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Self-financing water supply and sanitation services

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Financing investments in urban water supply and sanitation has been a perennial problem in all countries of Latin America and the Caribbean. The issue has increased in significance with the need to provide sewage treatment to reduce the gross pollution of many water bodies and to lessen the threat from waterborne diseases. In this paper, the authors explore, through a statistical analysis, the practicability of financing water supply and sanitation services from income generated by the tariffs. Particular emphasis is placed on the possibility of the whole population paying for sanitation services: an issue of some importance given the unequal distribution of income in most cites of the region.

The authors conclude that the available information on the costs of providing services, including the capital investment required to achieve universal coverage by the year 2000 as well as sewage treatment, rehabilitation of existing systems, maintenance, and institutional development, indicates that financing such needs from tariffs is feasible, particularly if subsidies are provided to the poorest households.

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Introduction

The cholera epidemic in Latin America during the last year has focussed attention on the deplorable state of excreta disposal in the majority of the cities of the region. The proportion of the population served by sewerage systems has increased in recent years, but not in the same proportion as the provision of water supply (ECLAC, 1990a). The lack of sewerage is compounded by the absence of sewage treatment. Only 10% of sewerage systems provide even partial treatment before discharge (PAHO, 1990a, p. 8). As a result, there is widespread contamination of the water bodies into which urban sewage is discharged and the easy transmission of diarrheal diseases through water or food is always a menacing possibility.

The financing of water supply and sewerage services is a perennial problem for most cities in Latin America. It is not only a question of financing the initial capital investment, but also of generating funds for the operation and maintenance of the systems once built. Moreover, the financial demands of water supply and sewerage systems are growing as population increases and water sources grow more distant and as it becomes increasingly necessary to dispose of human and industrial wastes safely.

A recent study shows that "the funding of capital investments in water-related projects is mainly provided from national sources" (ECLAC, 1990b, p. 53). Indeed, in the last decade more than 70% of capital funding for the expansion of water supply and sanitation services has come directly from such sources (PAHO/WHO, 1987, p. 25). During the International Water Supply and Sanitation Decade, the share of external funding, including loans, in capital investment in water supply and sanitation services has been lower for the countries of Latin America and the Caribbean, as a whole, than in the countries of Africa and Asia (WHO, 1987, p. 13). There is no reason to expect that the proportion of capital funding provided from external sources will increase in the 1990s.

In most countries of the region, the financing of water supply and sewerage systems is inadequate both to keep up with the needs of capital expansion for the growing urban population and for the maintenance of the existing systems. It is true that the provision of drinking water and sewerage services to

the urban population has increased in nominal terms, but the service provided is often very irregular and of questionable quality (PAHO, 1990a, p. 6). Not all countries have even managed to maintain the nominal levels of service reached in the past. In Buenos Aires, the proportion of the population served by the system operated by Obras Sanitarias de la Nación (OSN) has steadily declined over the last fifty years. In 1947, 94% of the population lived in a dwelling with a connection to the water supply system, in 1960 only 76% and by 1980 less than 60%. In the absence of provision of drinking water by OSN, the population of Buenos Aires has had to shift for itself. Sometimes this has led to the creation of local water supply systems providing good service, but in many cases the result has been recourse to sources of dubious quality and over- reliance on individual excreta disposal systems with a high potential for contaminating aquifers (Brunstein, 1988).

I

Income from the provision of water supply and sewerage services

Historically, the contribution to the funding of water supply and sanitation projects derived from the income of operating companies has usually been very small: a direct consequence of unrealistically low tariffs on the one hand and inefficient commercial management on the other (table 1).

Cost recovery policy has seldom been applied in water supply and sanitation services even in urban areas. It is not surprising to find, therefore, that the bulk of capital funding for water supply and sanitation has come in most countries from general government revenues either directly or in the form of government guarantees for loans from the World Bank or the Inter-American Development Bank (ECLAC, 1990b). This source of capital funding has always fluctuated considerably with changes in political priorities and suffered from the effects of macroeconomic mismanagement. The severe recession between 1982 and 1983, the effects of which continue to be felt in many countries of the region, resulted in efforts to reduce the size of the public deficit which have reduced the flow of funds from general government revenues. At the same time, there has been a region–wide change in the perception of the role of the public sector in the economy which has led to a general reduction in the scope of government activities. In particular, increasing consideration is being given to the need for potentially revenue-generating public services to become either self-financing or to be transferred to the private sector.

With few exceptions, public sector water supply and sanitation companies have been incapable of compensating the reduction in government contributions to capital financing by generating more funds from revenues. The resulting shortfall in capital funding has severely affected not only expansion programmes, but also the operation and maintenance of existing systems. The poor financial state of many utilities can, to a considerable extent, be directly attributed to the failure to adopt a tariff policy which would generate revenues sufficient to cover the total costs of the provision of service. In Mexico, for example, the total cost of providing drinking water through house connections has been estimated at about 240 pesos/m^3, whereas consumers are billed only some 40 pesos/m^3 (Mexico, 1989, p. 183).

In recent years, some countries have managed to improve the financial situation of water supply and sanitation companies by following sound tariff policies. In Chile, 56% of the funds invested in water supply and sanitation services by the Servicio Nacional de Obras Sanitarias (SENDOS) over the period 1985-1989 were generated from tariff revenues, and the contribution of such revenues to capital funds increased from less than 49% in 1985 to almost 68% in 1989 (World Bank, 1989). In Brazil, the sector has been partially self–financing since the adoption of the "Plan Nacional de Saneamiento" (PLANASA) in 1971 (World Bank, 1989). Political difficulties in

Table 1

LATIN AMERICA AND THE CARIBBEAN, WATER SUPPLY: AVERAGE COST OF PRODUCTION AND AVERAGE TARIFFS, 1985

(1985 US dollars per cubic metre)

Country	Average cost of production	Average tariff	Progressive tariffs
Argentina [a]	0.08	0.11	n/a
Barbados	0.34	0.68	No
Bahamas	0.37	1.10	Yes
Bolivia	n/a	n/a	Some areas
Brazil [a]	0.06	0.10	n/a
Chile	0.12	0.08	Yes
Colombia [a]	0.30	0.24	n/a
Costa Rica	0.17	0.07	Yes
Ecuador	0.09	1.81	Yes
El Salvador	0.30	0.20	No
Guatemala	n/a	0.11	No
Guyana	0.08	0.03	Some areas
Haiti	0.18	0.28 - 1.00	Yes
Honduras	0.20	0.26	Yes
Mexico	1.50	0.12	Yes
Nicaragua	0.14	0.38	Yes
Panama	0.07	0.29	Yes
Paraguay	0.52	0.43	Yes
Peru [b]	0.18	0.09	Some areas
Suriname	0.60	0.80	Some areas
Uruguay [a]	n/a	0.26	n/a
Venezuela [a]	0.58	0.34	n/a

Source: World Health Organization, Division of Environmental Health, CWS Unit, *The International Drinking Water Supply and Sanitation Decade: Review of Mid-Decade Progress (as at December 1985)*, CWS Series of Cooperative Action for the Decade, Geneva, September 1987.

[a] 1980.

[b] 1980; in 1985 the average cost of water production was US$ 0.12 per cubic metre.

maintaining the tariff policy established under the Plan led to a serious reduction in self-sufficiency for a number of years, but in 1990 almost 80% of the capital needs of the sector were provided from the rotating funds, replenished from tariff revenues, established under PLANASA (World Bank, 1989).

It is not, however, the level of tariffs alone that determines the contribution of revenues to the funding of water supply and sanitation services. Tariffs are an essential ingredient in good financial and commercial management, but other factors are also important. Water pumped, but not accounted for, reduces revenues and can also inflate the need for new investments. The experience of most water supply companies in the region indicates that high values of unaccounted-for water are the result of deficiencies in the commercial management, mainly problems in billing and the collection of payments and inadequate policies for dealing with overdue accounts, rather than being due solely to high rates of leakage in distribution systems (Yepes, 1990, p. 12). For example, it has been estimated in Mexico that of each 100 litres pumped in a typical distribution network, the user receives 60, is billed for 40, and finally only pays for 30. In addition, collection of the

payments due has been characterized by delays in billing of some 6-9 months (Mexico, 1989, p. 183).

Reducing such commercial losses does not usually involve high capital expenses, but it may require changes in management practice which are difficult to introduce in a bureaucratic environment. Better commercial management, however, can replace or postpone the need for new capital investments and also reduce production, pumping and treatment costs. A reduction of unaccounted-for water from 60% to 30% in a city growing at 3.5% per year would make it possible to postpone investments in new production facilities by up to 16 years.

Traditionally in Latin America and the Caribbean, the income of water supply and sanitation companies has been both small and variable. Cost recovery, however, has become an accepted principle for companies in the urban areas, although in practice it is seldom fully applied. In 1985, in nine of fifteen countries surveyed, tariffs in urban areas more than covered water production costs, and of the nineteen countries providing information on tariff structures some fifteen claimed to apply progressive systems which penalize higher consumption either nationally or at least in some areas (table 1).

One of the more serious consequences of inadequate tariff structures, and an additional argument for adopting tariffs that fully reflect costs, is that low tariffs for drinking water supply and sewerage do not, as a rule, benefit those who most need them. It is usually the poor who, through the lack of investment, do not have adequate access to public drinking water supply and, as a result, are forced to buy water from private water sellers at prices far exceeding those charged by water supply companies. It has been estimated that the cost of water bought from water sellers is 17 times higher in Lima, Peru, from 17 to 100 times higher in Port-au-Prince, Haiti, and from 16 to 34 times higher in Tegucigalpa, Honduras than the price charged by the official water company (World Bank, 1988a).

II

Self-financing water supply and sanitation systems

Self-financing water supply and sanitation systems can be defined as those in which tariff revenues meet the total costs of operating and maintaining existing installations, cover the capital costs of expanding coverage to remove the existing deficit in services and to supply a growing population, provide a reasonable rate of return on the capital invested, and also cover the associated costs of providing adequate treatment of sewage before discharge into the environment. The adoption of such criteria for water supply and sanitation system management would not mean that companies could not borrow money from national banks, the multilateral development banks or any other lending institutions. It would mean, however, that the total costs of any loans would have to be paid from the revenues received from the sale of water and sewerage services. It would not preclude subsidies either, but any subsidies would be clearly explicit transfers for reasons of social policy, and must not be designed to make up for deficits due to poor management. Such an approach would also pave the way for the companies to issue bonds or shares to the general investing public.

The tariff charged to customers would depend on a number of factors which affect long-term average and marginal costs, including the rate of interest for loans, the amortization period, the rate at which any existing deficit in the provision of services is made good, the growth rate of the population to be served, and the costs of operating and maintaining the existing works, among others. These factors will vary considerably from system to system, and consequently estimates for Latin America and the Caribbean as a whole or even for individual countries can be of only very limited usefulness. Estimates such as those made in this paper, however, can indicate the practicability of considering the application of a policy of self-financing from tariff revenue.

In order to explore the self-financing option, estimates of the required tariffs have been made on the basis of the known per capita unit costs of providing urban drinking water supply and sewerage services

Table 2

LATIN AMERICA AND THE CARIBBEAN: RANGE OF MONTHLY CHARGES REQUIRED TO COVER THE CAPITAL COSTS OF PROVIDING DRINKING WATER SUPPLY AND SEWERAGE THROUGH HOUSE CONNECTIONS

(1985 US dollars per person served)

Country	Drinking Water Supply			Sewerage		
	Minimum[a]	Average[b]	Maximum[c]	Minimum[a]	Average[b]	Maximum[c]
Argentina	0.39	1.05	1.64	0.43	1.16	1.82
Bolivia	0.28	0.75	1.18	0.32	0.87	1.36
Brazil	0.32	0.87	1.36	0.36	0.99	1.54
Chile	0.32	0.87	1.36	0.36	0.99	1.54
Colombia	0.28	0.75	1.18	0.32	0.87	1.36
Costa Rica	0.28	0.75	1.18	0.32	0.87	1.36
Dominican Republic	0.32	0.87	1.36	0.36	0.99	1.54
Ecuador	0.28	0.75	1.18	0.32	0.87	1.36
El Salvador	0.28	0.75	1.18	0.32	0.87	1.36
Guatemala	0.28	0.75	1.18	0.32	0.87	1.36
Haiti	0.26	0.70	1.09	0.26	0.70	1.09
Honduras	0.28	0.75	1.18	0.32	0.87	1.36
Mexico	0.32	0.87	1.36	0.36	0.99	1.54
Nicaragua	0.28	0.75	1.18	0.32	0.87	1.36
Panama	0.32	0.87	1.36	0.36	0.99	1.54
Paraguay	0.28	0.75	1.18	0.32	0.87	1.36
Peru	0.28	0.75	1.18	0.32	0.87	1.36
Uruguay	0.28	0.75	1.18	0.32	0.87	1.36
Venezuela	0.43	1.16	1.82	0.43	1.16	1.82
Average	**0.32**	**0.87**	**1.36**	**0.36**	**0.98**	**1.53**

Source: Calculated on the basis of World Bank data.
[a] Interest rate 2%, amortization period 75 years.
[b] Average of all rates and periods.
[c] Interest rate 10%, amortization period 25 years.

by house connections (WHO, 1987, p. 22). These estimates are based on the assumption that every customer will pay the full cost of maintaining his connection to the system in perpetuity, as well as operating costs. The amortized capital cost has been calculated using different real rates of interest (2% and 10%) and different repayment periods (25, 50 and 75 years). The calculations are presented individually for each country in terms of the lowest, highest and average charges to consumers which would be required to meet these costs (see appendix).

The estimates are presented in US dollars per month, both on the basis of a per capita monthly charge (table 2) and as a charge per cubic metre for those countries for which average water consumption data are available (table 3). In making these calculations, it is assumed that the new population to be served will be connected proportionately in each year up to the end of the century and that as the new customers receive a connection they will begin to pay on the same basis as the population connected at the beginning of the period. It is also assumed that everyone already connected will begin paying the

Table 3

LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES): MONTHLY CHARGES NEEDED TO COVER THE CAPITAL COST OF PROVIDING DRINKING WATER SUPPLY AND SEWERAGE THROUGH HOUSE CONNECTIONS

(1985 US dollars per cubic metre)

Country	Drinking water supply			Sewerage		
	Minimum[a]	Average[b]	Maximum[c]	Minimum[a]	Average[b]	Maximum[c]
Argentina	0.03	0.08	0.12	0.03	0.08	0.13
Bolivia	0.09	0.25	0.39	0.11	0.29	0.45
Chile	0.06	0.16	0.25	0.07	0.18	0.28
Colombia	0.08	0.21	0.32	0.09	0.24	0.37
Costa Rica	0.05	0.12	0.19	0.05	0.14	0.22
Ecuador	0.05	0.13	0.21	0.06	0.15	0.24
El Salvador	0.05	0.15	0.23	0.06	0.17	0.26
Guatemala	0.05	0.13	0.21	0.06	0.15	0.24
Honduras	0.06	0.17	0.26	0.07	0.19	0.30
Mexico	0.04	0.11	0.17	0.04	0.12	0.19
Panama	0.04	0.10	0.16	0.04	0.12	0.18
Paraguay	0.03	0.07	0.11	0.03	0.08	0.13
Peru	0.04	0.10	0.16	0.04	0.11	0.18

Source: Calculations by the authors on the basis of levels of water consumption given in World Health Organization, Division of Environmental Health, Community Water Supply Unit, *The International Drinking Water Supply and Sanitation Decade, Review of Mid-Decade Progress (as at December 1985)*, CWS Series of Cooperative Action for the Decade, Geneva, September 1987.

[a] Interest rate 2%, amortization period 75 years.

[b] Average of all rates and periods.

[c] Interest rate 10%, amortization period 25 years.

full capital cost of his connection in 1989, the base year for the calculations.

The tariff levels which would have to be set for urban water supply and sanitation systems in order to cover capital costs do not appear to be very high. It must be remembered, however, that the estimated tariffs would only meet the amortized capital costs of existing installations. The total costs which the tariffs would have to meet would be higher if the criterion of total financial self-sufficiency is to be met.

These costs are equivalent to approximately one- quarter of the total cost (estimated to be US$94 000 million at 1985 prices) of achieving universal provision of both water supply and sanitation services for the urban population by the year 2000. The total cost of providing water supply and sewerage services includes a number of other items as well as the replacement costs of the existing connections. These items include the capital investments needed to provide services to new customers, the rehabilitation of systems (many of which are in very bad condition), the costs of training staff and of institutional development and, finally, the cost of waste treatment. It is assumed that the cost of water treatment is included in the per capita estimates for providing drinking water supply. For Latin America and the Caribbean, on average, these costs would be equivalent to some 26% of the total cost of achieving universal provision of water supply and sanitation for the urban population by the year 2000.

The proportion of new capital investment which would be required for expansion so as to achieve complete coverage of the urban population with water supply and sanitation services varies considerably among countries. It is estimated to

Table 4

COST OF CAPITAL INVESTMENT NEEDED IN DRINKING WATER SUPPLY AND SEWERAGE SYSTEMS TO ACHIEVE UNIVERSAL COVERAGE OF THE URBAN POPULATION BY THE YEAR 2000 [a]

(1985 US dollars per person)

Country	Monthly charge
Argentina	3.13
Bolivia	2.10
Brazil	2.33
Chile	2.41
Colombia	2.11
Costa Rica	2.06
Dominican Republic	2.32
Ecuador	2.13
El Salvador	2.10
Guatemala	2.10
Haiti	1.87
Honduras	2.10
Mexico	2.37
Nicaragua	2.06
Panama	2.38
Paraguay	2.07
Peru	2.41
Uruguay	2.45
Venezuela	2.78

Source: Estimates prepared by the authors.

[a] Includes the capital cost of drinking water supply and sewerage services through house connections, major rehabilitation costs of existing systems, expansion of waste water treatment, and costs of training and institutional development.

range from 48.2% of the total cost of providing service in Uruguay (the lowest proportion of all the countries included in the estimate) to 85% in the Dominican Republic and Haiti: the countries where the existing levels of provision of services are the lowest.

The capital costs of achieving universal coverage by the year 2000 and of maintaining and rehabilitating existing services would mean the inclusion in the tariff of an average charge per person of almost US$2.00 a month in addition to the previously estimated amortized capital costs of the existing urban water supply and sanitation installations (table 4). Once again, however, these costs and hence the level of the additional charge would vary considerably among the countries of the region. The costs of providing new services would be lowest in those countries with the highest existing provision of water supply and sanitation services, i.e., Chile, Costa Rica and Panama, while they would be highest in the countries with the lowest present levels (the Dominican Republic and Haiti).

III

Necessary considerations in the application of a tariff

If tariff-based financing of water supply and sewerage systems is to become a reality, the tariffs established must be paid regularly by all users. This does not mean that all users must pay the same tariff. Tariff discrimination is both acceptable and necessary for the effective provision of such significant social services. Services should not, however, be provided free to even the poorest customers.

In setting tariffs, it is unrealistic not to take into account the existence of considerable inequalities of income in most countries and the large proportion of the population living in poverty, estimated to have been more than 170 million in 1986, of whom 94 million lived in urban areas (ECLAC, 1991). Tariffs must therefore be reasonable in relation to incomes as well as to the costs of installation, operation and maintenance of services.

It is generally accepted that, for the poorest sections of the population, the cost of water and sewerage services should not represent more than a small proportion (1% or 2%) of their income. For example, in the OECD countries the cost of water and sewerage services is estimated to be equal to 1% of average household disposable income (OECD, 1987, p. 122). It is not easy to establish the incomes of the poor in most Latin American societies, where many of the poor receive much of their income in kind and their cash income may be

derived from a variety of sources rather than from a single wage paid by one employer.

It is therefore necessary to use other indicators to obtain an idea of the possible incidence of the water and sewerage tariff on income. Information is available on the official minimum wage for a number of countries. The official minimum wage in the late 1980s ranged from US$50 to US$110 for those countries for which information is available, although in most cases additional bonuses are also paid (table 5). The minimum wage represents gross, not net income: it does not include the payment of social security contributions or any other deductions. The impact of such deductions is very variable, however, not just between countries, but from employer to employer, depending on the nature of the employment contract. It is therefore only possible to use these gross amounts for purposes of comparison. Additionally, the proportion of the population receiving the minimum wage is very variable. In some countries, such as Uruguay, the typical wage is considerably higher, while in others it is lower.

The level of the minimum wage is a provisional indicator for measuring the practicability of adopting a policy of financially self-sustaining water and sewerage services. The average manufacturing wage, at least for those countries with significant industrial employment, indicates the incomes of households immediately above the poverty level (table 5). Caution must be exercised when using any Latin American price statistics expressed in US dollars for any given year, given the high rates of inflation and fluctuations in exchange rates common to the countries of the region.

From the calculations made of the cost of providing water supply and sewerage services, it is possible to make an estimate of the proportion of both the monthly minimum income and of the average manufacturing wage that these costs represent (table 6). It is only in the minimum cost case that the costs of providing both water supply and sewerage services through house connections fall generally within the range of 1%-2% of the minimum wage. In some of the poorer countries, the estimated cost of water supply and sanitation tariffs, even for the minimum cost case, is more than 2% of the average manufacturing wage. The costs of providing water supply and sewerage services are lowest as a proportion of the minimum wage in Uruguay (1.75% for the minimum cost case and 3.91% for the maximum cost case). As a proportion of the average manufacturing wage, the costs are lowest in Venezuela, Chile and Colombia, while as a proportion of the minimum wage they are highest in Ecuador and Colombia.

According to the calculations made in this paper, self-financing through tariffs for urban drinking water supply and sanitation services would require tariffs somewhat above 2% of the monthly income of the poorer population in many countries. This result does not mean, however, that it would not be practical to introduce a policy of financing capital investments in water supply and sanitation from tariff income.

Two major qualifications can be made in respect of the results of the analysis presented here:

(i) The capital cost of maintaining the existing connections may be lower than the estimated cost of new connections;

(ii) The poor tend to consume less water than the national average.

It is not possible to know what the real cost of replacing existing installations might be. The estimated cost of a new connection is probably, however, an overestimate of the real cost. The monthly charge for amortizing this investment would be rather less than the estimates used here.

Poorer people consume less water for a variety of reasons, but mainly because they use water principally for drinking and cooking, which account for only a small proportion of total national demand, so that they will consequently pay less than the average (Gibbons, 1986, p. 20). In a recent study of the demand for water in Mexico, the authors present histograms of water consumption in a number of Mexican cities (Saavedra and Macay, 1991) which all show similar distributions of water demand, with the 30% of households with the highest incomes consuming half the total. The concentration of consumption is even greater in some of the cities included in the study: for example in the city of Victoria, Tamaulipas, 2% of residential users consume 40% of the water. This was the most extreme case in the sample, but similar concentrations of water consumption were observed in Juárez, Chihuahua and La Paz, Baja California Sur. In general, in all cities the skew and concentration of water consumption was remarkably similar (figure 1).

Table 5

LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES): MONTHLY MINIMUM AND AVERAGE MANUFACTURING WAGES, 1989–1990

(US dollars)

Country	Minimum Wage (to nearest US$10)	Average manufacturing wage (US$ 1985)
Argentina	80	260
Bolivia	...	170[a]
Brazil[b]	100	...
Chile[c]	60	320
Colombia	90	410
Costa Rica	...	180
Dominican Republic	...	210[a]
Ecuador[d]	50	220[a]
El Salvador	...	270
Guatemala	...	190
Honduras	...	230
Mexico[e]	110	270
Panama	...	350
Peru[f]	70	80
Uruguay[g]	90	200
Venezuela[h]	90	630[i]

Source: *Business Latin America*, March, 1991 and International Labour Organisation, *1988 Yearbook of Labour Statistics*, 48th Issue, Geneva, 1989.

[a] 1984

[b] Compulsory benefits add 50–80% to base wages.

[c] Large companies pay a minimum of three times this sum.

[d] Unskilled labour.

[e] Mexico City and most border cities; elsewhere wages are slightly lower.

[f] Private sector.

[g] In most sectors typical pay is higher.

[h] In addition there are bonuses for food and transportation raising the minimum by 20%.

[i] 1986.

Data on the consumption of water in Santiago, Chile also show a relationship between income and consumption, although the information is less precise. The population of metropolitan Santiago has universal access to drinking water through house connections. Within the metropolitan area, however, there are considerable differences in apparent per capita water consumption. In the municipalities with the highest proportion of high-income households, consumption is between 500 and 600 litres per capita per day, while in municipalities with lower average household incomes the per capita consumption is between 100 and 200 litres (Icaza and Rodríguez, 1988).

The Mexican study and the Santiago data confirm the pattern of residential water consumption found in other earlier studies in quite disparate social and economic situations. The Johns Hopkins University Residential Water Use Project showed, for the United States, a clear relationship between the level of household income and and the demand for water (Howe and Linaweaver, 1967). The connection between income and residential demand for water, it was concluded, is due to the

Table 6

LATIN AMERICA AND THE CARIBBEAN: MONTHLY CHARGES FOR DRINKING WATER SUPPLY AND SEWERAGE AS A PERCENTAGE OF THE MINIMUM WAGE AND OF THE AVERAGE MANUFACTURING WAGE [a]

(Percentages)

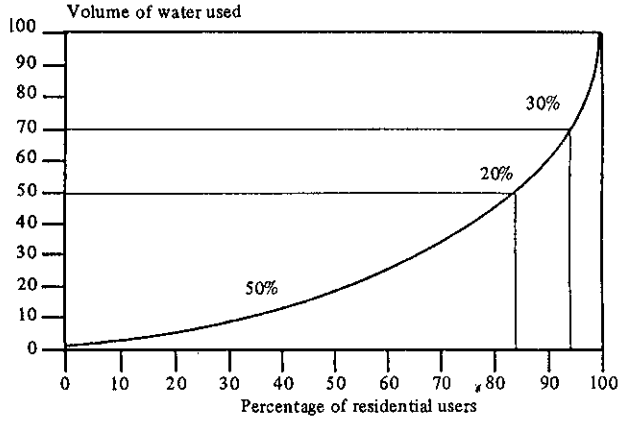
Country	Average manufacturing wage			Minimum wage		
	Minimum cost	Average cost	Maximum cost	Minimum cost	Average cost	Maximum cost
Argentina	0.67	1.20	1.68	2.17	3.91	5.47
Bolivia	0.63	1.23	1.77	...	...	...
Brazil	...	...	...	1.16	2.33	3.38
Chile	0.39	0.75	1.08	2.07	4.02	5.77
Colombia	0.26	0.51	0.74	1.21	2.34	3.37
Costa Rica	0.57	1.14	1.65	...	...	...
Dominican Republic	0.55	1.11	1.61	...	...	...
Ecuador	0.50	0.97	1.39	2.21	4.26	6.09
El Salvador	0.40	0.78	1.12	...	...	...
Guatemala	0.57	1.11	1.59	...	...	...
Honduras	0.47	0.91	1.31	...	...	...
Mexico	0.44	0.88	1.27	1.09	2.15	3.11
Panama	0.34	0.68	0.98	...	...	...
Peru	1.73	3.01	4.16	1.98	3.44	4.76
Uruguay	0.71	1.23	1.69	1.59	2.73	3.75
Venezuela	0.21	0.44	0.65	1.46	3.08	4.54

Source: Calculations by the authors.

[a] Includes the capital cost of drinking water supply and sewerage services through house connections, major rehabilitation costs of existing systems, expansion of waste water treatment and the costs of training and institutional development.

Figure 1

BREAKDOWN OF WATER CONSUMPTION IN MEXICAN CITIES



Source: Based on Saavedra and Macay, 1991.

greater use in higher-income households of water-using appliances, the larger number of bathrooms per household, and the consumption of water for lawn sprinkling. A similar relationship between residential water demand and the level of household income has been observed in New Delhi, India (Lee, 1969).

The implications of this skewed pattern of residential water demand for tariff policy lie in the possibilities it raises for internal subsidies between the minority of high-income residential consumers and the rest of the community. Such cross-subsidies would not only provide benefits for the poor, but would also increase economic efficiency in the provision of water supply and sewerage services; consequently, they could be expected to raise social benefits more than they would decrease private benefits.

IV

Some policy recommendations

Since the adoption in 1961 of the Punta del Este Charter, great efforts have been made to improve the provision of water supply and sewerage services to both the urban and rural population of Latin America and the Caribbean. These efforts, however, have consistently fallen short of the goals that have been established (ECLAC, 1990a). One of the major limiting factors has been the weak financial situation of publicly-owned water supply and sanitation companies, compounded by generally poor management. These two factors have led in some cases to poor growth, and even to decline, in the provision of services and have been a considerable limitation even on those systems that have shown the best performance. There is therefore ample reason to look for alternative approaches to the provision of these services in urban areas.

Moving towards self-financing of water supply and sewerage services is a major challenge for the countries of Latin America. This study shows that even in the poorest countries of the region the relief of financial restrictions is possible through the establishment of tariff systems which would generate sufficient revenues to cover the total cost of

APPENDIX

LATIN AMERICA AND THE CARIBBEAN: BASIC DATA USED IN CALCULATING FUTURE INVESTMENTS IN DRINKING WATER SUPPLY AND SEWERAGE FOR THE URBAN POPULATION

Country	Population served in 1988[1] ('000s)		Population to be served by 2000 [2] ('000s)	Estimated cost of house connection [3] (US$ 1985)		Required investment (billions of dollars)			
						Complete coverage		Total [a]	
	Water supply	Sewers	Water supply and sewers	Water supply	Sewers	Water supply	Sewers	Water supply	Sewers
Argentina	18 208	10 261	33 014	180	200	2 665.1	4 550.6	1 767.8	1 613.2
Bolivia	2 311	1 394	5 687	130	150	438.9	644.0	85.0	178.3
Brazil	96 577	45 000	143 397	150	170	7 773.0	17 577.5	3 217.4	5 091.5
Chile	10 287	8 654	13 112	150	170	423.8	757.9	330.6	608.9
Colombia	14 500	12 000	28 557	130	150	1 827.4	2 483.6	443.1	1 045.4
Costa Rica	1 685	722	2 188	130	150	65.4	219.9	47.1	74.2
Dominican Republic	1 913	882	5 729	150	170	572.4	824.0	76.3	167.5
Ecuador	3 963	3 441	9 042	130	150	660.3	840.2	141.2	320.2
El Salvador	1 672	1 339	3 799	130	150	276.5	369.0	53.1	131.3
Guatemala	2 393	1 617	5 800	130	150	442.9	627.5	87.5	187.7
Haiti	474	-	3 675	120	120	384.1	441.0	49.1	88.2
Honduras	1 600	1 178	3 625	130	150	263.3	367.1	50.7	122.3
Mexico	47 000	33 518	84 492	150	170	5 623.8	8 665.6	1 621.0	3 167.4
Nicaragua	1 436	685	3 466	130	150	263.9	417.2	46.4	103.7
Panama	1 063	805	1 749	150	170	102.9	160.5	35.9	69.3
Paraguay	866	437	2 921	130	150	267.2	372.6	31.2	83.2
Peru	8 679	7 640	21 014	130	150	1 603.6	2 006.1	672.5	962.7
Uruguay	2 387	1 436	2 937	130	150	71.5	225.2	162.0	156.6
Venezuela	12 142	10 611	22 462	200	200	2 062.0	2 370.2	613.2	963.5

Source: [1]PAHO Environment Health Programme, *Situation of the Water Supply and Sanitation Sector at the End of the Decade, Region of the Americas*, Washington, D.C., 1990. [2]Estimates of urban population made by CELADE. [3]World Bank, Regional Office for Latin America and the Caribbean, Technical Department, Infrastructure and Energy Division, Water Supply and Urban Development Unit, *Water Supply and Sewerage Sector, Proposed Strategy*, Washington, D.C., 1988.

[a] Including waste treatment, staff training and rehabilitation of systems.

providing house connections for both water supply and sewerage services to the whole population. The application of such a tariff structure would not be easy, however, and would require a considerable change in management attitudes and practices in the water supply and sanitation sector: a change which may not be possible without drastic institutional innovation.

Here lies one of the most potent arguments for privatization of water supply and sewerage services, although other types of institutional change may be as effective. Privatization does not necessarily involve the sale of whole systems to private entrepreneurs, although in many cases this may be the preferred alternative (Coing and Montano,1989). The granting of concessions for the partial or total provision of services may be just as potent an innovating force and would equally demand that tariffs cover the costs of providing service.

What must be achieved is not privatization *per se*, but rather a situation where water supply and sanitation services become self- financing public utilities, regardless of who owns them. Without self-financing, investment and the provision of services will remain in deficit and the quality of service will remain deficient. Achieving an improvement in these fields is the great challenge for water supply and sanitation policy in Latin America and the Caribbean during this, the last decade of the Twentieth Century.

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