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POLICY BRIEF

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Providing Urban Environmental Services in Developing Countries

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Introduction

The rapidly growing cities of the developing world generate immense social, economic, and political problems for their governments.[1] At best, such growth reflects the success of agricultural policy, where increased farm productivity has made agricultural labor available for industrial and other urban activities. At worst, city growth reflects the failure of a pro-urban, anti-rural policy bias that drives workers from the land before the growth in agricultural productivity makes them redundant there.

In either case, the growing numbers of poor, industrially unskilled workers and their families in the cities of the less developed countries (LDC's) place costly stresses on the urban environment and demand costly expansions of the urban residential infrastructure.

Why Provide Amenities?

This new LDC proletariat is poor in many ways. They work at low-capital, low-skill, low-wage jobs, often in the life-sustaining but seemingly unproductive "informal" sector. They are poor -- poor in their consumption of food and clothing and poor in the urban environment they endure. Of all the things the urban poor lack, why should LDC municipalities provide drinking water, sanitation facilities, and solid waste collection?

The answer is threefold. One, these urban amenities are provided by a competitive private sector only at much greater cost than experienced by an efficient single producer (scale economies*). Two, the availability and consumption of these services generate benefits beyond those enjoyed by the consumer (externalities*). And three, there are aspects of these amenities that make it difficult or inappropriate to deny the services to those who cannot or will not pay (an element of public goods*). In most societies, these urban amenities are also widely recognized as merit goods.* (Economic terms, followed by an asterisk when they are first used, are defined in the Glossary.)

Why Provide Amenities?

- An efficient single producer is much less costly than competitive private sectors.
- Availability of products generates benefits beyond those enjoyed by consumers.
- It is inappropriate to deny these services to those who cannot pay.

In short, "urban poverty is not simply a matter of individual income; it is part of the spatial and physical organization of the cities" (Roberts 1978: 37).

Lessons from the Now-Industrialized Countries

The provision of urban amenities in rapidly growing cities is hardly a new problem on this planet. The now-industrialized countries experienced it a century ago. Unfortunately for LDC policy formation, we do not learn much from earlier experience, for three reasons:

1. Population growth rates are much higher in LDC's than they were in the now-industrialized world a century ago. Thus, comparable rates of urbanization in LDC's have meant much larger rates of growth in the size of LDC cities. Providing urban amenities today is a much larger problem.

2. Today's industrializations are occurring at lower per capita income levels than historically experienced by the now-industrialized nations. Today's LDC's, on a per capita basis, do not have as many resources available for providing urban amenities as did earlier industrializing countries.

3. Nineteenth-century industrialization and urbanization were undertaken "on the cheap" (Williamson 1990: 270). Urban amenities were provided belatedly and inadequately, especially in the working-class sections of towns. The public tolerance of lower life expectancy in the cities than in the countryside led Friedrich Engels to label the British rural-urban migration "social murder." Such under-provision of amenities is, to twentieth-century thinking, neither morally nor politically defensible.

The goal of universal provision of basic urban amenities has long been accepted. The Twelfth World Health Assembly initiated the Community Water Supply Program with this objective as early as 1959. However, some quarter billion urban residents in LDCs are still without water of reasonable quality or access to sanitation facilities (World Bank 1992: 47). Specifically, 18% of the urban residents of developing countries are without safe drinking water, 28% without sanitation facilities, 30-50% without solid waste collection. At the current pace of progress, we cannot expect universal access to basic water and sewage in cities for another half century.

Causes of Inadequate Coverage

Inadequate coverage for basic municipal services in LDCs is usually attributed to the low GNP per capita, the rapid rate of population growth, and/or the rapid rate of urbanization in these countries. Scatter diagrams support such hypotheses: Figure 1 relates the percentage of the urban population with water and sanitation coverage to each country's GNP per capita.[2] Visually, there is a loose positive relationship between the two. But the dispersion in coverage rates is also very large for any given level of GNP per capita.[3]

Some quarter billion urban residents in LDCs are still without water of reasonable quality.

Contrary to the conventional wisdom, evidence from multiple regression analysis[4] suggests that the greater the extent or rate of an LDC's urbanization, the better will be the urban coverage of water and sanitation facilities. GNP and population, and their growth rates, add nothing significant to the explanation of such coverage.[5]

The actual extent of water and sanitation coverage in an LDC is not simply a matter of the country's ability to extend coverage. As the UNDP-World Bank Water and Sanitation Program put it:

> Failure to achieve coverage targets in the 1980s has as much to do with the manner in which funding sources have been mobilized, allocated, and used as with the absolute level of resources available (1990: 13).

Regression analysis supports this political interpretation: where the numbers of urban people are large, governments are responsive to urban needs.

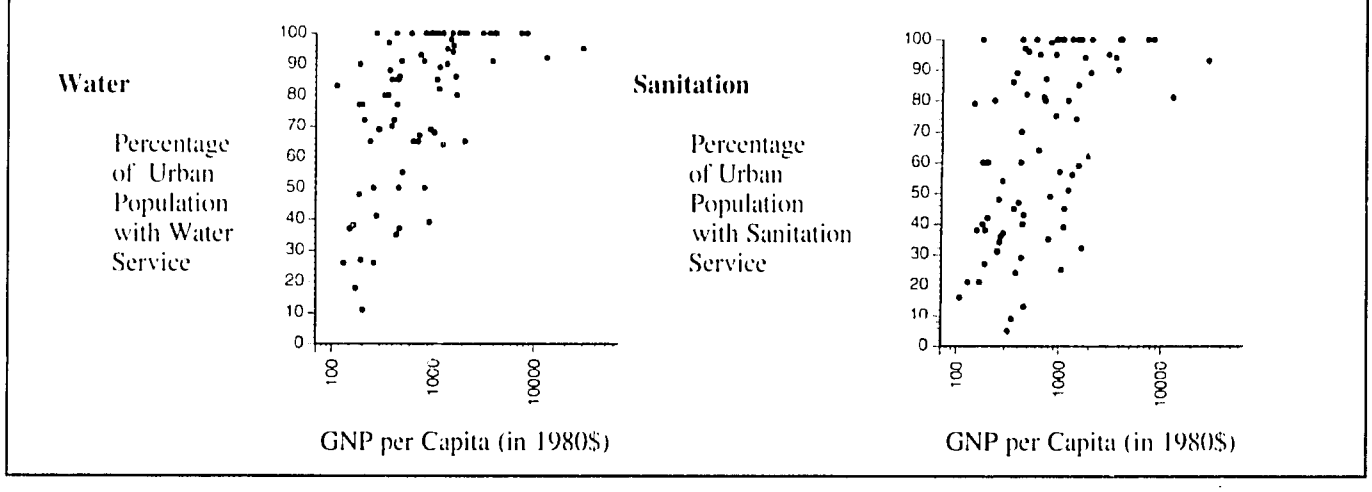
The High Cost of Providing First-Class Coverage

The basic urban amenities — water, sewage, and refuse disposal — are not cheap. "First-class" service in each of these can amount to a sizeable portion of the incomes of many of the poorer residents of LDC cities. Compare these typical costs with per capita GNPs that average $320 in low-income economies and $2,220 in middle-income economies (World Bank 1992):

Water. In a city of a half million people, the capital costs of an entirely new, modern water supply system run about $48 per person. Individual household connections cost another $100 each. These costs occur before a drop of water has been provided to the household.

Sewage. The capital costs of a complete, modern sewage system, with capacity for sewage treatment, run $300-$1000 per connected household. Even connecting

Figure 1. LDC Urban Coverage Rates and GNP per Capita



Cost of "First Class" Service	
Water	$100 per household
Sewage	$300-$1000 per household
Waste Disposal	$14-$113 per metric ton
GNP per capita	
Low income economies	$320
Middle income economies	$2220

a household flush toilet to an existing sewer system costs about $200. Again, these costs occur before a single toilet is flushed.

Solid Waste. Unlike water and sewage, there are few scale economies in solid waste. Solid waste collection and disposal in LDC cities often accounts for more than one fourth of the total municipal budget expenditure. Despite the lower wages of LDCs and the primitive landfill processes found in most, refuse collection costs rival those of the now-industrialized countries — $14-$113 per metric ton.

In short, "first-class" provision of the three basic urban amenities to all citizens is beyond the budgetary reach of most LDCs.

Prices and Revenues

Not only are the costs of urban amenities high, but it is often hard to recapture the benefits in the revenues. In addition, because benefits to the community are greater than benefits to individuals alone, communities should be willing to provide more services than a market solution would provide. Many LDCs compound these inevitable budget problems by applying inappropriate pricing policies that generate unnecessary losses. With losses come declining service levels, the need for subsidies, and the absence of financial reserves to provide for expansion as cities grow.

Let us now explore the price and revenue problems — both the inevitable and the "man-made" problems — that endanger the adequate provision of urban amenities. The economic theory of the pricing in basic competitive or monopolistic industrial structures is well developed and understood. But production of urban amenities rarely fits these simple models, and the teachings of economic theory become muddied:

1. When there are positive externalities, as with the provision of sewage facilities and refuse collection and the concomitant reduction of neighborhood disease, we know that private competitive markets will produce too little at too high a price. But it is not easy, in practice, to estimate the extent of the divergence from the optimum.

2. With public goods, such as street lights and air quality, the difficulty of excluding those who will not pay makes it less likely that the private market can provide these goods profitably. The absence of market information makes it difficult to estimate how much these goods are worth to people and hence how much it is socially desirable to provide. (For a survey of the techniques economists have developed for making these estimates, see Hoehn and Walker 1993.)

3. In natural monopolies,* such as water and sewage systems, there is an inevitable pricing ambivalence. We would like to provide the product to any family that is willing to pay the marginal cost* of the provision of that product to the family; but the marginal cost is below the average cost.* Hence, setting prices at marginal cost implies that there will be losses (i.e. price will be below average cost).

"Man-made" problems are added to these theoretical complexities. Many LDC municipalities set amenity prices too low, below both marginal and average cost. This is not done consciously but rather emerges over time when the general price level gradually or rapidly rises and it is politically difficult to raise amenity prices proportionally. Sometimes the prices are set sensibly, but the bills are not collected regularly.

Sometimes there are "leakages": when water piped into the system is unaccounted for in the billing. For example, 58% of the water is unaccounted for in Manila (Philippines). Overall, the World Bank estimates that "on average, households in developing countries pay only 35% of the cost of supplying water" (1992: 16).

At the current pace of progress, universal access to basic water and sewage in cities cannot be expected for another half century.

Sometimes municipal facilities are turned into employment-providers — some LDCs employ three to four times as many workers as needed in similar LDCs. Losses on these accounts can become huge.

Revenue shortfalls mean deterioration in the quality of service and delays in the expansion of services into new residential areas. It is usually the poorest urban residents who end up deprived. They live in the newest residential areas (i.e. the squatter settlements), and lack the political clout to insist on services and maintenance. When the poor are targeted for adequate levels of urban amenities, the general shortage of these services in LDC cities means that middle-income families quickly buy into these adequately serviced areas. The lucky poor who were selected to participate are left with a capital gain but still without services.

Public subsidy or financing of some urban services does not require public delivery of those services. In many cases, the well-known efficiency of the private sector, with some regulatory constraints, can be used to deliver publicly funded amenities.

The Willingness of the Poor to Pay for Amenities

To some extent, the desperate poverty of the urban poorest makes it difficult for them to display much willingness to pay for basic water, sewage, and waste collection services. But there is increasing evidence that the urban poor are, in fact, willing to pay surprisingly large sums for these basic amenities. Let's consider two examples.

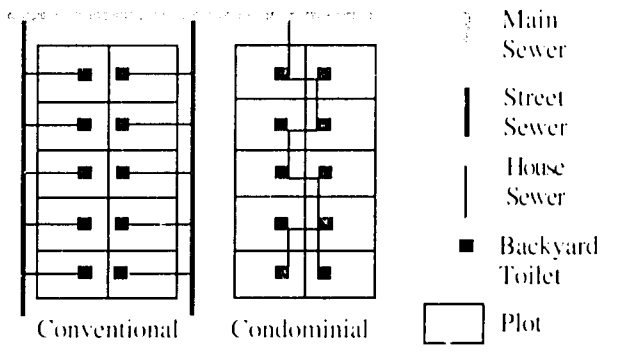
1. In Onitsha (Nigeria), only 10% of the households are connected to city water. They pay on average $3 per kiloliter. The rest of the city relies on private water provision. The very poor carry buckets to retail water vendors and pay the equivalent of $50 per kiloliter for their very small quantities of water.[7] The poor thus display a marginal willingness to pay for water that is 15 to 20 times the marginal willingness to pay of the rich.

2. In Ukundu (Kenya), households not connected to the city water system can get "free" water at distant open wells or buy water at nearby kiosks for $0.50 per kiloliter. Most (62%) of the families choose the kiosks. Each family's time-versus-money decision, implicit in its choice of well water or kiosk water, was analyzed. The cost of kiosk water, including the money value of the carrying time, was about $3.20 per kiloliter. It is, of course, the $3.20, not the $0.50, that indicates the willingness to pay for in-house connection or delivery.

Low-cost, labor-intensive technologies are becoming available for water, sewage, and waste.

There is less evidence of willingness to pay by the poor for sewage and waste collection. However, this does not necessarily mean it is a lower priority. Rather, the externality and public-good aspects of these amenities make their private provision rare.[8] Hence, it is virtually impossible to utilize market data to estimate willingness to pay for what could be a relatively cheap public amenity. When drinking water is not provided, it is found and bought somewhere. But when sewage disposal and waste collection are not provided, the growing and decaying presence of sewage, garbage, and litter is endured.

Figure 2. Conventional and Condominial Sewage Systems



Source: World Bank 1992: 107.

So far, we have examined the situation and the problems in the provision of urban amenities. The next two sections will describe two fundamental policy prescriptions for the appropriate provision of amenities in developing countries.

Appropriate Technology for Providing Urban Amenities

Because "first-class" service is usually prohibitively expensive, consideration of low-cost technologies is imperative if the poor of the LDC cities are to receive drinking water, sewage facilities, and solid waste removal in reasonable quality at affordable prices. Fortunately, in the past decade, a wide array of low-cost technologies for providing these basic urban amenities has been successfully developed and tested:

Water. Connecting each house to municipal piped water can more than double the capital cost of providing water in most LDC cities. Communal standpipes are the major way of reaching the poor at low cost. Mobile delivery (tanker or bicycle) or kiosk sales are sometimes utilized. And in some cases, where groundwater conditions permit, hand pumps can be used to replace contaminated open wells in smaller cities.

Sewage. Many low-cost innovative approaches exist for sewage. Small-bore sewers can be used in combination with septic tanks. Sewage systems, called "condominial," can utilize a shorter grid of smaller, shallower sewers as feeders into the main system (Figure 2).

Cost savings are largest if decentralized on-site sanitation can be used — most appropriately in low-density urban areas with well-drained soil and low water consumption rates. The pour-flush toilets developed in India and the ventilated pit latrine developed in Zimbabwe are widely used in LDCs.

Solid Waste. Capital is expensive relative to labor in LDCs. Thus, low-cost provision of municipal refuse removal services usually involves labor-intensive technologies. Rather than garbage pick-up at each house, communal dumpsters can cut costs, and, because the carrying distance is short, the litter problem is not made worse. Some communities use push carts.

Financial incentives can also motivate people to carry their wastes even greater distances. In Curitiba (Brazil), a city too densely populated for access by collection trucks, trash is collected at stations where bags of garbage are exchanged for food.

Where a single service to all is appropriate, the answer may lie in different prices to different people for the same product.

Privatization of solid waste services can also cut costs dramatically in many LDCs. And encouragement, rather than discouragement, of scavengers can not only reduce the volume of trash going to landfills, but also provide jobs and incomes for the very poor. Finally, state-of-the-art sanitary landfills should be postponed — just getting the trash to any "dump" is an immense improvement over leaving it in densely populated residential areas.

The basic lesson is that there are low-cost, labor-intensive technologies becoming available for water, sewage, and waste. Great improvements over no service can be attained at a fraction of the cost of "first-class" service.

Multiple Pricing of Urban Amenities

Slavish adherence to a doctrine of one-product-one-price will slow the spread of municipal services into poor areas. Though convinced of their need for better water, sanitation, and waste services, the poor cannot always pay even the marginal cost of providing them with state-of-the-art services.

The answer is often different products for different income groups — or, what comes to the same thing after self-selective migration, for different residential areas. But where a single service to all is deemed appropriate, the answer may lie in different prices to different people for the same product. Where very little water is demanded, free water for limited hours may be a better way to serve the poor than the costly installation and monitoring of meters.

Increasingly embraced for externality-generating urban amenities is "life-line" pricing, which takes the form of progressive prices, where the first few units of the service cost very little, but later units cost increasingly more per unit. Such two-part tariffs* have the dual advantage of subsidizing the poor and of permitting sufficiently high rates for the rich so that losses are avoided (Prakash 1987).

Finally, it is often the large, once-and-for-all, initial connection fee — rather than the ongoing water or sewage fees — that deters the poor from connecting into a municipal system for providing urban amenities. For these people, for whom the connection fees are too great for their own savings but too small to be of interest to the capital markets at reasonable interest rates, connection "mortgages" at commercial interest rates may be appropriate (Linn 1983).

Conclusion

There are compelling arguments for providing basic urban amenities for all residents of LDC cities, perhaps even on a subsidized basis for the very poor. Does this mean further increasing the "urban bias" (Lipton 1976) of development strategy? It need not. The urban poor need public provision of water, sewage, and waste disposal services more than the rural poor; the total cost of minimal provision of these amenities is higher in urban areas than in rural areas; and the external benefits of their provision are greater in urban areas than in rural areas. These three facts make such provision higher in priority in urban than in rural areas.

An urban-rural balance in the provision of public services does not mean an identical public expenditure on identical public services in the two areas. To offset the greater expenditure on water, sewage, and waste disposal appropriate for the urban poor, LDCs should stand ready to incur the greater expenses required to provide other services to the rural poor, such as education, health care, and transport. The argument here is not that the urban poor should be benefited at the expense of the rural poor, but rather that the urban poor should be benefited by receiving a more appropriate mix of public and private goods.

Cost of Alternative Sanitation Techniques

Technology	Mean Annual Cost (1978$)
Low Cost	
Pour-flush toilet	19
Pit latrine	28
Communal toilet	34
Vacuum-truck cartage*	38
Low-cost septic tank*	52
Composting toilet	55
Bucket cartage	65
Medium Cost	
Sewered aqua privy*	159
Aqua privy	168
Japanese vacuum-truck cart	188
High Cost	
Septic Tank*	369
Sewage*	400

Costs include appropriate shadow prices for unskilled labor, foreign exchange, and capital.
* Suitable for urban areas.

Source: Linn 1983: 151

POLICY BRIEF

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Glossary

Average Cost: The total cost of production divided by the total output.

Externality: This arises when an action by one household or firm directly imposes costs (negative externality) or benefits (positive externality) on other households or firms, and these direct effects are not fully reflected in market prices.

Marginal Cost: The additional cost incurred in order to produce one additional unit of output.

Merit Good: A good that the people as a whole think that all people should consume, no matter what their incomes.

Natural Monopoly: An industry in which any relevant level of output is more cheaply produced by one firm than by two or more. Natural monopolies are caused by scale economies.

Public Good: A good with two attributes: 1) even if it is consumed by one person, it is still available for consumption by others; and 2) it is difficult or impossible to prevent people from freely consuming the good. Because of this latter attribute, individuals have no incentive to reveal the value of the good to them by purchasing it or offering to pay a share of its cost.

Scale Economies: These occur when a firm's long-run average cost falls as its output increases over the relevant range of production. Marginal cost is below average cost.

Two-Part Tariff: A pricing technique in which users pay a fixed sum for access to a service and pay another charge for each unit of the service they consume. The charge per unit may vary, making the system a multi-part tariff. When the charge per unit increases with the amount consumed and starts at a very low rate, it is called "life-line" pricing.

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Endnotes

1. This Policy Brief has been largely excerpted from a longer EPAT Working Paper Draft (Coolidge *et al.* 1993); sources, more examples, and fuller explanations are given there.

2. Figure 1 utilizes 1980 data for 57 LDCs. GNP per capita is in US$ and displayed on log scale. Source: WHO 1984 and UNDP 1991.

3. Simple regressions of various measures of LDC urban environmental welfare on per capita GNP across LDCs and time generally uncover both the small positive relation and the high variability around a best-fit line.

4. Multiple regression analysis is suggestive. When the urban percent coverage rates (for water and sanitation, in turn) of these 57 LDCs are regressed on four independent variables (1980 GNP per capita, 1980s growth rate of GNP per capita, 1980s growth rate of population, and 1980 percentage of population urbanized), only the last estimated coefficient is significant. And, surprisingly, it is significantly positive in both regressions.

5. Of course, one must recognize the possibility of a reverse causation--the better the urban coverage of water and sanitation facilities, the greater the induced rate of rural-urban migration.

6. Prices in dollars are given only to indicate the relative magnitudes of the prices to the rich and the poor; their absolute values are biased by the overvalued exchange rate used for the conversion.

7. There is extensive developing country recycling of refuse, largely in the informal sector, but little solid waste collection and disposal.