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THE POPULATION/ENVIRONMENT/ WATER-AND-SANITATION NEXUS IN DEVELOPING COUNTRIES

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by

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Urban areas of developing countries are the location of critical interactions between rapid population growth and the environment. On the one hand, in rapidly-growing urban areas the aquatic environment is degraded by both the inadequate disposal of wastes and by attempts to compensate for inadequate water supply services. Conversely, the declining quantity and quality of available water means that the costs of providing urban dwellers with water is rising, often rapidly. Declining environmental quality and inadequate water and sanitation services impose large health and economic costs, especially on the urban poor.

This paper argues that large gains--in environment quality, health, equity, and direct economic returns--can be made by adopting an approach which comprises four key elements:

. managing water resources better, taking account of economic efficiency and environmental sustainability;

. providing, at full cost, those "private" services which people want and are willing to pay for (including water supply, and the collection of human excreta, wastewater, and solid waste);

. using scarce public funds only for those services (specifically the treatment and disposal of human excreta, wastewater, and solid wastes) which provide wider communal benefits; and

. developing flexible, responsive, institutional mechanisms for providing these services, with community organizations and the private sector playing a larger part.

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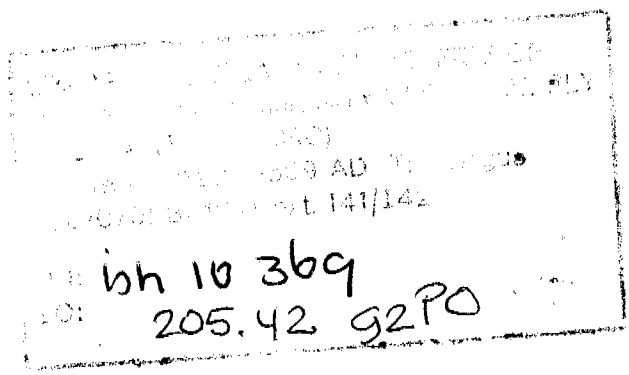
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I: THE POPULATION/ENVIRONMENT/WATER-AND-SANITATION NEXUS IN DEVELOPING COUNTRIES

Urban areas of developing countries are the location of critical interactions between rapid population growth and environmental degradation. On the one hand, in rapidly-growing urban areas the environment is degraded by both the inadequate disposal of wastes and by attempts to compensate for inadequate water supply services. Conversely, the declining quantity and quality of water available means that the costs of providing urban dwellers with water is rising, often rapidly. Declining environmental quality and inadequate water supply and sanitation services impose large health and economic costs, particularly on the poor.

(a) The effects of water supply and sanitation on the environment:

Population growth and the concentration of population in urban areas are fundamental factors contributing to urban environmental degradation. In 1990 most people lived in rural areas. By 2030 urban populations will be twice the size of rural populations. Developing country cities as a group will grow by 160 percent over this period, whereas rural populations will grow by only 10 percent. By 2000 there will be twenty-one cities in the world with more than 10 million inhabitants, and seventeen of them will be in developing countries.

The provision of services has not kept pace with population growth in urban areas, thus compounding the damage caused by the sheer growth in numbers. In recent decades there have been impressive but inadequate increases in the provision of water supply and sanitation services. Achievements have been impressive in that (as shown in Figure 1, overleaf), the number of urban people with access to adequate water supply and sanitation facilities increased by, respectively, about 100% and 50% in the 1980s, with the proportional gains in rural areas even greater. These achievements are inadequate in that the number of urban dwellers without adequate water services has remained virtually stagnant, and the number without adequate sanitation services increased by 70 million in the 1980s.

Not only have the numbers of people served increased substantially in urban areas, but, as incomes have increased, the per capita consumption of those already served has increased. The sum of these effects is that there have been large increases in the volumes of water abstracted from sources in and around urban areas, and large increases in the volumes of wastes generated.

The response to this rising pressure on the environment has been both insufficient and inefficient. In Latin America, for example, it is estimated that less than 2% of all sewage is treated. In World Bank-financed water and sewerage projects substantially less than one-fifth of all spending is for sewerage and sanitation components, a figure that has varied little over the last 15 years. The effects of these inadequate levels of investment are exacerbated by the fact that existing treatment facilities function poorly. In Mexico, for example, it is estimated that over 90% of all wastewater treatment plants are non-functional.

Figure 2 (overleaf) shows the results for surface water quality in developing countries . Surface water pollution is increasing rapidly, with particularly severe problems evident in towns and cities and the areas surrounding them. Groundwater contamination is a much less visible but arguably more serious matter than surface water pollution. This is so because under most circumstances the movement of water in aquifers is so slow that it takes decades for an aquifer to "purge" itself, and because large numbers of people in cities in developing countries draw untreated drinking water from urban aquifers.

Figure 1: Access to safe water and adequate sanitation in developing countries, 1980 and 1990

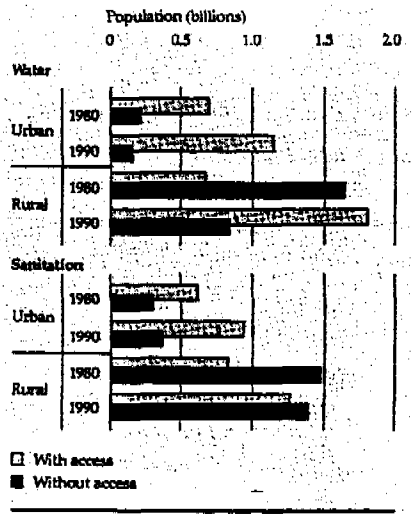
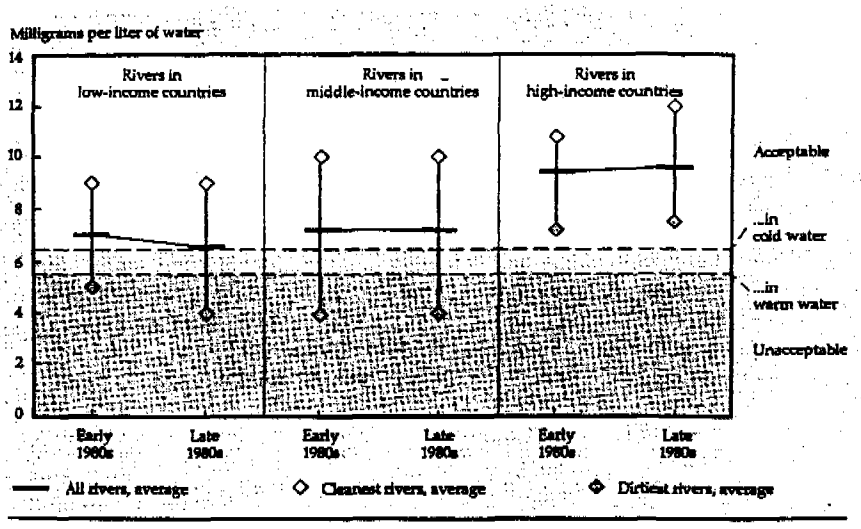


Figure 2: Dissolved oxygen in rivers: levels and trends across country income groups



In some urban settings, environmental degradation also results from the actions which households take to compensate for inadequacies in formal water supply services. There are two major categories of such effects. First, where piped water supplies are either unavailable or unreliable, and where groundwater is available, many households compensate by sinking wells. Where this practice is widespread, heavy overpumping of aquifers is common. In Jakarta, for instance, almost two-thirds of the population relies on groundwater. In Northern Jakarta, the water table has fallen continuously and rapidly since the mid-1970s. Seawater has contaminated the groundwater in a 5 to 10 kilometer wide continuous belt along the coastal plain. In an important catchment (the Sunter area) the level of chloride is currently exceeding 500 mg/l, about twice the WHO drinking water guideline value.

In some cities -- Bangkok, Jakarta and Mexico City -- excessive pumping has also led to land subsidence, causing damage to property, housing and infrastructure. In Bangkok, for instance, excessive groundwater pumping led to land subsidence of up to 1 meter per decade, resulting in cracked pavements, broken water and sewerage pipes, intrusion of sea water, and increased flooding in low-lying areas. To counteract this, major improvements were made to the piped water system in central Bangkok, with good results. Many wells (which occupied valuable property) are no longer used, and groundwater levels recovered by between 8 and 18 meters during the 1980s.

There is a second important way in which households' efforts to compensate for inadequate public water supplies often degrade the environment. To correct for unreliable water quality, many households boil their drinking water. This practice is widespread, particularly in Asia. In the city of Cebu in the Philippines, for example, about half of all families boil their drinking water (with the proportion actually higher for families who obtain their water from an unreliable, chlorinated piped supply!)

On the one hand, this practice is, indeed very effective in protecting the family from the effect of poor water quality. On the other hand, because this practice is so common, and because it takes a lot of energy to boil water, the energy costs incurred are enormous. In Jakarta it is estimated that over $50 million is spent each year on boiling water for domestic consumption, an amount that is equivalent to about 1% of the GDP of the city! Because the quantities of fuel consumed for this purpose are so large, and because firewood, coal and coke are often used for this purpose, this practice (and, indirectly, the inadequate water supply systems) makes a significant contribution to deforestation, urban air pollution and the other energy-induced environmental effects.

(b) The effects of environmental quality on the provision of water supply services:

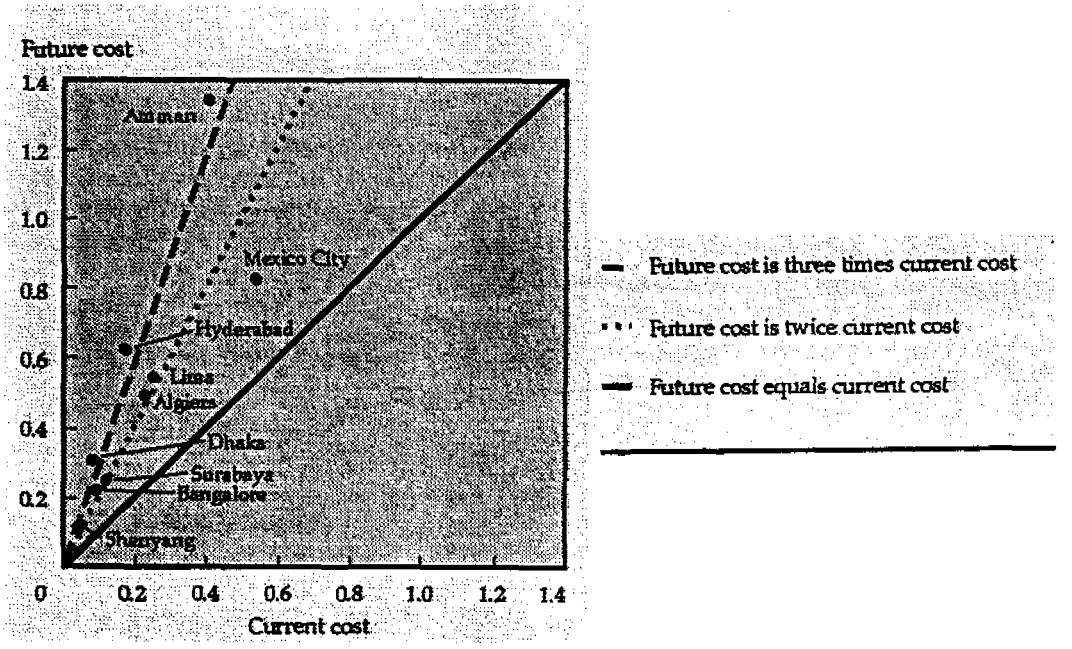
Many cities and towns face increasing difficulties in obtaining sufficient quantities of water of adequate quality. Without effective management of water resources, the cost of these supplies have risen and will continue to rise. In Mexico City, where much water is used inefficiently in nearby irrigated areas, the city has to contemplate pumping water over 1,000 meters elevation into the valley of Mexico; in Lima, upstream pollution has increased treatment costs by about 30 percent; in Shanghai, water intakes have already been moved upstream more than 40 kilometers at a cost of around $300 million; in Amman, the most recent works involve pumping water up 1,200 meters from a site about 40 kilometers from the city. A recent analysis of the costs of raw water for urban areas in World Bank-financed projects (Figure 3) shows that the unit cost of additional water from the "next" scheme is more than double the cost of water from the current scheme in most cases, and more than triple in several cases.

(c) The effects on health

The health benefits from better water and sanitation services are huge. When services were improved in the industrial countries in the nineteenth and twentieth centuries, the impact on health was revolutionary. To cite just two of many well-documented examples:

. Life expectancy in French cities increased from about thirty-two years in 1850 to about forty-five years in 1900--with the timing of changes corresponding closely to changes

Figure 3: Supplying water to urban areas: current cost and projected future costs
(1988 dollars per cubic meter of raw water)



in water supply and wastewater disposal;
. In a natural experiment in the Ohio River Valley in the early 20th century, some cities used untreated water while others treated their water. Over a 10-year period, death rates from typhoid fever were constant in the former group, but declined by over 80% in cities which treated their water.

Today, as shown in Tables 1 and 2 (overleaf), adequate water and sanitation services are just as vital. It is estimated that if all people used adequate water and sanitation facilities, there would be about 2 million fewer childhood deaths from diarrhea each year. Box 1 (overleaf) describes the improvements which are critical for improving health.

(d) The effects on productivity

Improved environmental sanitation has economic benefits. Consider the case of investments for sewage collection in Santiago, Chile. Their principal justification was the need to reduce the extraordinarily high incidence of typhoid fever in the city. A secondary justification was the need to maintain access to the markets of industrialized countries for Chile's increasingly important exports of fruit and vegetables. To ensure the sanitary quality of these exports, it was essential to stop using raw wastewater in their production. Given the current cholera epidemic in Latin America, this was prescient. In just the first ten weeks of the cholera epidemic in Peru, losses from reduced agricultural exports and tourism were estimated at $1 billion--more than three times the amount invested in water supply and sanitation services in the country during the 1980s.

Improved access to water and sanitation also yields direct economic benefits. For many rural people, getting water is time-consuming and heavy work, taking up to 15 percent of women's time. Improvement projects have reduced the time substantially. In a village on the Mueda Plateau in Mozambique, for instance, the average time that women spent collecting water was reduced from 120 to 25 minutes a day. That is a gain of some kind in people's well-being, whether the time is used to cultivate crops, tend a home garden, trade in the market, keep small livestock, care for children, or even

Table 1: The effects of improved water and sanitation on sickness

Disease	*Incidence: cases/year (millions)*	*Prevalence: # infected (millions)*	*Median reduction due to an environmental sanitation improvement (percent)*
Diarrhea	900		22%
Ascariasis		900	28%
Guinea worm		4	76%
Schistosomiasis		200	73%
Trachoma		500	50%

Table 2: Typical effects of improved water supply and sanitation on diarrhea morbidity

Conditions	*Median reduction in cases of diarrhea*
Improved water quality	16%
Improved water availability	25%
Improved water quality and availability	37%
Improved excreta disposal	22%

Box 1: Specific investments that matter for health

The potential health benefits from improved water and sanitation services are huge. What improvements must made to secure these benefits?

. With *water quality*, there are two key points. First, contrary to common belief, contamination of water in the home is relatively unimportant. What matters is whether the water coming out of the tap or pump is contaminated. Second, in most developing countries the imperative is to get from "bad" quality (over 1,000 fecal coliforms per 100 ml, say) to "moderate" quality (below 10 fecal coliforms per 100 ml), not necessarily to meet the stringent quality standards of industrialized countries.

. With *water availability*, as long as families have to go out of the yard to collect water, the quantities used will remain low (typically between 15 and 30 liters per capita per day). The use of water for personal hygiene usually increases only when availability rises to around 80 liters per capita per day, and generally depends on getting the water delivered to the yard or house.

. With *excreta disposal*, it is necessary to distinguish among household and neighborhood effects. For the household, the health impacts of improved sanitation facilities depend only on getting the excreta out of the house, and are thus similar whether family members use an improved pit latrine, a cess pool overflowing into a street drain, or a conventional sewerage system. For the neighborhood, the key is the removal of excreta, a task done well by a wide range of technologies, but badly by many commonly used systems (such as night soil collection and unemptied septic tanks). Because all the fecal-oral transmission routes become much more important where people live in close proximity to each other, the ill effects of poor environmental sanitation are greatest in high-density urban settlements.

rest. Because these time savings are clearly perceived by users, they mean that users are willing to pay substantial amounts (as discussed later in this paper) for easier access.

In the absence of formal services, people have to provide their own services, often at high cost. In Jakarta, for instance, about 800,000 households have installed septic tanks, each costing several hundred dollars (not counting the cost of the land). And in many cities and towns large numbers of people buy water from vendors. A review of vending in sixteen cities shows that the unit cost of vended water is always much higher--typically from 4 to 100 times, with a median of about twelve--than the cost of a unit of water from a piped city supply. The situation in Lima, Peru, is typical. A poor family pays a vendor $3 per cubic meter, which is more than twenty times what a middle-class family pays for water via a house connection. Thus, although a poor family uses only one-sixth as much water as a middle-class family, the monthly water bill for a poor family is three times that of the middle-class family. In the slums around many cities, water costs the poor a large part of household income --18 percent in Onitsha, Nigeria, 20 percent in Port-au-Prince, for example. Because so many people rely on vendors, these expenditures are huge. In Onitsha, for example, households pay vendors enough to provide for two-thirds of the full costs of providing piped water to 80 percent of the population.

The economic costs of compensating for unreliable services -- by building in-house storage facilities, sinking wells or installing booster pumps (which can draw contaminated groundwater into the water distribution system) -- are also substantial. In Tegucigalpa, Honduras, for example, the sum of such investments is large enough to double the number of deep wells providing water to the city. And the costs of compensating for poor water quality are great, too. In Bangladesh, for example, boiling drinking water would take 11 percent of the income of a family in the lowest quartile. With the outbreak of cholera in Peru, the Ministry of Health has urged all residents to boil drinking water for 10 minutes. The cost of doing this would amount to 29 percent of the average household income in a squatter settlement.

II: WHAT NEEDS TO BE DONE?

Investments in sanitation and water offer high economic, social and environmental returns. Universal provision of these services should and could become a reality in the coming generation. But the next four decades will see urban populations in developing countries rising by 160 percent, and domestic demand for water rising fivefold. Current approaches will not meet these demands, and there is a real possibility that the numbers unserved could actually rise substantially, even while aquifers are depleted and rivers degraded. The remainder of this paper suggests that there are four key policy changes which need to be made.

(a) Managing water resources better

The allocation of water between agriculture, industry and domestic users is politically difficult, but if mismanaged, will drive up costs and reduce the quality available for households. Meeting domestic needs will raise difficult issues of allocation and management. As countries and regions approach the limits of their supplies, it will become essential to allocate water efficiently among competing uses. For domestic users, an equally important issue will be the way water quality is managed. A city that discharges untreated sewage into a river imposes additional costs on other users downstream.

When there was little competition for water, it was (correctly) used in large quantities for activities in which the value of a unit of water was relatively low. In many countries the dominant "high-volume, low-value" user became irrigated agriculture. Today about 73 percent of all water withdrawals (and higher proportions of consumptive use) are for irrigation. This share is even higher in low-income countries. In most countries this water is provided at heavily subsidized prices, with users seldom paying more than 10 percent of the operating costs.

As demand by all three sectors increases, governments find it hard to change the existing arrangements. The allocation of water in all countries is a complex issue, governed by legal and cultural traditions. Users typically have well-established rights. Strong sectoral divisions between (often competing) ministries add to the difficulty of managing water resources efficiently. Reallocation is a contentious and ponderous process, generally responding only with long lags to changes in demand. Even though agricultural use of water has the lowest value per cubic meter, there is strong political opposition to diverting water from agriculture to other sectors. The result is that in many countries, industrialized and developing alike, large volumes of water are used to add little economic value in irrigated agriculture, while cities and industries, which would gladly pay more, cannot get enough.

This mismatch is most striking in the areas around large cities. In the Western United States, for example, farmers in Arizona pay less than 1 cent for a cubic meter of water, while residents of the city of Phoenix pay about 25 cents for a cubic meter of raw water. In the industrial heartland of China around Beijing and Tianjin, 65 percent of water is used relatively inefficiently for low-value irrigation, while huge expenditures are contemplated to bring water from other river basins to the cities.

Paradoxically, there is good news in these distortions. Their very size indicates that urban shortages could be met with only modest reallocation. In Arizona, for instance, the purchase of the water rights from just one farm is sufficient to provide water for tens of thousands of urban dwellers. Because of the low value of water in irrigated agriculture, the loss of this marginal water has little overall effect on farm output. To help such transfers, new market-driven reallocation methods have been developed. Thus the city of Los Angeles came to an agreement with farmers in the Central Valley of California whereby the city paid for improvements which reduced losses in the

irrigation canals. For the city this was a good deal, since the unit cost of the released water was less than half that of the cheapest alternative; and the farmers got cash without a cut in their net quantity of water. In another instance, when a recent drought dangerously reduced available water, the State of California set up a voluntary "Water Bank", which purchased water from farmers and sold it to urban areas. The farmers made a profit by selling the water for more than it was worth to them, while the cities got water at a cost well below that of other sources of supply.

In developing countries, too, a start is being made in applying innovative water resource management methods. In the North China Plain, the State Science and Technology Commission determined that the economic rate of return to a cubic meter of water used for agriculture was less than 10 percent of the return to municipal and industrial users. Once agricultural and urban users accepted that they had to talk to each other and had to look at water as an economic commodity with a price, progress -- including reallocation -- was made. And Jakarta has been reasonably successful in reducing the overpumping of its aquifers by registering groundwater users (especially commercial and industrial establishments), and by introducing a groundwater levy.

The striking feature of these "market-based" reallocation methods is that they are voluntary, they benefit both the buyers and sellers economically, they reduce the environmental problems resulting from profligate water use in irrigation and they reduce the need for more dams. Up to now these methods have been applied primarily in industrialized countries, but they show a way forward for developing countries.

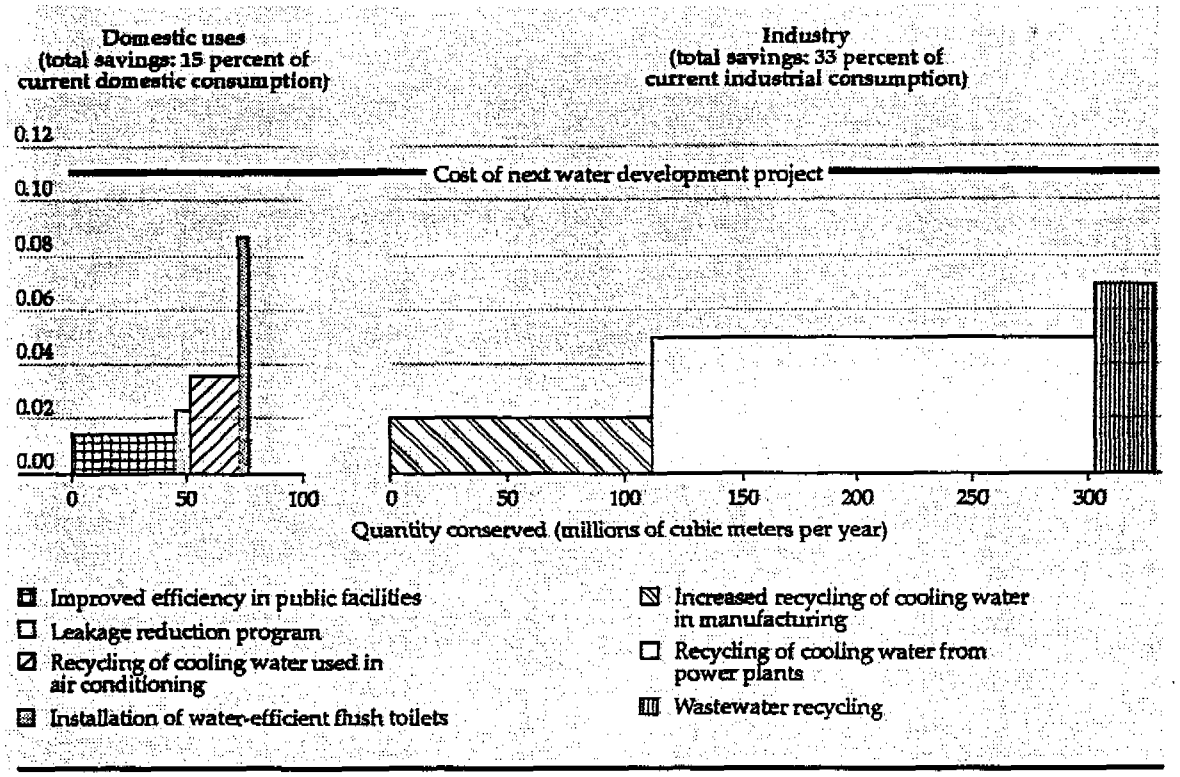
Industries and households also need to be given incentives to use water efficiently. Cities, like farmers, have tended to take demand as given and to see the task as increasing supplies to meet it. As was the case with energy twenty years ago, little attention is paid to conservation and demand management in the water sector. This is both economically and environmentally unsound. Consider the case of Washington, D.C. In the 1960s, the U.S. government concluded that sixteen dams and over $400 million were needed to meet the water needs of the metropolitan area. Because of resistance from environmentalists to the construction of the dams, the plan had to be reconsidered. Eventually the number of dams was reduced to one, and the total cost of the scheme to $30 million. The key changes were a revised plan for managing demand during droughts, and more efficient operating rules. Once again, this illustrates that better economics and a better environment are compatible.

Experience in industrialized and developing countries alike shows the potential for using water more cost-effectively in industry. In the United States freshwater withdrawals by manufacturing industries by the year 2000 are expected to be 62 percent less than withdrawals in 1977, primarily because of the increased costs industries have to pay for disposing of industrial wastewater. In Sao Paulo, Brazil, the imposition of effluent charges induced reductions of between 42 percent and 62 percent in water demand from three industrial plants. For Beijing, Figure 4 (overleaf) shows that a variety of conservation measures in industries and households could release large quantities of water at a substantially lower unit cost than that of the next supply augmentation project.

A particularly important conservation alternative is reclamation of wastewater. Water reclamation for urban, industrial and agricultural use is attractive both to improve the environment and to reduce the costs of water supply. Reclaimed wastewater has been used for flushing toilets in residential and commercial buildings in Japan and Singapore for many years. A recent reclamation scheme in the Vallejo area of Mexico City (Box 2, overleaf) illustrates the great potential, both economic and environmental, of wastewater reuse (and, to anticipate a theme developed later in this chapter, the scope for the private sector).

At present, in most countries the management of water resources is fragmented (there are no mechanisms whereby the effects of one use of water on another potential user are signalled) and "command and control" (since most allocations are by administrative fiat). The challenge is to replace this system with one which recognizes the unitary nature of the

Figure 4: Conserving water as an alternative to expanding supply in Beijing
(discounted cost in dollars per cubic meter)



Box 2 Environmental Improvement, water resources management and the private sector in Mexico

In 1989, faced with rising water prices and potential water shortages, a group of companies in the Vallejo area of Mexico City sought an alternative to water supplied by the public agency. About the same time the Mexican government decided to involve the private sector in water supply and wastewater treatment.

The industrialists realized that, if sewage flows could be adequately treated, this could be a cost-effective and reliable source of industrial water (and, incidentally, improve the environment by treating wastes and reducing the need for new water supplies). Twenty-six Vallejo companies organized a new, for-profit firm, Aguas Industriales de Vallejo (AIV), to rehabilitate an old municipal wastewater treatment plant. Each shareholder company contributed equity based upon its water usage requirements, with total equity totalling $900,000.

AIV operates the plant under a 10-year concession from the government. The plant now provides 60 liters/second to shareholders and 30 liters/second to the government as payment for the concession. The concession agreement gives AIV the right to withdraw up to 200 liters/second of wastewater from the municipal trunk sewer. AIV has plans to double the plant's capacity within five years at an estimated cost of $1.5 million. AIV provides treated water to shareholder companies at a price equivalent to 75 percent of the water tariff charged by the government (currently $0.95 per cubic meter).

resource and its economic value, and which relies heavily on prices and other incentives to encourage efficient use of water.

(b) Providing services that people want and are willing to pay for

During the United Nations Drinking Water and Sanitation Decade of the 1980s coverage increased. But about 1 billion people do not have an adequate water supply and about 1.7 billion people do not have adequate sanitation facilities. The quality of service often remains poor. In Latin America, for example, the levels of leakage and pipe breakage are four times and twenty times higher than is normal in industrialized countries. In Lima, Peru, 70 percent of the water distribution districts provide inadequate water pressure. In Mexico, 20 percent of water supply systems have unreliable chlorination facilities.

What has been done:

Developing countries cannot afford to provide all people with in-house piped water and sewerage connections. The policy has usually been to concentrate primarily on the (subsidized) provision of water, often via house connections for the better-off, and standpipes or handpumps for the poor.

Urban consumers in most industrialized countries pay all of the recurrent costs (operations, maintenance, and debt service) for both water supply and sewerage services. They also pay most of the capital costs of water supply and a large (typically over half) and rising portion of the capital costs of sewerage. The limited data available on rural areas of industrialized countries suggest that subsidies are somewhat higher, but also decreasing sharply. Solid waste collection and disposal facilities are usually financed by local government, with revenues from local taxes and intragovernmental transfers.

In developing countries, by contrast, consumers pay far less. A recent review of Bank-financed projects showed that the effective price charged for water is only about 35 percent of the average cost of supplying it.

The proportion of total project financing generated by utilities points in the same direction: internal cash generation accounts for only 8 percent of project costs in Asia, 9 percent in Sub-Saharan Africa, but more in Latin America and the Caribbean (21 percent) and in the Middle East and North Africa (35 percent). Unsatisfactory as these figures are, things are getting worse: internal cash generation financed 34 percent of costs in World Bank-financed projects in 1988, 22 percent in 1989, 18 percent in 1990 and just 10 percent in 1991.

Much the same applies with solid waste. Although household collection fees are successfully charged in some cities (including Cairo, Guatemala City, and Merida), in most cases these costs are met from local revenues, often supplemented by intergovernmental transfers. These expenditures typically account for between 30 percent and 50 percent of all municipal spending. Only a small proportion (typically 5 percent in developing countries, compared with 25 percent in industrialized countries) of all spending on solid waste is directed to its safe disposal.

A new approach:

In urban areas there is abundant evidence that most people want on-plot water supplies of reasonable reliability, and most are willing to pay the full cost of these services. In some areas this standard solution will have to be adjusted, and special efforts made to accommodate poor people. In Latin America, and more recently in Morocco, utilities have helped poor families to install a connection and in-house plumbing by giving them the option of paying over several years. Another option is a "social tariff", whereby the better-off cross-subsidize the poor. Properly executed, such policies are both sensible (since the poor use relatively little water) and compassionate. But there are dangers. Social tariffs can lead to a general spread of subsidies. And the assignment of noncommercial objectives to a public enterprise generally has an insidious effect on the achievement of all its objectives--commercial and noncommercial alike.

It is widely assumed that the demand situation in rural areas is quite different, that there people

have only a "basic need" which can be met via a public tap or handpump. However, a recent multi-country World Bank study of rural water demand (Box 3) found that most rural people want, and are willing to pay for, a relatively high level of service (yard taps). As shown in Figure 5, they will pay substantially more if that service is reliable. And, as shown in Figure 6, more people will make use of improved water supplies if innovative financing mechanisms are employed.

Twenty years of experience with the provision of water in rural Thailand (Box 4, overleaf), shows how it is possible to break out of a "low-level equilibrium trap" (in which a low level of services is provided, for which willingness to pay and thus revenues are low, and where operation consequently deteriorates) to a "high-level equilibrium" in which users get a high level of service, pay for it, and maintain the desired system.

Figure 5: How reliability of supply affects willingness to pay for piped water: Punjab, Pakistan

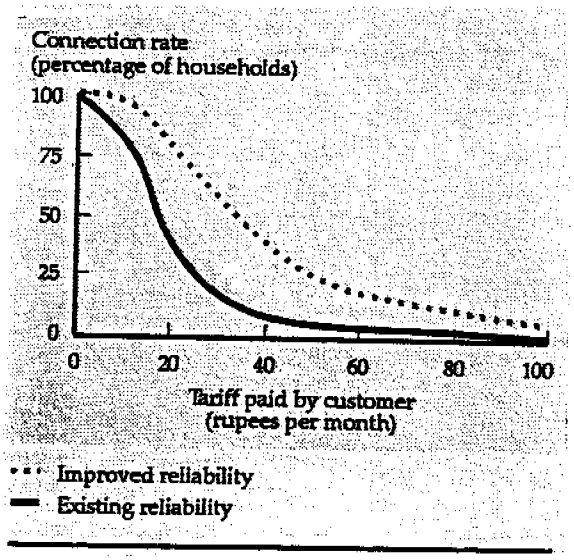
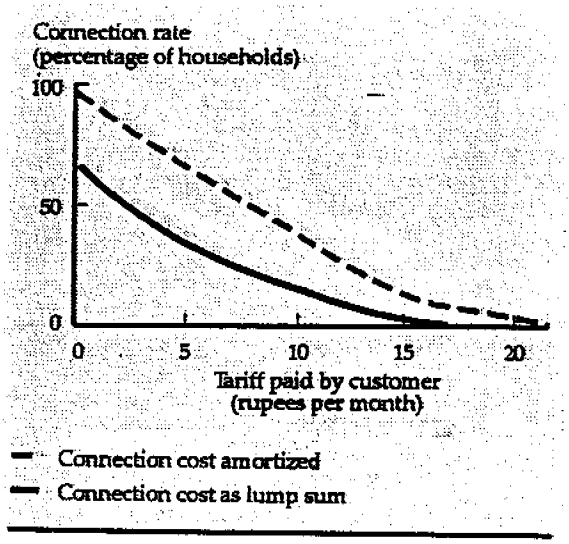


Figure 6: How spreading connection costs over time affects willingness to pay for piped water: Kerala, India



Box 3: The water services that rural people want and are willing to pay for

The World Bank in conjunction with other agencies recently completed a study of rural water demand in Brazil, Haiti, India, Nigeria, Pakistan, Tanzania, and Zimbabwe. The study suggests that, from this perspective, there are four broad categories of rural community.

Type I Communities: In which willingness to pay for private connections is high, and willingness to pay for public water points is low.

Such communities offer exciting possibilities because people want and are willing to pay the full costs of reliable water service delivered via private metered connections into the house or yard. The availability of free public taps (for the poor) will not appreciably affect the demand for private connections. The appropriate strategy is to offer and even encourage (specifically by amortizing connection costs into monthly water bills) private connections, to recover all costs via the tariff, and to deliver a reliable service. A striking finding from the World Bank study is that many more communities fall into this category than is commonly assumed, probably including many communities in Southeast Asia, South Asia, Central and Latin America and North Africa.

Type II Communities: In which only a minority of households are willing to pay the full costs of private connections, but the majority are willing to pay the full costs of public water points.

While the overall willingness to pay for improved water service is considerable in these communities, users vary greatly in their willingness to pay for different levels of service. In these villages the provision of free public water points (such as standpipes, wells or boreholes) would significantly reduce the demand for private connections. With a heavy reliance on public water points, there must be some charge for water from these in order to finance the system. Here the greatest challenge is to devise revenue collection systems that are sensitive to peoples' preferences about when they want to buy water and how they want to pay for it. Kiosks appear to be an attractive and flexible option for many households. Those who wish to have house connections should be able to do so, but must have metered connections and must pay the full cost. Many of the better-off communities in Africa and poorer communities in Asia and Latin America probably fall into this category.

Type III Communities: In which households' willingness to pay for improved service is high, but not high enough to pay the full costs of an improved service.

These are typically poor communities in arid areas. As in Type II villages, willingness to pay for improved water service is high (as a proportion of income). The distinction is that the costs of supply are so high (due to a combination of aridity and low population densities), that improved systems will not be built and operated without subsidies. Given the high priority which people give to improved water supply, if transfers are available from central government of from foreign donors, the households of the community would typically choose to spend the funds on an improved water supply. The primary service offered in such communities would be public taps, wells or boreholes, although metered yard taps should be allowed in the case of piped systems, with tariffs set to recover full costs. Type III communities are typically found in arid areas in South Asia and Africa.

Type IV Communities: In which willingness to pay for any kind of improved service is low

These are typically poor communities in which (a) traditional water supplies are considered more or less satisfactory by the population or (b) in which communities have come to see it as government's financial responsibility. In such communities self-financed improved water supplies are not feasible. Given the low priority afforded improved water supply, available subsidies could be better used in providing other, more highly valued, infrastructure services. For the time being, the appropriate rural water supply policy in such cases is simply to do nothing. For the second category, once government paternalism ceases, it may be that communities would express a willingness to pay and would become a Type II community.

Box 4 Breaking the "low-level equilibrium trap" in Northeast Thailand

A well-documented case in Northeast Thailand, covering a twenty-year period, demonstrates the importance of discovering what users of rural water services want, rather than assuming the answers.

Since the people were poor, the initial project aimed to provide protected water at the lowest possible cost. Because groundwater is abundant in the region, the technology chosen was handpumps. After five years, most of the handpumps were not working, and people's water use habits were largely unchanged. In a follow-up phase, motor pumps provided piped water at community standpipes. Again the project failed. Five years after implementation, 50 percent of the systems were not working at all, and another 25 percent operated intermittently.

Consistent with conventional assumptions, the failures were attributed to technologies that were too complex to maintain and to the inability of poor villagers to pay for improved supplies. Gradually, however, it became apparent that the main problem was not the capabilities of the villagers, but the fact that the service being offered was not what they wanted. They did not want handpumps, which were not considered an improvement over the traditional rope-and-bucket system. And standpipes were no closer than their traditional sources and so offered no obvious benefits. Only piped water to yardtaps could meet people's aspirations.

In the next project yardtaps were allowed, with the users paying the full costs of connection. Five years later the verdict was in: 90 percent of the systems were functioning reliably; 80 percent of the people were served by yardtaps; meters had been installed and locally adapted charging systems had been developed. Not only had the systems been well maintained, but because the service was so popular, many systems had extended distribution lines to previously unserved areas.

In other words, in terms of the typology discussed in Box 3, when these (poor) people were treated as "Type IV" basketcases, the cycle was the familiar low-level equilibrium trap. When they were treated as "Type I" communities, the cycle was broken and a high-level equilibrium established.

Increase investments in sanitation

Public investment in water supply and sanitation accounted for 10 percent of total public investment in developing countries, or about 0.5 percent of GDP. Spending on sewerage and sanitation accounts for substantially less than one-fifth of lending in World Bank-financed projects. Most of this has been for sewage collection, with little spent on treatment. In most developing countries much less than 10 percent of sewage is treated. Similarly, only a small proportion (typically 5 percent in developing countries, compared with 25 percent in industrial countries) of all spending on solid wastes is directed to their safe disposal.

Take account of demand:

There is abundant evidence that urban families are willing to pay substantial amounts for the removal of excreta and wastewater from their household environment. People want privacy, convenience and status; polluted water smells unpleasant and fosters mosquitos; and the installation of sewers typically increases property prices. As with water supply, so with sanitation: where public provision is absent, people pay significant amounts for privately provided services. Even in poor cities, the amounts paid are considerable. In Kumasi in Ghana, for example, large recurrent expenditures are incurred by those who use public latrines and bucket latrines--about 2.5 percent and 1 percent, respectively, of family income. In Kumasi and Ouagadougou, Burkina Faso, families are willing to pay about 2 percent

of household income for an improved sanitation system, or roughly the amount paid for water and for electricity. The examples of Orangi, Pakistan, and Northeast Brazil discussed later in this paper show that even poor families are willing to pay the willingness of households to pay substantial amounts for water-borne sewerage collection systems.

Expand the menu of supply options:

A vital element of a demand-driven sanitation strategy is expanding the menu of services from which users can choose.

In city centers there is no alternative to waterborne systems. Here developers are often allowed to build without investing in the public sewer system. Even in relatively poor cities this problem is not insoluble. For example in Fortaleza, a poor city in Northeast Brazil, developers of all high-rise buildings are required to, and do, install package sewage collection and treatment systems. The point here is not that this is a good technical solution, but that developers can easily absorb such costs and pass them on to those who purchase units in these buildings, even in a relatively poor city.

Beyond the urban core, however, conventional sewerage systems (with average household costs anywhere from $300 to $1,000) are too expensive for most developing countries. In recent decades there have been efforts to develop technological alternatives. Most of this work has been on the on-site disposal of excreta. Pour-flush latrines and ventilated improved pit (VIP) latrines are often the technologies of choice--they provide good service (privacy, few odors) at reasonable cost (typically less than $100 per unit), and their installation and functioning does not depend on the municipality or other organization. At even lower cost, of course, there are yet simpler improvements (such as the latrine slab program which proved so successful in Mozambique).

For a variety of reasons -- high housing densities, impermeable soils and the need to dispose of considerable quantities of domestic wastewater -- on-site solutions do not function well in many urban areas. Sewerage and wastewater collect in the street and low-lying areas, creating major aesthetic and health problems. And in many settings people aspire to "the real thing" (waterborne sewerage).

Current sanitation choices include a Rolls Royce (conventional sewerage), a motorcycle (an improved latrine), and a bicycle (an unimproved latrine). What is missing is the Volkswagen--something that provides much the same service as the Rolls Royce but which many more people can afford. Several types of "sanitation Volkswagen" are being developed:

- Effluent sewerage is a hybrid between a septic tank and a conventional sewerage system. Its distinctive feature is a tank located between the house sewer and the street sewer, which retains the solids, thereby allowing smaller sewers to be laid at flatter gradients and with fewer manholes. Such systems have been widely used in small towns in the United States and Australia, and in Argentina, Brazil, Colombia, India, Mozambique and Zambia. The (limited) cost data suggest that solids-free sewerage costs about 20 percent less than conventional sewerage.
- Simplified sewerage, developed in Sao Paulo, allows smaller, shallower, flatter sewers, with fewer manholes. This simplified design works as well as conventional sewerage but cost about 30 percent less. It is now routinely used in Brazil.
- The Orangi Pilot Project in Karachi (described in Box 5, overleaf) adapted the principles of effluent sewerage and simplified sewerage to the realities of a hilly squatter settlement in Karachi. The result--again, not just the result of clever engineering--was drastic reductions in the cost of sewers, from the $1,000 per household which was standard in Karachi to less than $100 per household (excluding the cost of the trunk sewers). The achievement is extraordinary--about 600,000 people are now served with self-financed sewers in Orangi.
- The condominial system (described in Box 6, overleaf), has been developed and applied in Northeast Brazil and is now being used in low-income urban areas throughout the country. It comprises shallow, small-diameter backyard sewers laid at flat gradients and costs about 70 percent less than a conventional system.

Box 5: Innovative sewerage in a Karachi squatter settlement: The Orangi pilot project

In the early 1980s, Akhter Hameed Khan, a world-renowned community organizer, began working in the slums of Karachi. He asked what problem he could help resolve. He was told that "the streets were filled with excreta and waste water, making movement difficult and creating enormous health hazards". What did the people want, and how did they intend to get it, he asked. What they wanted was clear -- "people aspired to a traditional sewerage system... it would be difficult to get them to finance anything else." And how they would get it, too, was clear – they would have Dr. Khan persuade the Karachi Development Authority (KDA) to provide it for free as it did (or so they perceived) to the richer areas of the city.

Dr. Khan then spent months going with representatives from the community petitioning the KDA to provide the service. Once it was clear that this would never happen, Dr. Khan was ready to work with the community in finding alternatives. (He would later describe this first step as the most important thing he did in Orangi – liberating, as he put it, the people from the demobilizing myths of government promises.)

With a small amount of core external funding the Orangi Pilot Project (OPP) was started. The services that people wanted were clear; the task was to reduce the costs so that these were affordable and to develop organizations that could provide and operate the systems. On the technical side, the achievements of the OPP architects and engineers were remarkable and innovative. Coupled with an elimination of corruption, and the provision of labor by community members, the costs (in-house sanitary latrine and house sewer on the plot, and underground sewers in the lanes and streets) are less than $100 per household.

The (related) organizational achievements are equally impressive. The OPP staff has played a catalytic role – they explain the benefits of sanitation and the technical possibilities to residents and conduct research and provide technical assistance. The OPP staff never handled the community's money. (The total costs of OPP's operations amounted, even in the project's early years, to less than 15 percent of the amount invested by the community.) The households' responsibilities include financing their share of the costs, participating in construction, and election of a "lane manager" (who typically represents about fifteen households). The lane committees, in turn, elect members of neighborhood committees (typically around 600 houses) who manage the secondary sewers. The early successes achieved by the Project created a "snowball" effect, in part because of increases in the value of property where lanes had installed a sewerage system. As the power of the OPP-related organizations increased, so they were able to bring pressure on the municipality to provide municipal funds for the construction of secondary and primary sewers.

The Orangi Pilot Project has led to the provision of sewerage to over 600,000 poor people in Karachi and to attempts by at least one progressive municipal development authority in Pakistan to follow the OPP method and, in the words of Arif Hasan "to have government behave like an NGO." Even in Karachi, the mayor has now formally accepted the principle of "internal" development by the residents and "external" development (including the trunk sewers and treatment) by the municipality.

(c) Investing in waste disposal:

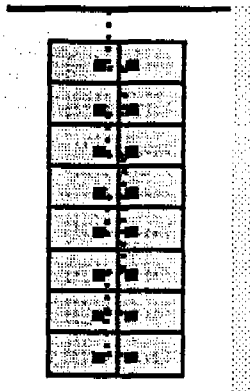
There is an important difference between "private goods" (including water supply, and even wastewater and solid waste collection), in which the primary benefits accrue to individual households and waste treatment and disposal, in which the benefits accrue to the community at large. In the case of the former, willingness to pay is an appropriate guide to the level of service to be provided, and the main source of finance should be direct charges to the users. In the case of waste disposal, however, public financing is essential. Governments that subsidize "private" water supply and wastewater collection services are left with less money to finance treatment and disposal services.

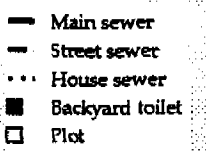
No developing country, however, will have the luxury of collecting and treating wastewater from all households. Because the costs of meeting such goals are extremely high, even in industrialized countries the full population is not served by wastewater treatment facilities. For example, coverage is only 66 percent in Canada and 52 percent in France. In making the inevitable choices (about place and level of treatment), the best ratio of benefits to costs will

Box 6: Innovative sewerage in Northeast Brazil: The "condominial" system

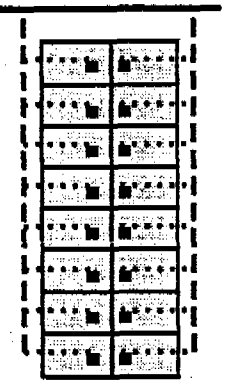
The "condominial" system is the brain-child of Jose Carlos de Melo, a socially committed engineer from Recife. The name "condominial" was given for two reasons. First, a block of houses was treated like a horizontal apartment building – or "condominial" in Portuguese (see Box figure 1). Second, "Condominial" was a popular Brazilian soap opera and associated with the best in urban life! As is evident in Box Figures 1 and 2, the result is a radically different layout (with a shorter grid of smaller and shallower "feeder" sewers running through the backyards and with the effects of shallower connections to the mains rippling through the system). These innovations cut construction costs to between 20 percent and 30 percent of those of a conventional system.

Box figure 1
Condominial sewerage





Box figure 2
Conventional sewerage



The more fundamental and radical innovation, however, is the active involvement of the population in choosing their level of service, and in operating and maintaining the "feeder" infrastructure. The key elements are that families can choose: (i) to continue with their current sanitation system; (ii) to connect to a conventional water-borne system (as in Box Figure 2); or (iii) to connect to a "condominial" system. If a family chooses to connect to a condominial system, it has to pay a connection charge (financed by the water company) of, say X cruzados, and a monthly tariff of Y cruzados. If on the other hand, it wants a conventional connection, it has to pay an initial cost of about 3X and a monthly tariff of 3Y (reflecting the different capital and operating costs). Families are free to continue with their current system (which usually means a holding tank discharging into an open street drain). In most cases, however, those families who initially choose not to connect eventually end up connecting. Either they succumb to heavy pressure from their neighbors. Or they find the build-up of wastewater in and around their houses intolerable once the (connected) neighbors fill in the rest of the open drain.

Individual households are responsible for maintaining the feeder sewers, with the formal agency tending to the trunk mains only. This increases the communities' sense of responsibility for the system. Also, the misuse of any portion of the feeder system (by, say, putting solid waste down the toilet) soon shows up in a blockage in the neighbor's portion of the sewer. This means rapid, direct and informed feedback to the misuser! This virtually eliminates the need to "educate" the users of the system in the do's and don'ts, and results in fewer blockages than in conventional systems. Finally, because of the greatly reduced responsibility of the utility, its operating costs are sharply reduced.

The condominial system is now providing service to hundreds of thousands of urban people in Northeast Brazil. The danger, however, is that the clever engineering is seen as "the system". Where the community and organizational aspects have been missing, the technology has worked poorly (as in Joinville, Santa Catarina) or not at all (as in the Baixada Fluminense in Rio de Janeiro).

usually be achieved by concentrating most public funds on waste treatment in large cities, and especially those with substantial "downstream" populations.

In recent decades some important advances have been made in innovative sewage treatment processes. At the lower end of the spectrum is the stabilization pond, a technology that has proved robust, easy to operate and (where land is not costly) relatively inexpensive. A promising intermediate (in both cost and operational complexity) is the upflow anaerobic sludge blanket, which has performed well in Brazil and Colombia. The point is the importance of developing technical solutions that are adapted to the climatic, economic and managerial realities of developing countries.

(d) Rethinking institutional arrangements

A recent comprehensive review of forty years of World Bank experience in water and sanitation pinpoints "institutional failure" as the most frequent and persistent cause of poor performance. This section deals with the key areas for institutional reform.

Improving the performance of public utilities:

A World Bank review of more than 120 sector projects over twenty-three years concludes that only in only four countries--Singapore, Korea, Tunisia and Botswana--have public water and sewerage utilities reached acceptable levels of performance.

A few examples illustrate how serious the situation is:

- In Accra, Ghana, only 130 connections were made to a sewerage system designed to serve 2,000 connections.
- In Caracas and Mexico City an estimated 30 percent of connections are not registered.
- Unaccounted-for-water, which is 8 percent in Singapore, is 58 percent in Manila and around 40 percent in most Latin American cities. For Latin America as a whole, such water losses cost between $1 and $1.5 billion in revenue foregone every year.
- The number of employees per 1,000 water connections is between 2 and 3 in Western Europe, around 4 in a well run developing country utility (Santiago in Chile), but between 10 and 20 in most Latin American utilities.

Financial performance is equally poor. A recent review of Bank projects found that borrowers often broke their financial performance covenants. A corollary is that the shortfalls have to be met by large injections of public money. In Brazil from the mid-1970s to mid-1980s about $1 billion a year of public cash was invested in the water sector. The annual federal subsidy for water and sewerage services to Mexico City amounts to over $1 billion a year or 0.6 percent of GDP.

Public utilities play a dominant role in the provision of water and sanitation services throughout the world. There are many examples of such utilities working effectively in industrialized countries and, as described above, a few in developing countries. An essential requirement for effective performance is that both the utility and the regulatory body (necessary for such natural monopolies) be free from undue political interference. In the case of the utility the vital issue is managerial autonomy, particularly as regards personnel policies; in the case of the regulatory body, the setting of reasonable tariffs. Although this recipe is simple and well-tested in many industrialized countries, it has been extraordinarily difficult to implement in developing countries other than those with high levels of governance. Sometimes utilities and regulators are nominally autonomous, but usually key policies (on investments, personnel policies and tariffs, for instance) are effectively made by government and heavily influenced by short-term political considerations.

Many projects financed by external agencies have addressed the problems of public water utilities via sizable action plans, technical assistance components, and conditionality. As with public enterprises in other sectors, most of these efforts failed, in the words of a recent Bank review because "public enterprises in developing countries are key elements of patronage systems,... overstaffing is often rife, and appointments to senior management

positions are frequently made on the basis of political connections rather than merit." And things have been getting worse rather than better. Achievement of institutional objectives in World Bank-financed water and sanitation projects fell from about two in three projects in the late 1970s to less than one in two projects ten years later.

Improving the performance of public utilities nevertheless remains an important goal, for two reasons. First, in the medium-term public utilities will continue to provide services to many. Second, improvement in the performance of public utilities is often a pre-condition if private operators (discussed below) are to be induced to participate.

Management at the lowest appropriate level:

A large proportion of overall water resources management problems are resolved when utilities perform efficiently. There are however, externalities, arising from the abstraction of raw and the disposal of wastewater, which demand a broader view. In industrialized countries river basin management in the past was largely a command-and-control type of exercise. Today the situation has changed dramatically, with negotiations among interested parties becoming the key to management of the resources. In this context the experience of the French River Basin Agencies is particularly pertinent. In broad outline, these agencies are governed by "water parliaments", constituted by the major parties in the basin which have an interest in the resource. This includes municipalities, industries, irrigation authorities, power agencies and environmental groups. The agencies specifically do not interfere with the operation of local utilities, but pay attention only to management of the externalities. This is done principally through the imposition of a water abstraction charge and a pollution charge, with the "water parliament" deciding on the levels of the charges in accordance with the specific needs of the basin. The revenues generated by these fees are re-invested in water production and wastewater treatment facilities which serve the needs of the basin. The critical features of the French model -- non-interference in the functioning of municipalities; a broad, consensual decision-making process; and the use of economic instruments -- are of broad applicability both in developed countries and in many developing countries.

Separation of regulation and provision:

Experience in industrialized countries shows that a central problem in improving environmental quality is that the public sector acts both as supplier of water and wastewater services and as environmental regulator. It is both gamekeeper and poacher. The results of this conflict of interest are similar throughout the world. In the United States, for example, publicly owned municipal wastewater treatment plants are the most persistent violators of effluent discharge standards. In England and Wales prosecutions of those responsible for sewage treatment were rare when the river basin authorities were responsible for water resource management, environmental protection, and services. Since 1989, when private agencies were given responsibility for the delivery of water and sewerage services (with public agencies retaining regulatory authority), fines have been increased substantially and prosecutions are diligently enforced. The flip side of separating powers is that service delivery agencies are, in the process, liberated from serving multiple tasks and can pursue well-defined and specific objectives.

Expanding the role of the private sector:

Increased private sector involvement is warranted in two areas. One is in services to public utilities. In industrialized countries the engineering of public works is dominated by private firms, which depend for their survival on their reputation for performance and assume a legal liability for the consequences of any professional negligence. These factors provide powerful incentives for providing cost-effective and high-quality services, and concurrently provide a stringent environment for the supervised "apprenticeship" training that is a required part of professional certification in these countries. By contrast in many developing countries (particularly in Asia and Africa) the engineering of public works is dominated by large public sector bureaucracies. Employment security is total,

promotion is by seniority alone, good work goes unrecognized, poor work is not subject to any sanctions and an atmosphere of lethargy prevails. The direct consequence is the construction of high-cost, low-quality facilities; the indirect effects include a weak professional labor force. The obvious answers are, first, to decrease the direct involvement of the government in public works; and second, to nurture the private engineering consulting industries.

More private involvement is also warranted in the operation of water, sewerage, and solid waste companies. Numerous studies in industrialized countries show that private energy, telecommunications and water utilities are more efficient than public ones. Many industrialized countries have found it difficult to reform public enterprises, except as part of a move to privatize them. Indeed, privatization is increasingly seen as a way not only to effect performance improvements, but also to lock in the gains achieved under reforming public ownership.

In developing countries there has been some experience with private sector operation of water and sanitation utilities. Cote d'Ivoire was a pioneer. SODECI, the utility in Abidjan, is considered to be one of the best-run utilities in Africa. The water utility of Macao was privatized in 1985, and showed dramatic improvements in performance, with consumption doubling and the percent of unaccounted-for-water falling by over 50 percent in six years. More recently Guinea has let a lease contract for water supply to its principal cities, with dramatic improvements in the financial condition in just the first eighteen months (as a result of raising the efficiency of collection from 15 percent to 70 percent).

Other countries have taken more incremental approaches. EMOS, the utility serving Santiago, Chile, has used private contracts for functions such as meter reading, pipe maintenance, billing and vehicle leasing. As a result, EMOS has one of the highest staff productivity rates among water and sewerage companies in Latin America, even when the labor content of contracts is taken into account. The ratio for water supply operations (including contracts) is about 3.5 employees per 1,000 connections--3 to 6 times lower than that for other companies in the region. The example of the Aguas Industriales de Vallejo in Mexico (see Box 2) shows that the involvement of the private sector can take remarkably innovative forms and can even deal with the "public good" issues such as wastewater treatment. In Southern Turkey the private sector has become involved in the management of the sewage treatment facilities which are vital for the region's tourist industry. Faced with persistently poor performance of their public utilities, many other countries are now seriously considering greater private sector involvement, in general following variations of the French model. For example, in Latin America, concession contracts are currently being let for the supply of water and sewerage services in Buenos Aires and Caracas.

Private involvement in this sector is not a panacea and never a simple business. In the United Kingdom water privatization is generally considered to be the most complex of all privatizations undertaken. In developing countries there are formidable problems. For the private operator, the risk involved in developing countries is typically high. In addition to the obvious political and macroeconomic risks, there is usually only rudimentary knowledge of the condition of the assets and uncertainty about the government's compliance with terms of the contract. There will often be strong opposition from groups-- such as existing agencies and labor unions -- who stand to lose from greater private sector involvement.

For the government, there are problems, too. Because of economies of scale, it is virtually impossible to have direct competition among suppliers in a specific area. Countries have tried a variety of solutions. In France there is periodic competition for markets. In England and Wales, economic regulators are mandated to reward efficiency by comparing the relative performance of different companies (a practice which is unlikely to be applicable elsewhere). In addition, in many developing countries it is often difficult to attract private sector interest. Only a handful of firms compete internationally for such contracts. And in Guinea, for example, only two of these international firms bid on the Conakry concession contract. Furthermore, in

many instances there are serious questions regarding protection of the public interest when the negotiations involve, on the one hand, sophisticated private companies and, on the other hand, relatively incapable and sometimes corrupt government agencies.

The case for private sector involvement is simpler and stronger still in the solid waste collection business. Whereas foreign control of water supply is often perceived to involve losing sovereignty over a strategic sector, no one cares if foreigners pick up the garbage. In addition, for populations over about 50,000 there are no economies of scale, and thus no natural monopoly. Experience in many countries--including Argentina, Brazil, Canada, Chile, Colombia, Japan, Switzerland and the United States--has shown that the private sector almost invariably collects solid waste more efficiently than municipalities. Unit costs for public systems are 50 percent to 200 percent higher, with the private sector efficiency gains apparently greatest in developing countries.

Increasing community involvement:

Community groups and other non-governmental organizations (NGOs) also have a role to play in the supply of water and sanitation services and the collection of waste. Box 7 tells the remarkable story of the provision of water and sewerage services to the urban poor in Sao Paulo, and of the (changing) roles of politicians, mobilized communities, and technical agencies in this success. As the Orangi and condominial examples show, in the urban fringe the most productive relationship between community groups and the formal sector is that of partnership. Often this will mean public financing of the "external" or "trunk" infrastructure (which may be operated by either the public or, preferably, the private sector) and the community paying for, providing and managing the "internal" or "feeder" infrastructure. Poor communities throughout the world have also demonstrated that they can collect solid waste. A frequent problem is that the formal system does not do its part, namely

Box 7: Democracy and Water Supply for the Poor: The case of Sao Paulo

In the 1980s the city of Sao Paulo, Brazil, made extraordinary progress in providing all of its residents with water supply and sanitation services. In 1980 just 32% of favellas (low-income, informal settlements) had a piped water supply, and less than 1% had a sewerage system. By 1990 the respective figures were 99% and 15%!

SABESP, the state water utility serving Sao Paulo, is a very sophisticated technical water supply organization. Until the emergence of democracy in Brazil, SABESP had defined its role narrowly and technocratically. Specifically it did not consider provision of services to the favellas to be its responsibility, since it was not able to do this according to its prescribed technical standards, and because the favelas were not "legal". Before the legitimization of political activity in Brazil in the early 1980s, SABESP successfully resisted pressures to provide services to the favelas. While SABESP was resisting this pressure, a small municipal agency (COBES) experimented with new technical and institutional ways of providing water and sanitation services to the poor. On the technical side this did not involve provision of "second-class" service, but of reducing the cost of providing in-house services by using plastic pipe and servicing of narrow roads where access was limited. On the institutional side it meant the community assuming significant responsibility for community relations, and for supervising the work of the contractors.

As the military regime withdrew and was replaced by democratic politics, the pressures on SABESP to serve the favellas increased. Pressure from the communities on SABESP were channeled through the municipal agencies, responsive officials and politicians (including the mayor and governor). Since COBES had shown how it was, in fact, possible to serve the favellas, SABESP had no option but to respond.

The lessons from Sao Paulo are that democratic politics in Brazil has played a fundamental role in allowing the demands of the poor to be expressed, and in transforming sophisticated technical agencies from being part of the problem into being part of the solution.

the transfer and disposal of the waste collected by the community.

Because many water and sanitation services are monopolies, consumers cannot force suppliers to be accountable by giving their business to a competitor. To give consumers a voice in the political process, consumers' associations and rate-payers' boards becomes vital. Paradoxically, because there is such an obvious need for oversight of the activities of a private operator of a natural monopoly, greater private sector involvement stimulates greater consumer involvement. In the United Kingdom, for example, water users have had a much greater say in the running of the industry since privatization.

The performance of water and sanitation institutions in rural areas has often been poor, with innumerable examples of malfunctioning and abandoned public water supplies. Until recently many external agencies--which have had great influence in the rural water sector--have argued that rural people are too poor to contribute to either the construction or the recurrent costs of this "basic need". In many countries users contribute nothing even to the maintenance of supplies.

In recent years external agencies and governments alike have become aware that involvement of the users is essential if water supplies are to be sustained. Generally it has been assumed that support -- in the form of information, motivation and technical assistance -- to the community will come from the government. The difficulty is that governments, especially in rural areas, are often weak, and their officials rarely have an incentive to provide such support. Here the private sector (including NGOs) may be able to help.

Promising examples of the involvement of small-scale private operators in developing countries include:

- In rural Pakistan there are about 3 million families have wells fitted with pumps, many of which are motorized. These supplies are paid for in full by the families, with all of the equipment provided and serviced by a vibrant local, private sector industry.
- In Lesotho, bricklayers were trained (by government) to build improved pit latrines. Government banks also provided (unsubsidized) credit for the financing of improved latrines. The program has been a singular success, thanks mainly to the aggressive role played by the bricklayers in expanding their markets (and, incidentally, providing services).
- In West Africa a private handpump manufacturer has developed a "Sears Roebuck"-type scheme whereby purchase of a pump includes five years of support, including training and the provision of spare parts. Later on, the community will be able to maintain the pump and will purchase the necessary spare parts from local traders. Because the private sector agent has clear incentives to provide such services effectively, this arrangement may work better than government support for communities.

Creating an enabling environment:

This paper has argued that massive improvements are possible, in the environment, health, economic efficiency and equity. The key is firmly in the hands of governments, for the single most important factor needed is political will. Where there are long-established and deeply-entrenched traditions of good public administration (such as in Botswana, Korea, and Singapore) it is evident that autonomous, accountable public sector agencies can provide efficient and equitable services. For the large majority of developing countries, however, such levels of governance are not attainable in the short run, and an important means for providing accountable and efficient services is greater involvement of the private sector. In this paper the examples of Chile, Cote d'Ivoire, Guinea, and Mexico have shown that once a political decision is taken to involve the private sector, it can be done successfully. Where there is a will, there is a way.

To allow helpful change to occur, government must concentrate on the things that it, and only it, can do. Its job is to define and enforce an appropriate legal, regulatory, and administrative framework. This includes tasks as fundamental and diverse as: rewriting legislation so that water markets can come into existence; rewriting contract laws so that the private sector can participate with confidence; building a

capacity for environmental and, where appropriate, economic regulation; developing financial mandates for utilities which encourage conservation; and setting and enforcing quality standards for equipment. Governments must also create conditions under which others--the private sector, NGOs, communities and consumers--can play their parts.

Structured learning:

Developing effective institutional arrangements is thus the core of the challenge facing developing countries in the water sector. This paper describes some of the promising directions which are emerging. In recent years a remarkable consensus around such ideas

Box 8: Structured Learning -- the PROSANEAR Project in Brazil

The 1960s and 1970s were the years of the "Brazilian economic miracle", with GDP increasing five-fold in the two decades. This growth was, however, spread very unevenly, with the top 10% of the population accounting for almost 50% of all income. Over the same period the proportion of population living in towns and cities rose from below 50% to almost 75%.

While great progress had been made in providing piped water (the proportion of urban dwellers with an adequate water supply had risen from 50% in 1965 to 80% in 1986), the provision of sanitation services lagged far behind. 50% of all urban dwellers and the vast majority of the poor did not have access to adequate sanitation services in 1986. Accordingly, with the end of military rule in the mid-1980s, one of the major challenges facing a democratic Brazil was (and is) the provision of sanitation services to the poor who live in the urban periphery. In this context, Brazil entered into negotiations with the World Bank for the financing of a project which would provide poor people with adequate sanitation services in urban areas.

As documented in Box 6, Brazil was a leader in developing innovative institutional and technological solutions to the sanitation problems of the urban poor, and had an able and experienced core of professionals dedicated to this task. These professionals, however, had no illusion about the task ahead -- they realised that something had been learned through experiences like the "condominial", but also acknowledged that there had been many failures. They realised that they were a long way from having a generalizable "model" for providing affordable, good quality sanitation services. Accordingly, they persuaded the World Bank to go along with a radically different approach. Rather than a conventional project which would have pre-established service levels, delivery systems and targets, they argued for an experimental program, the objective of which would be to stimulate agencies -- including local government and the state water companies -- to experiment with innovative institutional and technological approaches to providing sanitation services to the poor. This become the basis for the $200 million, World Bank-supported PROSANEAR Project.

The project is now under execution, and shows every sign of being a resounding success. A wide variety of innovative methods are being used at many levels. These range from modes of interaction between the World Bank and the Brazilian bank responsible for executing the project, to methods for involving communities in the decision to participate in the project, to community participation in project execution, down to methods for enabling households to make choices about service levels.

The project is important not only because it will bring improved services to many low-income families, but because it initiates a radically different process of providing services. The key elements are: fostering technical and institutional innovation; monitoring and evaluating processes and outcomes so that adjustments can be made rapidly both within sub-projects and across projects as successes and failures emerge; breaking the master plan/blueprint mold and providing a precedent for similar approaches in other developing countries.

has emerged. For example, at the International Conference on Water and the Environment in early 1992, 100 governments agreed to the "Dublin Statement", the two fundamental principles of which are that water should be treated as an economic resource, and that management should be at the lowest appropriate level.

Translating these sound principles into practice in a wide variety of cultural, natural and economic circumstances is an immense challenge. A great deal remains to be learned and to be done. From the examples of successful institutional reforms it is clear that this is always largely an experimental process, comprising two essential components. The first is to structure the reforms taking careful account of the incentives facing the various parties and careful account of experiences in other settings. The second is to monitor performance carefully, and to adapt as information becomes available.

This "structured learning" process is now getting underway. For instance, in Brazil the World Bank-financed PROSANEAR Project (Box 8), provides a framework and resources for municipalities and utilities to experiment with innovative technical and institutional arrangements for providing sanitation services to the urban poor. Sub-projects are approved only when they meet the broad guidelines (which require evidence that they have digested the lessons of experience, and that the arrangements take account of the incentives facing different stakeholders). And an intensive monitoring and evaluation effort ensures that sub-projects learn from their own emerging experience, and that of the experiences of other sub-projects. In rural areas, similar efforts are now underway in Sri Lanka and Indonesia. And an international "Utilities Partnership" has recently been formed by the United Nations Development Program, the multilateral development banks and selected bilateral aid agencies to stimulate the reform of urban water utilities, and to ensure that the lessons of experience are learned, shared and incorporated into practice.

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