



Tapping the Market

*Opportunities for Domestic Investments
in Water for the Poor*

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Tapping the Market: Opportunities for Domestic Investments in Water for the Poor

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Abbreviations

DPHE	Department of Public Health and Engineering
Kwh	Kilowatt Hour
MIME	Ministry of Industry, Mining and Energy
NGO	Nongovernmental Organization
O&M	Operation and Maintenance
UNICEF	United Nations Children's Fund
WHO	World Health Organization
WSP	Water and Sanitation Program

Overview

Throughout the developing world, millions of people lack access to safe water supplies. In the three countries covered in this report (Bangladesh, Benin, and Cambodia), 46 million people lack access to clean water. The problem costs these countries 0.2–0.7 percent of gross domestic product (GDP) a year—at least US\$275 million in total.

To improve access to safe water, particularly by the poor, developing country governments and the international development community are looking to the domestic private sector to play an expanded role. Figuring out how best to scale up private sector investment in the provision of safe water requires estimating potential demand and understanding the factors that constrain private sector investment from meeting it.

This report examines piped water schemes in rural areas of Bangladesh, Benin, and Cambodia, where the local private sector already plays a major role in the delivery of water (for the purposes of this study, the term “rural” also includes small towns outside of the main urban areas). The majority of households in all three countries currently get their water from private and communal sources. Little systematic information is available about these markets, however; most information on the private water sector focuses on large service providers.

Bangladesh, Benin, and Cambodia are countries where the Water and Sanitation Program (WSP)—a multidonor partnership administered by the World Bank to help poor people obtain affordable, safe, and sustainable access to water and sanitation services—is actively supporting client governments in engaging the domestic private sector. The WSP is well placed to offer practical follow-up of the study results in these countries.

The study examines the performance of networks in each country and investigates the prefer-

ences of poor households in locations served by them. It also examines commercial and investment climate factors that may affect firms’ actual or perceived costs and risks, driving their decisions about increasing investment in their business. Specifically, the study seeks answers to the following questions:

- Is lack of interest by the domestic private sector a rational response to weak market potential, or are lack of firm viability and the use of inappropriate business models preventing it from taking advantage of market opportunities?
- Are policy and investment climate factors increasing the (actual or perceived) cost and risk associated with doing business?

Market Potential for Rural Piped Water Schemes

In the three study countries, the potential market the domestic private sector could be serving is large. By 2025, about 20 million people in Bangladesh, Benin, and Cambodia are projected to get their water from rural piped water schemes—10 times the current number. This market will be worth at least US\$90 million a year, up from about US\$23 million in 2012.

Market growth is being driven by a combination of economic and policy factors. Population and income growth are important, but country-specific drivers are at play as well:

- In many locations in Bangladesh, current sources are unsustainable, because of contamination and the growing scarcity of water. A national policy aims to respond to these problems through public/private/community co-investment in piped water networks.

- In Benin, a key driver is the recent adoption of a policy to contract out management of networks built by the public sector.
- In Cambodia, the costs of alternative sources, the absence of public supply, and a liberal (if somewhat unregulated) government approach to licensing private networks are creating commercial opportunities for autonomous private investment.

Constraints to Serving the Market

A mix of commercial and policy factors are constraining the expansion of private schemes. The commercial factors are broadly similar across the three case study countries. The policy factors are more country specific. Although all three countries recognize the role of the private sector in increasing access and improving quality of service, each has policies that make it difficult for private firms to be profitable, thereby dampening their interest in investing.

Weak Demand

Households, especially poor households, purchase too little water from networks for operators to achieve optimal capacity utilization or to warrant significant investments in additional capacity. Poor households need higher volumes of water, but their purchases are limited by cost and their assessment of the value of network water with respect to alternatives.

Tariffs and connection fees are too high for many poor rural households. Standard daily per capita consumption of 40 liters of water would cost them 2.4 percent of income in Bangladesh, 5.6 percent in Benin, and 4.1 percent in Cambodia.¹ Although tariffs in Bangladesh and Cambodia do not yet breach the traditional ceiling of 5 percent of income, costs may be running up against budget constraints of poor households and what they are prepared to pay. In Bangladesh, for example, where expenditure on water by poor households consumes less than 1 percent of total household expenditure, a majority of households indicated that they could afford to pay only about half current tariffs. For many poor households, the cost of a private connection is an ever greater barrier to use of network water, with costs averaging 27 percent of monthly incomes in Bangladesh,

116 percent in Benin, and 34 percent in Cambodia.

Most households have access to inexpensive alternative sources of water (if only for parts of the year), including wells, springs, and boreholes. They are savvy about making trade-offs between price and value in choosing their water source. In the short run, competition from other sources will limit demand for piped water. In the longer run, the availability and opportunity cost of alternatives will likely shift incentives in favor of networks, especially if operators can ensure consumers of the quality of the service they offer.

Lack of Firm Viability and Inappropriateness of Business Models

At a certain network size, piped water systems offer considerable economies of scale in providing potable water. But reaping these economies requires operating above certain minimum levels of sales, and economic and financial sustainability requires charging prices that cover all costs. Getting this balance right is challenging.

Different business models have emerged in the three countries as a result of market and policy drivers. Each has achieved a different degree of success.

In Bangladesh, private sponsors co-invest in networks with the government and donors in localities where groundwater cannot be safely used. Customers are served through private connections. They pay a flat monthly fee, which results in low revenues despite high volumes. Combined with the fact that most networks have too few connections given the investment cost to households, the tariff structure means that few networks are financially viable.

In Benin, the business model is to cover a larger service area through manned standpipes. A top-down investment program designs and builds all networks, which are too large given the scale of the market. The tariff structure is determined by policy-driven financial models that grossly overestimate market sales, leading to very high fees and tariffs. Tariffs provide a large profit margin for every unit of water sold and most operators therefore make a profit on their leases, but they keep consumption levels low. As a result, aggregate revenues do not cover investment costs.

In Cambodia, financing, design, construction, operation, and management are wholly private. Networks serve households through metered connections. Nearly all networks yield positive returns on investment, and revenues enable adequate provisioning for depreciation. Designed capacity is well calibrated to the market and continuity of service is good. But lack of access to water sector expertise may be leading to suboptimal choices of design and equipment, and the potability of water may not be ensured.

Attitudes toward Investment and Serving the Poor

Water firms in Bangladesh and Benin, where the public sector and donors largely determine which assets are built, are circumspect in their attitudes toward investment. Few firms in Bangladesh were planning investment, and the investment that was planned focused on expanding the coverage of or repairing existing networks. In Benin, nearly half of firms interviewed were planning investment, but spending seemed to be going toward maintenance to allow assets to continue functioning. In contrast, in Cambodia, three-quarters of enterprises interviewed were contemplating investments in existing networks, with a strong emphasis on network and water production expansion, and half of the enterprises were interested in investing in new sites.

Enterprises identified a range of market-related risks that affect their investment plans. In Bangladesh, the main concern was that costs make profitability uncertain for both existing and new networks. This concern reflects current conditions in the market, where most firms are not profitable. In Benin, enterprises cited their lack of experience in developing (as opposed to operating) systems. They cited a wide range of risks, including concerns about water availability, lack of sufficient demand, and high cost of investment, and expressed uncertainty about which investments to make. In Cambodia, firms' greatest concern was access to finance.

Cambodian firms display a strong orientation toward serving the poor. In contrast, few firms in Bangladesh or Benin considered the poor as their target market, and many believed that their policies did not provide the poor with equal access to their services. In all countries, firms believed that

costs are beyond the reach of the poor and that no incentives exist to reach these harder markets.

Unsupportive Investment Climate

In addition to market-related risks, firms face a variety of policy and institutional obstacles. In Bangladesh, the pricing and ownership structures do not seem to allow networks to recover—or even earn a return on—their capital costs, and investment is contingent on government or donor co-financing. As a consequence, private operators appear reluctant to expand networks or sponsor additional networks. In Benin, the main barrier to expansion is the lack of capacity of the public sector in designing appropriately scaled networks and tendering them for private operation and the nature of the leases under which firms operate networks. In Cambodia, the incomplete nature of the legal framework on urban and semi-urban water supply and lack of clarity and consistency about the rules governing private investment in water networks may be constraining the types of investment that private firms are prepared to make. To manage the uncertainty associated with licenses, enterprises usually consider building networks only if they already own suitable land on which to build the system infrastructure.

The lack of good physical and financial infrastructure also stifles investment. Firms in all three countries singled out unreliable power supply as a key constraint to doing business. Energy is the single-largest element of operating costs, accounting for 43 percent of average costs in Bangladesh, 45 percent in Benin, and 63 percent in Cambodia. Where networks use diesel fuel (to generate electricity full time or as a back-up or to run intake pumps) energy costs are significantly higher.

The limited reach of the financial sector and the costs of accessing finance also limit firms' ability to invest. In Cambodia, for example, all loans must be collateralized by real estate.

Recommendations

The recommendations of this report are intended to help policy makers remove or relax the main constraints preventing the private sector from

providing piped water to the poor. Although they are based on the case studies, they are relevant for other countries as well.

Stimulate Demand by the Poor

1. Improve affordability by right sizing: design and build assets that are appropriate for small-scale networks, so that cost-recovery prices can be kept as low as possible.
 - Realistically assess demand and adopt design and construction standards and procurement rules to align network design with it.
 - Modify tendering systems to identify inputs in terms of performance and quality standards rather than by specifying particular brands or suppliers.
2. Improve affordability by smoothing and subsidizing expenditures: experiment with initiatives that enable poor rural households with volatile cash incomes to spread connection payments (and perhaps usage charges) over time.
 - Where facilities for cash transfers to the poor already exist, consider providing targeted demand-side support for the extreme poor.
 - Where networks are leased to private operators or involve co-investment by government or donors, consider including a requirement in lease contracts or project designs that concessional terms for connections be offered to poor households. Where network construction and operation are completely independent of government and donors, consider delivering support directly to households, rather than trying to impose community service obligations on operators.
 - Develop financing schemes that enable operators to offer customers installment plans for paying for private connections.
3. Establish appropriate standards to help firms signal water and service quality to the market.
 - Identify service and quality standards and means of achieving them that are both consistent with regulatory capacity and simple

enough for consumers to understand.

- Help firms implement standard procedures for ensuring water quality and to target information campaigns to their customers.

Improve Firm Viability and Business Models

4. Improve profitability by removing impediments to efficient pricing, without which private operators cannot be financially viable.
 - Introduce metering, so that firms are paid for increased usage (Bangladesh).
 - Where tariffs and charges are regulated, recalibrate models to avoid setting tariffs so high that they restrict consumption excessively (Benin).
5. Improve profitability by optimizing the extent of the network under contract, where contracted-out networks face competition from other publicly owned water sources.
 - Assess the feasibility of regulating exclusivity and alternative delivery in network locations (by including public water points in operator contracts with appropriate pricing, for example).
 - Develop regulated arrangements for sharing connections or resale of water from private connections to increase consumption and capacity utilization.
6. Expand private connections by establishing incentives for incremental upgrades of existing networks to offer more private connections which provide the convenience that consumers strongly value.
 - Grant concession contracts or enhanced lease contracts in which the private operator implements publicly funded investment in network expansion/densification (Benin).
 - Improve the planning, marketing, and design of networks to locate water points where households need them and to promote the use of private connections (Bangladesh and Benin).
7. Improve supply chains and technical support by improving professional capabilities for the design, construction and maintenance of small-

scale piped water networks.

- Foster the creation of professional associations to train and provide accreditation for consultants who design networks or provide other expertise to small-scale water operators.
- Support business brokering initiatives that could work with financial institutions to assess the risk and feasibility of network investments by small enterprises.
- Reduce the size of lots in the public procurement of water infrastructure development, in order to allow local players to compete and build capacity.

Improve the Investment Climate and Sectoral Policies

8. Provide market intelligence to improve information for potential investors about investment opportunities, so that enterprises are aware of the availability of water resources and market potential in areas outside of their current areas of operation.

- Improve sector investment planning to identify—and publicize—markets with potential for private participation.
- Provide technical support to local authorities to develop projects that can be taken to market.

9. Increase access to finance to address the low level of financial inclusion and the limited level of financing for small water projects.

- Develop financing facilities to support cash flow-based financing for water projects, including the use of blended funds, credit enhancements, guarantees and cost-sharing arrangements, and provide appropriate project development and appraisal support to financial institutions.
- Develop robust loan documentation that is consistent with national legal frameworks and assist with legal reform and clarification to facilitate market-based financing of and investment in water projects.

10. Increase access to land and energy, by facilitating land access for private water schemes and

addressing the high cost and limited and unreliable supply of energy.

- Where concession law structures are in place, use them to bring small-scale water projects to the market with provisions for land access and infrastructure development (Cambodia).
- Consider offering incentives for generating power for water projects in locations that are poorly served by the grid.

11. Improve government policy and practice by improving policy clarity and functionality to facilitate the provision of piped water in more marginal locations.

- Prepare operational guidance on the role of the private sector, and move from project- to policy-based approaches to increase transparency and competition, and avoid distortions created by inconsistency and idiosyncratic subsidization (Bangladesh, Benin, Cambodia).
- Improve arrangements for determining tariffs, and introduce incentives for expanding coverage and meeting service standards (Benin).
- Where the prevailing model is public-private partnerships, improve incentives for sustainable service delivery by including incentives to expand coverage and meet service standards, improving arrangements for determining fees paid by network operators, tying them to likely revenues and costs, and clarifying responsibilities for repair, replacement and expansion of the network (Bangladesh, Benin).
- To encourage supply in hard to reach or less profitable locations, where the prevailing model is autonomous private investment, develop a system of competitive tendering of rights to localities using a more traditional public-private partnership model, and ensure that interventions that stimulate private provision create a level playing field (Cambodia).

12. Improve government policy and practice by strengthening dispute-resolution arrangements, the absence of which deters investment.

- Provide training programs for public and private parties to contracts to improve their understanding of obligations, and introduce mechanisms to support regular business planning and performance review processes
- as a companion to dispute-resolution arrangements.
- Empanel independent reviewers and auditors to help contracting parties resolve disputes.

What Is the Problem?

Throughout the developing world, about 780 million people lack access to safe water. Outside of large urban centers, private providers dominate the water sector. In Bangladesh, for example, where access to safe water is relatively good, 28 million poor people and another 11 million people living above the poverty line still lack access to improved water sources.

In the three case studies examined in this report—Bangladesh, Benin, and Cambodia—only about 11 percent of the population gets its water from state utilities; the rest rely on a combination of self-supply, private provision, and community-run systems. In many cases, use of these alternative sources of water endangers health and well-being and reduces productivity.

Access Is Inadequate

Inadequate access to safe water is costly. According to conservative estimates by the World Health Organization, in Bangladesh, Benin, and Cambodia alone it costs about US\$275 million a year, 0.2–0.7 percent of each country’s gross domestic product (GDP) (WHO 2012) (table 1.1).

Table 1.1 Estimated Annual Economic Costs of Inadequate Water Supply in Bangladesh, Benin, and Cambodia, 2012

Country	Number of people without improved water (millions)	Cost (US\$ millions, in 2010)	Share of GDP (percent)
Bangladesh	39.0	176	0.2
Benin	2.3	49	0.7
Cambodia	5.0	51	0.5

Source: Country case studies; WHO 2012. Throughout this report, unless otherwise indicated, data for tables and figures have been taken from the country case studies (see References).

Note: Cost figures show economic benefits forgone as a result of not achieving universal access to improved water. They include the forgone health and time-saving benefits of access to improved water supplies.

Access to improved water increased over the past two decades, but progress has varied. In Bangladesh, overall access has been high since the late 1990s, but progress toward increasing coverage of the 25 percent of the population that was without improved water in 1990 has been slow. In Benin and Cambodia, changes have been more pronounced, albeit from much lower starting points (figure 1.1). None of the three countries is close to universal access, even in urban areas.

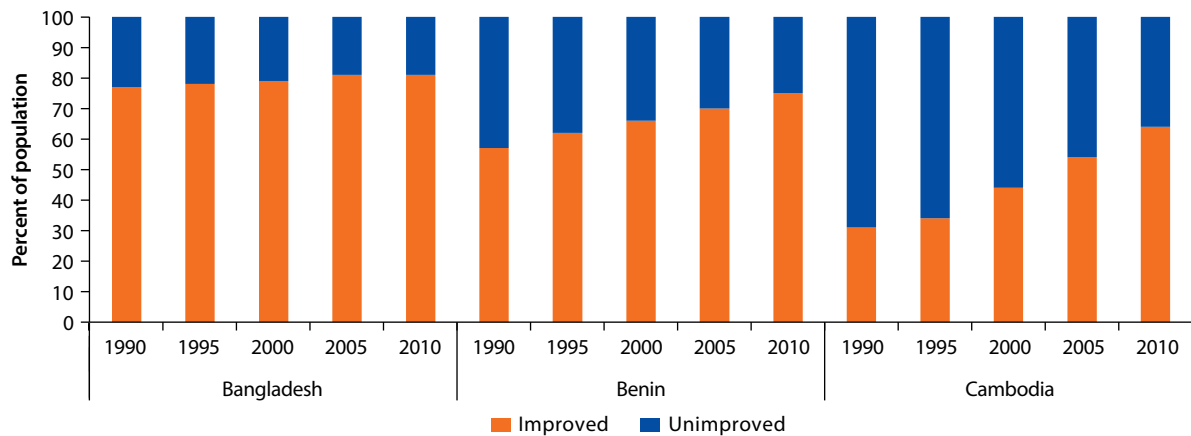
Improved water supplies can come from a range of sources including protected wells, springs, and boreholes. Most people in developing countries rely on these sources. Piped water systems have the potential to offer economies of scale and improved convenience. They are increasingly being installed in places where the population is sufficiently dense or alternatives are not available (for example, where local groundwater is contaminated or costly to access).

The Costs Are Borne Largely by the Poor

In developing countries, the direct costs of inadequate access to safe and convenient sources of water are borne predominantly by the poor. Poor people are much less likely to be served by public utilities, and they are less equipped to deal with the consequences of using unsafe water. Loss of income as a result of water-borne illness can have a catastrophic effect on poor households, which are often unable to afford treatment or to survive long without income.

Governments Cannot Solve the Problem

Private firms may be underinvesting in the water sector because people may not be willing or able to pay prices that reflect all of the social benefits of using clean water. The existence of these

Figure 1.1 Access to Improved Water in Bangladesh, Benin, and Cambodia, 1990–2010

Source: WHO and UNICEF 2012.

“externalities” does not necessarily provide a rationale for government provision of water, however. Moreover, even if it did, in most developing countries with large numbers of poor people, the government lacks the financial and organizational capacity to meet the need for improved water supplies from public resources.

In the countries covered by this study, most poor (and many nonpoor) households look to the private sector to help meet their water needs. It is the private sector that builds or supplies materials and components for self-supply, sells water from standpipes or water trucks, and builds and operates piped water systems.

Why This Study?

A vibrant and diverse local private sector is critical to the delivery of services, as a large body of research conducted over the past decade shows.² More and more governments have been emphasizing the role of the domestic private sector in their national strategies, and domestic players have been moving from niche provisioning to mainstream operations. Multiple levels of capacity constraints prevent the domestic private sector from delivering at scale, however, and few lessons are available to help them deal with these constraints.

This study examines the involvement of the domestic private sector in the construction and operation of rural piped water networks. Its aim is to understand the extent to which private sector schemes can provide the poor with safe water.

The study considers two sets of factors—commercial factors and investment climate factors—that affect firms’ actual or perceived costs and risks and, in turn, their decisions about investing in water

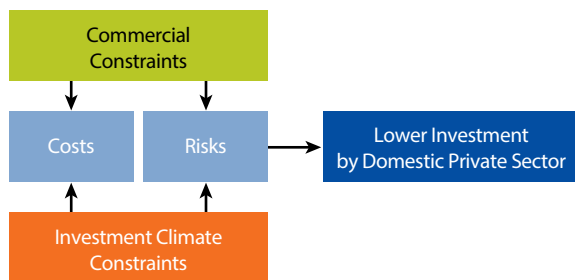
networks (figure 2.1). It examines both sets of factors by seeking answers to the following questions:

- Is lack of interest by the domestic private sector a rational response to weak market potential, or are lack of firm viability and the use of inappropriate business models preventing it from taking advantage of market opportunities?
- Are investment climate factors increasing the (actual or perceived) costs and risks associated with doing business?

To shed light on these issues, the study team conducted research into the water sector and its policy environment, surveyed operators of water networks, held focus group discussions with water users, and interviewed other stakeholders, including government officials, in Bangladesh, Benin, and Cambodia. The country studies examined “rural growth settlements”—villages with under 10,000 households (sufficient density to warrant a network solution); some infrastructure (roads, electricity, telecommunication coverage, education and health services); and economic dynamism despite reliance on rural practices and livelihoods.

Each study involved the preparation of a country analysis that examined the market structure, relevant supply chain, and policy environment; a survey of firms that deliver services to poor households; and focus group discussions with poor water users. Across the three countries, 89 firms were surveyed, and focus group discussions were conducted with 1,100 people.

Figure 2.1 Study Analytical Framework



Water Networks and the Role of the Government

Rural piped water schemes in Bangladesh, Benin, and Cambodia are similar, but the prevailing models in each country are very different. These differences largely reflect the role of the government in the sector and the impact it has on opportunities for private and nonstate actors to invest in or operate piped water networks.

Salient Features of Networks

Table 3.1 summarizes the salient features of rural piped water systems in the three countries studied.

In Bangladesh, most networks use groundwater. They typically have treatment plants only where surface water is used or systems are built to

address water contamination. All networks are connected to the electricity grid and use electric pumps. Most connections are made directly to households or institutions. No connections are metered.

Network structures in Benin are designed to standard specifications of government. They are therefore more uniform than networks in Bangladesh or Cambodia. All networks use groundwater; they do not have separate treatment plants. Only 25 percent of networks use electricity from the grid; of these, 40 percent use a back-up generator. The majority use diesel power for pumps or to generate electricity for production and distribution. Water is sold primarily through operator-managed standpipes, which are designed to serve 250 people. All connections are metered.

In Cambodia, schemes range widely in size, but about three-quarters of them draw water from rivers or ponds, using a pump to bring water into storage. Sixty percent rely on diesel or petrol for pumping and generating electricity. Seventy percent have a water treatment plant and combine an underground water storage tank with a water tower. Nearly all connections are made directly to homes and metered. Very few connections are for commercial or institutional customers.

Table 3.1 Salient Features of Rural Piped Water Systems in Bangladesh, Benin, and Cambodia, 2012

Feature	Bangladesh	Benin	Cambodia
Investment	Majority public financing (government or development partner); private firms and NGOs provide 20–30 percent of investment	Fully public financing	Fully private financing
Operator	Mostly NGO and community organizations, some private firms	Private firms	Private firms
Systems	Deep well water, mostly private connections; production metering only	Deep well water, mostly standpipes; production and consumption metering	Surface water, mostly private connections; production and consumption metering
Tariff structure	Flat fees	Volumetric	Volumetric

Role of the Public and Private Sectors

At one end of the spectrum is Benin, where the public sector finances, designs, and constructs water systems and only the operation and management of systems is delegated to private firms. At the other end of the spectrum is Cambodia, where the private sector finances, designs, constructs, operates, and manages all water systems. In Bangladesh, private operators have some equity stake in the networks and are involved in their design and construction (table 3.2).

Table 3.2 Investment in Construction of Water Systems in Bangladesh, by Sponsor, 2012

(percentage of average investment cost)

Constructed by	Percentage of average investment cost contribution		
	Government and donor	Private entity (firm or NGO)	Community
Private sponsors	70 ^a	22	8
Government sponsor, no donor funding	100	0	0
Government sponsor with donor funding	92	0	8
NGO sponsors	91	0	9

Source: DevCon 2013.

^a Initially, two sponsors contributed 40 percent or more of the investment cost, but the project rules were later changed reducing the required contribution to 30 percent.

Is Market Potential Sufficient to Justify Private Investment?

The water market is large: a conservative estimate of household outlays on water suggests that people in rural and semi-urban areas of Bangladesh, Benin, and Cambodia spend at least \$620 million a year on water. Poor people alone spend more than \$270 million a year on water (table 4.1). These estimates exclude households connected to public utilities (which operate primarily in metropolitan areas) and consumption of water from free-of-charge sources. They are thus a measure of what people are paying for water from small-scale operations.

The majority of people (90 percent in Bangladesh, 67 percent in Benin, and 92 percent in Cambodia) get their water from private (including self-supply) and communal sources. In addition to operating piped water systems, private operators supply rural households with facilities for self-provision or sell bottled or carted water. In Bangladesh, the private sector has helped more

than 60 million rural residents meet their own water needs using hand pump tube-wells.

The importance of small-scale rural schemes varies across the three countries. Only about 0.1 percent of the population of Bangladesh gets its water from such schemes (table 4.2). In contrast, 6.0 percent of the population in Cambodia and 15.9 percent in Benin use these schemes.

The contribution of small-scale piped water schemes is projected to grow in all three countries, with annual water sales expected to increase from \$23 million in 2012 to at least \$90 million by 2025.

A combination of market and nonmarket drivers is creating opportunities for private enterprises (table 4.3):

- In Bangladesh, private hand pumps are a cheap, widespread source of safe water for most of the rural and semi-urban population. The main driver of market growth for piped water services is the contamination of shallow water (primarily

Table 4.1 Estimated Size of Water Market in Bangladesh, Benin, and Cambodia, 2012

	Bangladesh	Benin	Cambodia	Total
<i>Size of market (millions of people not connected to state water utilities)</i>				
Entire country	135.6	6.1	13.0	154.7
Rural	107.2	5.3	11.3	123.8
Poor	45.4	3.5	4.1	53.0
<i>Value of market (millions of dollars)</i>				
Entire country	512.7	74.1	175.9	762.8
Rural	405.4	64.4	152.9	622.7
Poor	171.7	43.1	55.5	270.2

Note: Market values were estimated by assuming that average outlays on piped water in the households covered by the country studies are typical for all households in each country. These outlays do not typically cover all water consumed by households, and prices paid and costs incurred vary across within each country.

Table 4.2 Rural Piped Water Schemes under Private Management in Bangladesh, Benin, and Cambodia, 2012

Item	Bangladesh	Benin	Cambodia	Total
Number of rural piped schemes	75 ^a	350	300 ^c	725
Percent privately managed	100 ^b	35	100	68
Thousands of people served	200	500	1,400	1,730
Percent of population served	0.1	15.9	7.2	0.9

^a 150 schemes were found, but only half were operational.

^b Includes operation by nongovernmental and community organizations operating on a commercial basis.

^c Some sources cited in the country study cited estimates as high as 800 (GRET 2013).

from arsenic, iron, and salt). The government's 2011–25 Sector Development Plan for water estimates that by 2025, 10 percent of the rural population (about 11 million people) will be served by rural piped water schemes. (In 2012, about 200,000 people were served by these schemes.) Meeting this goal will require investment of about \$800 million.

- In Benin, annual sales of water from privately or community-managed networks in small settlements could reach \$22 million by 2025.
- In Cambodia, where private investors are building networks where public utilities are not operating, sites with suitable characteristics could support a doubling of the number of people supplied by private networks, to about 2 million people.

In each country, opportunities for private participation in small towns and rural areas are

shaped by the extent of national guidance (policy clarity), the government's willingness to engage private partners, and its ability implement policy effectively (operationalization) (table 4.4). The processes of political and national decentralization that have taken place in all three countries in recent years are also shaping the landscape: in all three countries the 'political distance' between network operators, customers, and the local political personalities that oversee their performance is very small.

In Benin, opportunities for providing rural piped water depend on the space created by the government and its capacity to invest in networks that private operators can run. In Cambodia, opportunities arise from the inability of public services to expand into markets with potential for profitability and the extent to which the government allows private initiatives to function without constraint.

Table 4.3 Drivers of Market Opportunities in the Water Sector in Bangladesh, Benin, and Cambodia

Country	Immediate driver	Opportunity created
Bangladesh	<ul style="list-style-type: none"> • Strong economic growth and social development: per capita GDP grew from \$1,164 (purchasing power parity) in 2005 to \$1,643 in 2010, and poverty rates dropped from 40 percent to 31 percent. • Stable and relatively large rural population (about 100 million) until 2030. • Unsuitability of current groundwater point sources, as a result of contamination (from arsenic, iron, and salt); scarcity of groundwater in northeast areas and switch to surface water sources; lowering of groundwater levels as a result of excessive abstraction from irrigation wells). • Large sector investment program budget (twice traditional funding levels from the public sector). 	<ul style="list-style-type: none"> • Demand for higher levels of service as a result of move away from hand pump tubewells. • Need for higher-investment solutions, which require more centralized treatment, storage, and transport. • Increased recognition by government of need to leverage private investments; greater openness to develop conducive business environment for private sector participation in water.
Benin	<ul style="list-style-type: none"> • Increase in construction of networks under public investment program: annual rural budget tripled between 2001 and 2010 (to \$26 million); target of 112 schemes by 2016. • Decision by commune (local government) authorities to put management of network out to tender. • New strategic framework for developing the private sector, which specifically includes the water sector. 	<ul style="list-style-type: none"> • Increased private sector lease contracts. • Smaller lot sizes of procurement introduced, allowing small firms to bid for projects.
Cambodia	<ul style="list-style-type: none"> • Strong economic growth and economic stability (average GDP growth of 8 percent between 2005 and 2010). • Large volume but low quality of water (most water comes from the Mekong and Tonle Sap rivers). • Inadequate public supply of water. 	<ul style="list-style-type: none"> • Supports increasing household ability and willingness to pay. • Relatively easy extraction and value-adding through treatment. • Secure niche markets.

Table 4.4 Clarity and Operationalization of Government Water Policy in Bangladesh, Benin, and Cambodia, 2012

Item	Bangladesh	Benin	Cambodia
<i>Policy clarity</i>			
Responsibility for service delivery (national or local)	National but in transition. Ministry of Local Government, Rural Development and Cooperatives has statutory mandate. In rural areas, mandate is implemented by Department of Public Health and Engineering (DPHE), a line agency, with support from local administrative institutions. Elected local governments operate at district and union but not subdistrict levels. Recent projects emphasize role of local governments as eventual asset owners.	Clear allocation of responsibility to local authorities under Law N° 97-029 of January 15, 1999, pertaining to organization of communes.	Less clear than in other countries and in transition. Memorandum of Understanding between Ministry of Rural Development and Ministry of Industry, Mining and Energy (MIME) (traditionally responsible for urban development) allocates responsibility for supervision of rural private piped water to MIME. MIME also directly delivers services through state agencies in provincial capitals. Recent decentralization laws and strategies place public service delivery at provincial, district, and commune levels.
Private sector engagement	Unclear. Although policies and strategies promote private sector development, there are no guidelines on operational definition or classification of private sector, scope of participation, or financing mechanisms. Different models emerge through projects.	Directional. National strategy stipulates that network operations need to be managed by private sector, and guidance is available for selecting them through a tender process under four possible arrangements, including possibility of engaging users associations or private firms.	Laissez-faire. A concession law exists, but most water businesses operate under a licensing regime that is not formalized in law and is governed by few regulatory constraints.
<i>Operationalization of policy mandate for private participation</i>			
Market identification and scope determination	Combination. Government sets parameters on location through priority development criteria/list; NGOs and private firms present proposals for partnerships.	Public only. Identified through national development program priorities and decision of local communes.	Mostly private. Except in specific development projects, private sector selects area in which it operates and scale of operations.
Investment financing and design	Combination. Water is funded mainly through national development programs under a cost-sharing arrangement. DPHE provides guidance on design. Generally, the private party (directly or through others) designs and builds the system, with supervision support/ approval by DPHE.	Public only. Infrastructure is developed through public engineering, procurement, and construction under specific guidelines.	Entirely private.
Fees, tariffs, and revenue generation	Negotiated. Tariffs are negotiated with communities and local governments. Firms defray administrative costs of supervision (for example, meeting costs) by local institutions. Level of return is not set.	Directional. Tariff formulas are used to determine the lease fees and level of tariffs. Level of margin is not set.	Market based. Main restriction on tariffs is what the market will bear (there is stiff competition from alternative sources).

(Continued to next page)

Table 4.4 (Continued)

Item	Bangladesh	Benin	Cambodia
Performance accountability	Vague. In most cases, local associations are formed to provide customers with voice.	Systematic, but not applied. Formal accountability process established in the contract, but does not work consistently in practice. No formal process for identifying well- vs. poorly performing firms, although the sector is small and word is likely to get around. No national level support for contract and conflict management visible.	Self-imposed. Licenses have minimal service level requirements, which are not systematically monitored. As firm investments are high and firms rely on the business, performance is closely linked to firm viability.
	Minimal national support through DPHE.		

What Affects Demand for Water?

Aggregate market potential for piped water is significant in the three countries studied. But demand by the poor is weak, because poor households are willing to allocate their limited cash only to a compelling service offer, especially when they can use alternative sources of water at very low monetary cost.

Focus group discussions with households in communities served by piped water networks explored a range of issues concerning demand for water, including desired characteristics of water supply, willingness and ability to pay, and perceptions regarding the performance of the network. Table 5.1 describes the sample of respondents.

Cost of Water (Tariffs and Connection Fees)

Tariffs and connection fees are too high for many poor households to afford. If met by water from networks, the standard daily per capita consumption of 40 liters of water would cost poor households 2.4 percent of their income in Bangladesh, 4.1 percent in Cambodia, and 5.6 percent in Benin (table 5.2).³ Although tariffs in Bangladesh and Cambodia do not breach the 5 percent of income

ceiling often applied in the water and sanitation sector, costs may be running up against household budget constraints and the limit to what poor people are prepared to pay.

In Bangladesh, water accounted for less than 1 percent of total household expenditures among the poor, but 53 percent of households indicated that the most they could afford to pay for piped water was \$0.78—about half the average actual tariff of \$1.50. In Cambodia, poor people living in a water network area indicated that they could pay no more than \$0.49 per cubic meter—about 20–30 percent less than the actual tariff of \$0.61; people living outside the network indicated that they could afford to pay just \$0.45.

Most poor people in Bangladesh and Cambodia have private water connections. In contrast, just 6 percent of focus group participants in Benin had one; almost all respondents there indicated that they could not afford a connection at current tariffs.

In Bangladesh, 100 percent of people who were not connected to the water network identified the high connection fee as the reason for not connecting, even though 70 percent of surveyed networks charge no connection fee for shared connections

Table 5.1 Characteristics of Focus Group Participants
(percentage of households interviewed, except where otherwise indicated)

Characteristic	Bangladesh	Benin	Cambodia
Number of villages covered	32	31	27
Number of people interviewed	221 women, 223 men	213 women, 189 men	99 women, 121 men
Classified as poor (percent for locality where focus group discussions held, all countries)	59	39	35
Has very poor quality housing	48	22	21
Lacks own latrine	10	74	—
Owens mobile phone	96	68	88
Average monthly spending on water (dollars)	\$1.30	\$8.00	\$3.80

Note: — = Not available. Poverty measured using national poverty line.

Table 5.2 Cost of Water Service as Portion of Household Income in Bangladesh, Benin, and Cambodia, 2012

Country	Monthly income of poor households (dollars)	Water service item	Cost per household (dollars)			Share of household income (percent)		
			Low	High	Average	Low	High	Average
Bangladesh	63	Connection fee	0	50.0	17.0	0	80.0	27.2
		Monthly charge (flat)	0	2.5	1.5	0	4.0	2.4
Benin	173	Connection fee	160.0	729.0	200.0	92.5	421.4	115.6
		Cost per cubic meter	0.6	1.2	1.0			
		Monthly cost (at 40 liters per capita per day)	5.7	11.8	9.7	3.3	6.8	5.6
Cambodia	101	Connection fee	20.0	50.0	34.0	19.9	49.7	33.8
		Cost per cubic meter	0.4	1.0	0.6			
		Monthly cost (at 40 liters per capita per day)	2.8	6.6	4.1	2.8	6.6	4.1

and about 20 percent do not charge for private connections. Other reasons included inability to pay the monthly tariffs (86 percent), lack of availability of connections (46 percent), and poor system performance (45 percent). When asked what they might be willing to pay for connections, 84 percent of respondents indicated a connection fee of less than \$12, about 30 percent less than the average actual fee of \$17.

In Cambodia, people who were not connected to the water network in their area indicated that a reasonable price to pay for a connection was about \$30, about 13 percent less than the average actual fee of \$34; people living outside the network area were willing to pay an average fee of \$26. These costs were lower than but not very far from actual costs.

Another perspective on affordability of connections comes from what people spend on water compared with other items of household consumption. Households in the survey areas pay much more for mobile phones than they pay for water, suggesting that they could afford to connect to a piped water system (table 5.3).

A key issue affecting households' ability to pay for water connections is the variability and lack of regularity of their incomes: in all three countries, income flows among poor rural households are seasonal, and levels of uncertainty about their incomes are high for many households. None of the network operators covered by the studies offered installment payment options, and no credit facilities were available to help potential users

Table 5.3 Selected Annual Household Expenditures by Poor Households in Bangladesh, Benin, and Cambodia, 2012 (dollars)

Item	Bangladesh	Benin	Cambodia
Mobile phone	68	120	—
Housing	51	36	—
Water	16	96	46
Electricity or gas	36	96	—
<i>Memo item</i>			
Average cost of private connection ^a	17	200	34

Note: — = Not available.

^a The connection cost covers only the cost of making the physical connection to the network and installing meters (where required).

cover their water costs. Majorities of focus group participants in all three countries expressed interest in installment payment options.

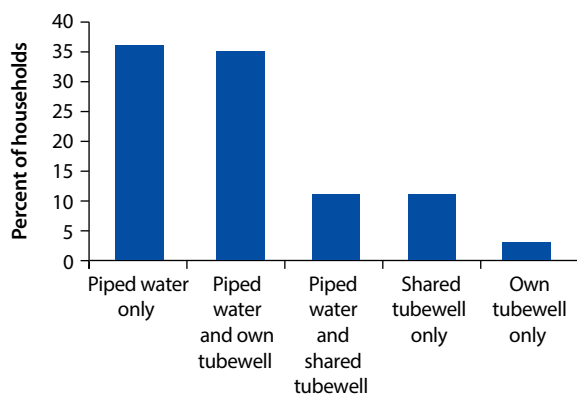
Competition from Other Sources of Water

Private operators of piped networks have to compete with other sources, including traditional wells, tube wells with hand pumps, watercourses, and rain. The existence of these alternatives reduces firms' revenue potential.

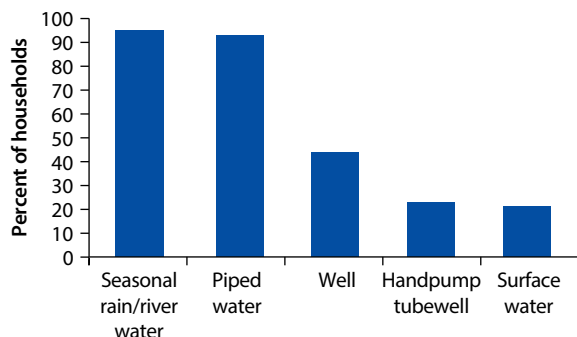
In Bangladesh, where piped water schemes are found largely in areas where contamination has made water from traditional hand pump tubewells unsafe to drink, almost half of households (47 percent) continued to use traditional sources as a complement to piped water (figure 5.1).

Figure 5.1 Sources of Water among People with Access to a Water Network in Bangladesh and Benin, by Use, 2012

a. Bangladesh



b. Benin



Note: Some households use more than one source, so the total percentage across all sources equals more than 100 percent.

Focus group discussions in Benin revealed that the rural poor use the least expensive source of water they can as long as they deem its quality acceptable for the use to which they put it (table 5.3). In areas served by a water supply network, 92 percent of focus group participants obtained some of their water from the network. However, the general pattern is for them to combine piped water with less expensive sources of water, depending on availability and use. People interviewed in Benin, for example, realized that river and pond water is not potable. Despite this knowledge, they often used such water for drinking and cooking (table 5.4).

In Cambodia, sales of very small networks (fewer than 750 connections) during the rainy season are half what they are in the dry season. Larger networks experience about a 25 percent drop in sales in the rainy season. During the rainy season, 75 per cent of households that had a network connection also used rainwater (figure 5.2). Interestingly, small numbers of households in the network area (but not connected), and households in the locality (but outside the network) used network water purchased from those with a connection (figure 5.2).

Table 5.4 Uses of Water from Different Sources by People with Access to a Water Network in Benin, by Use, 2012
(percentage of respondents)

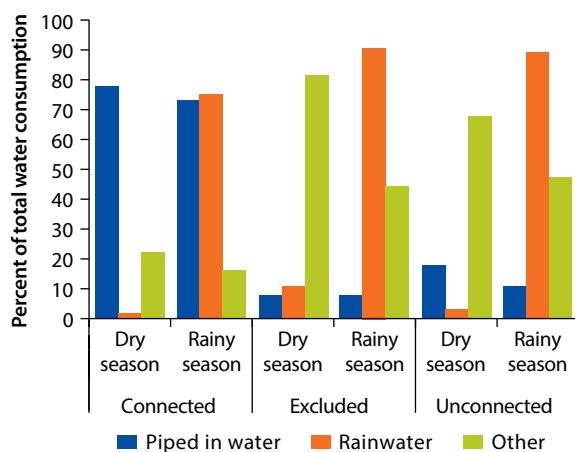
Use	Source						
	Private connection	Standpipe	Well	River	Rainwater	Hand Pump	Dam/Pond
Drinking	100	100	71	23	79	100	—
Cooking	100	100	80	53	81	100	—
Laundry	100	100	100	100	100	100	100
Bathing	100	100	100	100	100	100	—
Garden	0	14	100	70	99	0	100
Watering animals	78	99	100	10	97	100	—
Economic use	100	98	100	100	100	100	—
<i>Memo item</i>							
People using source as percentage of people interviewed ^a	6	91	44	10	95	2	2

Source: Hydroconseil 2013.

Note: — = less than 0.5 percent.

^a Some households use more than one source of water, so the percentages in this row add up to more than 100 percent.

Figure 5.2 Water Consumption in Cambodia in Dry and Rainy Seasons, 2012



Note: "Excluded" = households outside the current reach of networks. "Unconnected" = households within the network service area, but not connected to the system.

Service Features of Importance to the Poor

Poor rural residents are discerning consumers who make trade-offs among different sources of water and different expenditure items (such as mobile phones and water). Feedback from them suggests that firms need to provide a higher level of service if they are to convince these households to use (or use more) piped water.

Convenience and Reliability

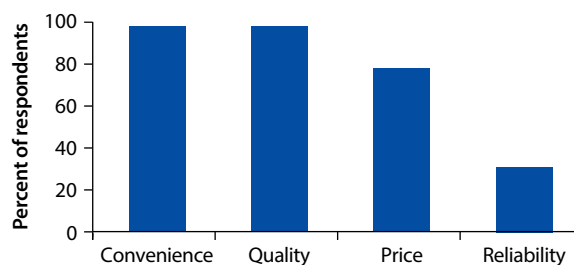
In choosing one source of water over others, focus group participants in Bangladesh cited convenience, reliability, and quality (table 5.5). In Benin, convenience and quality were identified by 98 per cent of respondents as being important factors in choosing a water source, significantly more (78 per cent) who rated price as important (figure 5.3). An important dimension of convenience was proximity of the water source.

In Benin, more than three-quarters of respondents ranked their system and its operator as very satisfactory across all dimensions of performance, with just 12 percent rating response to complaints and capacity to run the system (in terms of ability to repair breakdowns) as being unsatisfactory (figure 5.4). Far fewer respondents in Bangladesh rated their systems as very satisfactory: across each dimension of performance, about a fifth rated it as unsatisfactory, and half of respondents with a con-

Table 5.5 Factors Influencing Choice of Water Source by Poor Rural Households in Bangladesh, 2012 (percent of respondents)

Factor	Only piped water supply (PWS)	Only hand pump tubewell (HTW)
PWS more convenient	72	
HTWs unsafe	64	
No water in dry seasons	33	
HTWs out of operation	26	
HTWs located far away	24	
HTW water tastes bad	18	
High tariff		53
Low service quality in PWS		29
Connection disconnected		24
PWS irregular supply		23
HTW convenient		10

Figure 5.3 Factors Influencing Choice of Water Source by Poor Rural Households in Benin, 2012

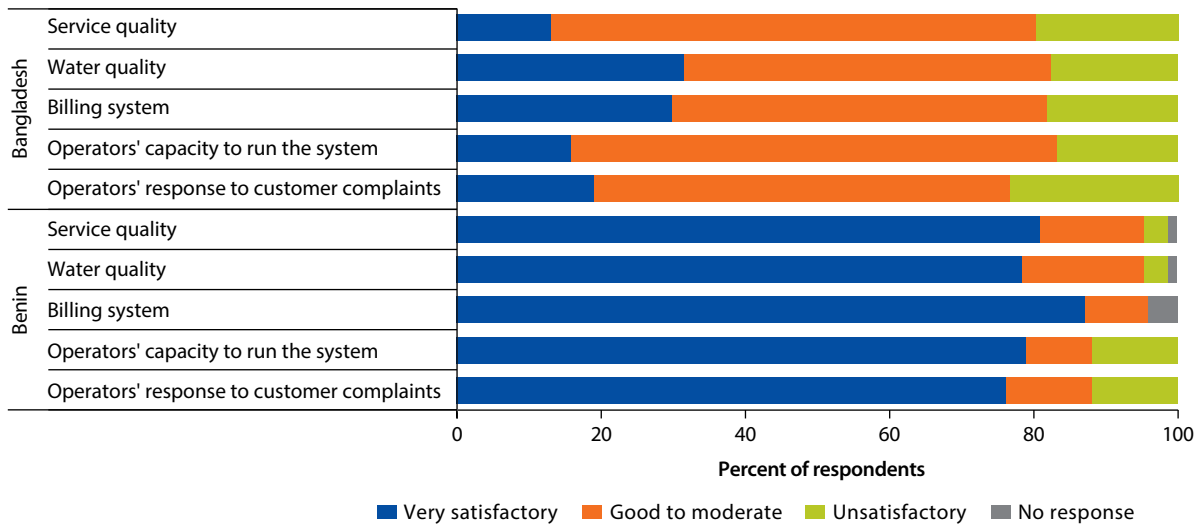


nection said they would not recommend it to others, citing low pressure, irregular supply, and price relative to service.

Quality

People in all three countries rated the quality of piped water as high, although they focused on different aspects of quality. In Bangladesh, households associated quality with the elimination of the contaminants that made traditional water sources hard or unsafe to drink. In Benin and Cambodia, households were concerned primarily with cleanliness, texture, and color. In Cambodia, taste was an important factor; some households did not like the taste of chlorinated water.

Figure 5.4 Consumer Satisfaction with Piped Water System in Bangladesh and Benin, 2012



How Is Piped Water Supplied?

Almost all of the enterprises building and operating networks in the three countries are small. They use quite different business models, however, reflecting the incentives and opportunities created by the nature of government involvement. There is also considerable difference across the three countries in financial and service performance, which seem to be affected by the ways in which governments have shaped business opportunities.

Firm Characteristics

Firms operating networks are small. Some have licenses to operate networks, but only in Benin are they formally registered.

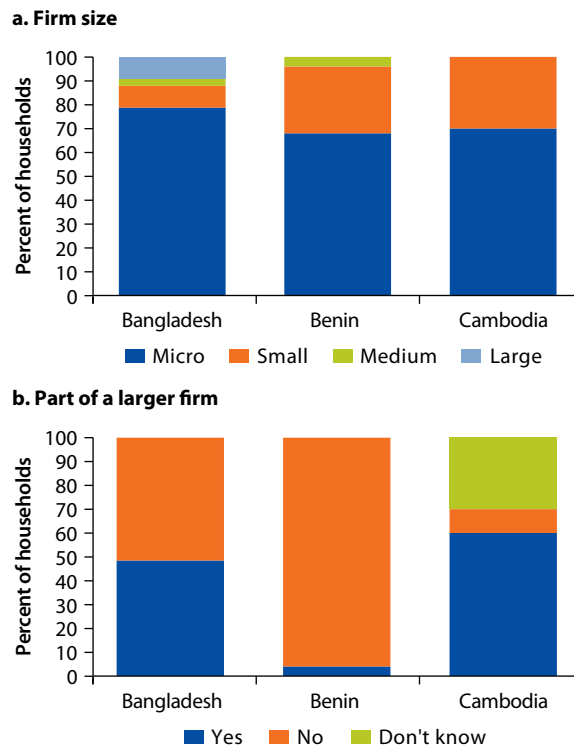
Firm Size

Rural piped water in Bangladesh, Benin, and Cambodia is provided largely by small businesses (operators with fewer than 20 employees) and microenterprises (operators with fewer than 5 employees) (figure 6.1). The sector also attracts some medium-size firms and firms that belong to larger enterprises.

In Cambodia, 70 percent of the enterprises interviewed were engaged solely in water supply as their primary business. In Benin, the proportion was just 44 percent; the majority of enterprises operated networks as a complement to their core activity (typically consulting services or contracting associated with other aspects of the water supply chain.) In Bangladesh, some schemes were operated as part of broader interventions by nongovernmental organizations (NGOs).

On average, enterprises in Bangladesh and Cambodia have invested around \$90,000 and \$109,000 in their networks (table 6.1). Investment is much smaller in Benin, where firms are not expected to invest in the water system (the public sector makes all water investments). As part of their application to manage

Figure 6.1 Size of Operators of Piped Water Networks in Bangladesh, Benin, and Cambodia, 2012



Note: Size is based on number of workers, including working proprietors. Micro: less than 5 workers; Small: 5–19; Medium: 20–99; Large: more than 100.

systems, however, firms need to provide an inventory of their human and capital resources, which can include means of transport, tools, and office and communications equipment. Although some firms own nothing more than basic furniture and equipment, more than half of the enterprises surveyed were operating more than one network, suggesting that their managerial capacity is more significant.⁴

Formality: Business Registration and License

The degree of formality of network operators varies considerably across the three case study countries.

Table 6.1 Total Investment by Water Network Operators in Bangladesh, Benin, and Cambodia, 2012 (US\$)

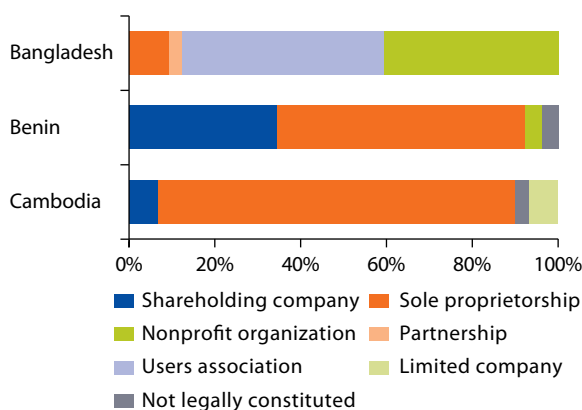
Investment	Bangladesh	Benin	Cambodia
Minimum	6,900	200	1,900
Maximum	229,000	15,300	340,000
Average	109,000	2,800	90,500

In Benin, firms have to be formally registered in order to tender to operate networks. The enterprises surveyed were predominantly sole proprietorships or shareholding companies (figure 6.2). In Bangladesh and Cambodia, about 60 percent of firms were not formally registered as businesses, even though more than half of the enterprises in Cambodia had been operating for seven years or longer. Most of the registered firms in Bangladesh were NGOs.

As the provision of water supply is often regulated, the requirements of business registration and licensing are sometimes separated. In Bangladesh, there are no requirements for licensing. The authority to operate a water supply business is implicit in the cooperation framework under which the water infrastructure was financed and developed. In Benin, no separate licensing is necessary, because operators are selected through a formal tender process and in effect obtain their authority through the lease contract.

Cambodia has 139 licensed private operators of piped water schemes. The total number of private schemes (licensed and unlicensed) is probably between 300 and 800. The number of licensed firms has been increasing over the years. Most firms

Figure 6.2 Legal Status of Water Network Operators in Bangladesh, Benin, and Cambodia, 2012



interviewed for this study had applied for a license to operate a water network or were in the process of doing so. Firms that are licensed tend to share the following characteristics:

They are larger than unlicensed firms, with 994 connections on average (compared with 254 for unlicensed firms), and they deliver significantly more water per connection.

They make larger investments. On average, investment was three times larger than that of unlicensed firms operating schemes of comparable size.

They have greater access to experts. A much larger proportion of licensed operations (69 percent) than unlicensed firms (7 percent) used external expertise to help with network design. Licensed firms were also more likely to have used the services of a construction company to build the network.

They charge lower tariffs (\$0.57 per cubic meter) than unlicensed firms (\$0.61) but higher connection fees (an average of \$49, compared with \$20 for unlicensed firms).

They are much more likely to have a treatment plant. All licensed schemes had or were building a treatment plant. Only 53 percent of unlicensed schemes treat their water.

Business Models

The business models adopted by firms appear to be strongly shaped by the incentives and constraints created by government involvement. Typical models vary considerably across the three countries.

Revenue Generation

In Bangladesh and Cambodia, systems focus on smaller coverage areas, serving small numbers of customers with short networks (table 6.2). They sell large volumes of water through private connections. Networks in Benin cover twice as many people and the pipeline is twice as long, but they distribute water through standpipes.

Networks in Bangladesh sell more water than networks in Benin or Cambodia. Firms charge a flat rate per month, however. As a result, their revenues per cubic meter are just one-sixth those of their counterparts in Cambodia. Revenues per cubic meter sold in Cambodia are about half those of networks in, but because sales volumes are low, revenues are twice those of firms in Benin and four times those of firms in Bangladesh.

Table 6.2 Service Coverage and Revenues of Water Network Operators in Bangladesh, Benin, and Cambodia, 2012

Item	Bangladesh	Benin	Cambodia
<i>Service coverage</i>			
Number of villages served	3	4	6
Number of people served	1,504	8,023	2,403
Number of private connections	196	24	490
Number of shared connections	18	14	0
Average number of people per connection	7	216	5
Average network length (kilometers)	7	14	9
<i>Revenues</i>			
Average volume of water sold (cubic meters per year)	62,376	11,506	40,026
Average annual revenue (dollars)	5,200	10,700	22,200
Revenue per cubic meter of water sold (dollars)	0.08	0.9	0.5

Tariffs and Pricing

Tariff levels vary widely within each country, but the variations do not seem closely related to differences in network costs. In Bangladesh, tariffs are set in consultation with the communities served, but it is not clear who is involved in this negotiation. There is considerable lack of clarity concerning ownership of assets. Partly because many networks are operated by NGOs and community-based organizations, tariffs are not set on a fully commercial basis. Eighty percent of firms interviewed in Bangladesh realized that tariffs do not cover the cost of the investment.

In Benin, tariffs are set using a model that also determines a renewal and extension fee, which is intended to cover depreciation of assets. Tariff rates are not used as a parameter for selecting firms tendering to manage a network but instead are preset by the *commune* (local government authority) based on the model. The average tariff in Benin is \$1.03 per cubic meter—70 percent higher than in Cambodia and nine times as high as in Bangladesh.

In Cambodia, operators appear to negotiate tariffs with customers and with local government officials, although the central ministry responsible for urban water provides some guidelines. Ultimately, given the wide availability of alternative sources of water, tariff levels are determined by the market.

Asset Optimization

Most schemes in each country operate well below design capacity. In Bangladesh, average output was 18 percent of design capacity; in Benin the figure was 30 percent. Perhaps not surprisingly, in Cambodia, where private operators build their own networks, production was higher (46 percent utilization), albeit still well below capacity. On average, service hours were much longer in Cambodia than in the other two countries, and a smaller portion of schemes had unaccounted-for water rates that exceeded 20 percent (table 6.3).

The technical design and quality of construction of the main infrastructure components varies across settings. In Benin, where the central government built the networks, experts engaged for this study classified the pumps, the condition and protection of pipelines, and the protection of water sources in 80 percent of networks as optimal; in 20 percent of networks, the choice of pumping and storage facilities was considered suboptimal. In Bangladesh, where network construction typically had significant input from government or donors, a broadly similar pattern was seen. In Cambodia, more than a third of networks were assessed as having suboptimal pump functionality and choice of pumping and storage facilities, and two-thirds were not providing adequate protection of the water source.

Table 6.3 Performance of Water Networks in Bangladesh, Benin, and Cambodia, 2012

Indicator	Bangladesh	Benin	Cambodia
Average hours of service per week	33	86	132
Average water produced per resident served (cubic meters per year)	44	2	15
Percentage of networks with unaccounted-for-water exceeding 20 percent	13 ^a	9	4

^a Consumption is not metered; figure is estimate by study team.

Financial and Cost Profile

To function sustainably, water networks need to generate enough revenues to cover operations, financing (where it exists), and depreciation. But only in Cambodia do operators face a clear imperative to cover the full value of network assets.

- In Bangladesh, the status of asset ownership is unclear. In most cases, there is no clear guidance on the level of provisioning for replacement.
- In Benin, the contract obliges the lessee to pay a fixed renewal and extension fee, which is based on a model that amortizes the construction cost of the water system. Fees covering replacement are paid to the local government (*commune*). The lessee also pays a *commune* fee to defray the cost of supervision. Where a water users association previously managed the network, the lessee may also pay a fee to the association. All of these fees are paid as fixed amounts per unit of water produced.
- In Cambodia, enterprises incur all capital cost themselves.

Financial Performance

In all three countries, about 80 percent of firms cover their operating costs (figure 6.3, panel a). Only some of these firms also cover depreciation (figure 6.3, panel b). In Cambodia, 90 percent of firms cover operating costs, and 80 percent of cover their full costs. On average, operations cost

more in Cambodia than in Bangladesh and Benin, but profit margins are also higher: average earnings before interest, tax, and depreciation were 48 percent of total revenue, compared with 43 percent in Benin and 31 percent in Bangladesh. Net profit margins were 23 percent in Cambodia and 17 percent in Benin; the average firm in Bangladesh incurred net losses of 45 percent.

Depreciation

In two of the three case study countries (Bangladesh and Benin), the majority of networks fail to cover depreciation. In Bangladesh, the problem is that effective tariffs are too low (table 6.4). As a result, after operating costs, the average firm is left with gross profits of just \$0.01 per cubic meter of water sold, not enough to cover depreciation. Part of the problem is that firms charge customers the same amount regardless of the volume of water they consume, so that increasing consumption raises operating costs without increasing revenues.

In Benin, the problem is that depreciation costs, which are based on the costs of investment, are too high. These cost are high because networks are overdesigned and built to too high a standard, with expensive materials imported from Europe. The renewal and extension fee (which is meant to provide a return to cover depreciation to the local authority that owns the network) is calculated as a function of the cost of the underlying asset: the more a scheme costs, the greater the

Figure 6.3 Share of Water Network Operators Covering Operating Costs and Full Costs in Bangladesh, Benin, and Cambodia, 2012

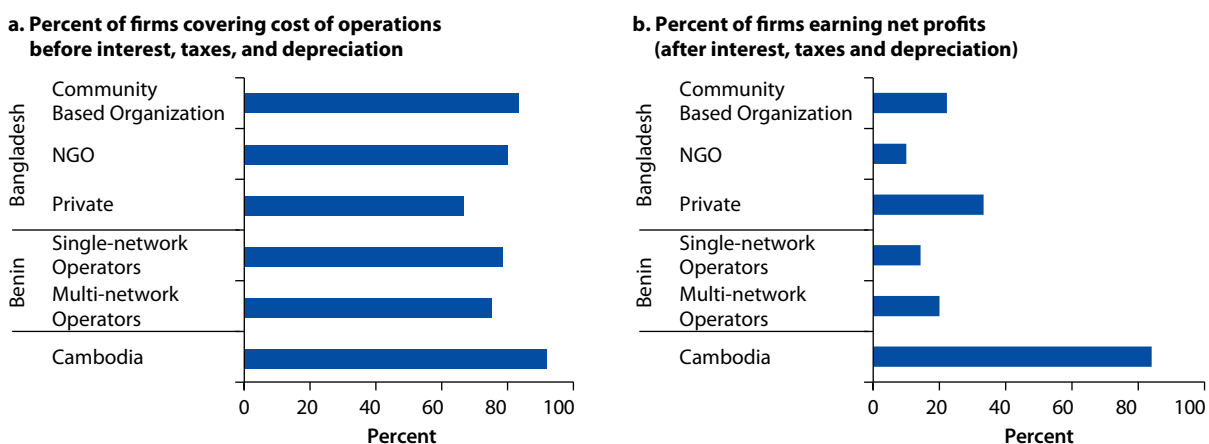


Table 6.4 Sales, Cost, and Income Indicators of Piped Water Operators in Bangladesh, Benin, and Cambodia, 2012

Indicator	Bangladesh	Benin	Cambodia
<i>Volume</i>			
Water sold/resident (cubic meters)	41.5	1.4	16.6
<i>Construction cost (dollars)</i>			
Minimum	7,000	98,000	8,000
Maximum	220,000	960,000	340,000
Average (excluding outliers)	109,000	260,000	70,000
Construction cost / kilometer pipe (excluding outliers)	16,000	20,000	14,000
Estimated average annual depreciation	3,182	9,500	3,000
<i>Operating cost</i>			
Cost/kilometer of pipe (dollars)	512	631	1,643
Cost/resident served (cents)	240	113	362
Energy cost/cubic meter water produced (cents)	2	18	16
Variable cost/cubic meter water sold (cents)	9	57 ^a	25
Tariff/cubic meter water sold (cents)	10 ^b	103	60
Margin/cubic meter water sold (cents)	1	46	35

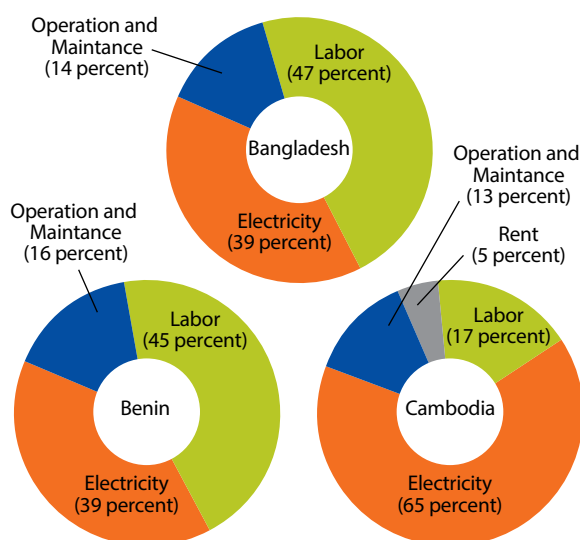
Note: ^a The variable cost in Benin, including fees, is \$0.92 per cubic meter, leaving a margin for the operator of \$0.10 per cubic meter.

^b Because customers are charged a flat rate, this is an implied charge per cubic meter.

depreciation that has to be covered. The average cost of construction in Benin appears to be two or three times the cost in Bangladesh and Cambodia; on a per kilometer of pipeline basis, it is 25 percent more expensive than Bangladesh and 40 percent more than Cambodia. Networks in Benin are also too large for the markets they serve: they are designed to deliver 40 liters per capita a day, even though actual per capita sales average just 4 liters a day. Tariffs are calculated on the assumption that costs are spread over a much larger volume (and hence value) of water sold than is actually achieved. The problem is exacerbated by the fact that the fees are levied on the basis of production, not sales.

Energy Costs

Energy is the largest component of network operating costs (figure 6.4). It is particularly costly for operations that have to use diesel to power generators and pumps.

Figure 6.4 Breakdown of Cost of Water Network Operations in Bangladesh, Benin, and Cambodia, 2012

In Bangladesh, where all networks have fairly reliable access to the electricity grid, energy accounts for 40 percent of average operating costs. In contrast, in Cambodia, where the majority of networks use diesel to power pumps and generators, energy accounts for 63 percent of average costs; for networks wholly reliant on diesel, energy represents 74 percent of average costs. A similar pattern is evident in Benin, where the share of energy in operating costs is 20 percentage points higher for networks using diesel fuel than it is for networks using electricity. Pumping using diesel costs about three times as much as pumping with electricity.

Unreliability of power supply affects the ability of firms to deliver a consistent level of service to their customers. The problem affects all three countries. Ninety percent of firms in Bangladesh reported a power outage the previous year, with the average firm reporting six outages a year. In Benin, networks with grid connections experienced outages of about 20 hours a month. In Cambodia,

networks with connections to the grid experienced 30 outages the previous year.

Labor Costs

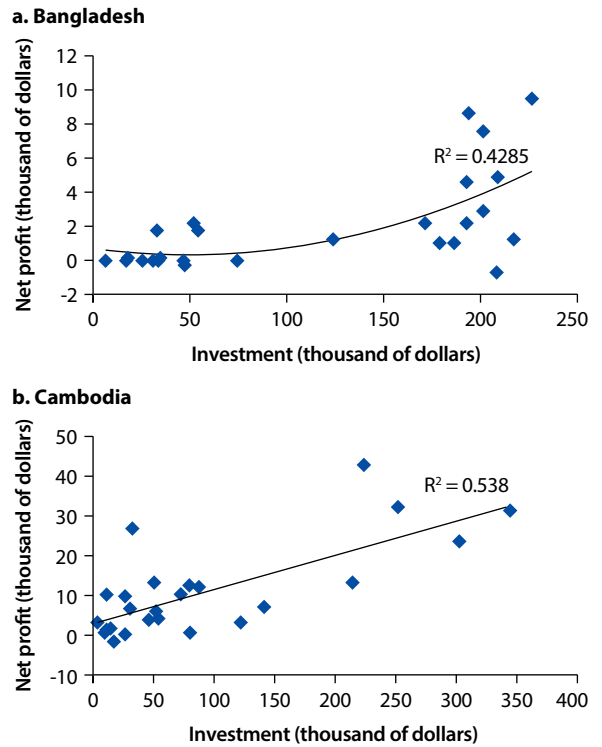
Labor costs largely account for the significant differences in variable unit costs across the three countries (\$0.68 per cubic meter in Benin, \$0.25 in Cambodia, and \$0.09 in Bangladesh). Higher labor costs are associated with the operation of standpipes, through which most water in Benin is sold. Labor costs in Cambodia may understate true costs, because they may exclude some (unpaid) family labor.

Drivers of Profitability

In each country, country-specific drivers of costs and revenues interact to determine overall profitability (figure 6.5). It is in Cambodia, where the government has little direct involvement in network siting, design, construction, and operation, that firms and networks are consistently profitable and covering all costs.

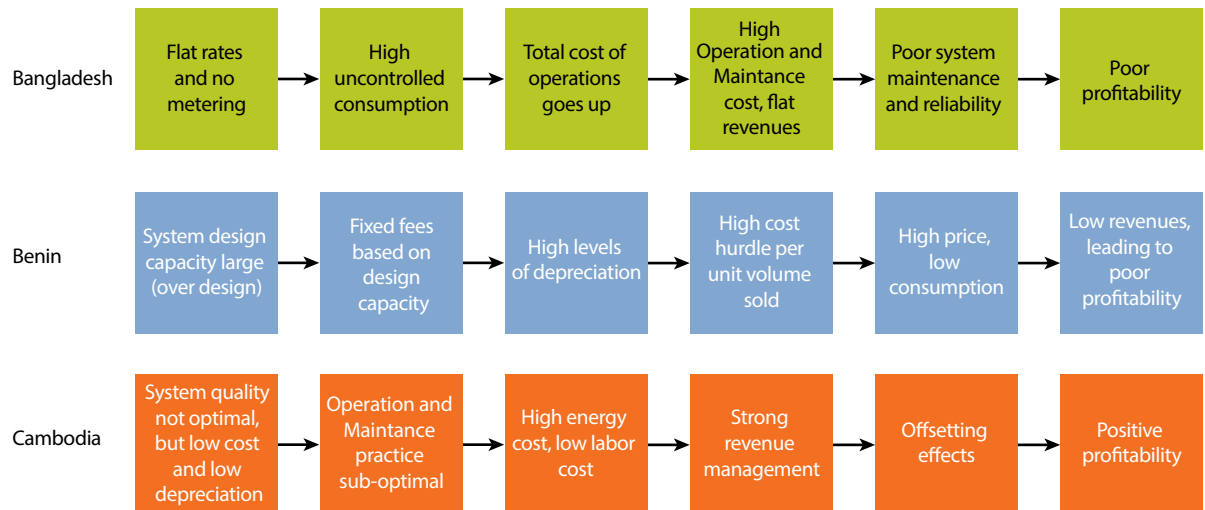
In all three countries, there is a strong correlation between profit and various measures of network size, such as the length of pipe in the network and the number of residents served. In Bangladesh and Cambodia, where operators have some or complete control over the size and cost of the network, there is a strong correlation between size, investment, cost, and profitability (figure 6.6). Enterprises that operate more than one network do

Figure 6.6 Correlation between Piped Water Operators' Net Profits and Investment in Bangladesh and Cambodia, 2012



not achieve greater network profitability than enterprises with single networks, however. In Benin, the ability to spread overhead costs over more than one operation did not seem to compen-

Figure 6.5 Cost and Revenue Patterns of Water Network Operators in Bangladesh, Benin, and Cambodia, 2012



sate for the additional challenges of managing a larger number of standpipe operators. Moreover, networks run by operators managing more than one network had above-average volumes of unaccounted for water.

Private Connections

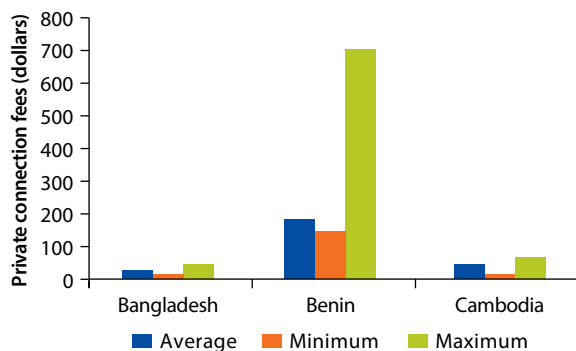
Across all three countries, the networks with the largest proportions of private connections are the most profitable. Consumption tends to increase with a private connection. Moreover, enterprises that use standpipes have to employ an operator to sell water and collect payment for consumption, not only adding costs but also creating principal-agent problems (a number of network managers in Benin perceive that theft of water facilitated by their standpipe operators is a significant problem). In Bangladesh, the number of connections is about 45–70 percent the number necessary for financial viability.

The costs of private connections vary widely, both within and across countries. The average connection fee is nearly six times higher in Benin (US\$200) than in Cambodia (US\$34) (figure 6.7). One contributor to the difference is that in Benin, networks use much more expensive meters and connection materials (sourced primarily from Europe) than do networks in Cambodia, which use much cheaper products from China and Thailand.

Profit Motive and Alignment of Ownership, Investment Decisions, and Management

Having a profit motive and putting ones' own money at risk is critical to actually earning profits.

Figure 6.7 Private Connection Fees in Bangladesh, Benin, and Cambodia, 2012



Note: As connections are not metered in Bangladesh, costs may not be directly comparable to the other two countries, since they do not include provision of a meter.

In Bangladesh, where piped water networks are sponsored and operated by a range of types of organizations, networks run by private enterprises that have invested in the network come closer to covering all costs than do government-sponsored networks or networks sponsored and operated by NGOs or community-based organizations. In Cambodia, where operators contribute all of investment capital, profitability is the norm. In contrast, in Benin, the agencies responsible for the investment are not involved in operating the network, design is not aligned with market demand, and tariffs do not reflect market conditions. Networks cover large numbers of consumers than their counterparts in Bangladesh and Cambodia, but they do so by providing lower levels of service (standpipes). Funds are not set aside for private connections, which are more profitable for the network, discouraging consumers from seeking them.

Interactions with the Construction Supply Chain

An important determinant of service quality and financial viability is the cost and quality of the water system. Both are affected by the supply chain for design and construction inputs. (Table A.5 in the Appendix describes the supply chain in each country.)

In Bangladesh, firms did not report difficulty procuring materials or accessing technical services. Both supply chains seem fairly competitive.

In Benin, separate agents are responsible for building and operating networks. The national public investment program, under the management of the Department of Water, builds the networks, which are usually funded by donor programs. The process is lengthy, partly because it depends on national and international contractors and consultants. It is also expensive. Tender documents specify parts and components. Pumps and generators are mainly imported from Europe, whereas plastic pipes and connectors come mainly from the regional market, as do facilities for water treatment and most meters (box 6.1). In contrast, materials purchased during the operating phase, such as material for extending private connections (meters, pipes, and fittings) and operating the system (chemicals) are available through retail outlets selling imported products from China and Nigeria.

Box 6.1 Construction of Water Networks in Benin

Construction of all water systems is handled through public procurement in Benin. The process is long and tedious, with the selection of a building company generally taking months or years. As most of the funding is external, funding agencies require the national government to implement stringent procedures to avoid leaks. These procedures further slow the selection process.

The capacity of both the Department of Water and *communes* (local government authorities) is low. Drafting tenders, selecting and monitoring candidates, and paying them require specific skills that local agencies do not yet possess. As a result, the selection process is defective and the quality of the work undertaken by the building companies appears to be deteriorating, as illustrated by the rising number of breakdowns on new water supply systems.

Public procurement is not cost-effective: standards for equipment and parts set out in construction contracts are “oversized” in both quantity and quality given current demand for water. Most of the equipment and parts listed in the bill of quantities is imported from developed countries and, sometimes, specifically from the developed country that is financing construction of the system. These parts are generally expensive to purchase and even more expensive to import.

The market of informal water providers in peri-urban areas is more efficient. These providers invest their own money to provide water to identified customers. Technical standards are lower than on systems funded by the government. Equipment is directly or indirectly imported from Nigeria or China. The standard is lower, but the equipment is less expensive, enabling these informal providers to charge affordable prices to customers in their local area.

The process for building water supply systems in rural areas through public procurement is not set up to respond to demand. Actors working in the water supply market pursue their own interests and objectives, which are not aligned with the demand for water:

- The Department of Water and local governments: Because contracting agents do not pay for the water supplied, they tend to require high standards and build assets that are larger than necessary.
- The contracted engineering consulting firm: The firm hired responds to the needs of the contracting agent (the Department of Water and local governments), which overestimate demand for water. The result is oversized water systems that cost more than water supply networks that are the right size.
- Donors: Donors’ main objective is to supply funds. One of their measures of success is the amount of money they lend to governments. Funding mechanisms distort the supply of water infrastructure by directly or indirectly determining the origin, quality, and quantity of inputs. These choices are not optimal given the current use of water supply systems.
- Work contractors: Contractors are recruited to build, not to operate, the water supply system. To increase their revenues, they tend to push for larger systems. In addition, control of works is weak.

Source: Adapted from Hydroconseil 2013.

In Cambodia, private enterprises both build and operate water networks. The market for materials and equipment is well developed, with competitively priced and reasonably reliable material imported from China and Thailand. A problem is that few local companies are able to provide professional consulting services for design, construction supervision, or monitoring systems. Interna-

tional consultants with these capabilities are available, but they cater mainly to larger firms that build and operate urban water systems. Local enterprises cannot afford their services. Sixty percent of the enterprises surveyed for the study did their own design work, and three-quarters built network facilities themselves or used local tradesmen and laborers.

Are Firms Interested in Increasing Investment and Serving the Poor?

Eighty-nine water network operators were interviewed for this study. Their attitudes concerning expanding their businesses and providing piped water services to the poor suggest that opportunities exist for the domestic private sector.

Intentions to Invest

Firms' business models and the incentives they provide drive the investment opportunities available to local entrepreneurs in the water sector. Three-quarters of interviewed enterprises in Cambodia had intentions to invest, and just over half were interested in investing in an additional network (figure 7.1). At the other end of the scale, only a third of enterprises in Benin intended to invest, and only 30 percent were interested in operating an additional network.

In Bangladesh, investment in new networks is strongly determined by the availability of sources of complementary funding, primarily from the government and donors. Of the 55 percent of interviewed enterprises that were planning invest-

ment, all were focusing on expanding coverage of existing networks or repairing or improving performance rather than building a new network.

In Benin, the central government is responsible for building networks. Given the short duration of lease contracts, operators have limited incentive to invest in additional capacity. Moreover, given that the operator pays a replacement and extension fee to the local government that tracks depreciation of the original network, there is lack of clarity concerning the responsibility/incentive for replacing or upgrading investment. Forty-four percent of firms interviewed in Benin reported that they were planning investment, but this investment appeared to be maintenance spending to allow assets to continue functioning.

In Cambodia, where network investment is autonomous and self-funded, enterprises face the full suite of potential investment options: expansion or enhancement of existing networks and the building of new networks. Just over three-quarters of enterprises interviewed were contemplating investments in existing networks, with a strong emphasis

Figure 7.1 Enterprises' Intentions to Invest in Existing or Additional Water Networks in Bangladesh, Benin, and Cambodia, 2012

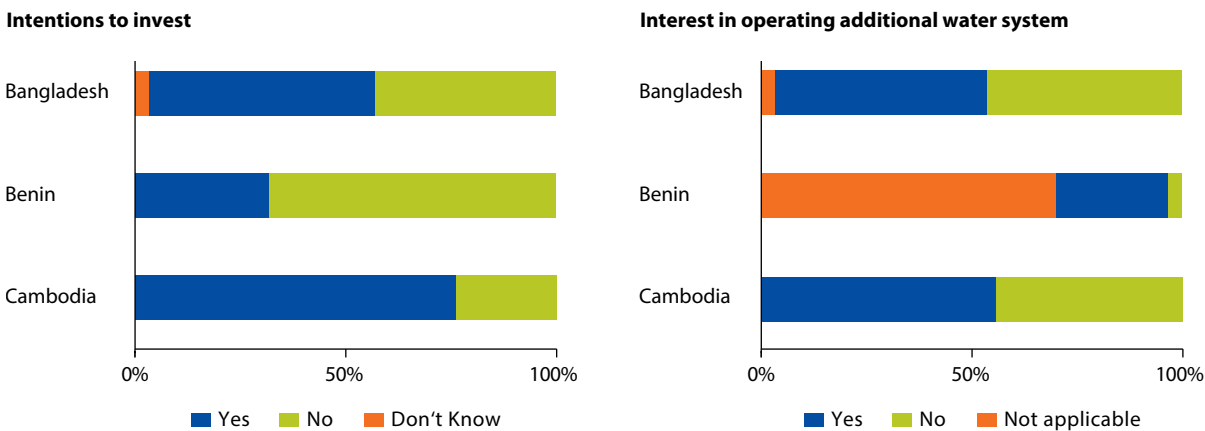
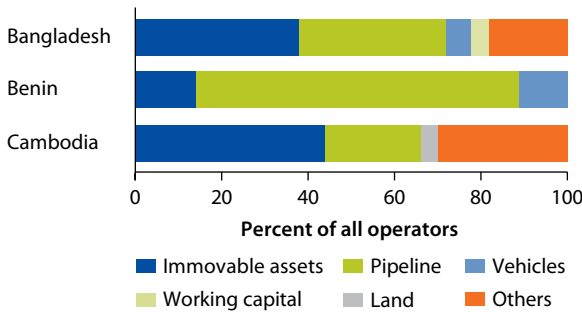


Figure 7.2 Areas for Future Investment Identified by Water Operators in Bangladesh, Benin, and Cambodia, 2012

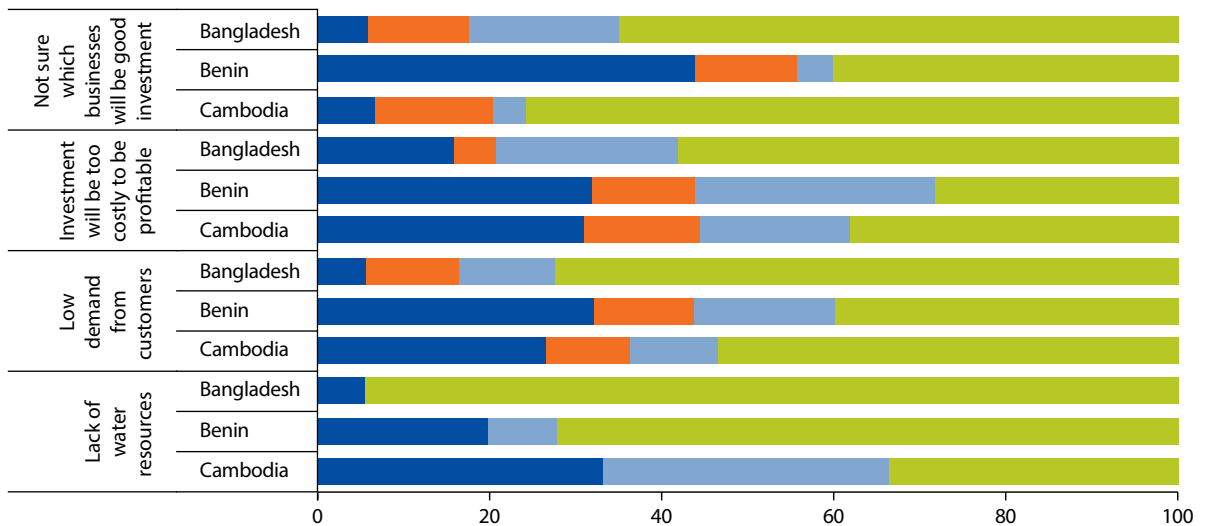


on expanding networks and water production; half of all enterprises indicated that they were interested in investing in new sites; and about a quarter were also contemplating other water-related investments, such as production of bottled water.

Figure 7.2 identifies the components in which enterprises were thinking of making investments in fixed or moveable assets. Extensions to pipelines were the most frequently cited area. In Bangladesh and Cambodia, where enterprises own (fully or partly) the network, firms were also contemplating investing in network infrastructure.

Figure 7.3 Obstacles to Investment in Existing and Additional Networks in Bangladesh, Benin, and Cambodia, 2012

a. Existing network



b. Additional network

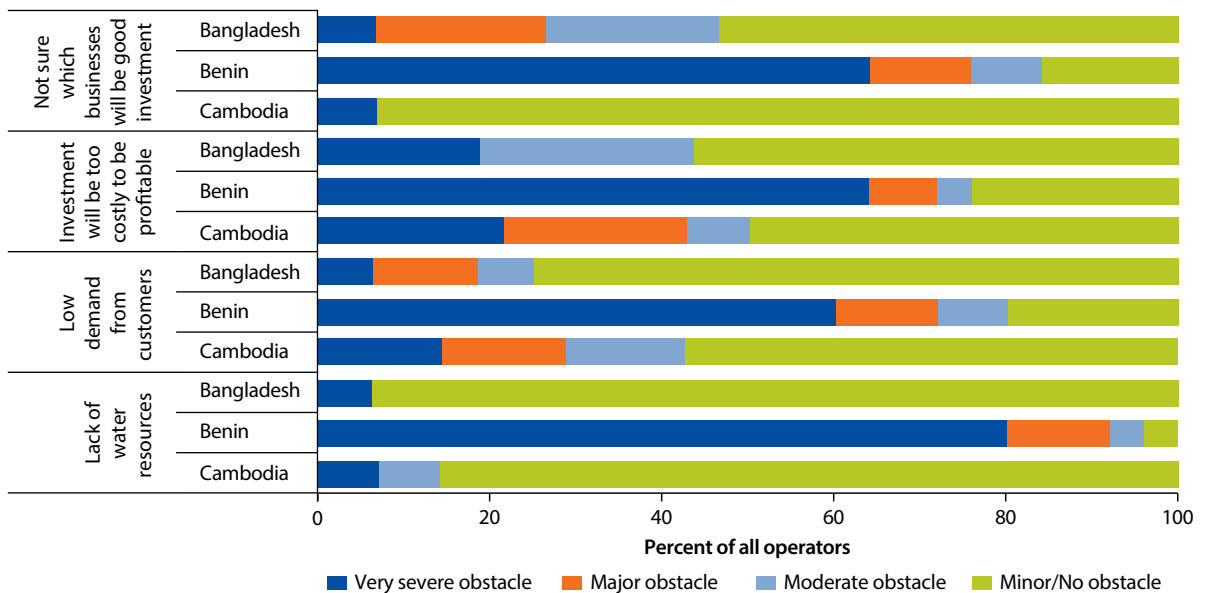
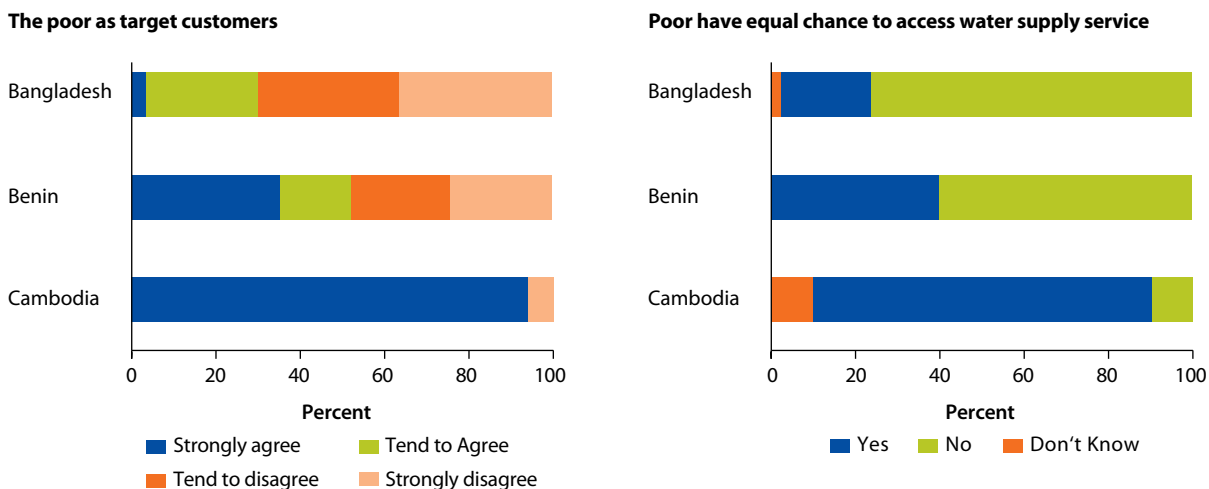


Figure 7.4 Enterprises' Perceptions of the Poor as Potential Customers in Bangladesh, Benin, and Cambodia, 2012



Perceived Risks

Enterprises contemplating investment were asked about their perceptions of potential obstacles (figure 7.3). The findings, particularly in Benin and Cambodia, have important implications for policy that encourages firms to expand into challenging markets. They suggest that better market intelligence on potential markets is needed.

In Bangladesh, the risks for existing and additional systems were similar. In Benin, the risks of the unknown were perceived as much higher. Regarding new networks, firms were much more concerned with water availability, the strength of demand, the cost of investment and whether investing is a good business decision. They also expressed significant concerns about demand and investment costs in existing networks.

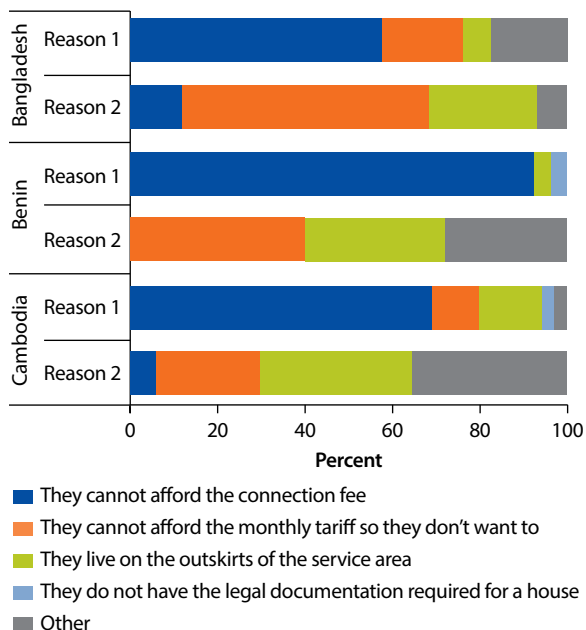
In Cambodia, firms seemed to think that additional investments in existing systems would be too costly to be profitable, possibly because of low demand among people not currently served.⁵ Incentives are likely to be needed to encourage firms to expand current networks to less profitable areas. Firms expressed slightly more optimism that there is greater demand in other systems and far more optimism that investment in other systems would generate profits.

Perceptions of the Poor as a Target Market

Enterprises in the three countries have quite different perceptions of the role of poor households

in their markets (figure 7.4). In Bangladesh, just 30 percent of enterprises reported that the poor were their target customers, and 80 percent agreed with the statement that the poor did not have an equal chance to access their. In Benin, 52 percent of enterprises considered the poor target customers, and 60 percent did not think they had equal chance of access. In Cambodia, 93 percent of

Figure 7.5 Enterprises' Views of Why Poor People Do Not Use Piped Water, 2012



Note: Enterprises in each country were asked to cite two reasons why they thought the poor did not have equal access to piped water.

enterprises identified the poor as target customers, and 80 percent reported that they did not have equal access to water.

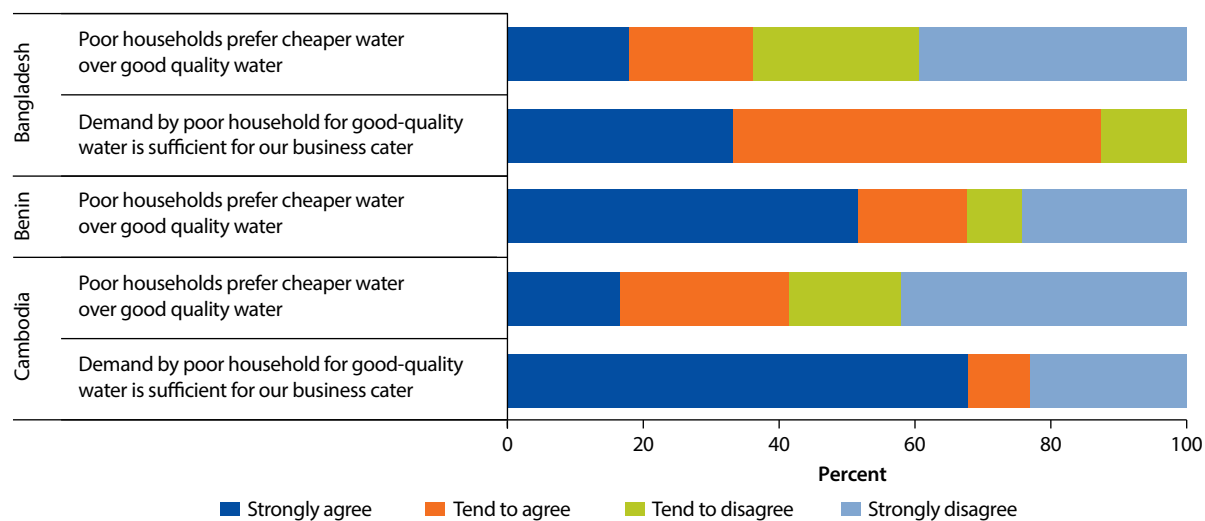
At least 40 percent of operators contemplating investment in Benin and Cambodia (where all operators are commercial) were concerned about the profitability of catering to the poor. A majority of enterprises (58 percent in Bangladesh, 92 percent in Benin, 69 percent in Cambodia) cited the costs of connection as the main reason why the poor do not have equal access to piped water (figure 7.5).

A majority of enterprises in Benin and Cambodia think that poor households prefer cheaper water over good-quality water (figure 7.6). In contrast, a majority in Cambodia think that these households' demand for good-quality water is sufficient to justify catering to it. In Bangladesh, where quality is

associated with the absence of dangerous contaminants, more than 60 percent of enterprises do not think poor households trade off price against quality, and nearly 90 percent think that demand for piped water by poor households is sufficient to justify catering to them.

Some enterprises in Cambodia view competition from other providers—water trucks, push carts, other piped water systems—as a possible constraint on demand for their services. But the critical challenge comes from self-provision and switching of sources. This finding highlights one of the fundamental challenges faced by piped water networks: they can deliver water at only one quality standard, but a significant proportion of household water use does not require that water be potable, and some uses do not even require that it be clean.

Figure 7.6 Enterprises' Views on Water Preferences of Poor Households, 2012



Is the Investment Climate Limiting Private Sector Involvement?

Government policy and practice, the quality of infrastructure, and access to finance shape the way firms perceive the tradeoff between risk and return when considering expanding their business. All of these aspects of the investment climate affect the water sector.

Government Policy and Practice

Sectoral policies in all countries have deficiencies, and implementation and enforcement suffer from incomplete and under-resourced decentralization of responsibilities to local governments. Enterprise representatives were reluctant to criticize government policies and performance, however. Many seemed to accept certain undesirable aspects of public sector behavior, such as corruption (table 8.1).

In Benin and Bangladesh, market opportunities in water depend on investment made by the public (and donor) sector. Government policy is therefore a much more important issue for firms than it is in Cambodia.

Lack of Policy Specificity

In Bangladesh, the lack of specificity of the policy framework on engaging the private sector is a significant constraint. Business opportunities are limited to development projects that have set up clear rules of engagement. Consistency is lacking on tariff setting and financing rules and mechanisms. The ownership structures of the water business and its assets are not clear (most project documents state that the communities are the owner of the assets but do not define who the communities are or how they are constituted as a body). These problems stifle private sector initiative and increase opaqueness, preventing more competitive markets from developing. As a result, only quasi-private entities, such as NGOs, have entered the market.

Table 8.1 Enterprise's Perceptions of Governance-Related Obstacles to Doing Business in Bangladesh, Benin, and Cambodia, 2012
(percent of enterprises identifying issue as a problem)

Country/severity of problem	Competence of		
	Corruption	local government administration	Political instability
Bangladesh			
None/no view	33	15	33
Minor to moderate	21	67	55
Major to very severe	45	18	12
Benin			
None/no view	60	56	36
Minor to moderate	8	20	16
Major to very severe	32	24	48
Cambodia			
None/no view	77	100	97
Minor to moderate	13	0	3
Major to very severe	10	0	0

Note: Totals may not add to 100 due to rounding.

Lack of Capacity

In Benin, the main direct barrier seems to be the lack of capacity of the public sector in developing appropriate designed networks and of the commune to tender for their operation. But the broader barrier may lie in the fact that policy crowds out autonomous private investment similar to that which is made in Cambodia.

Within the current framework for building and operating networks, local governments, which are in theory responsible for developing and building water supply networks, do not yet have the capacity to do so. As a result, arms of the national water admin-

istration system handle these functions. Operator selection has been reported to take as long as a year, and contracting construction can take years. The split responsibility for construction becomes more problematic when the network breaks down while still under the contractor guarantee or when technical information on the water supply network is required to set up the PPP contract. The local government has little power to force the work contractor to carry out repairs and inherits the water supply network without specific documentation on the network (such as well yield, map of the network, specific details of the electromechanical equipment), affecting the operations of the firm that takes over the management of the scheme. To overcome the weakness and delays associated with the fragmented responsibilities, the government might introduce other arrangements for engaging the private sector, such as design-build-lease contracts.

Lack of an Adequate Legal Framework

In Cambodia, the legal framework on urban and semi-urban water supply is still being developed. Regulation of private sector participation in water supply lacks clarity and exhibits a fair degree of informality and inconsistency in application. The licenses issued by the Ministry of Industry, Mining and Energy (MIME) authorize an enterprise to operate a network in a specific location and to use the associated water source for three years. Although this term is short, and could be seen as a deterrent to investment, enterprises seem confident that their licenses will not be revoked. Network operators appear to manage the short duration of their licenses by building infrastructure on land they own and by managing their relationship with local administrators.

Difficulty Obtaining Land

The difficulty of obtaining land on which to build networks makes it difficult for operators to expand. Along with the social capital that needs to be invested in local authorities, this constraint could be preventing firms from building networks in new areas despite their interest in exporting capital to other parts of the country. As the scope of the sector expands and competition for sites increases, more formal structures in licensing arrangements, provisions for land access, and dispute resolution mechanisms will be needed.

Bureaucracy, Uncertainty, and the "Hassle Factor"

In addition to having to deal with the uncertainties and risk created by policy and the capacity of government institutions to implement it, firms face formal and informal costs of doing business in the sector. In Benin, for example, enterprises must be formally registered to be eligible to tender for water network leases, a process that costs \$440–\$590. In Cambodia, unregistered enterprises tended to believe that registration was not necessary or very expensive. The process for obtaining a license is not well documented or established by a legal document, but practice requires gaining official approvals at the commune, district, and provincial levels before MIME will issue a license. The informal transaction costs of acquiring a license ranged from \$1,000 to \$5,000, averaging just over \$2,100; renewing a license averaged a little more than \$500 every three years.

Piped water networks are immobile and relatively long-lived investments. The nature of the contractual arrangement that operators have with governments, enforcement of those arrangements, and mechanisms for resolving disputes are therefore critical in shaping incentives for investment. In all three countries, the World Bank's Doing Business surveys indicate that contract enforcement is a costly and time-consuming process (table 8.2).⁶

Table 8.2 Time and Cost of Using Standard Legal Processes to Resolve Disputes in Bangladesh, Benin, and Cambodia, 2012

Country	Days required	Cost as percent of value of claim
Bangladesh	1,442	63
Benin	795	65
Cambodia	401	103

Operators in Bangladesh were skeptical about dispute-resolution processes. Formal arrangements for resolving disputes are not effective, and the weak quality of overall governance negatively affects the sector. Only 3 percent of respondents thought that the performance of their local government with respect to solving water supply problems was very satisfactory, and 38 percent considered it unsatisfactory. However, the fact that the

government and donors are involved in most networks probably provides operators with a fair degree of comfort in the short run that they are cushioned against risks associated with unclear policies and legal protections.

In Benin, the rules and obligations of each party are stated in the standard lease contract; operators have to make a guarantee deposit, which can be forfeited if they do not meet the terms of the contract. In practice, however, breaches occur without consequence or are left to fester until a contract is terminated—as seen in the way breakdowns of the water system are dealt with. Contracts state that the enterprise is responsible for repairing all faults except of wells. This clause is not respected, and network operators do not recognize repairs as an obligation. When a breakdown occurs, the operator either repairs the fault and allows the costs to be deducted from the lease fee to be paid ex post or does not repair the system, which is then taken out of service. The operator rarely bears the financial burden of a breakdown.

Contracts in Benin do not grant exclusivity of service to operators within the area set in the contract or clearly provide protection against arbitrary termination of agreements by local councils. Operators cannot count on local councils meeting their commitments under contracts. However, most operators seem reasonably confident that their contracts provide assurance that their property, equipment, and other investments will not be arbitrarily taken by the state.

In this respect, the proactive supervision of water providers by local government matters. Some local governments seem better equipped and engaged in the monitoring and management of water providers than others. These local governments have generally appointed a full-time technical agent, who is mobile and has a computer.

In Cambodia, licensed operators have no legal guarantee of exclusivity of rights to provide and operate a network in a given commune. Nevertheless, half of respondents felt that licenses provided them with protection against competition from other suppliers.

Infrastructure

Firms in all countries singled out unreliable power as the key infrastructure obstacle; the issue was most pronounced in Benin and Cambodia.

Energy is a critical input in Benin. Per cubic meter of water produced, fuel (\$0.31) is more expensive than electricity (\$0.12). However, connections to the grid are not universally available, and about 60 percent of rural water networks use energy from generators. Of networks that are connected to the grid, 40 percent have back-up generators, which they use during power outages.

In Cambodia, 80 percent of the enterprises surveyed used fuel as the major energy source, purchased from one of four distributors. Sixty percent also purchase energy from the national grid operator, from private retailers selling energy from the grid, or from stand-alone private operators generating and distributing their own electricity. Fuel appears to be subject to nationwide pricing policies. In contrast, electricity tariffs vary considerably, ranging from \$0.19/Kwh in Prey Vang Province to \$1/Kwh in Koh Kong Province. Where electricity cost more than about \$0.43/Kwh, operators tend to use fuel, generating their own electricity as necessary.

Access to Finance and Financial Services

Operators in Bangladesh and Benin have limited involvement in financing network construction. Lack of access to finance has therefore not typically been a significant obstacle; operators typically meet their expenditures from their own resources

Figure 8.1 Access to Finance as an Obstacle to Investment in the Water Sector in Bangladesh, Benin, and Cambodia, 2012

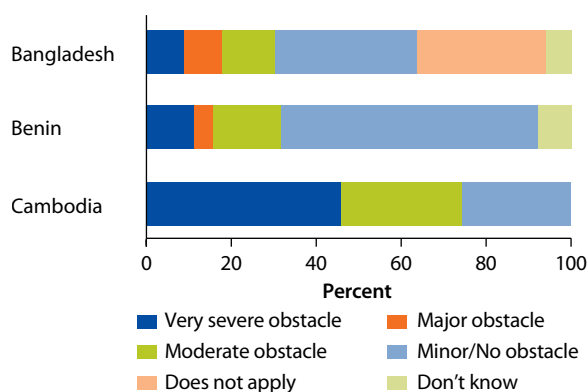
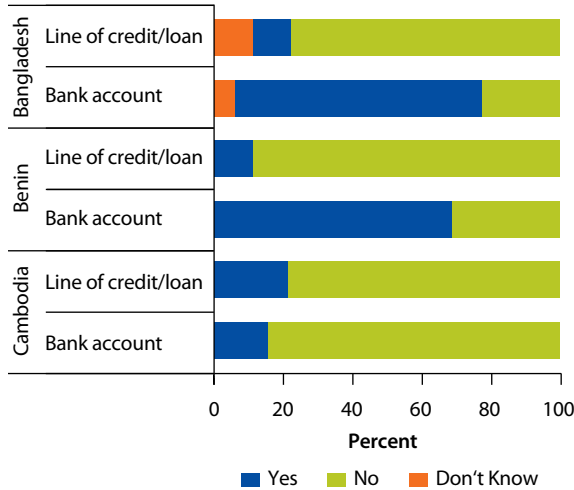
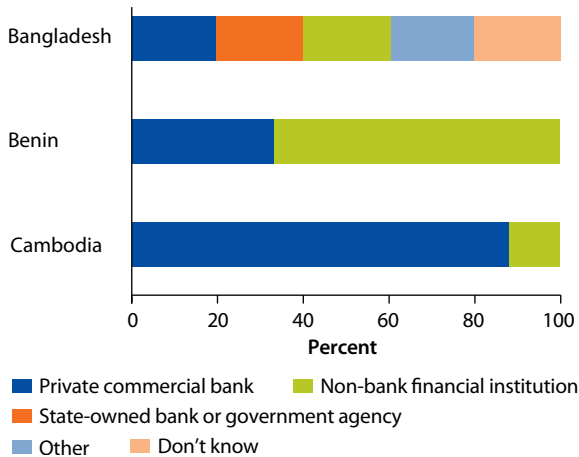


Figure 8.2 Water Operators’ Interactions with the Financial System in Bangladesh, Benin, and Cambodia, 2012

a. Prevalence of bank accounts



b. Sources of credit



(figure 8.1). In contrast, in Cambodia, where borrowing from formal financial institutions is widespread, enterprises expressed concern about collateral requirements and (to a lesser degree) interest rates. Commercial banks require that loans be collateralized with land or buildings, typically with a value of at least 130 percent of the loan amount.

In Bangladesh and Benin, just over three-quarters of all firms interviewed had a bank account, but only 12 percent had a loan from a formal financial institution. In contrast, in Cambodia, only 17 percent of firms had a bank account, but slightly more had a loan (figure 8.2).

Conclusions and Recommendations

Only about 11 percent of the aggregate population of Bangladesh, Benin, and Cambodia gets its water from state utilities—the rest rely on a combination of self-supply, private provision, and community-run systems. As population densities increase, piped water networks are becoming a viable source of water supply in many more settlements, and the private sector is becoming increasingly involved in the construction and operation of nonurban networks.

A variety of constraints prevents the domestic private sector from increasing supply from these networks to the poor, however. Commercial, water policy, and investment climate conditions all play roles in limiting private provision. By improving these conditions, donors and government policy makers could make the delivery of piped water to poor people in these countries more attractive to private investors.

Conclusions

The study aimed to characterize the potential market for rural private piped water systems and to answer the following questions:

- Is lack of interest by the domestic private sector a rational response to weak market potential, or are lack of firm viability and the use of inappropriate business models preventing it from taking advantage of market opportunities?
- Are policy and investment climate factors increasing the (actual or perceived) cost and risk associated with doing business?

Market Potential Is Strong

In the three study countries, the potential market the domestic private sector could be serving is large. Projections suggest that by 2025, about 20 million people in Bangladesh, Benin, and

Cambodia will get their water from rural piped water schemes—10 times the current number. This market will be worth at least \$90 million a year, up from about \$23 million in 2012.

Market growth is being driven by a combination of economic and policy factors. Population and income growth are important, but country-specific drivers are at play as well:

- In many locations in Bangladesh, current sources are unsustainable, because of contamination and the growing scarcity of water. A national policy aims to respond to these problems through public/private/community co-investment in piped water networks.
- In Benin, the government recently adopted a policy to contract out management of networks built by the public sector.
- In Cambodia, the costs of alternative sources, the absence of public supply, and a liberal (if somewhat unregulated) government approach to licensing private networks are creating commercial opportunities.

Constraints Are Preventing Private Investors from Serving the Poor

The commercial factors are broadly similar across the three case study countries. The policy factors are more country specific. Although all three countries recognize the role of the private sector in increasing access and improving quality of service, each has policies that make it difficult for private firms to be profitable, thereby dampening their interest in investing.

Weak demand. Households, especially poor households, purchase too little water from networks for operators to achieve optimal capacity utilization or to warrant significant investments in additional capacity. Poor households need higher volumes of water, but their purchases are limited

by cost and their assessment of the value of network water with respect to alternatives.

Most households have access to inexpensive alternative sources of water (if only for parts of the year), including wells, springs, and boreholes. They are savvy about making trade-offs between price and value in choosing their water source. In the longer run, the availability and opportunity cost of alternatives will likely shift incentives in favor of networks, especially if operators can ensure consumers of the quality of the service they offer. In the short run, however, competition from other sources will limit demand for piped water.

As a result, firms struggle to cater to the poor. To provide an acceptable standard of service—in terms of water quality, convenience, and reliability and continuity of supply—and cover network costs, they need to make good use of their fixed assets by selling as much water as network design will allow. Private connections appear to be an effective way to encourage households to increase purchases of piped water, but they are expensive relative to the incomes of poor households. There are currently no broadly applicable approaches to addressing issues of affordability or financing of outlays for water connections and services for poor households that are consistent with financial sustainability.

Private operators also face challenges in signaling to customers that their water is consistently safe to drink. Where public administrations are capable and corruption is not rampant, countries typically address the problem through state accreditation of the processes and systems used by utilities, accompanied by occasional testing and audits. National capacity to deliver regulatory functions has been challenged by the extent of decentralization of responsibility for water sector management: in Benin and Cambodia, decentralization has not been realized because it has not been accompanied by appropriate efforts to develop capacity and ensure adequate resourcing of devolved functions. The sector and governments need to develop ways to educate consumers about water quality and enable networks to adopt standard approaches to ensuring it.

Lack of firm viability and inappropriateness of business models. At a certain network size, piped water systems offer considerable economies of scale in providing potable water. But reaping these economies requires operating above certain mini-

mum levels of sales, and economic and financial sustainability requires charging prices that cover all costs. Getting this balance right is challenging. Firms in Cambodia are typically recovering the full costs of investment, but their counterparts in Bangladesh and Benin seem to struggle to maintain a reliable level of supply that meets customers' expectations.

Different business models have emerged in the three countries as a result of market and policy drivers. Each has achieved a different degree of success.

In Bangladesh, private sponsors co-invest in networks with the government and donors in localities where groundwater cannot be safely used. Customers are served through private connections. They pay a flat monthly fee, which results in low revenues despite high volumes. Combined with the fact that most networks have too few connections given the investment cost to households, the tariff structure means that few networks are financially viable.

In Benin, the business model is to cover a larger service area through manned standpipes. A top-down investment program designs and builds all networks, which are too large given the scale of the market. The tariff structure is determined by policy-driven financial models that grossly overestimate market sales, leading to very high fees and tariffs. Tariffs provide a large profit margin for every unit of water sold—and most operators therefore make a profit on their leases—but they keep consumption levels low. As a result, aggregate revenues do not cover investment costs.

In Cambodia, financing, design, construction, operation, and management are wholly private. Networks serve households through metered connections. Nearly all networks yield positive returns on investment, and revenues enable adequate provisioning for depreciation. Designed capacity is well calibrated to the market and continuity of service is good. But lack of access to water sector expertise may be leading to suboptimal choices of design and equipment, and the potability of water may not be ensured.

Attitudes toward investment and serving the poor. Water firms in Bangladesh and Benin, where the public sector and donors largely determine which assets are built, are circumspect in their attitudes toward investment. Few firms in Bangladesh were planning investment, and the investment that was

planned focused on expanding the coverage of or repairing existing networks. In Benin, nearly half of firms interviewed were planning investment, but spending seemed to be going toward maintenance to allow assets to continue functioning. In contrast, in Cambodia, three-quarters of enterprises interviewed were contemplating investments in existing networks, with a strong emphasis on network and water production expansion, and half of the enterprises were interested in investing in new sites.

Enterprises identified a range of market-related risks that affect their investment plans. In Bangladesh, the main concern was that costs make profitability uncertain, for both existing and new networks. This concern reflects current conditions in the market, where most firms are not profitable. In Benin, enterprises cited their lack of experience in developing (as opposed to operating) systems. They cited a wide range of risks, including concerns about water availability, lack of sufficient demand, and high cost of investment, and expressed uncertainty about which investments to make. In Cambodia, firms' greatest concern was access to finance.

Cambodian firms display a strong orientation toward serving the poor. In contrast, few firms in Bangladesh or Benin considered the poor as their target market, and many believed that their policies did not provide the poor with equal access to their service. In all countries, firms believed that costs are beyond the reach of the poor and that no incentives exist to reach these harder markets.

Unsupportive investment climate. In addition to market-related risks, firms face a variety of policy and institutional obstacles. In Bangladesh, the pricing and ownership structures do not seem to allow networks to recover—or even earn a return on—their capital costs, and investment is contingent on government or donor co-financing. As a consequence, private operators appear reluctant to expand networks or sponsor additional networks. In Benin, the main barrier to expansion is the lack of capacity of the public sector in designing appropriately scaled networks and tendering them for private operation and the nature of the leases under which firms operate networks. In Cambodia, the incomplete nature of the legal framework on

urban and semi-urban water supply and lack of clarity and consistency about the rules governing private investment in water networks may be constraining the types of investment that private firms are prepared to make. The challenges associated with acquiring land also dampen operators' interest in investing.

The lack of good physical and financial infrastructure also stifles investment. Firms in all three countries singled out unreliable power supply as a key constraint to doing business. Energy is the single-largest element of operating costs, accounting for 43 percent of average costs in Bangladesh, 45 percent in Benin, and 63 percent in Cambodia. Where networks use diesel fuel (to generate electricity full time or as a back-up or to run intake pumps), energy costs are significantly higher.

The limited reach of the financial sector and the costs of accessing finance also limit firms' ability to invest. In Cambodia, for example, all loans must be collateralized by real estate.

Recommendations

Water sector policies in all three countries recognize the contribution that private provision plays in meeting household needs. But current policies typically still work from a starting point of modifying models of state delivery rather than enabling poor households to interact with private systems. Much more could be done to stimulate the development of efficient markets in which private suppliers are motivated to meet the needs of the poor.

The study offers recommendations in three key areas: stimulating the demand for network services by the poor, improving business viability and business models by removing policy and other impediments to efficient behavior by private firms, and improving the investment climate and the incentives to invest in challenging markets (table 9.1). Because the prevailing models in the three countries span a broad spectrum of approaches, some recommendations are more relevant in some cases than others. They need to be adapted to specific country circumstances and the overall direction of policy toward the water sector.

Table 9.1 Policy Recommendations for Increasing the Provision of Piped Water to the Poor

Policy goal	Recommended action	Actor
<i>Stimulate demand by the poor</i>		
Improve affordability	<p>1. Right size: Design and build assets that are appropriate for small-scale networks, so that cost-recovery prices can be kept as low as possible.</p> <ul style="list-style-type: none"> Realistically assess demand and adopt standards and procurement rules to align network design with it. Modify tendering systems to identify inputs in terms of performance and quality standards rather than by specifying particular brands or suppliers. <p>2. Smooth and subsidize expenditures: experiment with initiatives that enable poor rural households with volatile cash incomes to spread connection payments (and perhaps usage charges) over time.</p> <ul style="list-style-type: none"> Where facilities for cash transfers to the poor already exist, consider providing targeted demand-side support for the extreme poor. Where networks are leased to private operators or involve co-investment by government or donors, consider building into lease contracts or project designs a requirement to offer concessional terms for connections to poor households. Where network construction and operation are completely independent of government and donors, consider delivering support directly to households, rather than trying to impose community service obligations on operators. Develop financing schemes that enable operators to offer customers installment plans for paying for private connection costs. 	Governments, development partners
Establish appropriate standards	<p>3. Help firms to signal water service and quality to the market.</p> <ul style="list-style-type: none"> Identify service and quality service standards and means of achieving them that are both consistent with regulatory capacity and simple enough for consumers to understand. Help firms implement procedures for ensuring water quality and to target information campaigns to their customers. 	Governments, development partners
<i>Improve business viability and business models</i>		
Improve profitability	<p>4. Remove impediments to efficient pricing, without which private operators cannot be financially viable.</p> <ul style="list-style-type: none"> Introduce metering, so that firms are paid for increased usage (Bangladesh). Where tariffs and charges are regulated, recalibrate models to avoid setting tariffs so high that they restrict consumption excessively (Benin). <p>5. Optimize the extent of the network under contract: where contracted-out networks face competition from other publicly owned water sources.</p> <ul style="list-style-type: none"> Assess the feasibility of regulating exclusivity and alternative delivery in network locations (by including public water points in operator contracts with appropriate pricing, for example). Develop regulated arrangements for sharing connections or resale of water to increase consumption and capacity utilization. 	Governments, development partners
Expand private connections	<p>6. Establish incentives for incremental upgrades of existing networks to offer more private connections which provide the convenience consumers strongly value.</p> <ul style="list-style-type: none"> Grant concession contracts or enhanced lease contracts in which the private operator implements publicly funded investment in network expansion/densification (Benin). Improve the planning, marketing, and design of networks so that water points are located where households need them, and promote the use of private connections (Bangladesh and Benin). 	Governments, development partners
Improve supply chains and technical support	<p>7. Improve professional capabilities for the design, construction, and maintenance of small-scale piped water networks.</p> <ul style="list-style-type: none"> Foster the creation of professional associations to train and provide accreditation for consultants who design networks or provide other expertise to small-scale water operators. Support business brokering initiatives that could work with financial institutions to assess the risks and feasibility of network investments by small enterprises. Reduce the size of lots in the public procurement of water infrastructure development, in order to allow local players to compete and build capacity. 	Governments, development partners, the business community

Table 9.1 (Continued)

Policy goal	Recommended action	Actor
<i>Improve the investment climate and sectoral policies</i>		
Provide market intelligence	<p>8. Improve information for potential investors about investment options, so that enterprises are aware of the availability of water resources and market potential in areas outside their current locations of operation.</p> <ul style="list-style-type: none"> • Improve sector investment planning to identify - and publicize - markets with potential for private participation. • Provide technical support to local authorities develop projects that can be taken to market. 	Governments, development partners
Increase access to finance	<p>9. Address the low level of financial inclusion and the limited availability of financing for small water projects.</p> <ul style="list-style-type: none"> • Develop financing facilities to support cash flow-based financing for water projects, including the use of blended funds, guarantees, and cost-sharing arrangements, and provide appropriate project development and appraisal support to financial institutions. • Develop robust loan documentation that is consistent with national legal frameworks, and assist with legal reform and clarification to facilitate market-based financing of and investment in water projects. 	Governments, development partners
Increase access to land and energy	<p>10. Facilitate access to land for private water schemes, and address the high cost and limited and unreliable supply of energy.</p> <ul style="list-style-type: none"> • Where concession law structures are in place use them to bring small-scale water projects to market with provisions for land access and infrastructure development (Cambodia). • Consider offering incentives for generating power for water projects in locations that are poorly served by the grid. 	Governments, development partners
Improve government policy and practice	<p>11. Improve policy clarity and functionality to facilitate provision of piped water in more marginal locations.</p> <ul style="list-style-type: none"> • Prepare operational guidance on the role of the private sector, and move from project to policy based approaches to increase transparency and competition, and avoid distortions created by inconsistency and idiosyncratic subsidization (Bangladesh, Benin, Cambodia). • Improve arrangements for determining tariffs, and introduce incentives for expanding coverage and meeting service standards (Benin). • Where the prevailing model is public-private partnerships, improve incentives for sustainable service delivery by including incentives to expand coverage and meet service standards, improving arrangements for determining fees paid by network operators, tying them to likely revenues and costs, and clarifying responsibilities for repair, replacement and expansion of the network (Bangladesh, Benin). • Where the prevailing model is autonomous private investment, develop a system of competitive tendering of rights in hard to reach or less profitable localities using a more traditional public-private partnership model, and ensure that interventions that stimulate private provision create a level playing field (Cambodia). <p>12. Strengthen dispute-resolution arrangements, the absence of which deters investment.</p> <ul style="list-style-type: none"> • Provide training programs for public and private parties to contracts to improve their understanding of obligations, and introduce mechanisms to support regular business planning and performance review processes as a companion to dispute-resolution arrangements. • Empanel independent reviewers and auditors to help contracting parties resolve disputes. 	Governments, development partners

Endnotes

- 1 Per capita consumption of 40 liters a day is the World Health Organization standard. For many waters users, actual consumption is much lower.
- 2 For evidence, see Kariuki and Schwartz 2005; Triche and others 2006; and Valfrey-Visser and others 2006, among others.
- 3 Per capita consumption of 40 liters a day is the World Health Organization standard. It is applied as a reference in the study countries. Households often purchase only part of their water consumption from networks, getting water from other sources, often at no monetary cost. In Benin, for example, the average household purchases about 4 liters per person per day: in Cambodia, network consumption averages about 35 liters per person per day. In Bangladesh, where connected households pay a flat monthly tariff, consumption of network water averages about 85–114 liters a day, depending on the type of network.
- 4 Of the 57 private firms managing water networks in Benin, 13 manage more than one network. One manages 27 networks, another manages 12.
- 5 The Cambodian firms' sense that the current market is near saturation is supported by a test conducted by the study team on potential returns to scale given current system configurations. It found that a doubling of production would increase costs by 88 percent. This finding suggests that although still potentially benefiting from scale economies, water systems in Cambodia are coming close to constant returns to scale. In contrast, doubling production would increase costs by an estimated 65 percent in Bangladesh and 79 percent in Benin.
- 6 The Doing Business project, managed by the International Finance Corporation and the World Bank, provides objective measures of business regulations and their enforcement for small- and medium-size local firms in 185 economies.

Appendix

Table A.1 Demographic, Geographic, and Socioeconomic Indicators for Bangladesh, Benin, and Cambodia, 2010

Item	Bangladesh	Benin	Cambodia
<i>Demographic and area information</i>			
Population (millions)	150	9	15
Rural population (millions)	107	5	11
Land area (km ²)	14,757	110,620	176,520
<i>Key socioeconomic indicators</i>			
Per capita Gross National Income (GNI) (purchasing parity) (current dollars)	1,649	1,580	2,080
Gini coefficient	32		44.37
Percent of population living on less than US\$2 a day (purchasing power parity)	77	—	17
Percent of population living below national poverty line	32	39 (in 2009)	—
<i>Characteristics of natural water resource</i>			
Annual rainfall (mm)	1,400	700–1,300	1,000–1,500
Rainy season	June–September		
Annual renewable water resources (billion m ³)	105 (in 2011)	26.4	476.1 (in 1999)
Annual freshwater withdrawal (billion m ³)	36 (2011)	0.264	
Main water source for human consumption	Groundwater	Groundwater	—
Main river systems	Ganges-Padma, Brahmaputra-Jamuna, Meghna, Teesta	Niger	Mekong, Tonle Sap
Main problem	Arsenic iron, salinity, overabstraction	No significant problem	Arsenic, high sediment load, turbidity, bacteriological contaminants
<i>Improved drinking water coverage (percent)</i>			
Whole country	81	75	64
Rural areas	80	68	58

Sources: Gini coefficient for Cambodia and percentage of population living below the poverty line in Benin are from country reports. All other demographic and socioeconomic data are from the World Bank Development Indicators, 2013. Data on annual rainfall, the rainy season, the main water source for human consumption, the main river systems, and the main problem are from country reports. Data on improved drinking water coverage are from WHO/UNICEF 2012.

Note: — = Not available. Data are for 2010 except where indicated otherwise.

Table A.2 Characteristics of Surveyed Piped Water Networks and Operators in Bangladesh, Benin, and Cambodia

	Bangladesh	Benin	Cambodia
<i>Average Employment</i>			
Number of full-time employees	2	5	3
Years in operation	5	7	8
Experience of manager (years)	5	8	11
<i>Average Production</i>			
Length of pipe system (km)	7	14	7
Total number of people served	1,504	8,023	3,177
Number of poor people served	274	4,050	N.A
Number of villages served	3	4	6
Number of private connections	196	23	648
Number of shared connections	18	14	0
Annual water production (m ³)	65,887	13,388	46,281
Annual water sales (m ³)	62,376	11,506	40,026
Annual water loss (m ³)	3,511	1,882	6,254
Production efficiency (percent)	18	30	46
Water supply availability (hours/week)	33	86	132
<i>Sources of water for production</i>			
Groundwater (percent)	91	100	19
Ponds/rivers, surface water (percent)	9	0	81
<i>Billing method (percent)</i>			
Flat rate per month	100	0	3
Based on volume consumed	0	100	97

Table A.3 Legal Status of Water System Operators in Bangladesh, Benin, and Cambodia (percent of all enterprises)

Item	Bangladesh	Benin	Cambodia
Registered/licensed	52	96	48
<i>Type of firm</i>			
Shareholding company	0	35	8
Sole proprietorship	13	58	88
Users association	56	0	0
Nonprofit organization	31	4	0
Not legally constituted	0	4	4
Part of larger firm	47	4	6
Independent firm	53	96	94
<i>Network management</i>			
Single-network firm	94	44	83
Multi-network firm	6	56	17

Table A.4 Summary Characteristics of Water System Operators in Bangladesh, Benin, and Cambodia

Country	General characteristics	Business model	Finance and profitability	Outlook on and view of the poor
Bangladesh	<ul style="list-style-type: none"> Estimated 75 schemes operated by 32 firms. 80% are microenterprises 85% are NGOs or users association Few are legally constituted. 	<ul style="list-style-type: none"> Many are NGOs. For 94%, water accounts for more than half of total revenue. 86% of operating cost is labor cost and energy cost. 	<ul style="list-style-type: none"> \$7,000–\$100,000 capitalization. 75% of firms recover operating cost, 45% have negative margins after interest, tax and amortization. 37% of firms keep financial records. Most firms have loans from commercial banks, nonbank financial institutions, or state banks. 	<ul style="list-style-type: none"> 40% plan to invest in current site enhancement. 70% do not view the poor as a target or believe the poor have equal access to water services.
Benin	<ul style="list-style-type: none"> Estimated 120 schemes. 60% are microenterprises, 40% are small. Firms are formally registered single proprietors or shareholding companies. 	<ul style="list-style-type: none"> Consulting and works in water supply; operations of systems. For 44%, water accounts for more than half of total revenue. 60% of networks are operated by single-network firm. 	<ul style="list-style-type: none"> Capitalization for office equipment. Most firms cover full cost, but a large percentage of gross margin is paid as government fees. 90% of firms keep financial records. 76% have bank accounts, 12% have loans through banks. 	<ul style="list-style-type: none"> 75% plan to invest, but only in maintenance and moveable assets. given lease contract. 50% view the poor as a target, slightly more than half believe the poor have equal access to water services.
Cambodia	<ul style="list-style-type: none"> Estimated 140 firms nationally. 70% are microenterprises, 30% are small. 75% not legally constituted but have license or authorization to operate. 	<ul style="list-style-type: none"> Build-own-operate piped water supply. Modular expansion, emphasis on revenue areas and low capital investment inputs. High levels of performance, satisfaction of customers. 70% focus on water as a business. 46% of cost is energy, 32% is depreciation. 	<ul style="list-style-type: none"> \$30,000—\$120,000 capitalization. Most firms recover full costs, with average net margins of 23%. No firms keep financial records. 17% of firms have bank accounts and 23% have loans backed by real estate mortgages. 	<ul style="list-style-type: none"> 20% of firms plan to invest. 93% view the poor as a target customer.

Table A.5 Characteristics of Supply Chains in the Water Sector of Bangladesh, Benin, and Cambodia

Country	Design and technical expertise	Materials supply	Construction	Operations	Technical and business support
Bangladesh	<ul style="list-style-type: none"> Competitive market: about 10 large national consulting companies specialize on water supply; many consultants are also available. 	<ul style="list-style-type: none"> Highly competitive market; local hardware suppliers carry pumps and pipes. 	<ul style="list-style-type: none"> About 100 national construction companies specialize in construction of boreholes. Pipes are available in the capital and in all districts. Business is procured through competitive bidding under public procurement. 	<ul style="list-style-type: none"> Operated largely by communities and NGOs, more recently by the private sector. 	<ul style="list-style-type: none"> Limited. Provided through Department of Public Health Engineering (DPHE) or large NGOs constructing water supply systems.
Benin	<ul style="list-style-type: none"> Semicompetitive: 30 firms in small market; tend to work in consortium. 	<ul style="list-style-type: none"> Most pumps and generators are imported from Europe. Pipes are imported from the region and sourced locally. 	<ul style="list-style-type: none"> 80 national and foreign firms operate independently, involved in general construction. Business is concentrated in public procurement. 	<ul style="list-style-type: none"> Limited skilled labor. Agency risks of standpipe operators. 	<ul style="list-style-type: none"> None
Cambodia	<ul style="list-style-type: none"> Local companies not mature, dominated by international firms catering to government bids; unaffordable to local private sector. 	<ul style="list-style-type: none"> Well-developed competitive markets: three importers of pipes from China and Thailand and new local factory for High Density Polyethylene seem to behave competitively. Pump suppliers at local level are highly competitive. 	<ul style="list-style-type: none"> Competitive in other markets (for example, housing), but water firms tend not to use external construction firms. Many local technicians unspecialized in water. 	<ul style="list-style-type: none"> Excludes foreign firms. 	<ul style="list-style-type: none"> Not developed for water sector, although competitive in more general sectors, such as accounting, information technology.

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