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Don't Blame The Poor: Cost Recovery for Rural Water

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Abstract

Findings from Nepal and Bolivia dispprove the common assumption that poor rural communities are unable to recover the costs of projects. Engineering, economic and institutional errors and decisions contribute to problems with cost recovery. Poorly designed and constructed systems increase capital and O&M costs and limit benefits. Methods to evaluate financial feasibility and strategies to improve project cost recovery are presented.

Introduction

Nobody likes to talk about cost recovery except the World Bank. In an analysis of feasibility studies of 43 water projects financed by 13 donors in Sri Lanka in 1982, only the Bank looked at cost recovery. It is commonly assumed that rural communities are too poor to pay the O&M, let alone the capital cost of projects. Since water is a basic need, it is implied that it is bad taste to bring money into the discussion because communities which need service most will be left out. In addition, engineers and the occasional social scientist involved in project planning, are not trained to evaluate cost recovery.

This combination of lack of knowledge and fear of what might be discovered if studies were actually carried out, results in the best planners training O&M personnel, setting up a water committee and leaving it with vague words about its responsibility to collect some money. In the absence of regular appropriations from an already overcommitted central government operating budget, the engineer reappears on the scene when the village system comes up for rehabilitation and expansion, actually a euphemism for rebuilding a system which has had little attention since the day it was constructed. If so many villages were not still in line for initial systems, this day of rehabilitation could easily arrive anywhere from one day to six months after the system was completed for 50% of the rural projects constructed under the Decade. Few professionals revisit completed systems, however, and constructed project statistics grow fatter.

Background: Cost Recovery and Project Benefits

The purpose of cost recovery is to sustain constructed water systems on a long term basis and to provide funds to support the future construction and expansion of additional systems. Limited government financial resources make rural water supply a low priority, and recurrent costs are increasingly difficult to allocate from the government's operating budget as the number of systems increases, unless there is some revenue from those using the service.

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Project benefits only accrue from properly functioning systems. If the costs to maintain them are too high, the benefits will not be equitably distributed or the system will fall into disrepair and the value of the project investment will be lost. When the argument is given that "something is better than nothing" an answer comes from the People's Republic of China about the ill-conceived Baoshan Steel Works: "Does it matter that the intentions were good, if no one benefitted?" When resources are scare, money inefficiently allocated has also been lost for positive use in other communities.

Contrary to the prevailing assumption about the financial limitations or collection skills of rural communities, evaluation of three hundred systems in Nepal and Bolivia indicate that a real constraint to implementing successful cost recovery programs is the failure of professional staff and executing agencies to consider critical technical, economic and institutional factors rather than the financial limitations of the villages. In communities ranging in size from 200 to 10,000, 50% of newly constructed projects were found to have poor or non-functioning systems, underutilized output and no health benefits attributable to the project to compensate for significant stress placed on community financial and human resources.

These conditions were common to two different countries with completely different implementing agencies, policies and engineering approach. What both projects had in common was their location in the poorest sections of remote areas of mountainous countries. The Bolivian systems were funded by a bilateral donor, implemented by an international NGO using a decentralized approach with staff Bolivian engineers and American supervision. Some of the Nepalese projects had a similar orientation using UNICEF funds and supervision; others were funded by the central government and designed and implemented by the national water agency.

The status of the Bolivian projects was especially interesting since they already incorporated aspects of project design which typically are meant to respond to problems in operation and maintenance and long-term system viability: strong community mobilization, and participation in the construction and supply of financial resources, the training of village operators, the organization of a village water committee responsible for the future system and collection of water fees.

An Evaluation of Non-Financial Factors Affecting Cost Recovery

An evaluation of the systems showed that about 50% had operating problems within days and 6 months of completion. Only 30% of the communities were found to be collecting any household fees, and these were insignificant, although they had been impressed with the importance of doing so. None of the communities had purchased a basic set of tools to use for maintenance. The NGO concluded from these results that the comunities were too poor to collect adequate funds, but since the systems had been handed over to the communities, the staff turned to the construction of other similar systems.

It was found that there was not a simple correlation between communities responsible for their systems, failure to maintain them and lack of financial resources to pay the price of doing so. In fact the planning, design and construction process which had been the responsibility of engineers had overlooked a number of factors which directly affected the community's ability to pay for the continued operation and capital expansion of the system. Failure to consider them left communities with inefficient systems, wasted their capital investment of 30% and threatened to be a drain on future resources. All affected the potential cost recovery on the system which would give it long term value.

Planning and Design Factors

In the planning process certain decisions were made:

1) The project only supplied one service level of patio connections. No public standpipes were provided. People were expected to contribute 30% of the capital cost of the project in labor and funds, and also purchase a patio connection in order to participate in the system. Even in the poorest communities the NGO assumed that at least 30% of the capital cost of the project of "more than basic" standard was affordable. Those who did not join the system were simply assumed to be malcontents and were permanently left out, although all projects were designed to effectively capture the full flow of the source. The results were that between 30 and 60% of the population was excluded from systems and were worse off than before, left to using inferior sources. Had the policy permitted a combination of standpipes and patio connections, an analysis of the alternatives would have demonstrated that the incremental cost of a few standpipes was very small, whereas the revenue base from which to collect household fees using a two-tier system to reflect level of service, would be greatly broadened.

2) The project was to supply communities with populations of 200-2000. However the NGO based its funding proposal on popualations of 400 and then committed itself to serving a certain number of communities for the funds received. This forced staff to allocate materials to small communities with small systems but few economies of scale. Thus where more people could have been served at lower cost per person in a community of 600 than two communities of 300, the NGO selected the small communities to ensure it met its quota. Distribution systems were also arbitrarily cut off in the middle of villages when they found they had used up a certain amount of pipe. The effect was to leave the communities with systems which immediately required extension using their own capital. The use of incremental analysis on the cost of service area expansion would have shown that more people could be served for less, than moving on to the next village. As in the example above the revenue base for cost recovery would have been expanded beyond the increased incremental cost of extending the distribution system. Where the community was left to extend the system itself, it clearly lacked the technical skill to do this, and was likely to lower the quality of existing service in its attempts.

3) No studies were carried out as to the ability or willingness of the villagers to pay. It was assumed they were able to. However the number of households which failed to join indicated that the cost was too high for many, and the failure to collect fees in communities strongly motivated and organized to do so indicated that financial resources had been exhausted by the high cost of the initial contribution.

4) In the design phase the community was not involved in the selection of alternative or service level. Had a study of ability or willingness to pay been combined with capital and O&M cost estimates for various alternatives, including more basic levels of service, the NGO and the community may have confronted the fact that they couldn't afford the system selected. Engineers could have tried to make the alternative more cost effective. Communities may have selected a more affordable option. As it was no one

had the facts until it was too late. No one was seriously looking at cost recovery for O&M and system expansion.

5) The NGO selected diesel pumps over electric pumps because the capital cost was lower. However the communities were unable to pay the higher operating cost of fuel and began to limit operations, rendering the system inefficient, in order to limit its costs.

6) Although the NGO told communities they had to collect fees, they never estimated the materials, equipment and labor needs nor their combined costs. The communities had no idea what was required or whether it could be afforded. The engineers never knew either. Knowledge at the planning stage that there is a gap between system requirements and the ability to meet them does not have to mean the project can't be built. Instead a re-evaluation must take place. Once the system is designed and constructed it is difficult to make adjustments.

Other problems with design reflected more standard engineering problems but still led to systems that didn't function: Sources were overestimated, the maximum day water demand was based on the wrong demand period, and tanks were constructed where they captured only a small portion of the source while the villages had to ration water and systems operated intermittently. In these cases the communities had committed their resources to systems which were poorly designed, and then were left to pay the higher price of trying to operate and maintain them.

Construction and Operation and Maintenance

In construction the problem was similar. Construction supervision was inadequate and systems suffered failures constantly which the communities had to pay to fix.

In training for operations and maintenance, communities were not trained in accounting and collection procedures, how to know when to purchase materials to maintain an inventory. They had no way of keeping the household fees current with the needs of the sytem over the years.

As a result of the problems found in the systems, the donor financed a "rehabilitation program" for about 50 systems which were less than a year old. This became part of a follow-up rural water supply project for the NGO.

Evaluating Strategies for Cost Recovery

The elements of a cost recovery program include assessment of annual systems costs of operation, maintenance and replacement, development of a water charge structure, an evaluation of the balance between projected annual costs and revenues, the ability of households to pay the projected monthly charges, and the potential for a working surplus. Issues involve how the costs will affect the poorest households' access to project benefits and strategies to lower the financial impact.

The following are some practical examples of how to assess the financial feasibility of rural systems. These are the result of preparation of projects in Bolivia and Nepal following the evaluations noted. The explanation and details are not intended to be complete. The full reports can be obtained from the author, CARE ("Bolivia Child Survival Project" August 1986) and The World Bank Water and Urban Department ("Nepal Western

Development Region Rural Water and Sanitation Project." April 1984).

Operation, Maintenance and Replacement Costs

Coming up with reasonable annual costs requires no specialized knowledge of the engineer. It is only necessary that he think out, for a given system, a) routine costs such as wages, materials, travel to purchase materials, fuel and b) contributions to the replacement for major or extraordinary repairs or replacement of worn out parts of the system, calculated on the basis of their economic life. The most important aspect of these costs is that they be based on the type of system constructed, the real physical conditions and village treatment of the system. Costs should represent the "worst case". It is better to assume that the village operator will be paid. If he will do the work voluntarily, all the better. These estimates should be made during the investigation and design phase and discussed with the water committee. The table "Bolivia Rural Water Supply: Annual Costs and Revenues" shows the cost of a Bolivian system to serve 50 families.

In Bolivia the instability of the Bolivian peso, with a 10,000% rate of inflation, convinced engineers it was meaningless to try to estimate future costs. Two actions could have been taken. First, the engineers still could have estimated the materials, tools, pipe which would be needed at given intervals and given this to the committee, which would make periodic visits to the market and assess the need to raise service fees in accordance with rising prices, and second, a district level storehouse could be set up with materials and equipment purchased in bulk to serve all the systems within one day's walk. This would minimize the impact of price changes although full replacement costs would still have to be charged to keep the storehouse stocked.

Water Service Fees

It is the responsibility of the project to offer guidance to the water committee in setting fees which reflect the funds necessary to keep systems operating properly, the villagers' ability to pay, and the level of service each would receive. In the first 200 projects in Bolivia the engineers had given up this effort, eventually convinced the villages could not generate the necessary funds. (This did not, however, lead them to change the policy of patio connections and high capital investment.) The lack of goals for the community, unaware of what they should buy, when and how much to collect to be able to do so, permitted small repair problems to build up and become large ones. The very vagueness of their instructions to "collect money" discouraged otherwise motivated people.

The table shows several categories of monthly household water charges to recover costs and equitably reflect through charges the different levels of service received. The most important aspect of the water charges is that no charge should be so high as to discourage use of sufficient quantities of water to achieve health objectives of the project. On the other hand, charges should not be so low as to encourage waste by users, prematurely signalling the need for additional investment. (Ideally the charge should reflect the true economic cost of development for each incremental cubic metre. This is best accomplished with average incremental cost (AIC). AIC is equal to the present value of the investment divided by the present value of the incremental water production during the useful life of the project). The committee should also be warned to raise the charges at appropriate intervals to keep up with price increases.

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BOLIVIA RURAL WATER SUPPLY
Annual Costs And Revenues
(in Millions of Pesos- 1986)

	Monthly Charge	Number of Connections	Annual Revenue
Connections			
Semi-public tap (4 households)	1.5	10	180
Semi-public dispersed	3.0	4	144
Patio connections	3.5	30	1260
Patio conn. w/ water seal toilet	6.0	5	360
Industrial (chicha, etc)	8.0	1	96
Additional taps	6.0	0	0
Water Fee Income			2,040
Other (connection fees)			20
TOTAL REVENUES			2,060
			Annual Costs
Wages			600
Chemicals			15
Materials			196
Replacement of civil work, plant & equipment			954
Other (administration)			94
Other (major repairs, reserves for bad accounts)			40
TOTAL COSTS			1,899
NET SURPLUS (+)			161
Consumption (m^3/connection/month)			9.1
Volume (thousand m^3)			5.5
Average Tariff (millions P/m^3)			0.372
Average Cost / Volume Sold			0.346
Operating Ratio (%)			92

The proposed rates show a logical relationship between the charge and the service received through increased quality and quantity and capital contribution. The fee set for the lower income group receiving semi-public service (one tap per four households) should be a nominal one. When a household in this group demonstrates increased ability to pay by applying for a patio connection, it would be charged accordingly, as would any other household which improves its service to the next level.

System Revenues and Costs

The table shows that even a system with relatively high annual costs serving a small village population is financially feasible. Water use was assumed to vary from 30 lcd for semi-public use to 75 lcd for patio connections with water seal latrines. It is also assumed that even during the life of the project, some households will begin to upgrade their service as they save money and see the advantages of higher levels.

The results of the income statement show that with a range of monthly charges to households of $0.75 to $3.00 depending on the level of service, the amount of water used and the ability to pay, the community can adequately cover its annual costs and have a surplus of at least $100.

Affordability of Project Services

Ability to pay and willingness to pay should be based on estimates of the lowest household income in the poorest departments served by the project. The water fees in the Bolivia case were found to be affordable. Three sources were used and cross-checked to arrive at a realistic basis for determining the low income household's ability to pay: an unpublished report by IFAD of Gross National Product Per Capita for the relevant departments was used to establish the average monthly household income in the poorest department. To establish the lower end of this income distribution scale, the daily rate and minimum monthly rate for farm and unskilled labor were used. Under the worst possible case the lower end of the income scale was established at $17-$26 per household per month. The highest level service, with water-seal toilet, could be achieved for less than four percent of monthly income. The lowest level could be attained for the value of one day's unskilled labor. These were found to be reasonable charges which communities should be both willing and able to pay and project designers could proceed with confidence.

Nepal Cost Recovery Findings and Strategy

The findings for potential cost recovery in Bolivia are supported by similar findings in Nepal. In Nepal the philosophy was completely different. Only a basic level of service was to be provided. Improved service levels in the form of patio connections would be justified only if they recovered the full incremental cost and generated sufficient revenues to effectively lower the monthly charges required of the lower income households.

NEPAL RURAL WATER SUPPLY
Monthly Cost Per Household
(NRs. 1984 prices)

Project	All Public Taps	Public Taps/ Yard Taps	Charge as % of HH Income	Yard Taps as % of Total
ArlangKot	6.0	3.6/13.0		
Daugha	2.7	0/10.5		
Dhurkot Bastu	7.7	0/0		
Musikot	3.2	0/12.3		
District Average				
Year 1990	4.8	2.9/13.0	<0.5 - 1.5	18.1
Year 2000	3.5	1.1/13.0	<0.5 - 1.5	18.9

The results showed that where only public taps were provided the costs in different villages ranged from $0.10 to $1.10 per month. In communities of over 2500, providing improved service was justified since it resulted in reducing the charge to low income households to $0.00 to $0.70 (patio connections were $0.88 per household per month plus a connection fee and the cost of labor and materials.) The Nepal project concluded that the most equitable and beneficial method of cost recovery was the use of a geographically based approach. Within each district, a district-wide flat rate would be applied per household for each service level. The rate for patio connections was $0.88 per household with that of public tap users at $0.18 to $0.60 per household. Small communities with high costs per capita would be subsidized by larger communities benefitting from economies of scale and a broader revenue base.

The justification for the cross subsidy between different user groups was that it constituted a benefit tariff proportionate to convenience and increased water use. The justification for district-wide rates essentially providing a cross-subsidy from larger communities to smaller ones was that by centralizing certain technical services for all systems in a district, all would be better served at a lower cost. An evaluation of ability to pay found that the charges represented 2 to 3 percent of monthly income for the poorest households. In five of the eight Nepalese districts it was found that a net operating income would exist to provide a source of investment capital for new rural works or the sanitation program.

Conclusions

An evaluation of rural water systems in Bolivia and Nepal found that engineering, economic, and policy decisions adversely affected the ability of villages to recover costs. Financial plans incorporating economically efficient design, realistic assessment of O&M costs, a broad revenue base, equitable, multi-tiered tariff structure, and an analysis of ability to pay by the lowest income households, demonstrate that even poor rural villages can recover all recurrent and significant capital costs.

COST MODELS FOR SMALL SYSTEMS TECHNOLOGIES: U.S. EXPERIENCE

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Introduction

The objective of water treatment is to provide safe and aesthetically acceptable water to customers in sufficient quantities at reasonable costs. Communities with an abundance of safe water generally have little trouble in meeting the above objectives. Communities that have a limited supply or a source of water that must be treated may be faced with many problems in meeting those objectives. These problems are amplified in small communities that have insufficient money or qualified personnel to construct and operate a water treatment facility.

In the United States, over 37,000 systems serve fewer than 500 people. A significant number of these systems have difficulty in providing water that meets the Maximum Contaminant Levels established under the U.S. Safe Drinking Water Act. In addition to quality problems many of these systems have financial difficulties as well. The cost of technologies required to meet the requirements of the act have raised many concerns among water utilities in general.

In response to concerns about impacts of cost on drinking water utilities, the Drinking Water Research Division of EPA initiated a study to develop standardized cost data for 99 water supply unit proceeses.[3] The approach was to assume a standardized flow pattern for the treatment train and then to estimate the cost of the unit processes. This approach requires assumptions about such details as common wall construction and amounts of interface and yard piping required. After the flow pattern was established the costs associated with specific unit processes were calculated. As built designs and standard cost reference documents were used to calculate the amount of excavation, framework, and materials such as concrete and steel. Information from existing plants and manufacturers was used to calculate the costs of equipment associated with a unit process.[3] Once basic information had been calculated, capital cost curves were developed. In 1984, three years after the first set of reports was issued, another report was issued containing cost curves for "small systems technology", using the same methodologies.[2]

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