

71 WSSCC97

Library
IRC International Water
and Sanitation Centre
Tel.: +31 70 30 689 80
Fax: +31 70 35 699 64

*Bridging the Urban-Rural Divide:
Public Water PLC's for Developing Countries*

Okke Braadbaart and Maarten Blokland

Water Sector and Utility Management Group
Sanitary and Environmental Engineering Dept.
IHE, Delft

Paper prepared for WSCC AND ADB Meetings
Manila
November 1997

Draft version II

71 - WSSCC97-14 297

*Bridging the Urban-Rural Divide:
Public Water PLC's for Developing Countries*

As the twentieth century draws to a close, the water supply sector in developing countries faces major challenges. Continuing population growth and rising standards of living mean that safe water is to be supplied to ever increasing numbers of households in increasing quantities. There is widespread mismanagement of existing water supply systems. And fresh water resources are continuously shrinking due to pollution and encroachment.

There is general consensus in the water industry as to what should be done to cope with this situation. Water should be treated as a scarce, and therefore economic, good. It should be carefully managed, priced in accordance with its cost, and allocated in accordance with sectoral priorities.

What is much less clear is how this new water regime is to be put into effect. What mode of water supply sector organisation is most appropriate for this task? Should the water industry be privatised? Should governments limit themselves to regulatory functions or do public water utilities still have a role to play? Should consumers manage their own systems and if so, how? It is these issues we tackle in a forthcoming book preliminary titled Public Water PLC's for Water Supply Management. This paper summarises the book's central argument.

Its main thrust is to provide a correction to the emerging new consensus on appropriate water supply management. By the new consensus we refer to the viewpoint that far-reaching private involvement in water services provision is the optimal form of management for urban and peri-urban areas, whereas rural systems should preferably be managed by user communities. The book argues that, even though basically sound, the policy prescriptions of the new consensus are incomplete. Banking on the private sector may be an appropriate strategy for dealing with developing country mega-cities. And community management may be the appropriate solution for the small settlements that dot the countryside of the developing world. But this still leaves us with the question of what to do with the secondary cities, towns and larger villages that harbour a substantial part of many countries' households.

We hold that **secondary urban nodes are too large for effective user management but too small and too numerous to be privatised**. Privatisation will not work, for one, because the number of qualified private operators is far too small to cover aggregate demand for water services of these nodes. For another, private operators will not be easily attracted to service secondary towns because profit margins are likely to be much lower than in metro cities. Table 1 (see following page) provides a rough indication of the size of this niche of secondary urban

nodes. In 1990, roughly a quarter of the world's population, or 1.2 billion, lived in settlements defined as 'urban' but containing less than 500,000 inhabitants.¹ Of these, approximately 800 million could be found on the Asian, African, and South American continents. Stated differently, a substantial part of the developing country population lives in smaller cities, towns and larger villages.

Table 1 Population distribution by settlement type, 1990

Region	Primary urban nodes (population over 500,000)		Secondary urban nodes (population under 500,000)		Rural settlements	
	absolute, in millions	percentage of total	absolute, in millions	percentage of total	absolute, in millions	percentage of total
Africa	80	13	121	19	431	68
Asia	443	14	571	18	2,175	68
South America	101	34	119	41	73	25
North America	126	43	84	29	82	28
Europe	187	26	333	46	201	28
Oceania	11	41	8	30	8	30
Total	948	18	1,236	24	2,970	58

Source: United Nations (1995)

In terms of sheer numbers of separate municipal units, secondary urban settlements far outnumber primary urban nodes. Whereas the developing areas boasted less than 400 large primary cities in 1990, the number of secondary urban nodes ran into tens of thousands. This means that not only do we face a problem of providing water services to large numbers of consumers but these are also to be provided through a huge number of independent supply systems.

We argue, furthermore, that **publicly owned Public Limited Companies (PLC's) may be an appropriate form of management for such secondary urban nodes.** The 'public water PLC' combines the strengths of market and state governance by offering a combination of private management and public ownership. Under this mode of organisation the water utility is an autonomous for-profit shareholding company with local and provincial government as majority stockholders. Performance-wise, public water PLC's have proven their mettle among industrialised countries, as will be made clear in what follows. However, so far no systematic investigation has been made of the functioning of this mode of organisation and its potential for developing countries. Our aim is to make a start with filling this conspicuous gap.

Modes of Sector Organisation: Overview

EUREAU, the European association of water utilities, distinguishes five main modes of water supply sector organisation. Table 2 presents an adapted version of the EUREAU scheme with six basic modes. Although the scheme has the drawback of being somewhat Eurocentric, it offers a useful shorthand for the discussion of complex water supply organisation issues following below.

Table 2 Water supply sector organisation: six basic modes

Mode of organisation	Who owns the infrastructure?	Who operates the infrastructure?	Legal status of operator	Who owns the shares?
<i>Direct public/ local</i>	Local (municipal) government	Municipal administration	Municipal department	Not applicable
<i>Direct public/ supra-local</i>	National or state/provincial government	National or state government administration	National or state government department	Not applicable
<i>Corporatized Utility (corporation/authority/board)</i>	Government or Utility	The corporatized utility	Parastatal, usually defined by special law	Not applicable
<i>Public-owned Public Limited Company</i>	Government or PLC	A PLC as permanent concessionaire	Public Limited Company	Local/provincial government
<i>Delegated private</i>	Any combination of government agencies	Government and temporary private concessionaire	Public Limited Company	Private shareholders
<i>Direct private</i>	Private agents	Private company	Public Limited Company	Private shareholders

Source: adapted from EUREAU (1992)

The adapted scheme distinguishes six basic modes of water supply sector organisation in terms of: ownership of utility infrastructure, that is treatment plant, network, and other assets; the identity of the system operator; the legal status of the system operator; and the ownership of the shares of the operating company, where applicable.

The terminology introduced here is interchangeable with terms used across the water supply industry. Thus, the direct public/local management mode comprises the municipal waterworks departments found in countries as diverse as Indonesia, the United States, and Spain. It has also recently grown into a dominant form in the transition countries of Central and Eastern Europe. These former central planning have shifted en masse from direct supra-local to direct local government, with some contemplating a further downgrading of central government involvement by introducing delegated private management.

The direct/supra-local management option refers to large government departments, at state/province or national level charged with the management of multiple schemes that serve a large number of municipalities on state or national scale. This form is e.g. found in the State

Public Health Engineering Departments in India.

Corporatized utility describes the prevalent management situation in most developing countries, where one tends to find large organisations, e.g., the State Water Boards in India, the Ghana Water Supply and Sewerage Corporation, or the Provincial Waterworks Authority of Thailand, responsible for water supply and assorted other services on a country or state-wide scale.

Delegated private management describes what is known as the French system of outsourcing construction and O & M activities to private firms. Delegated private management is also the management option currently favoured by the World Bank. In the developing world, it can be found mainly in mega-cities, e.g., Buenos Aires and Manila.

The direct private mode describes what is also known as the British model. More precisely it refers to the current situation in England and Wales, whose water utilities are both privately owned --stocks are traded on the Exchange-- and privately managed.

Finally, the public-owned water PLC refers to a mode of organisation where both the utility's infrastructure and the shares of the water company are owned by local and provincial government representatives while the operator is a PLC, that is, an autonomous for-profit organisation falling under commercial law. The public water PLC is crucially different from French delegated private management in that the operator is owned by public rather than private shareholders. Furthermore, the public water PLC is mostly a permanent concessionaire where its French counterpart is a temporary concession-holder.

The public water PLC also differs from direct public management, and it does so in two important respects: consumer influence and autonomy. First, under the public water PLC structure the utility's consumers have a direct say in strategic decisions, e.g., their representatives must approve of the annual budget, an investment plan, or a proposal to change the tariff. Consumer interests may be exerted in various ways. In the Philippines, five representatives of local interest groups (business, women, and so on) form a Governing Board which meets with the General Manager of the water utility on a regular basis. Umgeni Waterboard in Kwazulu-Natal province, South Africa, works under a similar, if larger, governing board. Under the Dutch system, consumer delegates exercise their power through the Board of Directors and the annual Shareholders Meeting.

Second, unlike direct public management, the public water PLC is always an autonomous for-profit entity. Unlike the municipal waterworks of direct public/local management, it does not form part of the administrative apparatus of a town or village. And unlike direct public/supra-local management, it does not form part of a technical agency such as the Ministry of Water Supply, the Department of Interior Affairs or a Public Works Department.

Public water PLC's are quite common in Western Europe, where they can be found in, e.g., Germany, the Netherlands, Belgium, as well as in the United States, but they are relatively rare in the rest of the world: examples can be found in the Philippines, Chili, and South Africa, among others.

Public Water PLC's: the Dutch Case

The performance of Netherlands water supply utilities is excellent and still improving. Table 3 (see following page), which provides a comparison of the performance of the Dutch water industry with that of four other developed countries, underscores this point. It is evident that in terms of water price, labour productivity (number of connections per utility employee), and maintenance state of the distribution network (as expressed in Unaccounted-for Water), Dutch water utilities are high performers. In addition, the quality of Dutch drinking water conforms to European standards and supply interruptions occur only sporadically if at all.

The public water PLC structure is integral to the success of the Dutch water supply sector. First, all stakeholders --local government, water utility management and employees, and water consumers-- are involved in strategic decision making. Second, utility management has sufficient autonomy to pursue its mandate of commercial policy-making. Before we take a closer look at this system of checks and balances, however, the necessary country and historical background is provided.

Table 3 Comparison of key performance indicators, five industrialised countries

Country	Dominant mode	Water charge, major cities, in ECU ¹	Utility staff per 1,000 connections	Unaccounted-for water ²
Netherlands	Public PLC	172	1.3	5
France	Delegated private	237	4.5 ³	15 ⁴
United Kingdom	Direct private	195	1.0 ⁵	28
Japan	Mixed	181	1.7	11
USA	Mixed	67	2.7	12

1. Average water charge for a family living in a house consuming 200 m³ per annum

2. Water produced minus water legitimately consumed

3. Paris only

4. Bordeaux only

5. Best estimate - 1.86 for water and sewerage

Sources: Cheong (1991); IWSA (1995); VEWIN (1994); Yepes & Dianderas (1996)

Country Context and Evolution of Water Supply

The Dutch, numbering nearly 16 mln, inhabit a surface area of only 40,000 km², making the Netherlands one of the most densely populated countries in the world. International interest in the 'polder model', the Dutch economic model, is on the rise due to remarkable achievements recently made in combating unemployment while maintaining low inflation and interest rates, an expanding

trade surplus, and healthy company profits.

The origins of Dutch public water supply date back to the 19th century. Initially, water supply development was a matter of local, often private, initiative. The report to the King of 1867 described the generally poor condition of water supply throughout the country and stressed the need for a national initiative. This advice was not acted upon, however, and it was not until 40 years later that the national government stepped in. Until such time it was local governments and private entrepreneurs that established piped water supply systems under direct public and direct private management. They did so particularly in the larger and richer municipalities, where attractive rates of return on investment could be achieved. By comparison, the provision of rural municipalities stayed behind.

From 1910 this started to change. At the national level, for the first time funds were allocated for water supply, and in 1913 a national agency, the Royal Institute for Drinking Water (RID), was created to advise and assist with drinking water supply development in the less profitable rural areas, particularly through the establishment of regional water supply systems. This task was to take more than 50 years to be completed. In tandem with restrictive legislation and licensing policies at the provincial level, the RID promoted the development of the regional water supply companies under delegated public management at the expense of other institutional forms.

After World War II rapid economic development and population growth took place. In 1957, a national Water Supply Act came into force. Apart from laying down quality standards and control mechanisms, the law also required the reorganisation of the drinking water sector into larger units able to exercise the required quality control, and face new technical and commercial challenges. Amalgamation of water utilities into larger vertically integrated units under delegated public management was the Governments preferred option, whilst horizontal integration with other utilities and other institutional forms were disfavoured. The governments' intention was to reduce the number of water utilities from more than 200 to around 15. For the intended reorganization to gain the desired speed it took another twenty years, and an amendment of the Water Supply Act (in 1975) that told companies to reorganize voluntarily failing which a Reorganization Plan was to be drawn up and enforced by the Provincial Governments. Now, another twenty years later, the number of companies is down to about thirty, and the goal of fifteen companies is expected to be achieved in another few years.

Table 4 Number and average size of Dutch water supply companies, 1994

Parameter	
No. of companies	35
-PLC's	30
-Other	5
Average size indicators	
-No. of connections	170,300
-Water volume supplied (million m ³)	34.8
-Staff	228

Source: VEWIN (1994)

Present Size, Structure, and Scope of the Dutch Water Industry

As per end 1994, the Netherlands had 35 water utilities, 30 of which were public-owned PLC's and the remainder being under direct public management. The average utility supplies 35 mln m³ annually to 170,000 connections through 3,000 kms of network, and employs 230 staff (see Table 4). The number of water utilities is expected to decrease to about six in 2005. Most water utilities operate independent from other service providers, but an increasing number is integrated with power supply companies. Integration with pollution control boards or water management boards as is common in other countries is not practiced in the Netherlands.

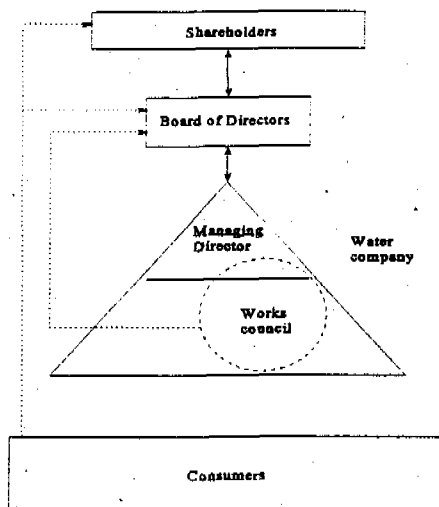
Concerns surrounding the Dutch water utilities focus primarily on source quality. Both surface and ground water quality are threatened by pollution from the highly industrialized and densely populated environment of North Western Europe. Combating pollution at source requires complex cross-national co-operation between countries traversed by the Rhine, Meuse, and Scheldt rivers, all of which flow through the Dutch delta to empty into the North Sea. The Dutch, as downstream recipients of upstream pollution, have played a leading part in this trans-boundary management effort. Furthermore, Dutch water supply companies are investing heavily in advanced treatment processes and experimenting with new technologies for the purification of surface and groundwater.

The First Key to Success: Management Structure

The Netherlands has organised its water supply in what may be called a typically Dutch compromise between private and public concerns. While nominally a private firm with a view to efficiency, each company is controlled by public actors to ensure that the public interest is safeguarded. This is compatible with a general Dutch tendency to pursue controlled economic liberalization - a minimum of state meddling while retaining the ultimate say in the management of a vital good.

Nearly all water companies are constituted as a 'Naamloze Vennootschap' (N.V.), equivalent to the British Public Limited Company (PLC), the American Stock Corporation, or the French Société Anonyme. In the Netherlands, the shareholders of the water supply companies are municipalities joined in some cases by the provincial government. Let us review the formal set-up of this structure and its functioning. By law, the PLC's management structure consists of a Managing Director, a Board of Directors, a Shareholders' Meeting and a Works Council. The powers of each of the actors are set by law, and further defined in the company bye-laws drawn up before a public notary. The powers are complementary and as such there are no strict hierarchical relations between the actors. Extensive powers are bestowed on the Managing Director, who is the company's legal representative with full responsibility for its operations. The Board of Directors meets the MD every two months and is charged with the supervision of and counselling of the Managing Director, as well as with the approval of important management decisions concerning investments, staff, take-overs and mergers, and so on, as defined in the bye-laws.

Figure 1 Management structure of Dutch public limited water supply companies



The shareholders of a water supply company meet with the MD and the BoD twice yearly. It is charged with the approval of the Annual Report, the rolling Five Year Plan, and the tariffs, the amendment of the bye-laws, and changes in company activities and structure. The Works Council, finally, is empowered to be informed on nearly all matters affecting the company, and has powers to advise, initiate, and concur on matters of direct concern to the company's employees.

The composition of the different bodies differs from one company to the other. Generally speaking the Managing Director, appointed by Shareholders or the Board, is a professional engineer, lawyer or administrator, and tends to be recruited externally. The Board of Directors numbers between five and 15 persons and is generally made up of public representatives. The Board members are appointed either by the Shareholders or by the Board members themselves. Between 25 and

50 mayors and aldermen represent the municipal (and provincial) shareholders.

This structure, in the first place, produces a clear division of responsibilities within the management structure. The Managing Director is in the driver's seat and carries the responsibility of running the business. Second, the other players respect the Managing Director, but hold considerable powers that force him to anticipate their position and co-opt their opinions in preparing his policies and decisions. Third, the Board and Shareholders are largely public representatives and will, in their dealings with the company, consider both company and public interest.

The Second Key: Water Supply as Commercial Business

The drinking water sector in the Netherlands has an annual turnover of Nlg.3,400 mln, made up of Nlg.2,400 mln operating expenses and Nlg.1,000 mln of investments (1995, exchange rate at US\$1=Nlg.1,75). Operating expenses are recovered in full from the consumers and investments are financed largely through loans. State subsidisation of operating and investment expenditures is unknown in the Netherlands: the companies rely entirely on their consumers and commercial banks for their financial operations. Let us investigate the cost structure of Dutch water PLC's to see how they treat their consumers and access the financial market.

Table 5 Breakdown of 1995 operating costs of two Dutch water supply companies

Item	Friesland Water Co.		Limburg Water Co.	
	Nlg. x 10 ⁶	%	Nlg. x 10 ⁶	%
<i>Direct costs</i>				
Personnel	27	26	37	20
Other	21	20	49	27
Subtotal	48	45	93	47
<i>Indirect costs</i>				
Depreciation	24	23	31	17
Interest	18	17	39	21
Groundwater tax	16	15	27	15
Subtotal	58	55	97	53
<i>Total</i>	107	100	183	100

Exchange rate: US\$1=Nlg.1,75

Source: primary data, annual reports

Operating costs. The components of operating cost are defined by private company law and consist of indirect cost such as interest payments, depreciation and environmental levies, and

direct cost related to the actual production, distribution and sales of drinking water, consisting of expenditures on staff, energy, chemicals, services, etc. Typically, indirect operating cost represents between 50 and 55% of operating expenditure. The balance of direct operating costs consists of personnel (20%) and other costs (25 to 30%).

Looking at cost allocation by activity, production and distribution costs are at 40 to 45% each, sales account for about 5%, and overheads for about 10%. The distribution of labour costs over the key activities shows that about half the personnel cost is in distribution, a quarter in production and the remainder in sales and overheads.

Cost control. Given their similar magnitudes, cost control is equally concerned with indirect and direct operating costs. Measures to control the indirect cost component include, among others, renegotiation of commercial loans during periods of low interest; structural improvement of key financial indicators to obtain favourable loan conditions; careful planning and cost-conscious design of new works to reduce and/or postpone interest payments and to lower depreciation cost. Efficiency improvement on direct operational costs include such measures as reorganisation, reduction of permanent and temporary staff; improved logistics; setting time and/or cost standards for routine operations; adapted maintenance guidelines and procedures; use of cheaper materials; changes in criteria for meter replacement and overhauling, mains renewal, and equipment overhauling; professionalisation of procurement of goods and services; improved budgeting and cost control.

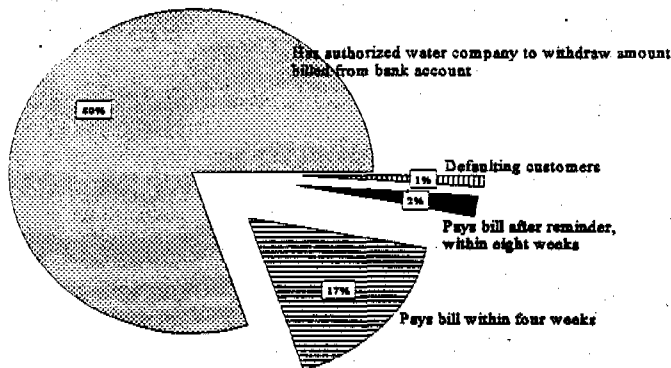
Customer relations. As it is the consumer who foots the bill for the entire operating budget of the company, it is but natural that (s)he gets the attention (s)he deserves. To illustrate, one water

company has set up Customer Information Centre as a single intake point where consumers can lodge complaints and obtain information on the spot on any relevant matter. The centre is facilitated by a computerised Customer Information System that allows prompt and accurate reactions to consumer queries.

Billing and collection. Out of 26 water utilities, 23 have metered all their connections, and bill the consumers a standing charge plus a fixed amount for each m³ consumed.

Large consumers are treated somewhat differently to promote cost-effective use of water supply infrastructure: customers showing peak drawoffs are charged in excess of the standard m³ price and those able to avoid peak withdrawals get water at a lower m³ price. Meter reading and billing practices vary from one company to the other. The company we investigated for this purpose bills

Chart 1 Collection Efficiency at Water Company East Brabant: Disciplined Customers



its customers four times a year. Three invoices concern advance payments and the last invoice, sent at year-end, is a settled billed based on a meter reading.

Investment. The other important party to the financial operations of the company is the financier providing capital for investments. Traditionally, commercial banks, insurance companies and pension funds have lent money to the water supply companies on favorable terms, on account of the water sector's low-risk profile: the combination of a government-supported monopoly, municipal/provincial ownership and steady demand guarantees a stable and reliable return on their investment. The recent upturn in investments and associated demands for capital that was originated by the upscaling process, the increasing cost of treating water and the recent product diversification drive have caused investors to rethink their strategies, however. As a result, water supply companies are increasingly concerning themselves with financial performance standards such as solvency and profitability ratios, and aim to achieve a performance that is more in step with private sector standards.

Dutch Public Water PLC's: Assessment

The main advantage of the Dutch public PLC structure is the combined strengths of public oversight and private management that it offers. Its strengths may be summed up as follows:

- under delegated public management there clearly is only one captain on the ship, the Managing Director, who carries all executive powers.
- the private limited structure provides a proven system of checks and balances between the main actors, i.e. the Managing Director, the Board Members, the Shareholders and the Employees.
- the fact that the Shareholders and Board Members are public office-holders makes it difficult to abuse the utility's monopoly power as these functionaries are inherently focused on both the wellbeing of the enterprise and that of the consumer.
- the public Shareholders and Board Members are municipal representatives and directly accountable to their constituents.
- the application of the PLC format provides for a commercial orientation of the company and its workers.
- the water company cannot turn to the government for the funding of its recurrent and/or capital requirements.
- for this reason the company cannot but charge the real cost of the product to the consumer; this encourages cost consciousness and consumer orientedness.
- dependence on the financial market for investment loans forces the companies to comply with industrial standards of financial performance.
- their twin dependence on consumers and commercial financiers, together with their accountability to the Board and the Shareholders, forces public PLC's to maintain a transparent system of performance monitoring.

Public Water PLC's for Developing Countries

Few developing countries have so far experimented with public water PLC's. Quasi-private corporations, boards and authorities were set up in great numbers throughout the developing world in the 1970s and 1980s. These parastatals do not qualify as delegated public companies, however, as they lacked the Private Limited status and consumers had no power over these organisations through representation on a board or as shareholders.

We believe that the persistent performance problems experienced by these national or state-level parastatal agencies may be traced to the following deficiencies. First, the absence of a mechanism for feeding back consumer interests, wishes and complaints into the parastatal's decision making at management level; the governing boards of water parastatals are usually manned exclusively by top-level civil servants and lack consumer representation. Often this is a consequence of the fact that the parastatal covers an immense service area.

Second, lack of autonomy. Many developing country water boards and authorities lack autonomy. Whereas many governments formally embrace the concept of an autonomous water utility, many have failed to put it into practice. In some cases devolution was enshrined in law but never carried beyond the paper stage. In other cases governments drafted and enacted statutes guaranteeing full autonomy in staffing, finance, and so on, to a newly-formed corporation, only to take away these powers through subsequent add-on regulation. And in yet other cases governments never became fully committed to enterprise autonomy because it was forced onto them by an external support agency, e.g., as a loan conditionality. It is a telling fact that the World Bank, in evaluating 120 water and sanitation projects carried out between 1967 and 1987, singles out the autonomy issue as a key reason for the failure of its projects (World Bank 1992:39-40).

Third, the continuance of a 'government mentality' in the semi-privatised water utilities. Often, a government line agency was transformed into an autonomous water corporation from one day to the other. More often than not, this change of formal legal status did not effect the desired improvements in cost recovery, consumer orientation and operational efficiency, however. In many cases, after the shock effect of the corporatization had worn off, little had changed besides the name of the utility. Part of the blame for this failure may be laid at the doorstep of utility management, who shrank from a more market-like approach and failed to shake off the subsidy syndrome. But an equal responsibility lies with government who left the newly-independent utilities completely unprepared for their task as quasi-private entities.

We contend that the public PLC may provide part of the solution to this quandary and we do so for the following reasons:

1. Secondary urban nodes are unattractive to and far surpass the present management capacity of the private sector, and will do so for decades to come.
2. The public PLC offers a useful compromise for those countries that consider French or British style privatisation a bridge too far.
3. The introduction of the public-owned PLC structure gives consumers a clear voice in the

utility's strategic decisions. This may help to solve the accountability problems that produce inferior services in so many developing countries.

4. The public PLC set-up may give utilities much-needed autonomy in particular with regard to capital procurement and cost recovery.
5. The shift to a public PLC structure may work as a cure for the subsidy syndrome afflicting so many developing country utilities.

Having said this, a number of caveats are in order for those countries willing to give the public PLC mode serious consideration. Political commitment to reform is a vital precondition for a successful transformation. The shift to public-owned PLC's will inevitably upset vested interests. Without broad-based political support, there is little chance of overcoming such hurdles. Furthermore, sufficient time should be allowed for building commitment to the new mode of operations among utility employees as well as for preparing them for their new mission. As the disappointing experiences with parastatals have shown, a change in legal status alone will not suffice to produce results. Finally, the paper autonomy of many of today's water corporations teaches one to be wary of backsliding. Public-owned PLC's will not solve all these problems in one blow. However, they may make the ride both faster and smoother.

References

- Cheong, Lai Cheng (1991) Unaccounted for Water and the Economics of Leak Detection, paper presented at 18th IWSA Congress, Copenhagen
- EUREAU (1992) Management Systems of Drinking Water Production and Distribution Services in the EC Member States in 1992, Brussels: EUREAU
- IWSA (1995) International Statistics for Water Supply, brochure published for the 22nd IWSA Congress, Durban
- United Nations (1995) Compendium of Human Settlements Statistics 1995, New York: United Nations
- VEWIN (1994) Waterleidingstatistiek (Water Supply Sector Statistics), Rijswijk: VEWIN
- World Bank (1992) Water Supply and Sanitation Projects. The Bank's Experience - 1967-1989, Washington: Operations Evaluations Department
- Yepes, Guillermo, and Augusta Dianderas (1996) Water and Wastewater Utilities. Indicators, 2nd Edition, Washington: World Bank

1. There is enormous variation in country definitions of what is urban and rural. Criteria employed vary from population size and density to legal status or level of public services provided. For this reason it is impossible to draw a firm quantitative boundary between urban and rural in aggregated cross-country data.