ADB

WATER for ALL SERIES 13

Small Piped Water Networks

Helping Local Entrepreneurs to Invest

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Edited by Charles T. Andrews and Almud Weitz

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Abbreviations

ADB	Asian Development Bank
DCC	Dhaka City Corporation
DWASA	Dhaka Water Supply and Sanitation Authority
GDP	gross domestic product
HC	house connection
HCMC	Ho Chi Minh City
HH	household
hr	hour
km^2	square kilometer
l	liter
m^3	cubic meter
MCWD	Metro Cebu Water District
MDG	Millennium Development Goal
NGO	nongovernment organization
NRW	nonrevenue water
O&M	operation and maintenance
PVC	poly vinyl chloride
RETA	regional technical assistance
SSPWP	small-scale private water provider
WHO	World Health Organization
WSP	Water and Sanitation Program (World Bank)
WTP	willingness to pay
WSS	water supply and sanitation
WU	water utility
WWF	World Water Forum

Note: $ values in this publication are local currency equivalents in US dollars.

Contents

Foreword

This book is about small-scale private water providers in Asian cities and the entrepreneurial potential of small piped network operators. It proposes that city officials, city water utilities, and local banks should work with small network entrepreneurs who can bring water supplies to the poor and disadvantaged immediately, on an agreed interim basis until the water utility is able to.

Published Asian Development Bank (ADB) studies on water in Asian cities in 1993, 1997, and 2004 track the generally disappointing performance of water utilities. Most water utilities in South Asia provide a very intermittent water supply throughout the entire city, whereas water utilities in Southeast Asia typically provide a better quality service, but only to part of the city—leaving many millions of residents entirely unserved. This book reports on the findings of an ADB study examining the role of small water providers in filling these service gaps.

Survey results from the study show that from city to city, 20–50% of residents are customers in informal water markets—they buy all or some of their water from small-scale water providers. The cart-pushing water vendor, the water tanker operator, the neighbor selling water from her well or reselling water from her utility connection, the engineer-turned small piped network operator, and the seller of bottled and barreled water—these are the familiar face of the informal water market in our cities. These local providers are here as long as city water utilities fail in their core mandate to provide continuous 24-hour supplies of clean water by piped connection to every house and business in the city. The survey results show that small providers are not profiteers—they do not exploit. But neither are they efficient and innovative, nor good at quality control. And they mostly do not deliver what people want most and are willing to pay for—a continuous supply to the house. Small private piped water networks are the exception.

The study examines small piped networks through case studies: how and who starts these operations; who they supply, with what, at what cost, and using what technologies; their business and risk management approaches; and what hinders their development. Their relationships with city hall, the city water utility, and the local banks are examined—and are shown to be difficult and limiting. Most important, the case studies show that it is the poor who benefit most when local

entrepreneurs invest risk capital and build and operate piped networks in unserved urban slums and low-income neighborhoods that have been failed by the city water utility.

The study finds strongly in favor of small piped networks, as short- and medium-term providers until the city water utility can expand services to the area.

The book offers practical recommendations to city governments and utilities for getting local water network entrepreneurs to invest. Small piped networks should be included in city development strategies, utilities should work with local entrepreneurs, small networks should be "formalized" with licensing and exit strategies and takeout agreements, minimum standards should recognize risk and pay-back requirements, enabling legal and contractual conditions should be created, and small operators should be integrated into the water supply chain to the extent possible. ADB will join with two or three cities to test and refine these recommendations during 2005–2006.

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Acknowledgments

The Asian Development Bank wishes to thank the small-scale water providers who furnished information to make this publication possible, including Phuc Doan and Hiep An companies of Ho Chi Minh City (Viet Nam); Fernando Miñoza and Virgie Zafra of Cebu and Inpart Engineering of Manila (Philippines); the tankers' association of Kathmandu Valley (Nepal); the pushcart water distributors of Delhi (India); and the independent water bottlers of Shanghai (People's Republic of China).

We are grateful for the support of local consultants in the surveyed cities who collected information and prepared reports on their local informal water markets.

We give special thanks to former ADB staff Maria Paniagua, who initiated and defined this study, and to Marc Vezina for his guidance on approach and methodology.

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Small Piped Water Networks: Helping Local Entrepreneurs to Invest

Introduction

This publication presents findings and recommendations from field research funded by the Asian Development Bank (ADB). Researching small-scale private water providers (SSPWPs) was part of a wider study on "Water in Asian Cities".[1] The SSPWP research investigated and analyzed the role of small providers in eight Asian cities, namely Cebu (Philippines), Delhi (India), Dhaka (Bangladesh), Ho Chi Minh City or HCMC (Viet Nam), Jakarta (Indonesia), Kathmandu (Nepal), Shanghai (People's Republic of China), and Ulaanbaatar (Mongolia).[2] Additionally, one SSPWP in Manila (Philippines) was studied.

Research objectives

The objectives of the SSPWP research were to (i) provide an overview of urban water suppliers beyond formal water utilities, (ii) increase the knowledge about the type of services provided by SSPWPs, (iii) define the profile of the most significant SSPWPs, and (iv) assess the main constraints and potential for SSPWPs.

Methodology

Under the supervision of ADB and a consultant team coordinator, a team of eight local consultants conducted field surveys on the scope and scale of SSPWPs in the eight selected cities.

The study started in mid-August 2002 and field surveys were finished in early January 2003. The field surveys included a household survey to define the water profile of each city. The surveys considered not just SSPWPs but all water services, including utilities, traditional water points, and other water providers set up by community organizations, nongovernment organizations (NGOs), and private operators. Case studies were also undertaken to get in-depth information on specific services provided by selected SSPWPs.

[1] The main study collected and analyzed data on the performance of water utilities in 18 Asian cities (Chengdu, Colombo, Delhi, Dhaka, Ho Chi Minh City, Hong Kong, Jakarta, Karachi, Kathmandu, Kuala Lumpur, Manila, Osaka, Phnom Penh, Seoul, Shanghai, Tashkent, Ulaanbaatar, and Vientiane). ADB published the findings in *Water in Asian Cities: Utilities' Performance and Civil Society Views*. The views of civil society were also collected and synthesized, and are appended to the publication..

[2] The studies were funded under Regional Technical Assistance 6031: *Promoting Effective Water Management Policies and Practices*, 26 April 2002.

Two workshops were organized. The first, held in Bangkok in September 2002, developed a common methodology and concept to facilitate comparison between cities and defined the surveys to develop the city water profiles. The second, held in Manila in November 2003, presented the data of the city water profile surveys conducted in each city and discussed the main objectives of the selected case studies.

The Survey Cities. The eight survey cities (Table 1) were selected in part because they cover the spread of city types in Asian developing countries: (i) the size of the population (ranged from less than 1 million [Cebu, Kathmandu, and Ulaanbaatar] to more than 10 million [Delhi, Dhaka, and Shanghai]), (ii) the surface area covered by the water network (ranged from less than 200 km^2 [Kathmandu] to more than 1,000 km^2 [Delhi, HCMC, Shanghai, and Ulaanbaatar]), and (iii) the population density (ranged from less than 1,000 persons/km^2 [Dhaka and Ulaanbaatar] to more than 5,000 persons/km^2 [Delhi, Jakarta, and Kathmandu]).

The survey of 18 cities under the "Water in Asian Cities" study showed that city water utilities in Asia's developing countries underperform—and have barely improved their services since the previous ADB survey in 1997. South Asian utilities provide extremely intermittent supply within their service areas, while Southeast Asian utilities characteristically provide limited service coverage (Table 2). In 2001, less than 50% of urban residents in Asia were connected to 24-hour water supply. The service level is probably worse than what utilities claim. Applying a more realistic average household (HH) size of 5 persons yields significantly worse service connection figures (Figure 1, for the eight SSPWP survey cities).

Table 3 (page 12) gives additional utility performance information for the eight SSPWP survey cities. Only Shanghai appears to have a well performing formal

Table 1. The 8 Survey Cities

	Cebu	Delhi	Dhaka	HCMC	Jakarta	Kathmandu	Shanghai	Ulaanbaatar
Region	SEA	South Asia	South Asia	GMS	SEA	South Asia	East Asia	Central Asia
Country	Philippines	India	Bangladesh	Viet Nam	Indonesia	Nepal	PRC	Mongolia
Population (in million)	0.655	13.8	10.5	5.3	8.35	1	13	0.74
Growth rate (%)	1.6	3.8	4.2	1.3	2.4	6	< 0	4.5
Surface area (km^2)	326	1,483	360	2,095	660	100	6,340	3,450
Population density (p/km^2)	9.26	9,300	95.3	2,520	12,620	17.57	2,050	13.3
Average GDP ($/y/cap.)	400	810	630	720	366	573	2,000	440

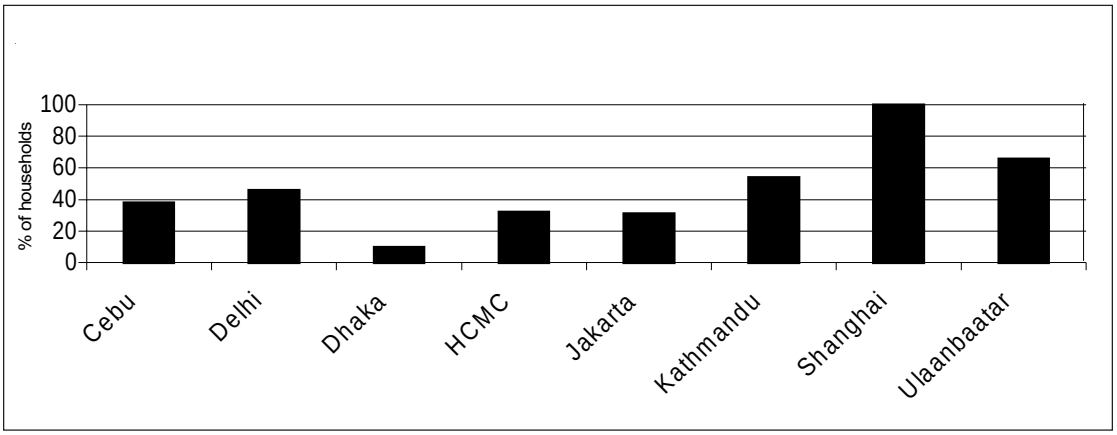
GMS = Greater Mekong Subregion; HCMC = Ho Chi Minh City; PRC = People's Republic of China; SEA = Southeast Asia.
Sources: Local consultants (2002) for data on Delhi, HCMC, Jakarta, and Shanghai; *Urban Indicators for Managing Cities*, ADB (2001) for Cebu, Dhaka, Kathmandu, and Ulaanbaatar.

Table 2. Coverage and Water Availability in 18 Asian Cities (2001)

Country	National GDP ($/capita)	City	Coverage (%)	Supply Continuity[a] (%)
Central and East Asia				
Japan	33,550	Osaka	100	100
People's Republic of China	960	Shanghai	100	100
People's Republic of China	960	Chengdu	83	100
People's Republic of China	24,750	Hong Kong	100	100
Uzbekistan	460	Tashkent	99	100
Southeast Asia				
Malaysia	3,540	Kuala Lumpur	100	100
Republic of Korea	9,930	Seoul	100	100
Philippines	1,020	Manila	58	88
Indonesia	710	Jakarta	51	92
Mekong Region				
Viet Nam	430	Ho Chi Minh City	84	75
Lao People's Democratic Republic	310	Vientiane	63	50
Cambodia	280	Phnom Penh	84	100
South Asia				
Sri Lanka	840	Colombo	69[b]	60
Pakistan	410	Karachi	58	0
India	440	Delhi	69	1
Bangladesh	360	Dhaka	72	0
Nepal	230	Kathmandu	83	0

[a] Percentage of connections served with 24-hour continuous supply.
[b] This does not include about 151,860 people served by 2,531 public taps in tenement gardens.
Source: National GDP. World Bank website. *Water Services: Water in Asian Cities.*

Figure 1. Percentage of Households Connected to Water Utility Network



HCMC = Ho Chi Minh City.
Source: ADB. *Water in Asian Cities* (RETA 6031).

Table 3. Level of Service Provided by Water Utilities in the 8 Selected Cities

	Cebu	Delhi	Dhaka	HCMC	Jakarta	Kathmandu	Shanghai	Ulaanbaatar[a]
Population[b]	720,000	13,800,000	10,500,000	5,300,000	8,350,000	1,000,000	13,000,000	740,000
Name of water utility	Metro Cebu Water District (MCWD)	Delhi Jal Board (DJB)	Dhaka Water Supply and Sewerage Authority (DWASA)	Ho Chi Minh Water Supply Company	Pam Lyonnaise Jaya & Thames Pam Jaya	Nepal Water Supply Corporation (NWSC)	--	Water Utility Company of Ulaanbaatar City (USAG)
Status	Government Corporation	Government Company	Government Corporation	Provincial Company	Private Companies	Government Corporation	Municipal: 2 District: 39 Town: 152	State Enterprise
Nonrevenue water (%)	n/a	53%	40	38	51	37	16	36
Staff per 1,000 connections	n/a	20	11	3.5	5.3	15	5.7	823
% of surface water	Low	83%	2	58	100	62	70	0
% of HHs that have access to piped system	n/a	69%	72	84	51	83	100	49
% of HH connection	35%	65%	10	57	54	71	100	53
No. of connections	51,730	1,375,000	185,000	330,000	610,000	123,000	3,000,000	1,400
Water availability (hours)	18–24	2–4	16	24	18	2–4	24	21
% of HHs with 24-h service	n/a	1%	0%	75	92	0	100	48
Social tariff ($)[c]	0.24	0.03	0.06–0.08	0.11	0.04	0.08	0.12	0.19 downtown 0.5 in *ger*[d] area
Average connection fee ($)	100	2	29	53	9–38	20	83	450

HCMC = Ho Chi Minh City, HH = household.

[a] The situation in Ulaanbaatar is quite unique with collective meters for buildings in the city and standpipes in low-income fringe areas.

[b] Based on local consultants' notes (2002); see Table 2.

[c] From *Asian Water Supplies: Reaching the Urban Poor,* Appendix 1: City Water Profiles and Summary Findings. ADB and International Water Association. 2003 (except for Cebu case studies).

[d] Traditional tent dwelling of Mongolian nomads.

Source: ADB. 2003. Water in Asian Cities: Utilities' Performance and Civil Society Views (except Cebu, % of HH connections, and as noted).

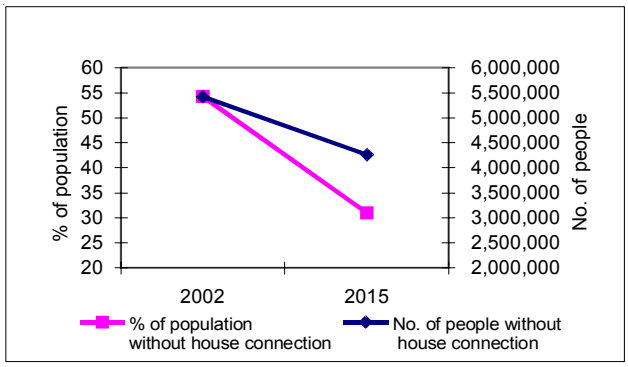
water market. Interestingly, this is achieved with a metro total of 193 separate water utilities. The case of Jakarta shows how difficult it will be to pull back water supply (let alone sanitation) service deficits in low-income cities (Box 1).

Box 1. Jakarta: More than 4 Million People Still Without House Connection in 2015

Based on data provided by the Jakarta Water Supply Regulatory Body for the Water in Asian Cities study (ADB 2003), there are 602,000 individual connections serving a population of around 4,580,000 in metro Jakarta (yielding an unlikely 7.6 persons/connection). Metro Jakarta's population is around 10 million.

With a yearly population growth of around 2.5% and a program to connect each year around 50,000 new customers (10% more than achieved annually during the last 5 years), the percentage of people who will not have an individual connection in 2015 will be 31% compared with 54% in 2002.

In real terms, this means that around 4.3 million metro Jakarta residents in 2015 will still be without water connection compared with 5.4 million today.



Household Survey. To better appreciate the scope and scale of SSPWPs in Asian cities, a common customers' survey was implemented by national consultants in each of the eight selected cities. Around 500 households in each city (except Shanghai[3]) were selected randomly for the sample to represent the different water supply situations present at city scale, within and beyond the area covered by the water utility. The different water supply situations are defined by services provided both by the city water utility and traditional water points. In areas served by the water utility, the main services provided are household connections, standpipes, and tanker services. In areas not served, the main existing services are wells (open and tube wells) where groundwater sources are available.

Representative areas for the survey were selected for each situation, and the size of the sample in each selected area was defined according to the percentage of population living in such areas. Box 2 (next page) shows the approach for Kathmandu.

The survey questionnaire was developed by the project team and adapted by the local consultants to take into account the specificities of their water situation. Due to the limited size of the sample compared with the population living in the eight cities (0.7–14 million), the results are not statistically representative, but provide an estimate of the scope and scale of SSPWPs.

[3] No household survey was carried out in Shanghai where the whole population is connected to pipe systems managed by water utilities. The field survey in Shanghai instead focused on remote and migrant living areas to check possible involvement of SSPWPs. However, no SSPWPs were found.

Box 2. Survey Structure for Kathmandu

Kathmandu and Lalitpur have 57 wards distributed in 8 main areas.

For the survey, 15 wards were selected to represent the different city areas:

(a) Kathmandu Metropolitan Corporation (12):
- Kathmandu Core, 3
- Kathmandu Central, 2
- Kathmandu North, 2
- Kathmandu West, 2
- Kathmandu East, 3

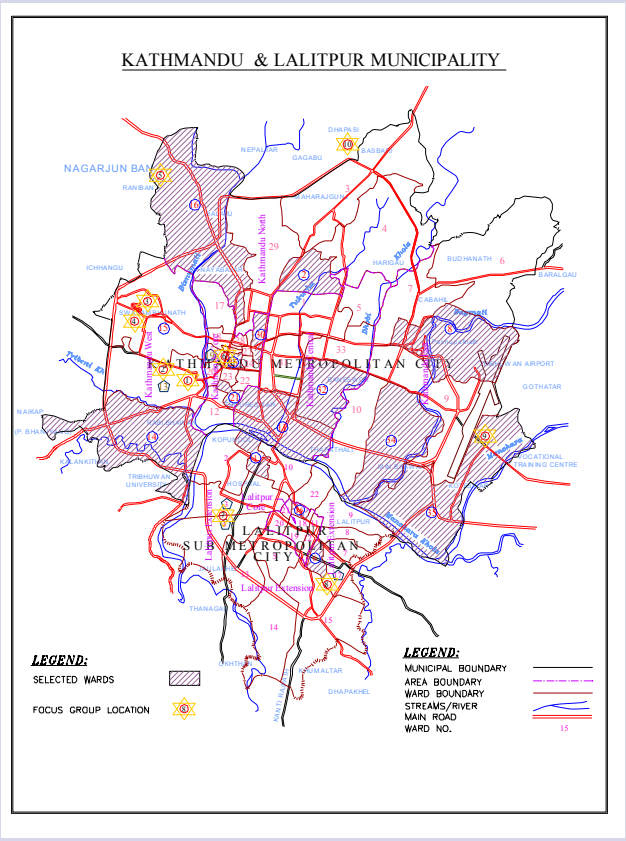
(b) Lalitpur Sub Metropolitan Corporation (3):
- Lalitpur Core, 1
- Lalitpur North, 1
- Lalitpur South, 1

The selected wards cover around 70,000 people. A total of 540 households (HHs) were surveyed.

Methodology followed to select HHs to be surveyed:

1. Enumerator approached the selected ward office.
2. With the support of ward officials, enumerator selected five different categories of areas covered by the utility.
3. Enumerator selected in each of these areas the required numbers of HHs belonging to four income categories and executed the survey.

Due to the very low percentage of HHs surveyed (4% of the selected wards and around 0.3% of total population), 15 focus groups were organized (one in each selected ward) to complement the information collected through interviews.



Source: Local consultant.

Small-Scale Private Water Providers

Small-scale private water providers (SSPWPs) are independent small companies, cooperatives, or individuals that supply water to users. They are independent to the extent that they are self-employed entrepreneurs or artisans. Most work without formal recognition from local authorities and are not subcontracted by the main water utility. Unlike in formalized private-public contracts, the small independent operator enters a market freely, takes risks, and invests without the benefit of any agreement with the public.

The rise of SSPWPs reflects the inability of water utilities to adequately provide for the water and sanitation needs of city dwellers (Table 4). In developing countries, water utilities have rarely achieved universal 24-hour piped water and sanitation services.[4] Millions of people, especially the poor, remain underserved or not served at all because of

- poor and inadequate WSS policies at national and local government levels;
- poor water utilities governance, resulting in inefficient investment and operations frequently rooted in corruption;
- low and irrational tariffs that benefit the nonpoor and disadvantage the poor; and
- legal and other institutional impediments to serving the poor, especially lack of land tenure.

Table 4. Number and Proportion of Urban Dwellers Lacking Provision for Water and Sanitation in 2000

Region	Indicative estimates for the number of urban dwellers without adequate provision for		Proportion of households in major cities connected to piped water and sewers	
	Water	Sanitation	House or Yard Connection for Water (%)	Connected to Sewer (%)
Africa	100–150 million (35–50%)	150–180 million (50–60%)	43	18
Asia	500–700 million (35–50%)	600–800 million (45–60%)	77	45
Latin America and Caribbean	80–120 million (20–30%)	100–150 million (25–40%)	77	35

Source: WHO and UNICEF, *Global Water Supply and Sanitation Assessment 2000 Report*.

Although mandated to serve poor households, water utilities often do not have the know-how to do so. Also, their service levels are often not tailored to demand but are based on technical standards that increase service costs beyond the capacity of low-income families. Moreover, their payment systems are not well adapted to the conditions and constraints of the poor such as irregular income and small consumption capacity.

[4] An insightful and frank discussion of why city water utilities underperform in Asia can be found in *Asian Water Supplies: Reaching the Urban Poor* by Arthur C. McIntosh, Manila, ADB 2003.

International experience shows that SSPWPs, in comparison with water utilities, can be more dynamic in filling the gap between supply and demand and have more incentives to grow and expand their services (Box 3). Be they vendors, tanker truck operators, or managers of small-scale distribution networks, SSPWPs provide a competitive and appropriate service to households that have no access to utility connection.[5] This is evident in Africa, Asia, and Latin America where SSPWPs serve large urban populations. (See Paraguay example, Box 4.)

Profit orientation strengthens SSPWPs. Sustained and motivated by profits, SSPWPs may be longer lasting and more expansionary than cooperatives, NGOs, and other not-for-profit providers.

Box 3. Competition in Water and Sanitation: Efficient Small-Scale Suppliers

The operational efficiency of small private operators compares well with that of large utilities. A study of Haiti and four West African countries reported virtually no water losses among the private operators. It further showed the private firms to have an employee-client ratio of 1:500, one that any utility company would envy. The study in Guatemala compared two private operators of aqueduct and sanitation systems with the state water company. The study found that the investment costs of the two private operators per new customer were lower than the state utility's—20% and 60%, respectively. The private firms' operating costs were also lower, 72% and 77%, and administrative costs again lower, 92% and 95%, respectively.

Source: Tova, Maria Solo. December 1998. *Competition in Water and Sanitation: The Role of Small Scale Entrepreneurs.* Private Sector Viewpoint Note No. 165. The World Bank.

Box 4. Small-Scale Water Providers in Paraguay

An estimated one third of the water connections made in the past 20 years in Asuncion and Ciudad del Este have been provided by *aguateros.* (A typical *aguateria* system supplies a cluster of houses and consists of a well, a pump house, and heavy polyethylene hosing. The system is relatively inexpensive and simple to install.) There are 350–600 independent aguaterias currently operating.They serve about half a million persons and represent an investment of some $30 million, at roughly $250/household.

Development is completely private. The aguatero makes the full investment and assumes all the risks. The customer must pay a connection fee, which is in fact the aguatero's principal income for amortizing the investment. The installations' precarious nature and legal insecurity in the medium term means that the investment must have a short payback, generally within 3 years.

Source: Torayno, Fernando.*Small Scale Water Providers in Paraguay*. Water and Sanitation Program, The World Bank, Working Paper Series, January 1999.

[5] Findings of this research have been summarized in the following papers: *Competition in Water and Sanitation:The Role of Small Scale Entrepreneurs* (Tova, Maria Solo, Private Sector Viewpoint, Note No. 165, December, 1998, The World Bank); *Independent Water and Sanitation Providers in African Cities*: Full Report of a Ten-Country Study (Bernard Collignon and Marc Vezina, 2000).

SSPWPs as defined by the research

For the purpose of the SSPWP research, the project team defined "small-scale private water provider" as having all of the following characteristics:

Small in scale. The provider's infrastructure or installation is not city-wide and covers only a single neighborhood or a part of it. The business has a staff of less than 100 and is, more often than not, owner-managed.

Independent. The provider does not receive any public subsidies or support from NGOs.

Private. Capital investment comes from private sources. Providing water is the main livelihood of the people behind the venture. The business is not driven by external investors.

According to this characterization, community organizations and NGOs that rely on volunteer work and receive financial aid from charities, other NGOs, and donor agencies are not considered SSPWPs.

How SSPWPs supply water

SSPWPs provide water by any of the following means: (i) having customers collect water from the provider's source, (ii) transporting water to customers' homes, (iii) piping water to customers' homes, and (iv) treating and selling water in bottles or barrels.

Having customers collect water from the provider's source. Customers are neighbors who collect water from the provider's dug well, hand pump, or water utility connection. Generally this enterprise requires only a small investment. Income from this is commensurately small and supplements other household income.

Transporting water to customers' homes. From a point source, vendors transport water by vehicle, ranging from a small pushcart to a large tanker truck. Customers provide their own storage or containers. Carters can deliver relatively small volumes (20–200 liters) while trucks can distribute several cubic meters at a time. The required investment varies: from a few dollars for a cart to $10,000 for a tanker truck.

Piping water to customers' homes. Operators of such systems (also called "pioneers") build and run small piped networks with individual connections to customers' homes. The operators either produce the water themselves or buy it in bulk from the water utility. If customers cannot afford a piped connection, the operators can also supply water by hose. Small network operators invest large amounts ($5,000–100,000) for fixed installations. Quality of service is high and matches the expectations of urban users.

Treating and selling water in bottles or barrels. Operators sell potable bottled or barreled water in shops and markets and can also deliver directly to customers' homes. Such operators account for only a small quantity of water supplied to

users. Investment in this type of operation may range from $5,000 to $100,000, depending on the quality of raw water and the technology used to treat it.

SSPWP users

For the purpose of the research, a user is considered to be served by an SSPWP if he or she hires or pays for SSPWP services on a regular basis at least during the dry season when other sources (utility or natural) cannot fill the daily water needs.

Many surveys have shown that water users, including low-income users, will readily pay for

Convenience. Users do not have to travel long distances or waste time queuing for water.

Reliability. They are assured of continuous (uninterrupted) service or, if not continuous, on a regular basis (same time every day); this facilitates housekeeping.

Quantity. They are assured of enough water to cover their needs for daily house chores.

Quality. They are assured of "safe" drinking water and "clean" water for cooking, dishwashing, bathing, and laundry.

Affordability. According to surveys, low-income families are willing to spend around 3–5% of their income on water; they also prefer to pay in small amounts (daily or every few days) and pay connection fees by installment.

Different types of SSPWPs satisfy these demand characteristics to varying degrees (Figure 2). Surveys further show that poorly served households prefer a house connection as their first choice, a private well as their second choice if conditions allow, and a shared connection or community-based model as their third choice depending on the type of management involved.[6] These preferences usually exceed the service available to them (Box 5).

In Cebu (Philippines), residents living in areas not served by the water utility and who get water from vendors or standpipes stated in a survey[7] their criteria for satisfaction: accessibility (> 80%), quality (78%), and affordability (55%). This shows that even among the poor, the top criteria is not affordability but a compromise between accessibility and quality.

[6] Survey in Phialat (Lao People's Democratic Republic), AsiaUrbs Project, BURGEAP, 2001.

[7] The survey was undertaken by V. Verdeil in 2001 as part of a research thesis, Local Water Markets: Practices and Territory of the Water Supply in Metro Cebu, March 2003.

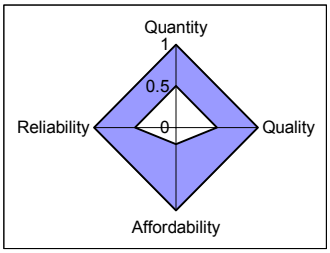
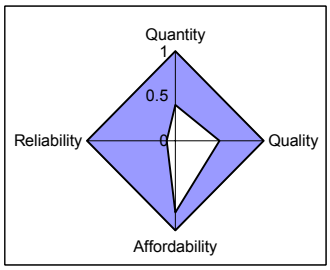
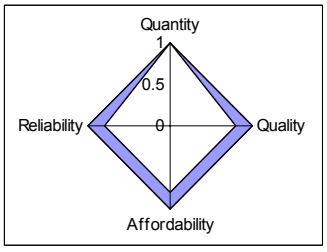
Box 5. Willingness to Pay for Safe Drinking Water in Rural Bangladesh

A field survey carried out during October–December 2001 covered about 2,900 households in rural areas with different water availability situations (high and low water table, coastal area, arsenic issues, etc.). Whatever the water and socioeconomic situations, there is a strong demand for piped water. Willingness to pay (WTP) is around taka (Tk)50 ($0.9)/month for public standpipes compared with Tk90 ($1.5)/month for domestic connections. For the initial capital cost the ratio is around the same with a WTP of $16 for standpipe and $30 for domestic connection.

The estimated mean WTP of all households taken together exceeds the actual operation and maintenance (O&M) costs of supplying piped water. Even the WTP of poor households is on average more than the O&M cost of piped water supply, both for public standpipes and domestic connection.

Source: The World Bank's Water and Sanitation Program, South Asia Region, Field Note, December 2002.

Figure 2. Demand-Response Characteristics of SSPWP Types

TYPE OF SERVICE	CRITERIA	RESPONSE
Pushcart		
	Quantity	Low volume per service (maximum = 200 liters)
	Quality	Depends on water source. Generally water quality deteriorates during transportation.
	Reliability and Convenience	Service is provided at home, generally on request.
	Affordability	Retail water is generally expensive, but actual amounts paid are low due to low quantity served at each time.
Standpipe		
	Quantity	People who fetch water from a point source or standpipe consume less water than those with a house connection (20–30 l/p/d compared to 50 l/p/d)
	Quality	Water from tap is usually safe. Contamination occurs during transport to house.
	Reliability and Convenience	Point source can be located at some distance from home. Standpipes are not open all the time (8–12 hours/day) and users may have to queue. Area around tap is often muddy.
	Affordability	Though cost of having a standpipe attendant inflates the volumetric cost of water, amounts paid remain low due to low volumes.
House Connection		
	Quantity	Users consume as much water as they want if service is reliable.
	Quality	Quality will depend on the source and effectiveness of treatment.
	Reliability/ Convenience	Service design ranges from 24 hours continuous to intermittent (but regular, depending on reliability of electricity supply).
	Affordability	Connection fees range from $15 to $100. Tariffs are generally lower for people connected to a piped system than for those not connected.

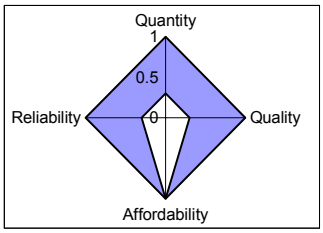
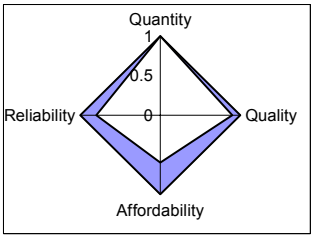
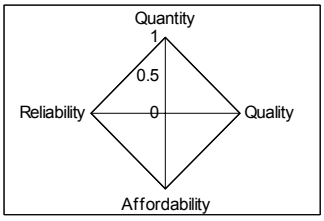
Note: Representations in this Figure were prepared by the study team.

Scope and Scale of SSPWPs in Asian Cities

Around 20% of residents in the selected cities (except Shanghai) regularly get their water from SSPWPs either to (i) supplement unreliable water utility services or groundwater sources during the dry season, or (ii) cover all their water needs.

Figure 3 shows how water utilities in the survey cities respond to the demand characteristics introduced in Figure 2. These significant differences in demand-response characteristics have resulted in a spread of SSPWP opportunities and responses in the eight survey cities.

Figure 3. Demand-Response Characteristics of Utilities

CITY	CRITERIA	RESPONSE
Delhi (similar for Dhaka and Kathmandu)		
	Quantity	Low volume partly due to limited water resources.
	Quality	Water quality is variable due to intermittent supply.
	Reliability and convenience	Only 1% of the population has access to 24-hour service and 70% of households get water for less than 4 hours per day regardless of their income level.
	Affordability	Water tariff is very low: \$0.03/m³ and \$2 for connection.
Ho Chi Minh City (similar for Jakarta and Cebu)		
	Quantity	Households connected to network generally get the expected quantity of water.
	Quality	The water quality generally seems good but is at risk due to high levels of leakage
	Reliability and convenience	Around 75% of customers have 24-hour water supply.
	Affordability	Water tariff: \$0.11/m³ Average connection fee: \$53
Shanghai		
	Quantity	Households connected to network get the expected quantity of water.
	Quality	Water quality is generally good.
	Reliability and convenience	100% of customers have 24-hour water supply.
	Affordability	Water tariff: \$0.12/m³ Average connection fee: \$83, but has been cancelled recently.

Note: Ulaanbaatar was not included as its situation differs substantially from the other cities—all houses and apartments are connected to the network, and informal settlements are served by water kiosks (standpipe).

Table 5. Various Water Situations in the 8 Survey Cities

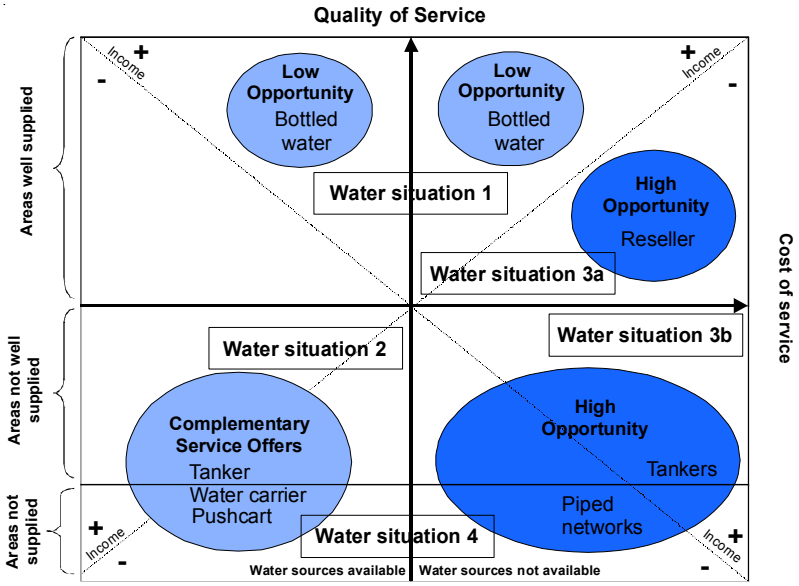
Water Situation	Cities	Utility Coverage	Reliability of Service	Alternative Sources	Income vs. Service Cost	Niche Market for SSPWP
1	Shanghai	High	High	Low	High	**No niche market** except for bottled water
2	Delhi Dhaka Kathmandu	Medium Medium Medium	Low Low Low	High High High	High Medium High	**Competitive market to supplement** the low service provided by water utility (WU)
3	Cebu Ho Chi Minh City Jakarta	Low Low Low	High High High	Medium Medium Medium	Low Low Low	**Supplementary market** for low-income HHs in areas served by WU **Big market opportunities** in areas not served by WU
4	Ulaanbaatar	Low	Low	Low	Low	**Low market opportunities** in *ger* areas due to low accessibility to water resources

SSPWPs and their niche markets

Based on three key variables—quality of water utility service, availability of alternative sources, and household income—four different water supply situations shape the (i) additional demand from water utility customers who don't receive the expected service from the utility, (ii) demand from consumers who live outside the water utility coverage area, (iii) niche market opportunities for different SSPWPs, and (iv) scope and scale of the different SSPWPs (Table 5).

SSPWPs generally develop a business approach based on an appropriate niche to fill the gap between existing supply (water utility and natural water sources) and existing demand. The better the service coverage and the availability of water, the lesser are the niche market opportunities for SSPWPs (Figure 4).

Figure 4. Niche Markets for SSPWPs According to Water Situation

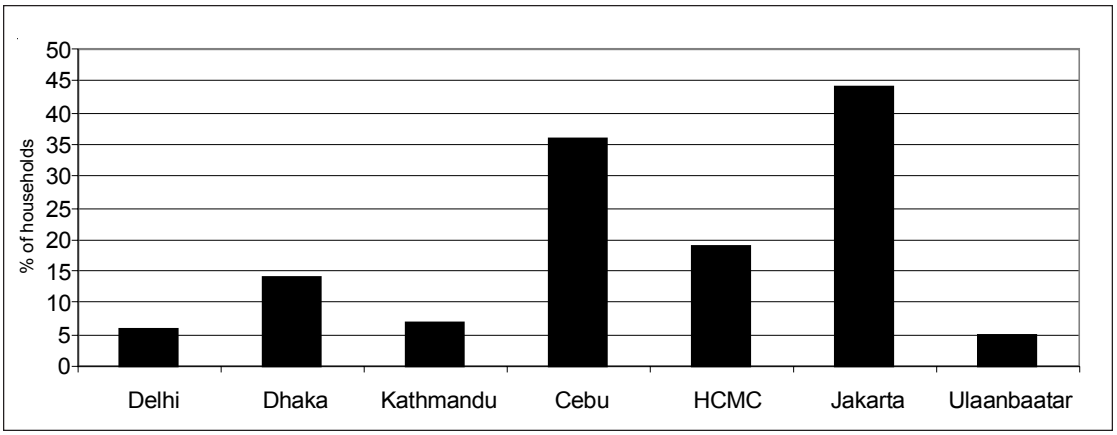


When the quality of service provided by the water utility is good (meaning coverage and reliability are both high), the niche market for SSPWPs is narrow and focused on low-income households who cannot afford a connection (water situation 3a). When the utility's service quality is low, there are more niche market opportunities for SSPWPs. If water sources are available (private wells especially), SSPWPs supplement the utility services and the water source with "safe" water—from water carriers, pushcarts, and tankers (water situation 2). Tankers also have niche opportunities where there are no alternative water sources (water situation 3b); this situation also offers niche opportunities to small piped networks. Bottled water markets align with medium- and high-income households. Water situation 4 characterizes the unserved *ger*[8] areas of Ulaanbaatar, which are located far from water sources and where even poor households rely on tankers.

[8] The *ger* is the traditional circular tent of Mongolian nomads (also called *yurt* outside Mongolia). Informal urban settlements, characterized by a variety of shelter but predominantly *ger* tents, are usually referred to as *ger* areas.

The information in Figure 5 shows the differing importance of SSPWPs between South Asia and Southeast Asia. (See also "SSPWP Activities Differ" on page 25.) The lesser role of SSPWPs in South Asia may be partly explained by the wider availability of alternative, albeit poor, water services, e.g., public standpipes, public tankers.

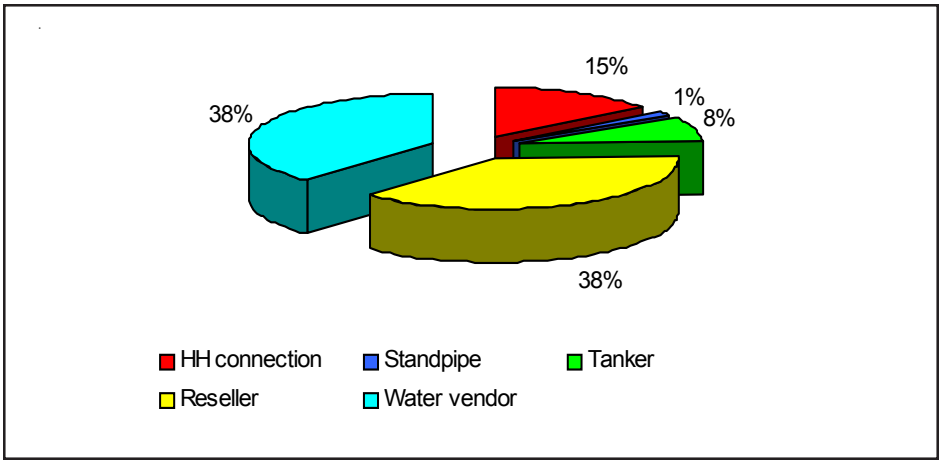
Figure 5. Percentage of Households Served by SSPWPs



Source: SSPWP surveys. Excludes Shanghai.

The survey results have been extrapolated to estimate the relative importance of SSPWP types in the seven cities, as shown in Figure 6. Resellers (those who sell water from their utility connection) and water vendors are the most common types of SSPWP, with each having a 38% share of the households that use SSPWP on a regular basis. These two types serve around 2.5 million people in the surveyed cities.

Figure 6. Percentage of Households Served by Different SSPWPs



Box 6. Small-Scale Bottled and Barreled Water Suppliers in Shanghai

It is estimated that around 700,000 m^3 of water are bottled or barreled in Shanghai every year. Typically, bottled water comes in containers less than 10 liters in capacity and barreled water in containers 10–20 liters in capacity. Shanghai's consumption of bottled and barreled water is much higher than its production since surrounding provinces also supply the city with such water. Bottled and barreled water is mainly consumed by offices and about 40% of households in Shanghai. Demand continues to rise.

There were approximately 100 bottled water suppliers and 300 barreled water suppliers in Shanghai in 2001. Large-scale producers accounted for almost all the bottled water production while small-scale producers accounted for 70–80% of the barreled water production. Typically, small-scale producers have a capacity of less than 30 m^3/d and do only barreling. They account for less than 10% of market share and merely supplement the production of large-scale bottlers.

Small-scale producers offer lower prices than large-scale producers. Small producers reduce costs by avoiding advertising, transporting their product over short distances, and benefiting from government tax breaks. They mainly serve low- to medium-income families. Small bottlers have proliferated because of low investment requirements, easy technology and operation, and limited government supervision.

Quality control by small producers is poorer than that of large producers. Stricter government supervision and control may expel some poorly operated bottlers and barrelers from the market.

Example of a typical small-scale producer in Shanghai:

- Capacity: 0.6–1 m^3/d
- Working staff: 3–4 persons
- Investment: $6,000
- Shipment: bicycle or tricycle
- Households served: 300–500
- Gross value: $12–15/$m^3$
- Net value: $7–10/$m^3$

Source: Zhang Windy, ERM Shanghai.

Because of the increasing demand for potable water, bottlers of drinking water have also become important players. The bottled water business has grown rapidly in the survey cities, particularly in Shanghai (Box 6). Bottled water markets are usually characterized by (i) uncertain quality of the utility's water, (ii) higher income levels of the population, and (iii) increased health awareness. Around 5–20% of residents in the surveyed cities drink bottled water. Bottlers in the survey cities number from 10 to a few hundred and produce around 5–10 m^3 per day per enterprise. These small enterprises use various treatment technologies (from UV ozonation to reverse osmosis) and package their water in containers ranging in size from 1 to 20 liters. They generally sell the bottled water directly to customers near their bottling premises.

Non-SSPWP alternative sources

Aside from SSPWPs, private wells and community systems are also important alternative water sources.

Private Wells (Own Source). Data from the household surveys highlight the importance of private wells (open or equipped with a manual or electric pump) for city households, particularly in areas not served by water utilities. In the seven selected cities, an average 24% of households use wells to cover their daily needs at least partially. In South Asia, well water is readily accessible and is often used by people connected to the utility piped system to supplement poor service.

In Southeast Asia, wells are used mainly by people living in areas not served by water utilities.

Community Systems. People in the survey cities also get their water from community systems: 55% of Dhaka residents access systems developed by NGOs and communities, 15% of Cebu's population get their water from systems built by community organizations, and 22% of Kathmandu's inhabitants fetch water from traditional stone spouts.

In *Dhaka*, NGOs have developed water supply projects aimed at providing better service in low-income informal settlements which make up around 30% of Dhaka's population. These settlements fall under the jurisdiction of the Dhaka Water Supply and Sewerage Authority (DWASA) which has a strict policy on water connections: it only provides connections to applicants on presentation of a "holding number" confirming landownership. Since most slum dwellers are squatters on government land, they cannot fulfill this requirement and are forced to rely mainly on illegal connections established by those who control slum housing. The NGO initiative involved negotiating with the Dhaka City Corporation (DCC) to obtain permission for road cutting and situating water points on DCC land. Under the project design, NGOs are the formal customers of the water utility and generally implement extensions from the main pipe system to the slum areas where they provide water through specific water points.[9] The responsibility for running the services is delegated to a community association who has to pay the DWASA water bills and reimburse the NGOs the cost of setting up the water points (around $750 each). The water tariff to cover charges is around $0.46/m^3, while the official DWASA rate is $0.13/m^3. So far, NGOs have helped set up some 150 water points serving 17,500 families, or 110,000 people. For low-income areas too far for the DWSA network to reach, NGOs have implemented boreholes equipped with hand pumps.

In *Kathmandu*, the traditional urban water supply system of *dhunge dharas* is the primary alternative to the municipal piped supply. The spouts provide an essential source of water for the city's middle- and low-income residents. The existence of this readily accessible public supply alters the dynamics of a water-scarce city, changing it from an environment of drastic inequality to one of varied access for all. Depending on where they live in the city, people spend up to 45 minutes walking to the nearest dhunge dharas, often waiting in line for 6 or more hours. Water for the most part is free but the community may charge small fees for the spouts' maintenance and improvement. However, the lack of effective institutions and resources to undertake this threatens the spouts' sustainability.

[9] Comprising a 3 m^3 underground tank with two suction hand pumps on top, and with separate bathing and washing platforms.

SSPWP activities differ

There are marked differences in the level of SSPWP activity between South Asia and Southeast Asia, as well as between cities and among neighborhoods adequately served and underserved/unserved by water utilities.

Between South Asia and Southeast Asia. In South Asia SSPWPs play a relatively minor role (5–15%). In Delhi, Dhaka, and Kathmandu, SSPWPs co-exist alongside utilities which provide irregular water at low pressure. They also have to compete with alternative sources like utility standpipes and tankers (Delhi), open wells, tube wells with hand pumps, and community standpipes (Dhaka), or traditional stone waterspouts (Kathmandu).

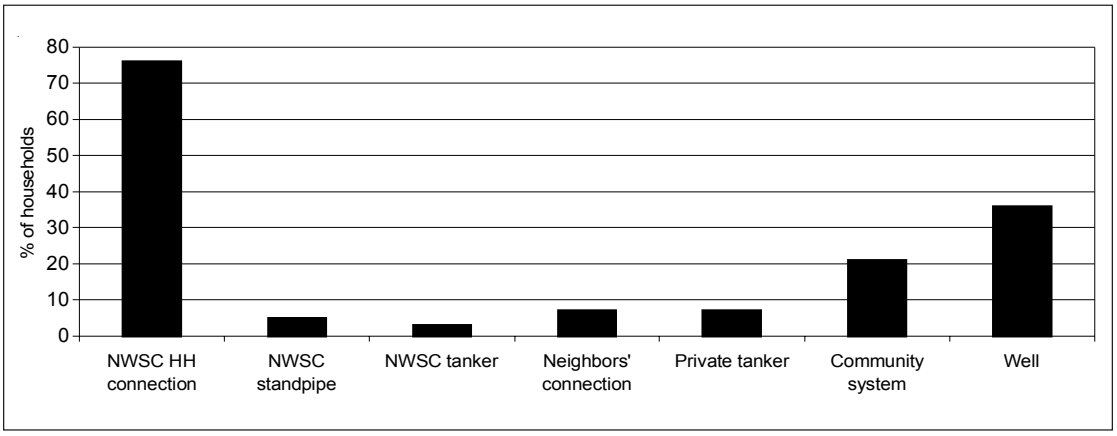
People in these cities develop coping strategies between the different alternatives and diversify their water sources, shifting between suppliers depending on the time of year, cost, reliability, and water quality and quantity to fill their daily needs. Table 6 and Figure 7 show the coping strategies in Kathmandu.

Table 6. Water Dynamics in Kathmandu

Household Income	Source Available				
	NWSC	Tanker	Private Well	Community Well	Dhunge Dhara[a]
High	X	X	X	Rare	Rare
High middle	X	X	X	Rare	Rare
Middle	X	X	X	Rare	X
Low middle	X	X	X	X	X
Low	X	Rare		X	X

[a] Public waterspout.
Source: Yarror Moench, 2001–ISET/NWCF.

Figure 7. Water Supplies Used in Dry Season in Kathmandu



HH = household, NWSC = Nepal Water Supply Corporation.
Source: Household survey under ADB SSPWP study, K. K. Jha, October 2002.

Unlike in South Asia, SSPWPs are vitally important in Southeast Asia, serving 20–45% of city populations. In Cebu, Ho Chi Minh City, and Jakarta, SSPWPs serve two niche markets: (i) areas where utility coverage is lower than 50%, and (ii) communities where low-income families do not connect to the water utility due to perceived high connection fees or monthly billing schedules not suited to their daily income structure.

A household in a Southeast Asian city will use fewer coping options than a counterpart in South Asia. This is because water supply from utilities in Southeast Asia is relatively more reliable and there are fewer standpipes. But the problem in Southeast Asian cities is that millions have no access at all to water utilities.

SSPWPs in Ulaanbaatar only play a minor role even in *ger* areas where the utility only provides standpipes and not house connections. This is mostly due to the difficult access to water sources and the very cold climate, which poses technical and management challenges for piped systems.

Box 7. SSPWP Market Potential in Delhi and Cebu

Delhi: Low Market Opportunities

Measured indicators suggest the Delhi Jal Board (DJB) underperforms and its service is worsening. For example, water supply coverage decreased from 80% in 1997 to around 60% in 2002. Despite low connection fees and cheap tariffs ($0.03/m^3 and $2 for connection fee), 80% of surveyed household respondents rate DJB's water supply services as medium to bad.

Only 1% of the population has access to a 24-hour service, and 70% of the households get water for less than 4 hours per day. About 85% of the households with a DJB connection have on-site water storage, and almost 45% of connected households also have tube wells or hand pumps and/or use water tanker services.

The 40% of Delhi's population without direct access to DJB, mainly living in poor areas not served by the utility, get their water from public standpipes, public tankers, and communal hand pumps. All these services are provided for free. Standpipe pressure is low and water supply is unreliable so that people have to spend many hours to fill their cans.

Despite an ostensibly dire public water supply situation, SSPWP operations in Delhi serve only about 5% of households. Why? DJB's fleet of 1,000 public water tankers is one reason; also groundwater is generally accessible, though diminishing rapidly; and although service levels are poor within service areas, they are expansive and they are cheap. It seems that city dwellers in South Asia will tolerate more than their Southeast Asian counterparts before they turn to SSPWPs for their water supply.

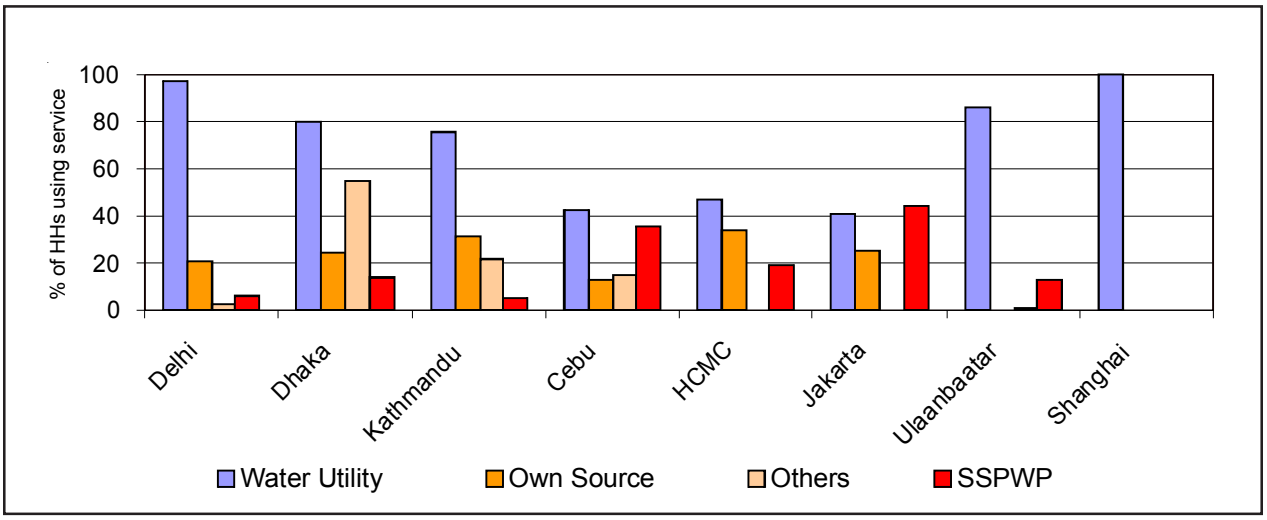
Cebu: A Favorable Situation

Rapid population and economic growth is increasing water stress in Metro Cebu. Metro Cebu's water supply is mostly derived from a groundwater aquifer, which is rapidly depleting and retreating. Meanwhile there are no firm short-term plans to transfer additional surface water supply to Cebu. This water source problem may be one reason why the government-owned Metro Cebu Water District (MCWD) is not encouraging the extension of its piped network, which covers 32% of metropolitan households. In Cebu the requirements to access a connection from MCWD are many and very difficult to meet by most of the 35% of the population who are poor. Would-be customers must pay a $100 connection fee and show evidence of a land title or tax declaration, current residence tax certificate, affidavit of house ownership, plumbing permit, and an identification card before filling out an application form. (See also Boxes 11 and 13.)

Source: Local consultants.

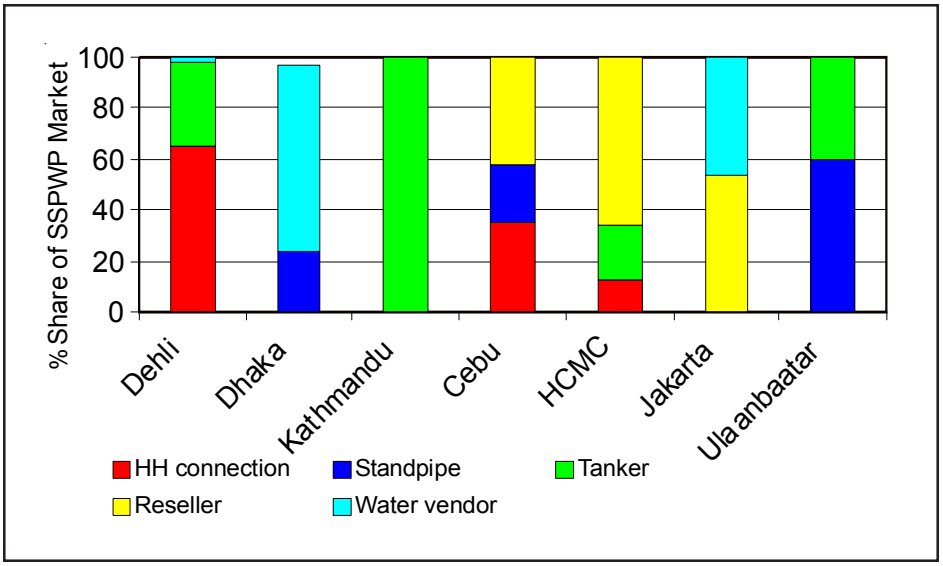
SSPWPs seek and serve niche markets, as illustrated earlier in Figure 4. Where utility service is good and cheap or where there are alternative water sources, the niche market for SSPWPs is small. The scope for SSPWP involvement becomes greater when the utility's service is poor or relatively expensive in an environment with limited alternative sources. The different water situations in Delhi and Cebu have a strong impact on SSPWP market share (Box 7).

Figure 8. Different Water Sources Used at City Level



HCMC = Ho Chi Minh City

Figure 9. SSPWP Services in the Survey Cities (within and outside utility service areas)



HH = household, HCMC = Ho Chi Minh City
Note: Total SSPWP market shares vary from city to city, e.g., 36% in Cebu,6% in Delhi, and 3% in Ulaanbaatar.

Between Cities and Among Neighborhoods. The type and scope of services also differ between and within cities in the same region (Figure 8). Based on the household surveys, a distinction can be made between (i) services provided *within* areas served by water utilities and (ii) services provided *outside* these areas. The distinction contributes at least partially to the different patterns of SSPWP services in the survey cities (Figure 9).

Within areas served by water utilities, the scope of the SSPWPs varies with the level of utility services. In South Asia, where utility service areas are large but services are unreliable, water vendors and tankers are the main private providers but they compete with alternative sources that are often free. Users opt for quick access to additional water to supplement the unreliable utility services.

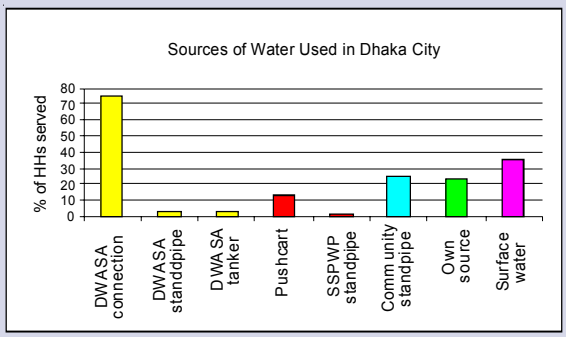
The Dhaka situation (Box 8) illustrates the niche market approach of SSPWPs within utility service areas in South Asia. Water vendors mainly cater to the low- to medium-income customers who can afford to buy hundreds of liters at a time, having limited storage at home. Private tankers—too few to register on the graph in Box 9—cater to the medium- to high-income households who can afford this service and have larger storage tanks (capacity of 5 m^3 or more).

Box 8. Dhaka: A Multi-Service Strategy for DWASA Customers

Due to poor service provided by the Dhaka Water Supply and Sanitation Authority (DWASA), around 70% of customers get additional water from alternative sources. Unexpectedly, around 25% of households with a legal connection also have an illegal DWASA connection. Pushcarts serve around 17% of DWASA customers and charge about \$3.50/m^3 of water, limiting its uses to cooking and drinking.

Around 25% of all households have their own well despite half of them having DWASA connections. Wells are highly favored because they provide relatively high water volumes for most household needs.

Surface water from lakes, ponds, and rivers is another important alternative source for around 12% of households.



Source: Local consultant.

In Southeast Asia, utility service areas are smaller but supplies are more reliable. Resellers and water vendors are the main SSPWPs (Box 9). They use utility water to provide water to low-income households who cannot afford or cannot obtain a utility connection. The resellers and their customers may be neighbors.

In Cebu, SSPWPs within the Metro Cebu Water District (MCWD) service area developed water businesses using their own wells. The operations are sophisticated enough to require registration from local authorities, including from MCWD. This takes place in a varied and competitive informal water market (Box 10). MCWD connects only to households with land titles, thus excluding most of the 35% of the population living below the poverty line. Private operators connect an electric pump and small water tank to their wells enough to serve 3–15 families in the neighborhood. Many systems grew from investments originally intended

Box 9. Resellers in Ho Chi Minh City

Around 12% of urban residents get their water from resellers. Customers are predominantly medium low-income households (70%) who either cannot afford the connection fee or do not have access to the piped system.

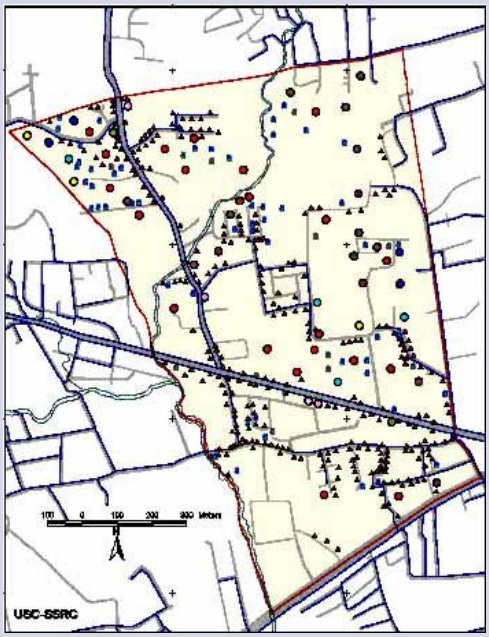
Resellers serve 3–5 neighbors through a secondary meter (locally made at $5–10). They are billed according to the quantity of water used.The average quantity of water bought by the reseller's customers is around half the average consumption of utility customers (17.5 m^3/month compared with 36 m^3/month). The water tariff paid to the resellers is between $0.13 and $0.5/$m^3$. Averaging $0.25/$m^3$, this is around twice the utility's social tariff of $0.11/$m^3$. Ho Chi Minh Water Supply Company (HCMWSC) has developed the following block tariff system based on consumption per capita:

Consumption/month/capita	*Tariff/m^3*
< 4 m^3	$0.11
4–6 m^3	$0.17
6–10 m^3	$0.21
> 10 m^3	$0.27

The utility's block tariff system affects the reseller's tariff, depending on the quantity of water resold. With an average consumption of 36 m^3 and 5 persons/household for those connected to HCMWSC, the consumption per capita is around 7.2 m^3/month at a monthly unit tariff of $0.21/$m^3$. If this customer resells water to 3 neighbors who have a monthly consumption of around 17 m^3, the total monthly consumption is 87 m^3 corresponding to 17 m^3/capita/month. Thus, the water tariff is $0.27/$m^3$. Even with a small margin of a few cents per cubic meter, the water tariff for resellers' customers will be three times more than the social tariff.

Source: Local consultant.

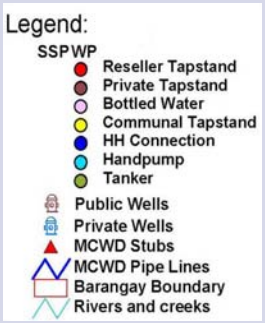
Box 10. Merry Mix of Water Suppliers and Sources for Cebu Community



Barangay Labangon, a community of 5,500 households, is located in an area served by the Metro Cebu Water District (MCWD). Because of connection constraints (household too far from pipe, land title issues, etc.), many private and community systems have been developed and compete against each other. Households in the barangay can freely choose from among various types of water sources: household connection, standpipe (private or communal), and reseller.

- 4 SSPWPs provide household connections servicing from 3–16 households each;
- 14 SSPWPs each serve 5–30 households through private taps;
- 21 resellers each serve 3–30 households through taps; and
- 4 communal standpipes each serve between 35–45 households.

Altogether they serve around 20% of the households in the barangay.



Source: Survey by University of San Carlos (Cebu), December 2002.

to improve only the well owner's water supply. Generally, the operator does not charge a connection fee. Customers pay for plumbing services, water meter, and galvanized iron piping from their house to the operator's house. The average total cost of the materials is approximately $60. Customers pay their bills weekly or monthly.

Outside areas served by water utilities, tankers and water vendors are the most common private providers. Tankers serve mainly high-income households (example in Kathmandu, Box 11). In South Asia, water vendors get their water from free sources (standpipes, traditional waterspouts, or tube wells). In Southeast Asia, many water vendors get their water from standpipes managed by water utilities and pay for the water they fetch. Tankers generally get their water from a natural water source (spring or river).

Box 11. Kathmandu: Private Tankers Serve Industries and High-Income Households

Municipal supply has increasingly struggled to meet the water needs of this city. Because residents have become accustomed to house connection, private tankers have moved in to provide door-to-door water delivery especially when supply from the water utility is low. The tankers mainly serve institutions and high-income households due to their relatively high-priced water ($1.30/$m^3$ compared with $0.08/$m^3$ from the piped system) and the need for large capacity storage on the part of customers. Their clientele is broken down as follows: industries (33%), residences (24%), mineral water plants (13%), hotels/restaurants (11%), hospitals and schools (10%), and offices (9%).

There are at present 35 private tanker operators with 65 tanker trucks doing business in the Kathmandu valley. They supply around 775,000 m^3/year, representing a $1 million turnover at about 10% profit. Medium- and low-income households with little storage capacity are served by smaller tankers (5 m^3). All tanker operators came from the transport sector. As tankers, none of them is registered with the government and thus not subject to price or quality regulations. The leading companies among them have organized themselves into a tankers' association and established water quality standards for the private market but some customers still doubt the quality of their water because of their poor hygiene practices.

Source: Kishore Kumar Jha (Multidisciplinary Consultants Ltd.).

The field surveys revealed the emergence of local private entrepreneurs developing small piped networks outside utility service areas. SSPWPs build and finance the networks themselves and provide direct connections to households. They are most active in Cebu (Box 12), Delhi, Dhaka and Ho Chi Minh City, and serve approximately 750,000–1 million people in the survey cities. The approaches of these private operators are different in each city and are summarized in Table 7.

Box 12. Cebu Piped Network Operator Fills Urban Villagers' Water Needs

Fernando Miñoza, an engineer and entrepreneur with diverse local business interests, developed a small-scale water system in Barangay Barayan. The system started to operate in July 2002.

The owner built the system in response to requests from his employees and their immediate neighbors to provide water to their households. The design of the distribution network and technical standards are similar to those implemented by the Metro Cebu Water District (MCWD) in low-income areas. A 15-m high water reservoir with a capacity of 20 m^3 serves 24 hrs/day water through a main distribution line (a 2-inch, 400-m long galvanized iron pipe). This line is equipped with a series of 1-inch stub-outs to which 1/2-inch metered pipelines are connected. Mr. Minoza obtained the necessary permits from the *barangay* (community), a business permit from the city, and a license from the National Water Resources Board.

In the beginning, the operator encountered problems with some lot owners who refused to grant him right-of-way for the distribution pipes. However, the users themselves managed to convince the lot owners to allow the installation of pipelines at no cost on condition that these be installed underground or only in designated areas.

The owner invested $6,000 to set up the system, inclusive of a water tank. Seventy customers were using the system after a few months. Now, three sitios in Bacayan are served by this system.

Responding to demand, Mr Minoza plans to build another reservoir at Upper Bacayan, and, in the near future, build another system in Pulangbato, a barangay approximately 3 kilometers from Bacayan that is not within the coverage area of MCWD.

The water tariff is $0.75/$m^3$, and the customer is responsible for making the house connection. The customer can either purchase the needed materials (e.g., pipe, meter) from any hardware store, or from the hardware store owned by the operator himself. On average, the total cost of materials is estimated to be $60. The operator does not require any legal or administrative documentation.

Four part-time caretakers oversee the day-to-day operation of the system each servicing approximately 17 clients. The operator believes that, at the moment, the current setup is adequate.

Monthly bills are sent to households who are required to make their payments at the office of the operator, which is located nearby. Those who cannot settle their accounts on time are given a 2-month grace period, after which they are disconnected. But this has never happened.

Randomly-selected consumers, who were asked to comment on the services provided by the operator, all expressed satisfaction. They said that before the system was in place, they had to queue to fetch water from nearby public wells, which was inconvenient and time-consuming.

Customers perceived the operator's tariff to be higher than that of the utility but said that this is something that they would have to live with in the absence of an efficient and adequate water supply system. Nevertheless, they said that they hoped the operator would make an effort to make the water safe and palatable.

Source: Survey done under the direction of Fiscalino Amadora Nolasco, University of San Carlos (Cebu), 2002.

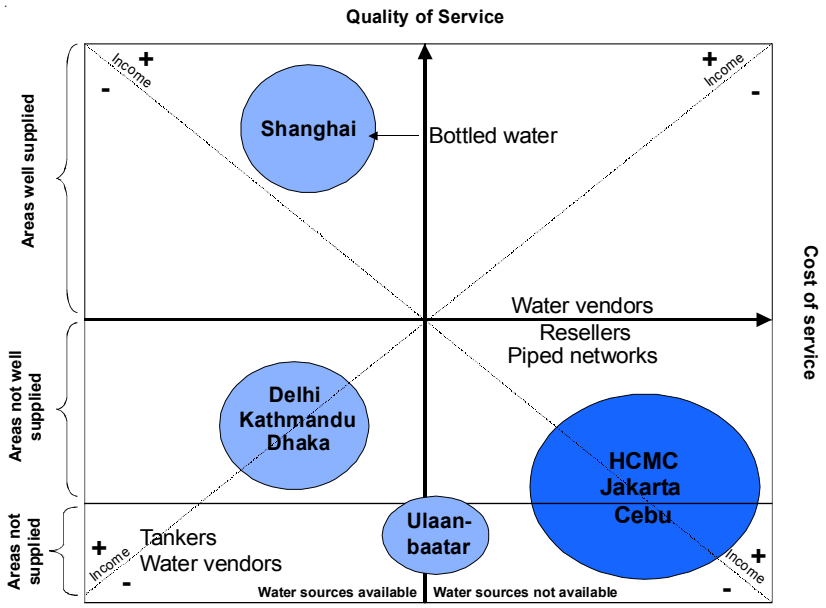
Table 7. Main Characteristics of Small Piped Networks

City	Status	Water Source	Level of Service Provided	Water Quality	Average No. of HHs Served	Approx. No. of Networks in the City
Cebu	Legal	Groundwater	- HH connection 24 hrs/day - Hose connection 3–4 days/week	Untreated	75–100	5
Delhi	Illegal	Groundwater	- HH connection 1–1.5 hrs/day	Untreated	50–700	> 100
Dhaka	Illegal	DWASA (illegal connection)	- Standpipe (99%) - HH connection (1%)	Untreated	9,000	1
Ho Chi Minh City	Legal	Groundwater	- HH connection 24 hrs/day	Treated	100–500	> 20

DWASA = Dhaka Water Supply and Sanitation Authority, HH = household

The study's surveys show a correlation between SSPWP niche operations and the city or neighborhood's utility service and water sources. In areas where the cost of services provided by the water utility is affordable and/or alternative sources are readily available, water vendors and tanker trucks are not present. Relatively well-off households buy bottled water even when the distribution network provides adequate coverage at a reasonable price. In cities where the cost of utility service is high and alternative water sources are not readily available, water vendors, resellers, and piped system operators compete with or supplement the water utility. Figure 10 slots the eight survey cities into the model introduced in Figure 4.

Figure 10. SSPWP Niche Markets in the 8 Cities



HCMC = Ho Chi Minh City

User charges by SSPWP type

SSPWP water user charges vary widely in the survey cities. However, survey results show that this does not indicate profiteering or exploitation on the part of the SSPWPs. SSPWP charges are typically higher than the social tariffs charged by the water utility, which is to be expected given that utilities subsidize their social tariffs with revenues from customers paying higher block tariffs (Table 8). Vendors (pushcart or water carrier) and tankers generally charge the most, due partly to the small volume of water supplied. SSPWPs who have a more efficient ratio of investment to volume of water sold charge less (Figure 11). Piped network operators, who have the highest level of investment, also supply the highest volumes of water.

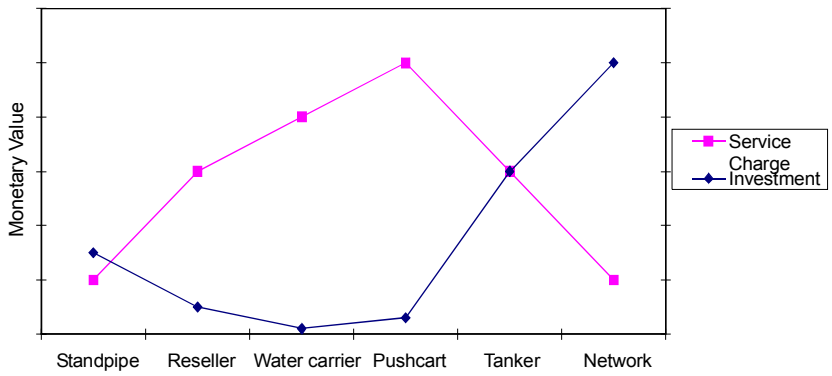
Vendors and resellers operate with short-term investment horizons, hence their investments are small (< $150) and their payback periods short (< 3 months), which is based on daily payments from low-income customers. Their customers

Table 8. Average Water Charges of SSPWPs

City/Country	Percentage of Population Served by SSPWPs	Type of SSPWP and Share of SSPWP Market	Average Water Price ($/m³)	
			SSPWP	Water Utility (Social Tariff)
Cebu/Philippines	36	HH connection (35%) Standpipe (23%) Reseller (42%)	0.5–0.8 1.50 1.50	0.24
Delhi/India	6	HH connection (65%) Tanker (33%) Water vendor (2%)	0.2–0.3 2.00 6.00	0.03
Dhaka/ Bangladesh	14	Water vendor (73%) Standpipe (24%)	0.86 3.50 0.25	0.06–0.08
HCMC/Viet Nam	19	HH connection (12%) Tanker (22%) Reseller (66%)	0.22 0.90 0.60	0.11
Kathmandu/ Nepal	7	Tanker (100%)	1.30	0.08
Shanghai/People's Republic of China	0	No SSPWP	-	0.12
Ulaanbaatar/ Mongolia	5	Standpipe (60%) Tanker (40%)	1.60 1.80	0.19

HCMC = Ho Chi Minh City, HH = household
Source: Survey results.

Figure 11. Charges and Investment Levels for SSPWP



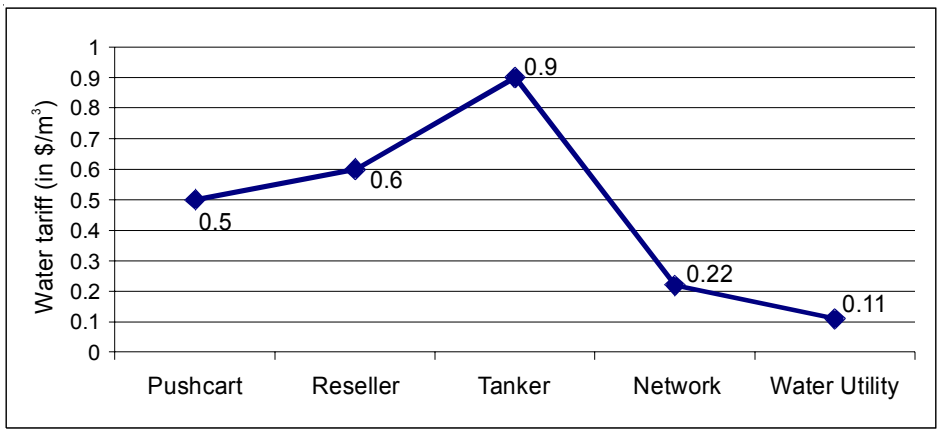
typically earn between $1 and $5 per day and may be day workers or workers without regular wages. Surveyed vendors aim to earn at least $1 per day (Box 13, next page).

Tankers and piped network operators have a mid- to long-term payback horizon and make initial capital investments ranging from $5,000 to $100,000. Investments, which cover water production and either pipe network installation or truck purchase, are committed in a high-risk unregulated environment. An analysis of their business plans indicate a payback period of from 3 years to more than 10 years. Their monthly net profit ranges from $200 to $500, which is similar to the income of their customers.

SSPWP water charges are linked to (i) net revenue targets, which are a factor of invested capital and water sales volume, and (ii) the required investment payback period related to operating risks.

Network operators offer a better service at a lower price than vendors and resellers, but at a higher price than utilities. SSPWP (all types) water supply charges range from \$0.2 to \$3.5/m^3 whereas water charges of small piped networks in the survey cities range from \$0.2 to \$0.8/m^3. SSPWPs' charges in Ho Chi Minh City (Figure 12) are significantly lower than in other cities.

Figure 12. Average SSPWP Water Charges in Ho Chi Minh City



Box 13. Operational Details of Pushcart Providers in Delhi

A pushcart operation is generally a family business engaging three to four family members. Since the water pressure at the standpipe is generally high only at night, one member from each provider's family works all through the night to fill water, and in the morning another takes over. Other family members transport water to the client households. Water is also filled during the day but filling is slow due to low water pressure. Pushcarts charge \$5–6 equivalent per cubic meter. On the face of it, this is expensive water compared with the "free" water from the public standpipe. But only small quantities of water are involved—1–2 m^3 per day per pushcart—and participants in the family pushcart business may earn only \$1–3 for each 10-hour plus working day.

	1st Provider	2nd Provider	3rd Provider
Area	Okhla Vihar	Batlahouse Ext.	A.F. Enclave
Size of settlement (no. of HHs)	800–1,000	1,500– 2,000	2,000–2,500
Age of settlement	18 years	15 years	18 years
Provider living in the locality or not	No, living nearby	Yes	Yes
Since when providing service	Last 10 years	Last 2 years	Last 6 years
No. of clients (HHs)	40	30	50–60
Source of water	Standpipe	Standpipe	Standpipe
Hours of water availability at source/day	8 hours[a]	8 hours[a]	10 hours
Provider's hours of work/day	12–14 hours	8–10 hours	12–14 hours
Quantity of water delivered/day	1,600 to 1,800 liters	1,200 to 1,500 liters	About 2,000 liters
Charges[b] (for 25–40-liter can)	\$ 0.17–20/day	\$ 0.12 to 0.17/day	\$ 0.12 to 0.2/day
Type of vehicle used	Tricycle	Tricycle	Tricycle
Investment	\$30	\$30	\$30
Source of funds	Own funds	Loan	Own funds
Average monthly earnings	\$ 200–300[c] (< \$100/pers)	\$100–200	\$200–300

[a] 4 hours in the morning and 4 hours in the evening.
[b] Depends on the transport distance.
[c] These are generally family enterprises engaging at least three members of a family.
Source: Usha Raghupathi, National Institute of Urban Affairs.

A Closer Look at Small Piped Water Networks

Households seek out water supplies that match price and service level preferences. Theoretically, piped supplies from the city water utility should offer the best fit: except that many Asian water utilities fail in their core business—they do not offer a good quality piped supply, especially to the poor, at any price. Small privately operated piped networks fill the gap created by the failure of city water utilities. Entrepreneurs who own and operate piped networks mimic the water utility business in terms of cost and quality of service. They offer a household connection with similar or more hours of service provided by the utility.

These operators have proven to be efficient, effective and responsive. They are efficient in managing their operations, indicated for example by extremely little non-revenue water. As "locals" they tend to reach low-income families whereas utilities can't or won't. The poor and disadvantaged perceive a lower risk in dealing with the private operator's local "line manager" than with the utility's administrator. Small network operators are more sensitive than utilities are to the faint demand signals coming from low-income households. And these operators are quick acting entrepreneurs. They quickly apply their own resources to a business opportunity, including in low-income neighborhoods.

Network operators are the focus of the case studies in this publication because field surveys highlighted their emerging significance and potential to benefit the poor. Small network operators invest more and conduct business markedly different from vendors and resellers. Table 9 summarizes the water market situations for network operators in Delhi, Dhaka, Ho Chi Minh City, Cebu, and Metro Manila. Table 10 (next page) summarizes their operational characteristics.

Table 9. Water Market Situations for Small Network Operators

	Legal Status	Status with Local Authorities	Water Source	Area Served	No. of Networks	Average No. of HHs Served
Delhi	Illegal	None	Groundwater	Unauthorized colonies	> 100	50–700
Dhaka	Illegal	None	Water from utility network (illegally)	Slum area	1	9,000
Cebu	Legal	Yes (taxes)	Groundwater	Low-income areas within or outside the utility supply area	> 10	15–100
Ho Chi Minh City	Legal	Yes (taxes)	Groundwater	Urban and peri-urban areas	> 20	100–500
Manila	Illegal	Yes (taxes)	Groundwater or from water utility	Low-income areas (slums)	?	Inpart Engineering 35,000

How networks get started

Small network businesses start either as neighborhood self-help schemes or as commercial businesses.

Neighborhood self-help. A household improves its own on-site supply (usually by installing a well pump or pumped tube well) and is approached by neighbors to "share" some of the water with them, either by hose or piped connection

Table 10. Main Characteristics of Service Provided

City	Level of Service	Hours of Service	Water Quality	Connection Fee	Water Tariff	Billing
Delhi	House connection	1–2 hrs/day	Groundwater No treatment	$30–40	$0.27/m^3	Fixed tariff on a monthly basis
Dhaka	House connection	4 hrs/day(2 hrs morning and 2 hrs evening)	Water from utility network	$17	$0.86/m^3	Metered volume on a monthly basis
Dhaka	Standpipe					Volume served
Cebu	House connection	24 hrs/day	Groundwater No treatment	$60	$0.5–0.8/m^3	Metered volume on a monthly basis
Cebu	Hose connection	Few hours every 2 days	Groundwater Not safe	$10	$1.0–1.5/m^3	Volume (served by caretaker) on a weekly basis
Ho Chi Minh City	House connection	24 hrs/day	Groundwater treatment unit	$30	$0.22/m^3	Metered volume on a monthly basis
Manila	House connection	24 hrs/day	Groundwater or from utility network	$30	$0.7/m^3	Metered volume on a daily basis
	Delivery by hose	On request		0	$1.3/m^3	Volume served

(Delhi, Cebu). The water source owner agrees, initially in order to preserve social harmony. Eventually, supplier-customer transactions are structured on a cost-sharing basis that may factor in a small profit for the supplier. Neighbors interested in getting service pay all the connection costs. Consumed water is paid for either at a set price (Delhi, Cebu) or a metered price (Cebu). Depending on water volume available from the source, financial capacity of the owner, and his or her standing with the local authority, the network is usually limited to a few customers—15–20 as in Cebu (Box 14), and 50 as in Delhi.

Box 14. Example of a Cebu Provider: from Standpipe to Household Connections

In 1999, Virgie Zafra installed a standpipe at her home for personal use. Soon her immediate neighbors were asking to fetch water from her pipe which eventually made her decide to sell water. After getting clearance from the *barangay*, authorization from the water utility, and a business permit from the City, she started selling water from a tap to approximately 20 households at about $1.6/m^3. Virgie spent $2,000 to set up her system, inclusive of a water tank (< 2m^3). She was able to raise the investment money partly from the earnings of her husband, an overseas contract worker.

But the business did cost Virgie her home privacy each time customers came to fetch water from the pipe. In 2001, she decided to offer household connections instead. Soon she was servicing 16 household connections. Virgie does not charge her customers a connection fee, only the cost of plumbing services and materials such as iron pipes and water meter. On average, total cost of materials was about $60 and water tariff was $0.5/m^3 in 2002. Her system distributes an estimated 7 m^3 per day (200 m^3/month) and earns a monthly gross profit of about $26 before debt amortization.

Virgie herself sees to the system's day-to-day operation. She relies on a neighbor, an experienced plumber, when technical problems arise. She does the collection herself, on a pre-agreed date.

Commercial business. An entrepreneur develops a water distribution network in an assessed market area. The water source is usually a pumped dug well or tube well. From the outset, the operator offers neighbors connections based on a schedule of connection costs, water price, payment method—either a set payment or payment by volume—and billing periods (Dhaka, Cebu, Ho Chi Minh City, Manila). The size of networks and the number of their customers vary considerably (from 50 in Cebu to several thousands in Manila). The operator takes a predominantly commercial approach, including maximizing market share and achieving a reasonable level of profitability.

These two approaches—*neighborhood self-help* and *commercial business*—respond to distinct driving forces. Self-help schemes appear to be first driven by a desire to improve the living conditions of one's family and then by a need to avoid the disadvantages of selling water from home. The commercial approach is driven by normal entrepreneurial incentives, i.e., return on investment, taking into account assessed market risk, and has particularly strong potential for improving water supply in underserved and disadvantaged urban neighborhoods.

The water network entrepreneur

All network operators studied had some prior entrepreneurial experience. Apart from the owner of Phuc Doan Company in Ho Chi Minh City (Box 15), all operators had civil engineering backgrounds (Table 11). Network operators typically diversified or redirected their businesses to the water supply business as they responded to changes in their core business environment (e.g., the impact of the Asian financial crisis in 1997, property-related issues, increased competition, etc.). Civil engineering businesses readily adapt to the water supply business, which requires concrete superstructures and in-ground works (mainly reservoirs, trenching, and pipe laying). In addition, such businesses are typically adept at negotiating transactions and contracts with local authorities.

Box 15. Phuc Doan Company of Ho Chi Minh City: From Garments to Water Supply Business

The Phuc Doan Company is the first private water company in Ho Chi Minh City. The business is new and distributes piped drinking water in District 12, a fast developing peri-urban area still without paved roads, drainage and sewerage. The area is not served by the city water utility and has good quality groundwater. Its owner decided to switch from the highly competitive garment manufacturing business to the water supply business.

With support from a local engineering company Phuc Doan developed a system capable of 24-hour potable water supply at good pressures. With distribution capacity of 720 m^3/day, it currently distributes only 100 m^3/day. And with a connection capacity of 2,000, it had only connected 400 households as of early 2003. Phuc Doan will have to sustain losses as it works on a steady increase in the number of connections over the next 2–3 years. Phuc Doan also bottles water but the market is highly competitive and the company so far bottles only 10 m^3/d.

Households connected to the network are charged \$0.22/m^3. Actual use is about 250 liters or about 7.5 m^3 per household per month. The company expects growth in both customer and household consumption. House connections cost customers \$33. Company staff delivers bills and collects payments from customers on a monthly basis.

Table 11. Background of Some Small Network Operators

Name of Company	Former or Current Main Business	Decision Point	Amount of Investment	Annual Turnover ($ equivalent)
Inpart Engineering Manila	Civil engineering company < 1998	Asian crisis in 1998	$350,000	$750,000
Fernando Minoza Cebu	Entrepreneur and civil engineering company	In 2002 to serve water to his employees	$10,000	$100,000
Hiep An Ho Chi Minh City	Entrepreneur and civil engineering and real estate	To serve buildings in an area not covered by water utility	$100,000	$10,000
Phuc Doan Ho Chi Minh City	Garment manufacturing	Increased competition in Viet Nam in garment manufacturing	$100,000	$8,000–10,000
Khalil Ahmed Delhi	Shop	Demand of neighbors for water service	$9,500	$10,000

All surveyed investors said they expected to recover their investments (in the areas not served by the water utility) because they are able to take market share away from water vendors. They further said that they were attracted by the monopoly-like conditions of their new businesses unlike the conditions in the highly competitive construction industry. They added that although they expected to make only modest profits in the water business, it offered certainty and stability.

Network investments

The steady growth in network investments reflects a strong business model based on matching level of service with demand and willingness to pay. Much of network operators' investment is in house connections. In Metro Manila, Inpart Engineering invested $350,000 over a period of 5 years in low-income areas. Inpart delivers water to approximately 125,000 persons through piped connections (40%) or through hose connections to house storage tanks (60%). In Ho Chi Minh City, the Hiep An and Phuc Doan companies have invested $80,000 each to produce and treat water that is distributed to 400 households via individual house connections. Small networks each serve fewer than 100 households in Cebu and 50–700 households each in Delhi. The small network in Dhaka serves only 100 households through individual house connections; only 1% of the population is served by SSPWPs as other consumers get water from standpipes.

The small network operators' investment capital comes either from their own equity or loans from friends and family (Box 16). It is significant to note that none of the small operators studied had availed of a bank loan. Bank finance is difficult for them to access because (i) banks won't lend to nonlegal and informal businesses, (ii) banks are skeptical about businesses selling water to poor households, and (iii) water supply systems are not regarded by banks as valuable collateral. Even with more than 25,000 customers served in Manila and good commercial indicators (rate of payment, in particular), Inpart Engineering has failed to convince a single commercial bank that selling water in disadvantaged districts is a bankable enterprise. In the absence of reasonably priced medium-term bank financing, small operators borrow from nonbank lenders at short-term and usurious rates (5–10% per month).

Box 16. Impact of Interest Rate on Business Profit: Example of Inpart Engineering in Manila

Inpart Engineering's owner borrows money from relatives at 5–15% interest per month to raise $50,000–100,000 to implement a typical piped water supply system in low-income areas. For an investment of around $100,000 (around $30–40 per household), Inpart Engineering sells around 30,000 m^3 of water monthly, serving over 3,000 households. The cost of finance is a major component of the water price and greatly impacts profitability.

To illustrate: if, at a given water tariff, a scheme's gross profit would be 13% of turnover if it were financed by a 15% per annum bank loan (including amortization over 5 years), that same scheme would be loss-making if it were financed by a 10% per month interest loan even without amortization.

Network technologies

To reduce investment and operational costs per connection, small networks use low-cost technologies that suit their customer base. The case studies highlighted low-cost innovation, not technical innovation. While network operators use the city utility as their technical model, they usually (i) use cheaper materials (flexible polyethylene, glued PVC instead of cast iron, and commercially available meters), (ii) reduce connection security levels (no antireturn valves and visible meter box), and (iii) simplify pipe laying (shallower trenches, or pipes on the ground or along the walls of houses). They also reduce nontechnical water losses, especially illegal connections.

Networks and utilities: Similarities and differences

Despite similarities with utilities, different commercial philosophies underpin small network businesses. Because they operate in areas close to where they or their relatives live, small operators do not require guarantees or land deeds. This can be an extremely important differentiation particularly in a city like Cebu where the water utility requires many legal documents from prospective customers.[10] Network connection fees are typically lower than utilities': 40% lower in Dhaka ($17 vs. $29) and Cebu ($60 vs. $100) and 400% lower in Manila ($30 vs. $124). This is so because they only cover the bare cost of the connection, generally around $30. In comparison, utility connection costs are typically higher and pricing policy may also include a profit element in the connection fee, resulting in fees from $60 to $100. The Delhi Jal Board fully subsidizes its connection fees and is a lone exception among the survey cities.

Billing System. Most start-up small piped networks adapt the utility model for service level and billing (Table 12). In time, however, their billing arrangements become more flexible than utilities'. Network operators tailor their billing systems to their customers' income characteristics. For example, Inpart Engineering, which supplies mostly slum and low-income areas, collects fees daily through a large network of *aguadors* (water carters). Small operators in Cebu collect weekly or monthly. Few small operators (Ho Chi Minh City and Delhi) follow the water utility practice of billing and collecting monthly. Small operators do not have clear disconnection policies

Table 12. Comparing Service and Billing Approaches of Utilities and Small Networks

City	Level of Service Provided by Water Utility		Level of Service Provided by Small Operators	
	Hours of Service	Billing	Hours of Service	Billing
Delhi	Low 2–4 hrs/day	Fixed tariff	Low 1–2 hrs/day	Fixed tariff
Kathmandu (nearby the city)	Low 2–4 hrs/day	Fixed tariff	Low 1–2 hrs/day	Fixed tariff
Ho Chi Minh City	High 24 hrs/day	Meter	High 18–24 hrs/day	Meter
Cebu	High 18–24 hrs/day	Meter	High 24 hrs/day	Meter

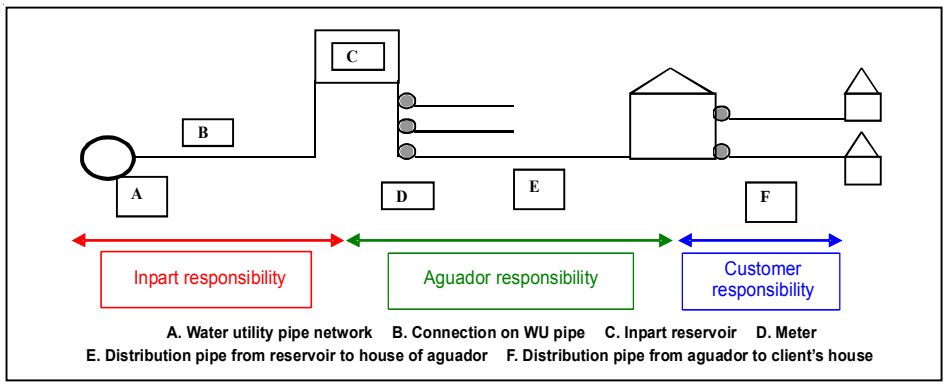
[10] Land title or tax declaration, plumbing permit, residence tax certificate, applicants identification card, and affidavit of house ownership.

and disconnect customers only as a last resort. Delinquencies nonetheless are low because of the agreeable billing and collection scheme.

Risk management. While small operators lack the formal accounting systems and practices used by well-run businesses to limit financial and commercial risks, they make up for it by employing clever operational strategies and tactics such as:

Intermediaries to reduce nonrevenue water (NRW). Small operators usually limit water losses by passing on the risks of technical and nontechnical losses to an intermediary. At the same time, the intermediaries' day-to-day presence on the ground allows the network to be constantly supervised. Inpart Engineering is organized in such a way that all risks of losses are passed on to aguadors whose meters are situated at the head of the network (Figure 13). The "primary network" between the reservoir and the aguador is allocated to him or her and, by installing the meter as close as possible to the reservoir, the aguador controls his or her at-ground connection to the district being served.

Figue 13. Inpart Engineering Operational Set-up



Assurances to reduce political risk. Small operators require some kind of "authorization" from local authorities to develop their schemes. Apart from the required formal approval from the municipality and the utility as in Cebu, small network operators usually depend on close relationships with neighborhood municipal officials and political patrons to obtain the necessary environment of "tolerance" for their operation. This is essential if they are to be allowed to operate within the water utility's exclusive service area. Transaction costs associated with maintaining this "tolerance" are added to the price of water sold. Small operators usually, but not always, avoid dealing directly with utilities who view them as illegal competitors and not potential partners.

Legality and level of service. The study shows that the legal environment for operating small networks influences the level of service offered to customers. This is illustrated in Table 13 comparing Delhi and Ho Chi Minh City. Operating under a legal environment, Ho Chi Minh City's small piped networks have installations technically similar to those of donor-funded small-town piped systems or water utility systems (e.g., having their own water treatment and using buried PVC-piped networks with draining/purging capability); they also employ local engineers experienced in low-cost water treatment. In contrast, operators in Delhi

Table 13. Legal Environment and Small Networks

Delhi	Ho Chi Minh City
Illegal environment	Legal environment
Service: 1–1.5 hrs/day	Service: 24 hrs/day
No meter	Meter
No treatment of water	Treatment of water
Investment: $10/household connected	Investment: $80–100/household connected
Tariff: $0.28/$m^3$	Tariff: $0.22/$m^3$

only drill a borehole and distribute untreated water in galvanized iron pipes laid on the surface; households then make their own (unmetered) connections.

Small piped water networks: The realities

The study results show up several surprising realities about small network operators. Among these: (i) they are rarely innovative, and (ii) they do not make excessive profits.

Network operators are streetwise, but they are rarely inventive. Small network operators are regarded by some to be more innovative than city water utilities. Small operators do offer an appropriate level of service in low-income areas based on low-cost technology. They can effectively calibrate their commercial responses because they know their customers well. But when it comes to technical innovation, the study shows that only one small operator, in Viet Nam, had introduced a genuinely innovative low-cost water treatment technology, yet this was probably developed not by the operator but by local research institutes. As the study indicates, SSPWPs tend to imitate service and technological approaches used by water utilities. Although not particularly inventive, SSPWPs strive to keep installation costs down as a response to (i) risky business environments, (ii) limited own capital, (iii) limited debt finance available, and (iv) limited technical skills. Small operators are savvy managers who handle risks well.

Water network operators do not profiteer. During water shortages and in the absence of effective regulation, water vending can appear to be profiteering. Remove these distortions, however, and SSPWPs strive to reduce costs and prices. The tariff charged by small network operators (in all survey cities) is higher than the water utility's social tariff (Table 14) because SSPWPs cannot cross-subsidize from nonpoor and commercial customers to poor customers since nearly all small network customers are low-income earners.

Table 14: Tariffs of Utilities and Small Network Operators

City	Social Tariff Charged by Utility	Tariff Charged by Small Operators	Comments
Delhi	$0.62/month	$4.2/month	Flat tariff Social tariff is highly subsidized
Dhaka	$0.6–$0.8/month	$0.86/$m^3$	Monthly flat tariff for around 10 m^3
Cebu	$0.24/$m^3$	$0.5–0.8/$m^3$	
HCMC	$0.11/$m^3$	$0.22/$m^3$	
Manila	MWCI: $0.33/$m^3$ MWSI: $0.52/$m^3$	$0.7/$m^3$	High tariff charged by *Inpart Engineering* is due in particular to daily recovery system, which implies high percentage on sales for aguadors (20%)

HCMC = Ho Chi Minh City, MWCI = Manila Water Company, Inc., MWSI = Manila Water Supply, Inc.

The real-life profile of the small network operator working in low-income neighborhoods does not fit the image of a profiteering businessperson. The small operators encountered during the study spoke highly of their social role in serving areas not reached by utilities. Due to the risky legal conditions, however, they said it was necessary for them to structure their pricing to achieve shorter (2–3 year) payback periods. Small water networks' pricing also reflects smaller volume water sales and the absence of external subsidies and soft loans. Significantly, small operators that do have some formal legal status are typically able to comply with requisite technical and quality standards.

Information from the research is insufficient to construct financial operating models for small network operators. However, the case studies indicate gross operating profits of 20–50% of turnover, excluding undisclosed "taxes" and financing costs. The highest profit margins are in Delhi (50% for all the three studied networks) where the business and legal risks are high. Fully authorized small network operators in Manila and Cebu show gross profits from 20% (Inpart Engineering, Manila) to 25–30% in Cebu. Net returns to small operators are similar to mid-range incomes in their cities, which are around $200 per month.

Small network operators care about their water quality. Water quality at source is monitored in Cebu, Delhi, Ho Chi Minh City, and Manila. While they do not have treatment facilities, network operators in Cebu regularly disinfect their elevated tanks and other important equipment. They also advise their customers as to the potability of their water. Ho Chi Minh City network operators take a longer term business view: they allocate about 30% of their total system investment for treatment facilities to fully treat their tube-well water. Many small operators do care about the quality of their water but do not give this the highest priority since customers give higher preference to reliability and convenience of service.

Difficulties resulting from informal status

Administrative, legal, financial, and trading conditions in city water supply markets frequently disadvantage small water networks and other SSPWPs.

Small water network operators are severely hampered by their informal status. Without formal recognition and licensing by local authorities and the city water utility, small networks operate on a commercially precarious footing. This has the effect of inflating business costs and hence water charges. The risk of expropriation forces operators to shorten payback period. Their informal status increases financing costs. Without formal licensing and regulation, small operators must pass on to consumers the cost of bribes and other petty corruption.

The low-cost technology of some small water network operators compromises the level and long-term sustainability of their services. Depending on perceived willingness to pay, unauthorized small operators use low-cost technology and equipment to shorten payback periods. Aside from compromising their services, this also limits their operations to established urban areas where they can get a quick payback on their investment by catering to a larger established market. They cannot achieve the same fast payback from urban fringe locations because the customer base takes time to build. Therefore, they require risk-reducing official recognition and licensing (Table 15).

Table 15. Network Payback Periods Under Different Conditions

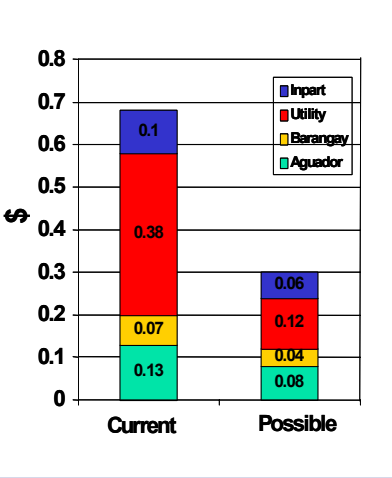
	Without Water Treatment	With Water Treatment
Established Urban	< 3 years	3–7 years
Urban Fringe	3–7 years	7–10 years

The high bulk water charges of the city water utilities penalize small network businesses. Without special negotiated rates, a small network business is charged the rate of a commercial/industrial customer despite its purpose to supply low-income communities (Box 17). Special negotiated rates that entitle the small operator to a lower tier block tariff are rare. Higher bulk water costs are passed on to low-income customers.

Box 17: Impact of Bulk Supply Costs: Example of Inpart Engineering in Manila

Inpart Engineering sources its water from the Manila Water Company, Inc. (MWCI) through a bulk supply arrangement brokered by its client *barangay* (community). The bulk tariff paid by Inpart is over three times the social tariff charged to households by MWCI: $0.38/m^3 equivalent compared with $0.12/m^3 equivalent.

If the bulk meter rate charged to Inpart were $0.12/m^3, it would effectively reduce the final price to consumers by a little more than half—from $0.68 to $0.30/m^3. This assumes that the current negotiated revenue margins to Inpart, the barangay, and the *aguadors* would be retained. Even if reduced overall pricing lessened the volumetric margins remitted to Inpart, MWCI, the barangay, and the aquadors, higher consumption resulting from lower prices might restore aggregate remittances.



Policies and Actions to Support Small Piped Water Networks

Policy recommendations from this study relate only to small private water supply piped networks, which are more efficient than other types of SSPWPs and which are the only form of SSPWP able to give underserved households what they want most and are willing to pay for—a direct house connection to a reliable supply of clean water.

Why support small piped water networks

The right goal: universal 24-hour coverage. Every city in Asia can achieve universal 24-hour piped water supply within the timeframe of the Millennium Development Goals (MDGs)—2015. Achievements in unlikely cities such as Phnom Penh (Cambodia), Male (Maldives), Makassar (Indonesia), and Bangkok (Thailand) show how possible this is—for every city in Asia. Simple financial modeling shows that every major city in Asia could be self-financing its city-wide water supply systems within 5 years. Every city can afford to have every house connected by pipe or hose to a continuously available supply of clean water. Low-income and poor households want to be connected and are willing to pay for the service.

Millions would have to wait 5–10 years to get connected. Water utility service backlogs are so severe in many cities that even with sound policies and leadership millions of families would for many years be struggling to cope with paying 20–30 times more for water than those with a connection, with getting only 20–30 liters per day, and with the daily threat of disease from unsafe water. Small private water networks could connect most of the disadvantaged and at-risk millions almost immediately and supply them with clean water while they remain on the utility's waiting list.

Millions might never get connected. Inevitably, many cities will remain badly managed and water supply backlogs might actually increase. Only small private water networks will get connections to the millions of disadvantaged and at-risk families in these cities.

Protecting utility markets and public revenues. Small piped water supply entrepreneurs can increase water utility profitability, work to guarantee the monopoly rights of utilities and concessionaires, contribute to city hall revenues, and be vote catchers for local politicians—if they are included in water market partnerships. Their role has to be defined, formalized, and monitored. Key to this will in most cases be to accept that small entrepreneurs are filling a gap on an interim basis.

Getting entrepreneurs to invest

Five constraints work against small water network entrepreneurs and put at risk millions of families in Asian cities: (i) investments in small water networks are not included in city development; (ii) laws and regulations outlaw or marginalize small water network entrepreneurs; (iii) city water utilities and concessionaires exclude small entrepreneurs, or ignore them; (iv) water utilities and concessionaires have unfavorable bulk water pricing policies for small entrepreneurs; and (v) commercial banks won't lend for water supply investments. Political will and

adjustments in commercial attitude could quickly minimize these constraints and reduce poverty in Asian cities.

Include small water network investments in city development plans. Small operators can and will help achieve the MDG targets. They could do more if authorities and city water utilities would recognize and help catalyze this potential—to fill service gaps that utilities can do nothing about by themselves in the interim. Integrating small operators in local investment plans would accelerate network expansion.

Utilities and small operators can usefully collaborate. The relative strengths and weaknesses of utilities and small operators underpin tremendous collaborative potential. Utilities can exploit economies of scale to process water relatively cheaply. They also enjoy better financing terms and can deliver piped water at lower cost. However, many utilities are not adept—or competitive—in all segments of a city's water market. While not enjoying economy of scale and financing advantages, small operators still process and deliver water far more cheaply than vendors and truckers. But their main strength is in their ability to manage operating risks particular in low-income neighborhoods. They can profitably serve such areas immediately. The collaborative potential is in two distinct city market segments:

(i) Underserved areas near the utility's primary network, wherein the utility provides bulk water to the small operator for household distribution, on a relatively short-term interim basis.
(ii) Areas outside the utility's network area, wherein the utility may be able to support the small operator with fee-based technical assistance for water treatment and other aspects, possibly on a longer-term interim basis.

Plan for small operators. With proper licensing and regulation, both scenarios could increase the utility's short-run turnover and profitability, while not jeopardizing its longer-term growth. Exit strategies for the small operator are crucial. It may be useful for the local government and the water utility to delineate and declare underserved city/fringe areas where small operators would be encouraged to operate within prescribed parameters. The local government and the water utility could facilitate and guide this process: (i) the local government, acting according to strategic city development and services delivery objectives; and (ii) the water utility, acting according to its WSS mandates and minimum service and performance standards.

In this process, the local government might be responsible for setting the level of service and how local authorities and civil society are to participate in order to arrive at the most appropriate definition of the priority areas. With priorities defined, it would then be important for city and neighborhood authorities and users to come together to establish their expectations on minimum service levels and other aspects, including billing and collection. Monitoring parameters should be agreed, including water pressure, hours of service, quality of water, and so on. The process should enable customer monitoring of service performance, including feedback and reporting mechanisms from the field to local authorities and the regulator, where one exists.

Retain appropriate technical standards. As stated, small operators typically use low-cost technical options in order to limit their exposure and to be able to adapt to demand. It was also noted that in more secure markets, such as in HCMC, small operators apply technical standards close to those used by the water utility, and they follow business plans with longer payback periods (3–10 years, depending on the context). Whatever the legal and regulatory context, small operators compete on the strength of their ability to adapt to local demand characteristics; in formalizing small network operations it would be counterproductive to prescribe overly demanding and rigid standards. Standards should encourage local entrepreneurs and reflect their financial constraints and the willingness to pay of their low-income customers, for instance:

(i) in informal neighborhoods within the existing service area of the utility but still not connected, lower cost technical standards should apply, in particular avoiding trenching (flexible piping along lanes, walls, etc.); and
(ii) in neighborhoods outside the utility service area but likely to be connected in the medium term, technical standards should be close to those of the utility in order to facilitate the network eventually being taken over by the utility.

In this second case there may need to be a take-out agreement or some other kind of financial support from the utility or local government in order for the small operator investment to be viable at an affordable water price to residents. Project financing support could be considered for small operators, since it could leverage local private capital and be structured to include "output-based" incentives.[11]

Enable legal and contractual environment. Small operator-friendly laws, regulations, and concession contracts can be tremendously important for catalyzing local capital and innovation to help serve the poor. The Municipality of Ho Chi Minh City recognizes that local network operators can contribute to meeting coverage targets. It developed a legal framework to "socialize investments" and engage local firms wishing to develop small-scale water networks in Ho Chi Minh City (Box 18).

For concession contracts with small private operators, it would be beneficial to

(i) avoid a rigid definition of monopolistic rights and build in the possibility of working through a third party operator;
(ii) for regulatory purposes, households connected to a small network within the concession area could be "counted" as being served by the concessionaire, thereby encouraging bulk supply-distribution collaboration; and
(iii) avoid a "subrogation" clause whereby the concessionaire is held responsible for the quality of water sold on by local distributors and resellers.

[11] "Output-based," as distinct from "inputs." Output-based indicators might include, for example, connections made, water consumed and accounted for, etc.

Box 18. Legal Framework to Involve SSPWPs in Ho Chi Minh City

Ho Chi Minh City faces two main challenges for improving its water supplies:

1. Inadequate water sources due to rapid population and economic growth since 1990 (developed source capacity is about 30% less than theoretical demand). The shortage is worsened by technical losses increasing from 20% to 30% in recent years; and

2. Rapid expansion of the city with large peri-urban and fringe rural areas not served.

Despite major investment programs, including the acquisition of new water production units, the Ho Chi Minh City Water Supply Company is "running after demand." Over 55% of the city's residents are not served by the utility. Forecasting that many residents would remain unserved for the next 5–10 years and taking notice of the role of small piped network operators, the Municipality decided in December 2001 to develop a legal framework to involve small-scale water providers in helping the City reach its Master Plan target of providing access to clean water to 90% of the population by 2005.

In 2002 the Municipality and the utility prepared a regulation to "socialize" investments in safe water supply, which was proclaimed by the People's Committee in August 2003. This regulation aims to facilitate investment by local private companies to (i) increase water production, (ii) improve the level of service in areas not served by the water utility, and (iii) rehabilitate the pipe network in areas where water leakage is high. Local authorities (from the Department of Public Works, Department of Planning and Investments, and the People's Committee of Districts) identify the areas for the socialization program while the water utility sets the technical specifications.

The regulation defines the (i) types of investment possible, (ii) procedure in shortlisting prospective investors, (iii) rights and responsibilities of investors, and (iv) handover process at the end of the subdelegation contract (2 x 5 years or when the area is reached by the utility network). Private piped network operators have to comply with the technical standards set by the utility.

The regulation is designed to bring the utility and small network operators together. For instance, it requires the utility to give technical, administrative, and materials procurement support. The Municipality, meanwhile, will give the small network operators tax exempt status.

In 2002, the Hiep An Company, a private company based in District 8, entered into a pilot project with the utility for the utility to sell it 700 m^3 of safe water daily. The company invested around $100,000 and serves safe water to around 100 households in District 8. It is currently studying to invest another $100,000 in another district to serve a commercial center and around 200 households.

Formally engage small network operators. Study results point to the possibility of local government and utilities engaging local private water network operators to deliver water at prices that are not inflated by unfavorable legal and business conditions, including

(i) *Direct contracting*. The city government contracts a local private operator to produce and distribute drinking water in a selected area. Special attention would be required for water management issues particularly relating to groundwater abstraction. The operator bears all production (pumping and treatment) and distribution costs.

(ii) *Subdelegation*. The city utility sells water in bulk to a local network owner and operator. The bulk supply pricing could reflect the savings accrued to the utility by foregone capital investment and O&M costs. Presuming a financially rational tariff regime exists for the utility, the bulk supply rate to the small operator could be less than the lowest block tariff to individual customers.

Some basic principles should guide processes for selecting small network operators for such arrangements. Processes should encourage prospective operators who have strengths in dealing with local conditions and challenges, especially in informal settlements. It is also important to match operations scale with the financial capability of operators. Tendering processes should not disadvantage operators who may already have invested in an area. It might sometimes be better to screen and approve proposed systems rather than to tender them, considering technical (past experience, recognized entrepreneurial ability, etc.), financial (investment capacity, etc.), and social (references from recognized local or moral authorities, etc.) criteria. The approval process may be more or less sophisticated depending on the nature of the proposal. Whatever the selection process, it should be transparent and independently regulated.

To encourage small local entrepreneurs who may only be able to operate in one neighborhood at a time, the city government or utility could prepare a list of preferred small network service areas that local entrepreneurs could selectively register their interest in. Existing conditions and service standard parameters would be described for each service area. All this would result from an inclusive and participatory strategic planning program.

Any executed contract or license issued to build and operate a small piped network should include at least the following:

(i) Time-bound coverage and service level targets;
(ii) Water supply pricing and adjustment formula;
(iii) Concession period and exit/takeout undertakings;
(iv) Performance monitoring requirements and criteria, and regulation arrangements; and
(v) Termination clauses.

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ISBN 971561543-0

This publication was produced by the ADB Water Awareness Program.
For more information about ADB's work in the water sector and its "Water for All" policy, please visit us at **www.adb.org.water**.

ISBN: 971-561-543-0
Publication Stock No. 080104
Printed in the Philippines