperative and CPC operators, respectively. Another striking result is that the most commonly reported problem to cooperative operators is poor water quality (33 percent). For CPC operators, availability and supply consistency are the main problems. A combined total of 52 percent stated that they often receive complaints regarding service interruptions and broken pipes.

Financial and service problems (fFigure 40. Financial and Service Problems Users Complain about Most

Figure 335. Technical Problems Users Complain about Most

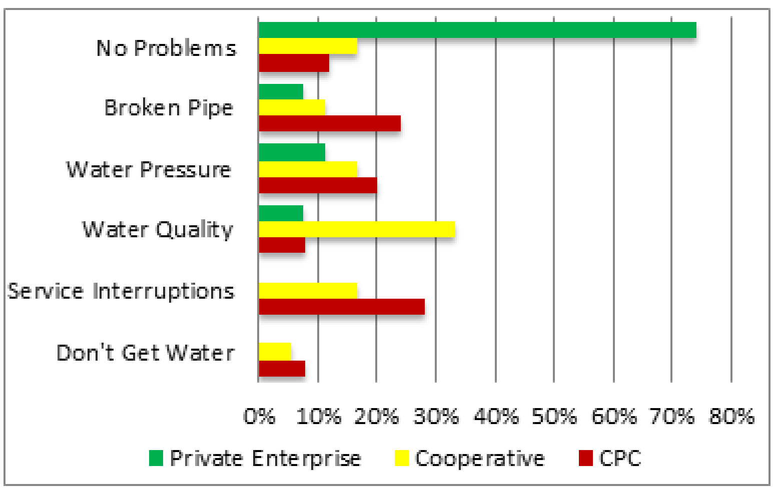
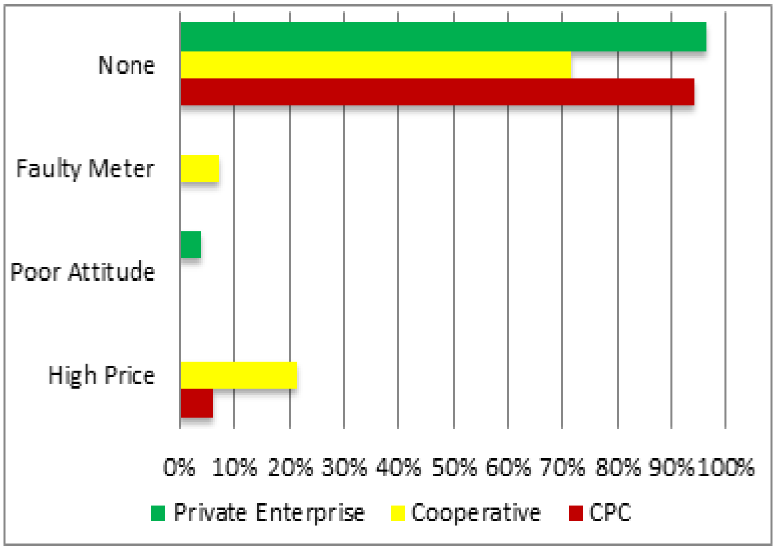


Figure 41. General User Satisfaction by Management TypeFigure 40. Financial and Service Problems Users Complain about Most

Figure 41. General User Satisfaction by Management TypeFigure 40. Financial and Service Problems Users Complain about Most

Figure 41. General User Satisfaction by Management TypeFigure 40) were relatively inconsequential, with the overwhelming majority of operators from all system types reporting that they receive very few complaints about their water meters, attitude of management, and water tariffs.

Figure 344. Financial and Service Problems Users Complain about Most



6 CONCLUSIONS AND FINAL REMARKS

6.1 Summary Assessment

Before examining their relationship to management practices, it is first useful to summarize the user satisfaction ratings for system water availability, water quality, and management service. Figure 1. Management Types for EMW's Rural Water Supply Project

Figure 1. Management Types for EMW's Rural Water Supply Project

Figure 1. Management Types for EMW's Rural Water Supply Project

Figure 1 presents the average ratings across all three criteria for each management type. Water users of privately managed systems tended to be significantly more satisfied than users from systems of other management types; 93.9 percent of them expressed a satisfaction rating of "Good" or "Very Good," compared to just 54.6 percent and 59.9 percent for cooperative and CPC systems, respectively. Another perspective on this summative data is provided in table 8, which shows the average satisfaction rating for each criterion across management types—the overall average satisfaction for privately managed systems is roughly 20 percent higher than that of cooperative and CPC managed systems.

Figure 351. General User Satisfaction by Management Type

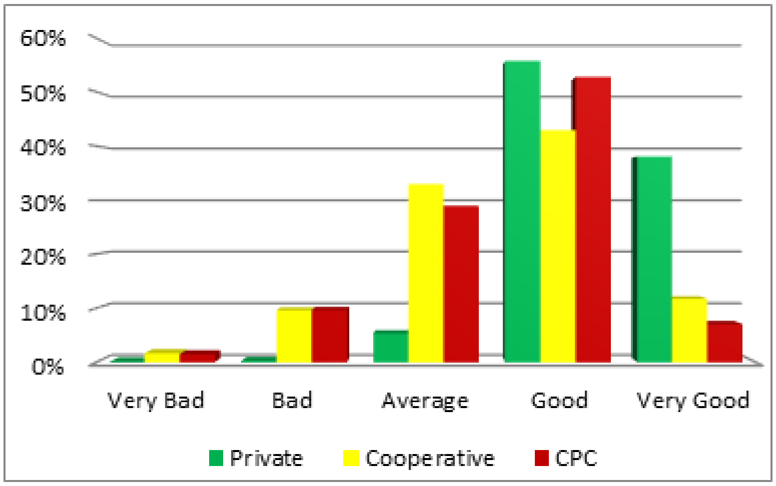


Table 8. Average User Satisfaction by Management Type

	Availability	Management	Quality	Average
Private	4.30	4.30	4.28	4.30

Cooperative	3.49	3.68	3.34	3.50
CPC	3.42	3.61	3.58	3.54

Note:* Rating scale is 1-5, where 1 = Very Bad and 5 = Very Good**.

The key question, then, is whether or not there is any correlation between these satisfaction ratings and actual quality of management. One would expect private operators to manage their systems better than their cooperative and CPC counterparts, as reflected in their relatively higher satisfaction ratings. Table 9 summarizes key indicators regarding observed management practices and confirms this hypothesis.

Table 9. Key Indicator Summary

		Private	Cooperative	CPC
Operator survey	Read production meter at least monthly	81%	43%	18%
	Monthly tariff collection	100%	64%	59%
	Water losses	22%	23%	31%
	% of schemes where revenues < O&M costs	4%	7%	35%
	Water distributed per worker (M^3)	1,794 M^3	706 M^3	688 M^3
	Revenues per worker (VND)	7.8 million	2.5 million	2.8 million
Customer satisfaction survey	% rating availability as “good” or “very good”	93%	54%	56%
	% rating water quality as “good” or ”very good”	92%	45%	60%
	% rating management as “good” or ”very good	98%	64%	67%
	System breakdowns 3 or more times per month	12%	45%	55%
	Repairs take longer than 1 day	3%	30%	46%
	24-hour supply	75%	65%	50%

In short, this study concludes that private operators have:

- Higher labor productivity
- Lower water losses
- More consistent tariff collection
- Fewer system breakdowns, and
- Less downtime for system repairs when breakdowns actually do occur.

As suggested throughout the study, this is most likely due to the superior performance incentives of private operators. Private operators are usually the system owners themselves, and thus have a strong profit motive to provide a responsive, high quality service. Water managers contracted by CPCs for ongoing operations and maintenance, on the other hand, are typically hired on a fixed salary basis. Thus they tend to lack the motivation to carry out routine operation and maintenance tasks (such as minor system repairs or collecting water tariffs) in a systematic and timely fashion. While handing over management to multipurpose cooperatives generally leads to a more business-like mode of operation, cooperative operators still display a distinct lack of performance incentives, as reflected by their comparatively poor management practices.

Moreover, because of their better management practices, private schemes also tend to be significantly more sustainable than cooperative and CPC systems. In addition to having fewer and less severe breakdowns, privately managed schemes:

- Set aside more revenue to cover routine O&M costs
- Are more likely to have a dedicated savings fund in case of emergencies, and
- Are less likely to have overdue payments exceeding 10 percent of their expected revenue.

In sum, the 2013 customer satisfaction survey looked at scheme performance from the consumer's point of view, whereas the operator's survey collected a number of performance indicators similar to those used for "benchmarking" in urban water utilities. The findings of both surveys corroborate the general conclusion that private entrepreneurs tend to manage their schemes better than cooperatives or CPCs. As a result, private rural water supply systems are more efficient, productive, and reliable. On all accounts, they consistently achieve a much higher performance standard than cooperative and CPC systems. It is only natural that water users of privately managed rural water supply schemes tend to be much more satisfied with their service providers. Moreover, given the private operators' sound financial management and their timely attention to repairs, the private owned and operated systems are likely to be much more sustainable than cooperative and CPC systems.

6.2 The Role of GPOBA in Enabling Private Sector Participation and Sustainability

The GPOBA grant was flexible and enabled EMW to experiment with different management models. The number of schemes that were community managed or operated by private individuals under contract with the CPC was too small to be analyzed in this report. However, the unreported data from the CSS and OS, as well as EMW's own monitoring data and field observations, confirm that these schemes suffered from the same weaknesses as the CPC managed systems.

Following the mid-term review, EMW entered into partnership with private owners and operators in the Mekong Delta. With financing from GPOBA and a companion grant from AusAID, 81 schemes serving over 26,000 people (around 130,000 persons) were implemented in a little over one year. Consequently, this became the first large scale donor-supported program supporting private owners/operators in Vietnam.[10] The OBA grants were instrumental in generating this wave of private sector activities.

Although there was no national legal and regulatory framework in place to encourage public-private partnerships in rural water supply, a few provinces in the Mekong Delta (led by Tien Giang and Dong Thap) had enacted some enabling policies in the 1990s. The initial response by the private sector was positive. However, gradually, interest waned as shortcomings in the regulatory framework became clear. In simple terms, the Provincial People's Committees (PPCs) set ceiling tariffs for both public and private schemes (to ensure "affordability"). The tariff was only slightly above the operating costs and did not allow private entrepreneurs to recover their investments and earn even a modest return on the capital. This left private entrepreneurs with only two options: either to charge very high connection charges to consumers that would discourage people from getting piped water, or not invest at all.

Households served by public schemes (financed by the government itself or by donors) benefited from significant government subsidies. In recent years, these subsidies have been in the range of $300 to $400 per connected household.[11] Given this situation, it is obvious that private water supply schemes also require a (capital or operating) subsidy in order to be financially viable. For reasons well explained in the literature, OBA is one of the best—if not the best—method of addressing this kind of subsidy need.[12]

As noted, the results of the OBA subsidy were substantial in terms of the number of schemes built and the number of people served. However, more significant was the efficacy of the subsidy. The average capital subsidy received by the private enterprises was $64 per connection (to be compared to $300 to $400 in public schemes). The private sector mobilized from its own resources around $53 per connected household. The connection charge paid by each customer averaged $18 (about half of what they pay in most public schemes). Thus the OBA subsidy was a highly cost-effective use of public/donor funds.

Equally important are the results of this study. Private water enterprises not only provide superior quality of service to the customers, but by all indicators they also operate in a more sustainable manner. Thus GPOBA and AusAID have directly contributed to a more sustainable operation of rural water supply.

In the long run, the GPOBA grant may make an even greater contribution to an equitable and sustainable development of the rural water supply in Vietnam. The government, and especially the Ministry of Agriculture and Rural Development (MARD), has recently started to emphasize the potential role of the private sector in rural water supply and is contemplating further reforms to the legal and regulatory framework. The results of EMW's program in the Mekong Delta, financed by GPOBA and AusAID, have so far provided much of the actual data on

[10] ADB has undertaken a small pilot operation in a peri-urban area of Tien Giang.

[11] See East Meets West (2014).

[12] See, for example, Mumssen, Johannes, and Kumar 2010.

which this new interest in public-private partnerships is based. For example, preliminary results from this study were presented at a High Level Meeting on Mobilization of Private Section Participation in RWSS Sector, organized by MARD, the World Bank, and the Australian Embassy in November 2013. Consequently, the GPOBA grant may play an important catalytic role in changing government policy and setting the rural water supply sector on a more sustainable path.

APPENDIX A. CUSTOMER SATISFACTION SURVEY QUESTIONNAIRE

Customer Satisfaction Survey

	Name of Respondent	HH Size:		Distance From System (km):			
	Gender of Respondent:	Male/Female		Relationship with Head of Household:			
	Project Name:	Project Code:		Commune:		District	
	WATER AVAILABILITY AND ACCESSIBILITY						
1)	How long have you been getting water from the project water system?	________ months			________years		
2)	Before the water project, what was your primary water supply?	Well	River	Rain	Buy from other	Other	
3)	Who usually collected water from this source?	Husband	Wife	Son	Daughter	Other	
4)	How much time was spent each day collecting water from this source?	1-10 min	10-30 min	30-60 min	1-2 hrs	> 2 hrs	
5)	Before the water project, how did you treat drinking water?	Boil	Filter	Buy bottled water		No treatment	Other
6)	Beside water from the system, do you use other water sources?	yes	no				
7)	Do you now have enough clean water for your household's needs?	Yes	No	Depends: explain			
8)	If you don't have enough clean water from the system, what sources of water supply do you get to satisfy your clean water need?	Well	River	Rain	Buy from other	Skip	Storage tank
9)	How many hours per day do you have water?	24h	day time	half a day	every other day	Every other time	No water in dry season
10)	Do you generally know when the system will be shut down	Yes	No	Don't know			
11)	After water project, how do you treat drinking water?	Boil	Filter	Buy bottled water		No treatment	Other
12)	What is the cost for clean project water per cubic meter?	________ VND/m3		Don't know			
13)	About how much do you spend on clean project water per month?	________ VND/month		Don't know			
14)	Given your alternatives, do you think the price for water is reasonable?	Yes	No	Don't know			
15)	Has the project's water system ever broken down?	Yes	No				
	a) Was it just your connection, the whole system or both?	Connection	System	Both	No power	Other	No
	b) How many times are you unable to get water per month?	0 times	1-2 times	2-4 times	5-9 times	> 10 times	Don't know
	c) How long does it normally take to fix?	< 1 day	1-2 days	3-6 days	7-14 days	> 14 days	Still Broken
	d) Who normally pays for the repairs?	Water provider	Customer	Other funding sources	No one		
16)	If the system breaks down, how would you satisfy your water needs?	Wait for repairs	Onw's Well	River	Rain	Buy water	Get water from other place
17)	Are you satisfied with the availability of the project's water supply?	Very Bad	Bad	OK	Good	Very Good	
	RELIABILITY OF THE WATER SERVICE						
18)	Is the water pressure usually strong enough for your household needs?	Strong	OK	Weak	Depends		
19)	Do you have a water meter?	Yes	No				
	If yes, does it have any problems?	Inaccurate	Unclear	Dont know	No Cover	No	No protection box
20)	Do you know who manages the water system?	Private enterprise	CPC Staff	Cooperative	Water user group	Contracted private operator	Other:
21)	Do you know whom to contact about problems?	Yes	No				
22)	How can you contact this person or office?	Telephone	Ask someone to deliver the message	Come to house or office	Wait until he or she comes by	Never ever contacted before	
23)	Is the water management available for advice/complaints/repairs?	Yes	No	Depends: explain	Don't know		
24)	Are you satisfied with the performance of the water manager and board?	Very Bad	Bad	OK	Good	Very Good	Don't know
25)	How do you think the water system service can be improved?	No	reduce water tariff	better water quality	Regular supply of water	Replace the technician	Higher presure

WATER QUALITY OF CLEAN WATER							
26)	Color of the water:	Very Bad	Bad	OK	Good	Very Good	Don't know
27)	Smell of the water:	Very Bad	Bad	OK	Good	Very Good	
28)	Taste of the water:	Salty	A little bit salty	Sour	Good	Very Good	
29)	Is this a marked improvement on the quality of your previous source of water?	Yes	No	Depends: explain			
30)	Does the water quality change during the dry and rainy seasons?	Yes	No				
	If yes, how does it change in dry season?	Water is more turbid	More iron/sediments	Smelly	algae in water	more salty	No
31)	Has the water quality changed since the start of the project?	Yes	No				
	If yes, how?	Worse	Better				
32)	Are you satisfied with the system's water quality?	Very Bad	Bad	OK	Good	Very Good	
33)	What do you value most about the piped water system?	Convenient	Saves time	Good quality water	Good for family health	Other	No
34)	What do you dislike about the piped water system?	Unreliable	Water is expensive	Quality of water is bad	Irregular supply of water	Satisfied	No

APPENDIX B. OPERATOR SURVEY QUESTIONNAIRE

The Water Project:

Operator Survey 2013

	Interviewer:		Tel:			Date:	
	Scheme name:		Scheme code				
	Commune	Province			District		
	Interviewee		Position				
1)	When did the water scheme build?	Year___________					
	a. Design capacity:	No. of households:			Cubic meter/day (or month):		
	b. Actual capacity:	No. of households served:			Water volume produced/day (or month):		
2)	What type of management modality?	Private enterprise	CPC	Cooperative	Water user group	Contracted private operator	Other:
3)	How many working staff are there?	Total:	Technical:	Financial:	Management:		
4)	What is the monthly water volume produced and consumed in cubic meter?	Production:			Consumption:		Don't know
5)	Water loss percentage (internal calculation):						
6)	How often do you read the production meter?	Daily	Weekly	Every month	At least every 6 months	Very rare	Don't read as of broken meter
7)	What is your monthly electricity consumption?	_____________kWh/month		Don't know			
8)	How much do you charge for a cubic meter?	__________ VND/m3			Don't know		
9)	How much are the monthly revenues?	_____________VND		Don't know			
10)	How often are customers billed?	Every month	Every second month	3 months	6 months	Others	
11)	How do people pay their bills?	When visited	They come to the office	Pay through a bank	Other (Explain)		Don't know
12)	How do you keep track of billing and collection?	Computerized billing system	Special account book	Ordinary notebook	Other (Explain)		Don't know
13)	How many people pay their bills late (or not at all)	Around 1%	Less than 5%	Less than 10%	Less than 25%	More than 25%	Don't know
14)	Does the monthly revenue meet the operational costs?	Yes	No				
15)	Roughly, how large is the shortfall?	No	_________%	Don't know			
16)	How much do you save from the revenue for repair?	About 10%	About 20%	About 30%	About 40%	No	Don't know
17)	Is there a special fund or account to provide for future repars?	Yes	No	Don't know			
18)	How do people report problems?	Telephone	They come to the office	Find manager	Other:		
19)	What are the technical problems that people report/complain about the most?	Don't have water	Service interruptions	Water quality	Water pressure	Broken pipe	No
20)	What are the financial and service related problems that people complain about the most?	Collection without bill issuance	Wrong water consumption record	High price	Poor service attitute of the manager	Wrong meter	No
21)	Since the completion of the water scheme, are there many serious repairs?	Yes	No	Don't know			
22)	What are the common problems for the system and distribution connection?	Depleted water source	Damaged pump	Broken well	Electricity system	Connection pipe	
23)	What are common reasons for system repairs?	Broken tertiary pump	Chemical system	Filter system	Sendimentation tank	Electricity system	General meter
24)	Who is normally responsible for doing and paying the repairs?	System operator	Customer	Depend: explain			
25)	What do people appreciate most about the piped water system?	Good quality water	Convenience	Supply all year	Good service	Cheap price	Other

Signature of the interviewer Signature of interviewee

APPENDIX C. ASSESSMENT OF THE HEALTH IMPACT OF EMW'S RURAL WATER SUPPLY PROGRAM IN CENTRAL VIETNAM

Introduction

This appendix summarizes the methodology and main results of an independent assessment of EMW's rural water supply program in the Central Region of Vietnam. The following text is taken verbatim from the assessment report.[13]

Objectives

Objectives of this research included determining whether: (i) access to piped water systems presented health advantages over access to other "improved" water sources, (ii) systems consistently delivered safe drinking water, and (iii) access to new pour-flush latrines resulted in even greater health impacts. This assessment was intended to be an independent appraisal of the EMW model for the implementation of community piped water systems and improved sanitation, with the purpose of improving EMW's model for commercially inspired approaches to providing water and sanitation infrastructure access. A separate study of sanitation investment was intended to identify factors that drive demand for consumer investment in sanitation improvements, specifically the pour-flush latrine option promoted by EMW.

Overview of Methods

This study had two phases: (i) an initial cross-sectional sampling and recruitment phase (1 month) and (ii) a longitudinal data collection phase (4 months). There were a total of four visits to 300 quasi-randomly selected households (divided between those with a piped water connection, those with a piped water connection as well as a pour-flush latrine, and control households with neither), where we collected interview data and water samples for microbial and other analyses in the laboratory. The three groups of households were compared to assess differences possibly related to investment in water and sanitation improvements as well as differences relating to drinking water quality and health.

Sites, participation, and recruitment

This study was conducted in central Vietnam in collaboration with EMW. Communities were randomly selected from EMW focus areas, which were selected by EMW as resource-limited. From EMW intervention records, we randomly selected households from the list of all households investing in a water connection, a water connection and a pour-flush latrine (sanitation), or neither after receiving information about water and sanitation benefits and financing strategies from EMW's programs. Importantly, we allowed households that had invested in non-EMW-sponsored latrines (or built one themselves) in the second group. All household with piped water were connected to an EMW-sponsored system, however. We visited the selected households in a cluster-randomized order to introduce the study and

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[13] WaterSHED Asia. 2010. Study financed by USAID. Two established researchers in the environmental health field (Joe Brown and Mark Sobsey) directed the study.

determine eligibility. If the household was eligible, we presented the primary caregiver (senior female, charged with caring for children and collecting water) with the informed consent form. If the primary caregiver and the head of household (if different) consented to participate, the household would be enrolled in the study. All survey data was collected from the primary caregiver, who acted as the study's point of contact with the household. Of the >8,000 households initially identified by EMW records, we recruited 300 households in total: 141 households connected to a piped water supply system, 83 connected to a piped system and a pour-flush latrine, and 76 households who had received the EMW program offer but declined to invest in either.

Participants included household members ranging from children (newborns) to adults in the study areas. The participants were persons living in households within a village that EMW has implemented their community piped water system and in some cases sanitation program. The study population included three groups: households that had invested in a paid water connection, households that had invested both in a paid water connection and sanitation, and control households who decided not to invest in either water or sanitation improvements offered by EMW. Therefore, the complete study population included all of the members of the households from 300 households in central Vietnam.

Recruitment was performed at the village and household level. We worked in villages that EMW already had a presence in and therefore a relationship with the communities. In addition, before household recruitment began we discussed the purpose of our project with the village leaders in each community in order to gain their approval and support.

At the household level, the required criteria for participation in the study were: a willingness to participate and having invested in EMW piped water or both piped water and sanitation or was in the target area of these programs. For the first 300 households consented to participate in this study, each was presented with a narrative description of the project (both written and orally, by a native speaker of Vietnamese from the region with experience in household survey techniques) and asked to participate in a study entailing three additional household visits by the project team over the course of 4 months. The recruitment phase lasted 1 month. At any point in time, participants could un-enroll in the study at their request with no consequences. All recruitment and informed consent procedures and documentation were reviewed and approved by the University of North Carolina – Chapel Hill Institutional Review Board and by local Vietnamese authorities before use in this study.

Findings

Findings from this research (summarized below) support the following conclusions: (i) households not investing in improvements are likely to have been poorer than those investing in piped water and sanitation; (ii) many households in the control group had good access to wells considered to be of high quality; and (iii) households connected to a piped water supply had consistently improved drinking water quality over those relying on other sources and household with both piped water and sanitation experienced even safer household water as indicated by microbial counts. Additionally, significant problems were identified with EMW piped water systems, such as intermittent service and no detectible chlorine residual at the household level. Although providing improved water quality over alternative sources, piped water systems still delivered an unacceptably high level of microbial indicator bacteria (TC and *E. coli*). Both groups of households investing in water and/or sanitation improvements were at reduced risk of diarrheal disease compared with the control group, although this difference was statistically significant only when comparing the water + sanitation group to the control group without access to latrines or piped water. Health and microbiological data both point to a significant impact of adding sanitation to programs where piped water is available.

Table C1. Results Table

	Piped water	Piped water + sanitation	Control
Households	141	83	76
Persons per household	5.1	4.9	4.9
Homeownership (%)	72%	72%	49%
Single parent household (%)	8.5%	6.1%	16%
Mean land owned or rented, *soa*	1700 (1400–2100)*	1300 (1000–1600)*	1200 (900–1400)*
Bedrooms in house	2.2	1.7	2.1
Mean electricity bill per month (VND)	77,000 (65,000–88,000)*	52,000 (40,000 – 64,000)*	65,000 (53,000 – 77,000)*
Education of primary caregiver			
No school	1.4%	1.2%	1.5%
Primary school	15.0%	22.0%	17.0%
Some secondary school	53.0%	57.0%	52.0%
Secondary school	21.0%	16.0%	20.0%
Some university/technical or higher	8.7%	3.7%	11.0%
Education of household head			
No school	1%	1%	1%
Primary school	29%	39%	20%
Some secondary school	22%	18%	23%
Secondary school	36%	26%	38%
Some university/technical or higher	12%	16%	18%
House construction wealth indicators			
Sheet metal roof	39.0%	27.0%	41.0%
Earth floors	3.6%	3.7%	12.0%
Thatch or bamboo walls	1.4%	2.4%	6.6%
Cases diarrheal disease, all	40	23	33
Observational periods, all	597	349	306
Cases diarrheal disease, under 5s	17	9	5
Observational periods, under 5s	104	55	51
Longitudinal incidence of diarrheal disease, all	0.067	0.066	0.110
Longitudinal incidence of diarrheal disease, under 5s	0.16	0.16	0.10
Untreated household water			
Mean *E. coli* per 100ml (cfu)	130 (92–170)*	71 (38–100)*	320 (120–530)*
Mean TC per 100ml (cfu)	2100 (1400–2800)*	2500 (800–4200)*	13,000 (8100–18,000)*
Boiled household water			
Mean *E. coli* per 100ml (cfu)	27 (13–42)*	5.7 (0.22–11.0)*	21 (3.1–38.0)*
Mean TC per 100ml (cfu)	310 (130–480)*	190 (0.85–380.0)*	2300 (0–5000)*
Mean turbidity per 100ml (NTU)	2.4 (2.2–2.7)*	2.2 (1.9–2.5)*	2.7 (1.7–3.6)*
% with boiled water in household at time of visit	98%	100%	98%
% reporting intermittent service	100%	100%	--
Residual chlorine in water	0%	0%	0%

Note: TC = Total Coliform; cfu = colony forming units; NTU = Nephelometric Turbidity Units
** 95% confidence intervals.*

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