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Water and Sanitation Program

PROSANEAR

People, Poverty And Pipes

A Program Of Community Participation and Low-Cost Technology Bringing Water and Sanitation to Brazil's Urban Poor

by Yoko Katakura and Alexander Bakalian

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INTRODUCTION

PROSANEAR: PEOPLE, POVERTY AND PIPES

The authors of this paper, Yoko Katakura and Alex Bakalian, are well known in the water sector for their work in LAC. Between the two, they cover a formidable area of financial analysis and engineering and have pioneered projects bringing water and sanitation to the poor in Peru, Paraguay, Brazil and recently involving approaches involving privatization of water supply services in Argentina.

Bakalian, as task manager of PROSANEAR I, introduced new technologies (the condominial sewer) into the Bank's operational lexicon. He has gone on to develop projects focused on bringing water and sanitation services to the urban poor and rural poor in Peru and Paraguay. Most recently he has been key in supporting the new focus on free entry and competition in water and sanitation services. By identifying and supporting the small-scale independent water providers in Paraguay, he has virtually opened up a new concept of private sector participation with strong implications for the poor.

During the World Bank's Water Week, December 1997, Katakura presented her findings on the distribution of benefits of privatization in Argentina among stakeholders. She demonstrated that the poor actually come out the losers in the PSP process, or at least in its early forms. At present Katakura is the Task Leader for the PROSANEAR II, in Brazil, (a Portuguese acronym for the Water and Sanitation Program for Low-Income Urban Population) that will follow up the PROSANEAR I - a pilot program - just concluded (1992 - 1997).

The subject of this paper, PROSANEAR - PEOPLE, POVERTY AND PIPES, entails a new sector vision. In it the authors argue strongly that PROSANEAR I comes as a clear answer to failure of the past experiences of top-down and supply-driven projects in Brazil's shantytown neighborhoods, called *favelas*. The paper describes the PROSANEAR I experience in detail, as an innovative project that offers new hope for bringing water and sewerage services to Brazil's *favelas* and perhaps to poor urban neighborhoods around the world. With World Bank financing, Brazil recently completed the pilot program that developed and tested a new approach to delivering water and sanitation services to the urban poor and enjoyed a whole new level of success.

This experimental phase clearly showed the power of combining community participation and low-cost technology.

The authors highlight the key to PROSANEAR I's success as stemming from the combination of two novel approaches to delivering urban services: cost-effective, appropriate technologies and community participation. By putting engineers and social experts on the same team, PROSANEAR found a way to overcome the usual shortcomings of a top-down approach. Instead of carrying out a top-down (pre-designed) project, PROSANEAR teams went into communities to ask what kind of water project the people wanted if- any-and what kind they would be willing to support with their money and labor. Instead of expensive, high-tech systems, neighborhoods were able to choose from a range of simpler, innovative systems that made water and sanitation affordable and more environmentally appropriate for poor, crowded settlements. There were no blueprints for how each project should be designed or executed.

This paper also brings the reader up-to-date on the powerful results of PROSANEAR I, beyond the water and sanitation improvements, which influence demand and project sustainability after construction of the system. Many residents went on to make additional improvements to their houses. For the first time some residents had a formal postal address and a water bill in their name and had graduated from squatter status to permanent citizenship— a new level of identity within the society. Also, the project showed to many water companies that the poor would pay for water and sanitation service. The poor will pay, since they understand what they are paying for and receive adequate services for their payments. Since PROSANEAR, local construction and consulting firms have adjusted their business practices to include the community consultation and low-cost technology alternatives that worked so well - giving the entire community an unusual chance to speak and gain respect.

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The Problem: Providing Water and Sanitation for the Urban Poor

One of the hardest things about life in Brazil's urban slums is the lack of clean water and sewage disposal systems. In a crowded neighborhood, these two simple urban services can mean the difference between health and disease, cleanliness and filth, convenience and daily backbreaking labor. But the water and sanitation services that city dwellers take for granted as basic to a safe and decent household typically do not exist in the growing slums that dot the urban landscape in Brazil. These shantytown neighborhoods—called *favelas*—have grown so explosively and so haphazardly that urban services are either non-existent or plainly inadequate.

The *favelas* are a water engineer's nightmare. They are crowded and chaotic. Flimsy tin shacks are stacked on one another along forbiddingly steep hillsides—or are mired together in muddy swamplands. They often lack strong local organizations, and too often are plagued by drug-related violence. Brazil's state-owned water companies find it impossible to maintain water systems or collect bills in the *favelas.* Thus, even as Brazil greatly improved water and sanitation services throughout the country in the 1980s, the urban *favelas* have remained unconnected. Instead of clean water piped directly to their homes, *favela* residents often pay ten times the legal rate from water pirates who tap illegally into the main systems. And instead of sewage being piped safely away for sanitary treatment, wastewater flows down *favela* streets in stinking rivers, or is dumped into natural drainage channels to feed polluted streams and lagoons. About 21 million Brazilians do not have access to safe water, and twice as many lack access to sewerage networks or septic tanks. Most of them live in the *favelas*.

New Success Means New Hope

Is there a way to overcome such daunting challenges in order to meet a crucial basic need? Yes. An innovative project offers new hope for bringing water and sewerage services to Brazil's *favelas* —and perhaps to poor urban neighborhoods around the world. With World Bank financing, Brazil recently completed PROSANEAR, a pilot program that developed a new approach to delivering water and sanitation services to the urban poor–and enjoyed a whole new level of success. PROSANEAR provided 900,000 poor people with fresh water piped directly into their homes, and one million people were also connected to sewerage systems. This is more than four times the number of new connections that project planners hoped for when PROSANEAR began, and all for a cost below original estimates: less than $98 per person for water connections and less than $140 for sewerage.

Cost-Effective Technology and Community Participation

PROSANEAR worked so well by combining two novel approaches to delivering urban services: cost-effective, appropriate technologies and community participation. By putting engineers and social experts on the same team, PROSANEAR found a way to overcome the usual shortcomings of top-down infrastructure planning. Too often, urban water projects start with the unannounced arrival of a distant water board, which builds a complicated system based on a standard design, and then leaves without explaining the technology installed. That doesn't work in the *favelas*, where standard designs are foiled by the haphazard layout of the houses. Furthermore, *favela* residents are poorly equipped to pay for and maintain systems that have never been explained to them and which in many cases they never requested. Not surprisingly, Brazilian water

companies routinely bypass slum neighborhoods in favor of areas where systems are easier to install and bills easier to collect.

PROSANEAR went about it differently, as explained below:

- Instead of implementing a pre-designed project, PROSANEAR teams went into communities to ask what kind of water project *the people wanted*–if any–and what kind they would be willing to support with their money and labor.

- Instead of expensive, high-tech systems, neighborhoods were able to choose from a range of simpler, innovative systems that made water and sanitation affordable and more environmentally appropriate for poor, crowded settlements. In many places, groups of households were batched together in a creative "condominium" approach that not only made the networks more efficient and affordable, but also forged new bonds among neighbors.

- PROSANEAR sought a more permanent impact by mobilizing local clubs—women's, sports and religious groups, for example, to educate people about the importance of sanitation, and to teach them how to operate and maintain their new systems.

With all of these innovative elements at work, PROSANEAR projects became more than just infrastructure projects; they became neighborhood projects, fueled by the creative energy of fully informed and involved local residents.

The Results: Cleaner Water and Stronger Communities

The results were powerful, and they went far beyond the better health and greater convenience enjoyed by one million people newly connected to water taps and toilets.

- For many residents, getting a formal postal address and a water bill in one's own name meant they had graduated from squatter status to permanent citizenship—a new level of identity within the society. Many went on to make additional improvements to their houses.

- Some groups that came together to build water systems stayed together to work for other neighborhood needs, such as garbage removal or income generating activities.

- Women—deeply involved at all stages of the PROSANEAR project—found an unusual chance to speak and gain respect in the community.

- PROSANEAR cured many water companies of the misconception that the poor would not pay for water and sanitation services. The poor will pay, as long as they understand what they're paying for and receive adequate services for their payments.

- Local construction and consulting firms have adjusted their business practices to include the community consultation and low-cost technology alternatives that worked so well in PROSANEAR.

CHAPTER I - THE PROBLEM
GROWING *FAVELAS*, INCREASING RISK

Growing Cities

Brazil's growth in the last half century has been characterized by steady and rapid urbanization. Between 1950 and 1991, the urban population jumped from 36 percent to 75 percent of Brazil's total population. The number of people living in urban areas increased more than five-fold, from less than 20 million people in 1950 to over 110 million in 1991. While this great migration has swelled Brazil's low-income urban neighborhoods, investments in urban services in these neighborhoods have not kept up with population growth.

Delivering Water and Sewerage Service to the Urban Poor

The government has worked hard to increase water and sanitation coverage in Brazil, but those efforts have concentrated on neighborhoods where users are more able to pay. Unfortunately, Brazil's success in connecting more people to water and sanitation systems between 1970 and 1991 had little impact on the urban poor. Of the 21 million Brazilians who live without access to safe water—and the 44 million without access to sewerage networks or septic tanks—the vast majority earn less than US$300 a month. According to 1991 data, the urban poor account for nearly 60 percent of the 24 million Brazilians living below the poverty line.

Shut out from the formal (and subsidized) water and sanitation systems, the urban poor rely on the "invisible water market." Private water dealers collect water from illegal hookups which bleed the municipal system, or from unsafe sources such as open wells. These water pirates charge poor customers up to ten times more than the public network water fee.

For sanitation, there is no alternative to a formal system. Poor residents live with their sewage flowing openly in the narrow passageways between houses. In crowded settlements, these are deadly conditions. The lack of clean water and sanitation poses grave public health risks, ranging from skin conditions to water-borne diseases. These diseases are often fatal, especially among young children.

Box 1.1 Evolution of Brazil's Water Sector and the Main Providers

State water companies were created in Brazil in the early 1970s to provide water and sanitation services on behalf of municipal governments. Before the National Water and Sanitation Program (PLANASA) was created, local governments were responsible for delivering water and sanitation services. Under PLANASA, they were encouraged to turn over these concessions to the state water companies in exchange for federal funding. About 85 percent of the population are served by the state water companies today.

Under PLANASA, the water sector expanded rapidly by investing in infrastructure and achieved impressive results. PLANASA assigned top priority to increasing urban water supply coverage, which was 45 percent in 1970, and set a 90 percent coverage goal for 1985. An impressive 83 percent coverage was achieved.

Unfortunately, as gains were being made in water supply, sanitation lagged far behind. As far as sewerage was concerned, both the goals and the achievements were modest. The percentage of people connected to public sewerage in urban areas crept up from 24 percent in 1970 to 37 percent in 1991. The target level was 50 percent by 1985. Sewage treatment remained minimal: only 10 percent of total wastewater received any form of treatment. In most locations, raw municipal and industrial wastewater was dumped directly into rivers and coastal waters.

Furthermore, PLANASA largely left out the urban poor, both in water supply and sanitation services. State water companies preferred to invest in higher income areas, where bills were easier to collect and where the geography and layouts of carefully planned neighborhoods meant few technical complications. PLANASA also encouraged engineers to rely on high-cost advanced technology, which was not appropriate for low-income areas. For both water supply and sanitation, the water companies grew accustomed to the standards–and costs–developed for middle to higher income neighborhoods. The *favelas* posed a new challenge for the water companies.

Looking for a Better Way

In 1982, Brazil launched a small pilot program called PROSANEAR (a Portuguese acronym for the Water and Sanitation Program for Low-Income Urban Population). The Ministry of Interior managed the pilot program, which was financed by federal funds. The program experimented with different types of low-cost technology to extend water and sanitation services to the urban poor, but with only limited success. The program faced various technical and financial difficulties and was about to be abolished by the late-1980s.

At about the same time, the World Bank and Caixa Econômica Federal (CEF — a Brazilian Government development bank) reviewed the experiences of PROSANEAR and found some valuable lessons. It was thought the program *could* be successful if the best of the early work was combined with some innovative new approaches. Thus, in 1992 Brazil launched PROSANEAR I with help from a US$100 million loan and some technical guidance from the World Bank.

CHAPTER II - THE PROSANEAR I DESIGN

Although PROSANEAR I was a much larger program than the earlier pilot program, it was designed to maintain the same experimental approach. The objective was to find out what worked, and to test new ways of delivering water and sanitation services to the *favelas*. To succeed, PROSANEAR I had to have an adaptable approach that encouraged learning and innovation at every level, including technologies, institutional arrangements, community involvement, cost recovery, and financial arrangements. There were no blueprints for how each project should be designed or executed. Instead, PROSANEAR I laid out a set of basic principles that would guide project planners as they designed site-specific plans for different neighborhoods.

The Five Principles of PROSANEAR I

- ***Community participation.*** Every project must be tailored to the specific needs of the individual community and be designed with active community participation.

- ***Appropriate technology at low cost.*** Simple solutions may be the best solutions, especially if high-tech systems are too complicated and too costly for poor neighborhoods. In order to give engineers the incentive to consider alternative technologies, PROSANEAR I established a ceiling on the per-capita cost for both water and sewerage investments.

- ***Environmental protection.*** Providing water without a way of disposing of it safely can make environmental problems worse. All projects that provided water were required to provide sewage collection and disposal as well.

- ***Cost recovery.*** Customers will take better care of systems for which they have paid. Users were charged for hookups, water use and sewage collection.

- ***House connections.*** In an urban setting, house connections are more convenient and equitable than public standposts. PROSANEAR I financed water and sanitation connections for each house.

Identifying Sites And Designs

Beneficiary and Project Eligibility

After laying the five guiding principles, PROSANEAR I had to find neighborhoods where the experimental projects would begin. Keeping in mind PROSANEAR's overall goal of delivering *affordable, sustainable* water and sanitation services to the *urban poor*, project planners developed three main criteria for selecting communities:

- Priority was given to *favelas* in cities of more than 50,000 people;

- All participating families earned less than $300/month (three minimum salaries), of which at least 40 percent earned less than $100/month.

- Recipients agreed to pay for the water and sewerage in accordance with tariff schedules maintained by the water utilities.

Keeping in mind PROSANEAR's mission, these criteria were used to approve individual project designs:

- The projects conformed with the most appropriate technical and environmental standards for the neighborhood, and represented the cheapest

alternative for providing water, sewerage, drainage, or sanitation services;

- Water projects had a per-capita construction cost of less than US$98, and sewerage projects had a per-capita cost of less than US$140 (1988 dollars);
- Total investments for bathrooms, drainage, and solid waste disposal could not exceed 10 percent of the project's total cost.

Geographical Spread

Using these criteria, PROSANEAR I set out to establish projects in a variety of different conditions. Planners wanted to see how the PROSANEAR approach would work in different regions and in various city sizes and geographical situations. They wanted to work with different kinds of executing agency arrangements (executed by municipalities, state water companies, or other organizations), and in different types of communities (organized, less organized, migrant populations). Overall, PROSANEAR I projects operated in more than 100 different communities in 17 cities with varying characteristics (see Table 2.1).

Table 2.1 PROSANEAR I Projects

State/ Region	*Cities*	*Population of the city (000)*	*Number of Beneficiaries (000) Water/Sewerage*		*Main Geographical situations/ Population density*	*Community Characteristics before PROSANEAR I*
Amazonas	Manaus	1,011	102	4	Flat Low density	Strong women's organization, organized community
Pará	Belém	954	126	126	Flat, subject to floods High density	Strong political groups. Was initially against PROSANEAR.
Ceará	Fortaleza	3,049	37	186	Flat, river nearby area prone to floods High density	Strong community organization. Initially against condominial sewer.
	Crateus Quixada Juazeiro do Norte	173			Flat, dry Medium density	Low community organization. Church leadership.
Pernambuco	Recife	1,298	*7*	9	Close to river Prone to floods High density	One community lead by a charismatic leader (a woman). Other communities also fairly well organized.
Minas Gerais	Juiz de Fora	386	18	12	Hilly Low- medium density	Strong community organization. Already had community committees.
Mato Grosso do Sul	Campo Grande Dourados	526	11	17	Low density	Not organized. Foreign immigrants. Sanitation not initially priority, but health priority.
Rio de Janeiro	Rio de Janeiro	5,587	471 /1	445/1	Hilly High density	Organized. Access to favela often hindered by violence.
	Angra dos Reis	149	49	70	Mostly hilly Low density	Not very organized. Communities accustomed to participatory approach, because municipality had adopted participatory budget allocation system.
Santa Catarina	Florianópolis	234	2	26	Medium density	Organized. Violence prevalent.
	Chapecó	118			Hilly Low density	
	Joinvile	388			Flat Low-medium density	
	Lages	151			Low density	
Total			822	895		

/1 Under implementation. Estimated beneficiaries by December 31, 1997

PROSANEAR I Management

PROSANEAR I was not a single project. Rather, it consisted of dozens of separate projects in many different communities. Each project was the product of neighborhood residents working with the engineers, consultants and officials of the local water agency. All the projects needed guidance to promote efficiency and ensure adherence to PROSANEAR's principles. Thus, PROSANEAR I was implemented by local executing agencies, with assistance and oversight from both regional and national coordinating units.

The Executing Agencies

State water companies, state governments, and municipalities—whoever provided water services in the area—were the official "executing agencies." These agencies identified and assessed candidate communities. They began the crucial community mobilization needed to build support for the project. They oversaw the development of technical options, construction, operation and maintenance training, monitoring and follow-up. Each of the agencies established a multi-disciplinary PROSANEAR execution team made up of engineers, community specialists (social scientists, etc.) and administrators.

Although the executing agencies coordinated all aspects of the project implementation at the local level, many other institutions played key roles throughout the life of the projects, and became essential members of the PROSANEAR team. Local schools and churches were the main forces behind community mobilization. Local health agencies contributed a range of hygiene education activities. Mothers' club and youth groups were central to project implementation.

Regional Offices

Regional offices were also set up to ensure that the many local projects moved along in a timely manner. PROSANEAR I units—made up of CEF staff and including at least one engineer and one social worker—were set up in CEF's regional offices to facilitate, supervise, and monitor the local projects underway in that region. During the early preparation of the local projects, the CEF's regional offices helped the executing agencies prepare project designs and bidding documents. The regional offices helped with the community participation part of the process, which was a new area for many of the executing agencies. During the construction stage, CEF's regional staff periodically visited project sites to monitor progress and identify problems.

The National Office

A central project coordination unit was set up in Brasilia, staffed by CEF engineers, community participation specialists, procurement officers, and contract administrators. This group was responsible for program planning, monitoring and supervision of the overall program advancements. They also provided training and technical assistance to the different project implementation teams. The central unit also served as an information clearing house, exchanging best practices and technological innovations between states. Finally, the central unit provided basic implementation guidelines, model terms of references, and model procurement documents.

Table 2.2 PROSANEAR Project Implementation Arrangements

Responsibilities	Institutions
Program Administration and Coordination	Caixa Economica Federal (CEF) in Brasilia
Project[1] Identification and Supervision	CEF's Regional Offices
Project Execution	State Governments State Water Companies Municipal Governments Municipal Water Companies
Project Implementation Support	Consulting firms Construction firms Local Government Agencies (health agencies, schools, etc.) Local NGOs (religious organizations, churches, etc.) Local community organizations

1/ Projects are at the City level. A project comprises several communities or areas.

What PROSANEAR I Financed

PROSANEAR I financed investments in water supply, sewage collection, sewage treatment, as well as complementary investments such as bathrooms and in-house connections. The program also financed community mobilization and participation efforts, technical assistance, and studies to evaluate how well the many innovative methods of PROSANEAR I really worked.

The PROSANEAR I projects were jointly financed by the World Bank (50 percent), the local water companies, state or municipal government (25 percent), and the CEF (25 percent). The World Bank loan was made to the CEF, which in turn lent those funds along with its own funds to the water companies or state and municipal sub-borrowers. Water companies, the state governments, or municipal governments were responsible for paying back the Bank and CEF loans.

CHAPTER III - PROSANEAR AT WORK THE POWER OF COMMUNITY PARTICIPATION

Each PROSANEAR project was unique, responding to local conditions. However, all the projects followed a basic approach established by PROSANEAR I.

A PROSANEAR Project From Start to Finish

A PROSANEAR project began by informing local water agencies that funds were available for water projects in *favelas*, and that the participating agencies would be required to include the communities in the planning and building of the projects. Requests for assistance went through six stages: (1) project identification; (2) community mobilization; (3) development of technical options and presentation to the community; (4) construction of facilities; (5) operation and maintenance; and (6) monitoring and follow-up. At every stage, the teams of engineers, social workers and local residents working on the projects followed a basic framework that ensured community involvement (see Box 3.1).

Project Identification

When a request for assistance came in, PROSANEAR I first had to determine whether the community and the project in question fit the program's criteria (see chapter II). Teams collected baseline data on site conditions, socioeconomic status of residents, sanitation and health conditions, community resources, active entities (public, private, and non-governmental), and the level of community organization. Community specialists met with the community leaders—both formal and informal—to start the dialog about the project. This meant that team members had to be in the neighborhoods when the residents were home, often at night and on weekends. Meanwhile, the broader community was informed about the project through various community resources (vehicle-mounted loudspeakers, newspapers, community radio programs, religious organizations, etc.). The main objective at this stage was to determine the communities' own development priorities and whether water supply and sanitation services were high enough on that list to ensure local support for the project. In some cases, improving health conditions in the neighborhood was a high priority for the community, but installing clean water and sanitation was not. When residents were educated about the connection between sanitation and health, support for water/sewerage services increased significantly.

Box. 3.1 A Framework for Community Participation

PROSANEAR I used a participation strategy based on a dynamic process of interaction. This strategy is grounded on the premise that successful, sustainable infrastructure in low-income urban areas is only possible when everyone is involved—beneficiaries, builders and planners, and financiers. Collaboration on the projects starts from the bottom up, beginning with partnerships between individual communities, public water companies and local governments, and progressing to partnerships between state and federal government, and between the federal government and the World Bank.

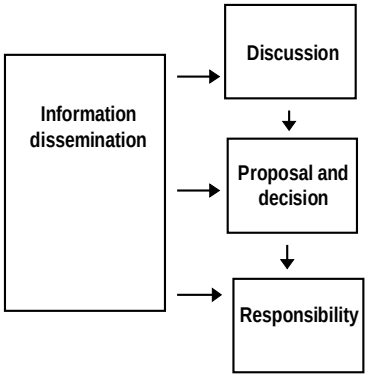
This process of community participation requires the following elements to succeed:

Information Dissemination. A continuous feedback process occurred through which the community learned about potential activities in the area, and the agents learned about community dynamics.

On-Going Discussion. Project teams and communities engaged in regular discussions of community conditions and dynamics, as well as various technical options as they arose.

Proposal and Decision. Agents and communities eventually had to move from discussions to decisions regarding the technical options that suited the particular community.
Responsibility. This was the final objective of the participation process. The agents committed to providing water and sanitation systems that suited the community, guaranteeing the operation of the system, and charging fair rates for the services. The users committed to paying for the service, using the systems properly, and maintaining the equipment.

Figure 3.1 Elements of Community Participation



Community Mobilization

The second step was to mobilize the community to be involved in the project and participate in project decisions. At this stage, the interest of the community in the project was gauged. Community specialists went into the neighborhood to identify the groups that could help. Women's groups were often the most effective allies for working in the community, and the women themselves were frequently key to getting the projects underway (in the *favelas,* women are more likely to be the head of the household and a permanent part of the community). With the help of local groups, events were held to mobilize and organize the populace. At neighborhood meetings, residents heard presentations on the technical options available, the maintenance of the systems, and the importance of proper hygiene (see Box 3.2 and Table 3.1). A variety of educational, cultural, and recreational activities—such as sporting events, street theater, songs, essay and poster contests—were also used to support sanitary and environmental education.

Table 3.1 Examples of Community Events Organized and Materials Produced

Project	Community Activities	Materials Produced and Used
Campo Grande	• Outreach activities: house visits, contacts with community organizations and local institutions, meetings with students, radio programs • Education: adults literacy class, students' analysis of communities, backyard garden campaign, courses on health and nutrition, pottery workshops • Events: recycling campaign, movies, shows, photo exhibits, poetry competitions, sport tournaments	• Handbooks on health, work force, and piped sewage • Newsletter "Health" • Board games
Recife e Olinda	Community meetings with local schools and health posts.	• Handbooks on health and hygiene education • Brochures: "History of Water," "Avoiding Waste," "How to Maintain Sewer Systems," • Games
Fortaleza	• Outreach activities: community meetings, house visits • Community organization: creation and training for project implementation teams and for project maintenance groups • Education: hygiene education seminars • Events: shows, group visits to other communities with water and sanitation	• Handbooks on sanitary education • Movie and theater piece on hygiene education • Leaflets, invitations, illustrative and educational posters, • Games: crossword puzzles • PROSANEAR songs
Rio de Janeiro	• Outreach activities: community meetings. • Community organization: choice of block names (addresses), selection of block leaders. • Education: training of local promoters of sanitation projects and hygiene education, and of school teachers, workshops on correct use of the systems • Events: trip to water production and treatment facilities	• Handbooks on PROSANEAR • PROSANEAR T-shirts and baseball caps • Comic books: "How Sewage Comes to the Community" • PROSANEAR rap songs

Box 3.2 A COMPREHENSIVE APPROACH TO HYGIENE EDUCATION

Only by understanding the connection between sanitation and health would the community feel committed to using and preserving the systems. Thus PROSANEAR I took a creative, comprehensive approach to hygiene education. Beneficiaries learned why and how to properly operate and maintain their new systems. People learned the importance of disposing of solid and liquid waste separately, how to periodically clean grease traps, and how to perform basic maintenance, such as unclogging sewerage pipes. The community also learned about water-borne diseases, personal hygiene, skin conditions, sexually transmissible diseases, immunizations, dental health, and solid waste recycling. By involving local institutions such as universities, foundations, and schools, PROSANEAR helped make hygiene education permanent in the communities.

The project teams used a variety of educational methods to make sure the beneficiaries took an active role in learning. Some of them are described below.

- "Multiplicadores": community members (usually women) or school teachers were trained to teach the principles of hygiene to the rest of the community.
- Alternative media: project teams generated brochures, comic books, newsletters, and posters on solid waste, sanitation, and health. They distributed printed material produced by the municipal authorities or state water agencies. And local radio stations played messages relevant to the hygiene campaigns.
- "Health" games: project teams developed (or used existing) games for children to play. The rules of the games illustrated the operation and maintenance of the new water supply and sanitation systems.
- Events: Project teams organized festivals, photo exhibitions, and community contests focused on themes such as solid waste collection and recycling. Community members, particularly children and young people, competed in sport tournaments, gave concerts, participated in poetry contests, and wrote songs. In Rio de Janeiro, a youth group composed a rap song (including music, lyrics, and dance) on the benefits of good sanitation. In Fortaleza, a beneficiary group produced a play.

The hygiene education component of PROSANEAR I produced important spill-over benefits. It promoted health education in schools, improved municipal planning, established health posts, and strengthened relations between low-income settlement populations and local institutions. In Manaus, for example, municipal authorities and NGOs have asked the "multiplicadores" to work with them on other projects.

Drawing up Plans

Project engineers undertook a reconnaissance survey of the challenging topography of the favelas, and drew up a list of technical options that would deliver the desired services in an affordable, environmentally sound manner. While engineers presented the options at community meetings, community specialists worked to facilitate the decision-making process. Once the community had settled on a plan, each household signed a letter of agreement (termo de adesão), promising to pay for the service and maintain the systems.

Constructing Facilities

After the community picked its plan, the PROSANEAR team submitted the final proposal for the CEF's approval. The construction firm was contracted and materials were purchased. Where communities chose to undertake the construction themselves, (e.g. absorption pits in Campo Grande) the PROSANEAR team provided technical assistance and supervised the work. Meanwhile, the engineers held operation and maintenance training sessions for selected community representatives. When construction was completed, the contractor conducted system testing for a brief period.

Operating and Maintaining the Systems

For six months after the systems became operational, the field teams remained in the area to reinforce hygiene education, review the general operation and maintenance of the constructed systems and help the neighborhoods develop new ways to earn income (some became active artisans). For the longer term, the project team trained selected residents to perform simple maintenance activities, such as unclogging pipes or repairing cracked pipes (See Box 3.3). In other areas (Rio de Janeiro and Belem) the operation and maintenance duties were contracted out to private firms.

Monitoring and Evaluation

Monitoring was not a separate stage. It took place continuously during the projects at two levels:

- Public Evaluation - the community residents themselves systematically evaluated project performance with the help of a multi-disciplinary project team.
- Technical Evaluation - the project team evaluated the procedures followed, and verified whether the construction activities were in accordance with community wishes. PROSANEAR teams visited the project sites after a certain period of time (six months to one year), to verify that the systems were functioning. Many of the PROSANEAR teams hired independent consultants to carry out a participatory assessment to measure community satisfaction.

Box 3.3 Operation and Maintenance Arrangements in Fortaleza, Ceara

Low-cost systems, in general, require more frequent on-site maintenance efforts than the conventional system. The use of narrower pipes and the shallower placement of pipes in the alternative systems caused frequent clogging. PROSANEAR I reduced the incidence of clogging by educating the communities on the proper use of the system. But this alone could not eliminate all the clogging problems. The community shared the responsibility of maintaining the system, thus reducing the water companies' maintenance requirements and ensuring prompt identification and resolution of problems.

In Fortaleza, Ceara, the water company decided to delegate the maintenance efforts to the community. The company selected one unemployed resident per neighborhood (of about 3,000 people) trained him or her, and providing simple maintenance equipment. This individual was responsible for the maintenance in the neighborhood. By living in the neighborhood the maintenance person could intervene promptly, solve the minor problems (such as clogging), and detect the cases that required assistance from the water company. To date most problems dealt with by the neighborhood maintenance personnel have been manageable.

Everyone is satisfied with this arrangement. The maintenance personnel receives about US$240 a month (about two minimum salaries), in addition to water company employee benefits. The community gets immediate attention and rapid service while the water company pays less for a more effective way of solving problems.

Table 3.2 PROSANEAR I Generic Implementation Arrangements

Steps	Activities	Responsible Agencies
PROJECT IDENTIFICATION		
Social Assessment	• Collect and analyze socioeconomic indicators • Assess community organization, existing infrastructure, hygiene and health practices, and community priorities	• Executing agencies through consulting firms, specialized in community assessment
Project identification	• Visit communities, present the project, and explain procedures • Confirm interest of the community in project • Submit basic project proposal to CEF	• Executing agencies
COMMUNITY MOBILIZATION		
Community mobilization	• Identification of existing formal and informal community groups • Selection of community leaders • Formation of smaller community units ("condominiums") for decision-making • Series of community events including income generating activities • Series of PROSANEAR promotional events organized by community groups	• Executing agencies through consulting firms specialized in community mobilization • Local leaders, community groups
Hygiene education	• Series of hygiene education sessions to help community understand why sanitation is important • Project team educate local school teachers and mothers as "multiplicadores," so they can become trainers	• Executing agencies through consulting firms • Local school teachers • Mothers
DEVELOPMENT AND PRESENTATION OF TECHNICAL OPTIONS		
Development of basic project design	• Develop basic engineering designs based on available data and field visits	• Executing agencies through engineering firms
Presentation of technical options	• Present and discuss technical options	• Executing agencies, engineering firms and community mobilization group
Decision-making	• Community decides which options to choose • Community members sign letter of understanding with the executing agencies, asking for the chosen technology options, and agreeing to pay for them	• Executing agencies, engineering firms and community mobilization group
Community planning	• Prepare final design • Final approval of project design • Develop community work plan, and train communities to participate in construction	• Executing agencies, engineering firms and community mobilization group • CEF approves final design
CONSTRUCTION		
Construction	• Preparation of bidding and contracting documents • Construction of systems • Supply of materials for the communities • Technical assistance if communities construct	• Executing agencies • Construction companies hired by executing agencies • Executing agencies

OPERATION AND MAINTENANCE		
Training in Operation and Maintenance	• Train community representatives on how to operate and maintain the system on site or appoint and train selected residents for system maintenance • Hold hygiene education sessions on use of systems	• Executing agencies with construction/engineering firms • Executing agencies with community leaders
Conclusion of Work Operation and Maintenance	• Community starts to use the system • Community start to pay for the system and services	• Executing agencies, for larger repairs • Community residents .
MONITORING AND EVALUATION		
Monitoring and follow-up	• Periodic visits to check functioning of the systems • Tariff collection • Periodic participatory assessment	• Executing agencies (or through consulting firms) • CEF •

Two Distinct Approaches to Community Participation

Each PROSANEAR project approached community participation differently, depending on the unique characteristics of each settlement and the type of water supply and sanitation system residents selected. Nonetheless, each of the projects fell into one of two basic approaches to community involvement: one that stressed the project itself, and one that stressed community development.

Participation With A Project Focus

When communities were relatively well organized, and when community members were fairly clear about their priorities as a community, PROSANEAR I teams were not required to put much effort into basic community organization and mobilization. Instead, the community was already prepared to focus its attention on the more technical aspects of the project itself, for example, choosing designs and selecting locations for the various systems. This project-centered approach required a smaller team, which meant lower costs for the overall project. Projects were completed sooner and local water agencies needed less assistance to carry them out. However, since the community participation process was narrowly focused on water supply and sanitation, the ability to use meetings to discuss other concerns of the residents was limited.

Box 3.4 The Project-Centered Approach to Community Participation in Rio de Janeiro

The PROSANEAR teams had to be both creative and practical when it came to making community participation work in difficult environments. The project in Rio de Janeiro was one of the most formidable that PROSANEAR I undertook. The answer to participation in Rio's tough *favelas*? Focus strictly on the project.

About one million people live in substandard housing with poor sanitation conditions in Rio's 800 *favelas*. Most of these shantytowns are hilly and houses are built one on top of the other. Reaching them through winding alleys and steep, narrow passageways is difficult. But physical barriers are not the major obstacle to access to the low-income neighborhoods, drug traffickers are. Police are often needed to restore law and order, but drug related violence still frequently shuts down access to the *favelas.*

To cope with this dangerous environment, the project team had to negotiate with the informal community leadership. By focusing strictly on the water and sanitation projects and not on other aspects of community life, the project was allowed to proceed, albeit slowly. Nevertheless, the water project did have an indirect benefit beyond the narrow scope of the new water and sewerage system. The technical arrangement of the water network best suited to Rio's *favelas* was the condominial system (see Chapter 4), which organized the community into small groups for their water service. Within these smaller groups, the talk often turned to other, non-water related neighborhood concerns. As a result, the condominium associations became breeding grounds for the emergence of new leaders capable of reorganizing the community and strengthening civil society.

Despite these difficulties, the project produced substantial results. Thanks to the enthusiastic involvement of local residents' organizations, the project team completed systems in 13 *favelas*, benefiting 230,000 people in just under 3 years.

Participation With A Focus on Community Development

The project-centered approach worked where the *favelas* enjoyed a relatively high level of organization. In many cases, however, the *favelas* were newly created communities without strong organizations. These communities were less likely to have a set of clearly identified priorities, and some basic community development work was needed before the project could even be introduced. Only after communities were more organized and their priorities established was the PROSANEAR I concept presented to the communities. (See Box 3.5)

In this community development-centered approach, meetings were likely to address many things besides water and sanitation services. Often residents were eager to talk of other problems, such as their need to find new sources of revenue. Once the discussion turned to the importance of water and sanitation, residents were more prepared to hear about how PROSANEAR could work for them. If water and sanitation were simply not a priority, the PROSANEAR teams helped the communities contact other government organizations that could better address their needs.

This community development-centered approach was comprehensive and helped the community beyond the narrow project objectives — a benefit in settlements with low levels of informal organization. However, this approach required a large field team at all stages of the project, making project costs substantially higher (see Table 3.3). Reaching group consensus was often slow. The project became more complex if it went beyond simple water and sanitation and involved the local government and other agencies. There is the risk that community priorities will go beyond what the project can finance. Another risk is that if the project was spread too thin, it would not achieve its fundamental goals.

Box. 3.5 The Community Development-Centered Approach in Campo Grande and Dourados.

The community development-centered approach required more time and more money than the simpler project-centered approach. But the permanent benefits fully justified the extra effort. Communities are better able to manage and maintain their new services when they are better organized. In addition, people's (especially women) new self-esteem is increased. They learned to be community leaders, entrepreneurs, social workers, and, more importantly, citizens. Newly organized communities were amazed at their own ability to participate in politics, demand and obtain additional services, and collectively undertake income generation activities.

PROSANEAR I used this approach in Campo Grande in the state of Mato Grosso do Sul. The *favelas* of Campo Grande have been recently settled by rural migrants from different parts of Brazil and neighboring Paraguay. The population is mixed and many people are only temporary residents. The level of community organization was relatively low and residents lacked a collective identity. The project team found that people perceived their problems as individual ones and did not realize the advantages of collective action. Clearly, the team needed to promote community mobilization before the project could even begin.

The community organization process was long and difficult. It proceeded by trial and error. In the end, what worked best was to compile a common history for the community. This technique encouraged residents to think of themselves as a group living in an area, and to explore the causes of problems that affect the community as a whole.

The team initially divided neighborhoods into small groups of about 20 neighboring families. Unfortunately, these groups did little to make the community come together. So the project team chose a different focus: it helped form common interest groups, such as groups of migrants from the same area, groups whose priority was income generation, or groups focusing on health problems. This format was more successful.

The project team faced another obstacle: residents did not consider sanitation to be a priority. Indeed, it was often one of the last requirements mentioned. They were largely disinterested because they had come from rural areas, where the sanitary conditions were much different than in a crowded slum. Instead, they said that health was their top priority, namely reducing the incidence of water-borne diseases among children. The project team, therefore, carefully explained the link between proper sanitation and health. The community then recognized sanitation as a high priority and the project went forward successfully.

Table 3.3 Community Participation Costs

State	*Cirites*	*Total Cost (US$000)*	*Beneficiary Population*	*Per capita costs (US$)*	*Approach (Project or Community Focus)*
Amazonas	**Manaus**	481,459	94,116	5	Project
Pará	**Belém**	1,257,654	126,411	10	Project
Ceara	**Fortaleza** **Crateus** **Quixada** **Juazeiro do Norte**	1,580,948	223,377	7	Project
Pernambuco	**Recife**	276,192	10,486	26	Project
Minas Gerais	**Juiz de Fora**	53,681	17,672	3	Project
Mato Grosso do Sul	**Campo Grande** **Dourados**	1,182,508	17,146	69	Community
Rio de Janeiro	**Rio de Janeiro**	Paid by the State Government			Project
	Angra dos Reis	3,365,026	95,223	35	Community
Santa Catarina	**Florianópolis** **Chapecó** **Lages** **Joinville**	347,028	26,047	13	Project
	Total	8,544,496	610,478	14	

Note: This table is based on the contract values of the consultants who were in charge of one or more of the following activities: community mobilization, hygiene education, technical designs and supervision of works.

CHAPTER IV - THE COST-EFFECTIVE TECHNOLOGY OPTIONS

The second key to PROSANEAR I's success–in combination with community participation–was low cost, appropriate technology. PROSANEAR engineers tapped a range of cost-effective water and sewerage innovations developed recently in Brazil. In water supply, for example, costs were kept down in some places simply by reducing the per capita design allocation of water quantity from 150 liters per-person per day to 120 liters. And there were significant variations in the sewage disposal systems, ranging from on-site systems such as absorption pit tanks (Campo Grande) to condominial sewerage (Fortaleza, Recife, Rio de Janeiro, and Angra dos Reis). Not only did the systems work, they cost far less than planned–below the investment ceilings established by the project—between US$12 and US$50 per capita for water supply and between US$15 and US$123 for sanitation.

Table 4.1 Technical Options Used in PROSANEAR - by states

State	Cities	Water	Sewerage Collection	Sewerage Treatment	Complementary Investments
Amazonas	Manaus	Conventional	Absorption pits		
Para	Belem	Conventional	Condominial	UASB	
Ceara	Fortaleza	Conventional	Condominial	Stabilization Ponds Communal Septic Tanks	
	Juazeiro Norte	Conventional	Condominial	Stabilization Ponds	
	Crateus	Conventional	Condominial	Stabilization Ponds Communal Septic Tanks	
	Quixada	Conventional	Condominial	Stabilization Ponds Communal Septic Tanks	
Pernambuco	Recife	Conventional	Condominial	UASB	Rain water drainage canal
Minas Gerais	Juiz de Fora	Conventional	Conventional	Communal Septic Tanks	
Mato Grosso do Sul	Campo Grande	Conventional	Absorption pits		Inhouse sanitary installation
	Dourados	Conventional	Condominial		Inhouse sanitary installation
Rio de Janeiro	Rio de Janeiro	Conventional	Condominial	Existing treatment plant	
	Angra dos Reis		Condominial/ Absorption pits	UASB	
Santa Catarina	Joinville I	No water investment	Conventional Septic tanks with filters		Inhouse sanitary installation
	Florianopolis		Conventional		Inhouse sanitary installation
	Chapeco		Conventional		Inhouse sanitary installation
	Lages		Septic Tanks with filters		Inhouse sanitary installation

Water Supply

In most cases, PROSANEAR I water supply projects were designed to become part of existing main water systems. Most communities were serviced by simply extending the existing public water network to their neighborhood. The water was then pumped to an elevated tank and distributed within the neighborhood. This was possible because most PROSANEAR I project sites were either within or at the periphery of a large city with existing trunk infrastructure. In Belem and Campo Grande, wells were dug and chlorinated water was pumped to elevated tanks from which it was distributed to the beneficiaries. In order to control the wasteful consumption of water, many projects also included water meters (Belem, Campo Grande, and Fortaleza).

Sewage Collection

Brazilian engineers have long adopted a range of cost cutting criteria in the design of sewerage systems. Most PROSANEAR sewage collection designs were based on criteria such as those listed below:

- minimize collection network length
- decentralize treatment
- minimize the number of manholes and design smaller manholes (diameter 0.6 - 0.9 meters)
- calculate sewer slope based on the tractive force of 0.1 kilogram per square meter
- reduce minimum pipe diameter to 100 millimeters
- lay pipes with a maximum cover of 0.65 meters under sidewalks and 1.5 meters below paved streets

The Condominial System

The condominial sewerage system is a beneficiary-centered urban sanitation alternative developed in the early 1980s in northeastern Brazil. It is called condominial because it treats a block of houses like a "horizontal" apartment building, with the sewer lines passing through or near each lot. It is easily adaptable to the physical conditions found in unplanned poor urban neighborhoods. Block network pipes can be laid out in three different ways:

- *Back-of-the-lot:* In the residents' back yards along the fence, the pipe collects waste from adjacent lots and passes it down the block to a street line;
- *Front-of-the-lot:* In residents' front yards, with one pipe passing down each side of the block; and
- *Sidewalk:* Under the sidewalk in front of residents' houses.

Households connect to the block line through small collection boxes. Back yard and front yard users connect to a common block feeder line that is located within residents' private lots, making the feeder network collective. Back yard and front yard users are responsible for maintaining the private feeder line before it reaches the public sewer in the street. Some blockages may require accessing the network from a number of different house collection boxes, so cooperation can be important. Each sidewalk customer is connected directly to the sidewalk line by a private line for which he/she is responsible for maintaining. The sidewalk line is located on a public right-of-way, and thus is typically maintained by the water company.

Residents of each block or cluster of houses must discuss the three location options and reach agreement on the one that best adapts to the block's physical characteristics, and that meets their financial resources and level of commitment for maintenance. In high density and irregular areas such as squatter settlements, residents cannot always choose from the three options because irregular terrain and household layout often permit only one configuration, usually the back yard option. In these settlements, sewerage lines pass under narrow footpaths, collecting wastes from clusters of houses delimited by each pathway.

Absorption Pits

In a few cases of the PROSANEAR I projects (parts of Campo Grande and Angra dos Reis), simple absorption pits were constructed. These pits, which were lined with precast concrete rings, were constructed under the sidewalk and were about 3 meters in depth with about 1.5 meter diameter. In the case of Campo Grande only one pit was constructed, while in Angra dos Reis two alternating pits with a flow diversion box were constructed.

Waste Water Treatment

Although less than 10 percent of wastewater in Brazil receives any treatment, most of the PROSANEAR I projects included treatment as part of the system design. A new sewerage system is fully effective only when it includes sewerage treatment. A sewerage system without treatment merely transfers the sewage from one area to another, contributing only marginally to the general sanitary conditions of a city—health risks and environmental harm remain. With treatment included, sewerage systems will actually reduce the level of disease-causing microorganisms and limit the discharge of organic matter to levels the particular environment can handle.

Recently a number of low-cost technological options for sewage treatment have been implemented, such as communal septic tanks, anaerobic reactors with upflows through sludge beds, and stabilization ponds (see Table 4.1).

Communal Septic Tanks

Septic tanks are among the most popular forms of sewage treatment at the household level. In many Brazilian cities septic tanks have been extended to communal use. Many systems are built to handle the wastewater of whole neighborhoods, eliminating the need of a pump for treatment. The functions of the septic tank are to settle the solids, float grease, anaerobically decompose accumulated organic matter, and store sludge. Unlike typical tanks, where the effluent is drained into an absorption field, the communal septic tanks built in Brazil usually include an anaerobic filter where the effluent is passed through a bed of stone media before being discharged to a nearby receiving waster body. The main advantage of this system is its adaptability to the local physical environment given its small size. In many cities the communal tank occupies nothing more than a city lot and can be very inconspicuous. In Ceara, circular designs have been used with precast rings. Typical depth ranges from 3 to 5 meters for the sedimentation tank, as well for the anaerobic tank. Beside the fact that these systems require little maintenance, a main advantage is that they are modular and are easily expandable.

Upflow Anaerobic Sludge Blanket Reactors (UASB)

Since the early 80s, the UASB reactor has been in use in Brazil , especially in the state of Parana where there are more than 150 units. Under PROSANEAR I, this reactor was built in Recife, Angra dos Reis and Belem. Various designs have been used. The simpler design consists of a circular tank where the sewage is introduced at the bottom of the reactor and is allowed to flow upward through a sludge layer which acts both as a filter and a suspended medium for sewage decomposition. Another design, consists of modular rectangular tanks that can be expanded over time. The reactor requires a steady inflow of sewage in order to not disturb the location of the sludge blanket. The main advantages of this reactor is its small land requirement and its efficient removal of biochemical oxygen demand (BOD). The main disadvantages are its relatively high requirement for supervision, and sensitivity to toxic shocks and sudden variations in inflow rates.

Stabilization Ponds

Stabilization ponds are commonly used in Brazil particularly in the Northeast. Ponds are typically classified as facultative, maturation, aerated, or anaerobic according to the biological activity that takes place in them. Under PROSANEAR I, the two most commonly used systems were: an anaerobic pond followed by facultative and maturation ponds; and facultative ponds. The two primary advantages of anaerobic treatment compared with an aerobic process are the low production of biological sludge and the lack of aeration equipment. The disadvantage is that it is an incomplete stabilization and most often requires a second-stage aerobic process.

In Fortaleza, only facultative ponds were built due to the limited availability of land. The advantages of these ponds are the low initial cost and easy operation as compared to mechanical plants. Potential problems are their poor assimilation of industrial waste and difficulty in meeting the minimum effluent standards for discharge to surface water.

Maturation ponds (also called tertiary ponds or polishing ponds) serve as the third stage processing of effluent. The main reason for this type of pond is to reduce the bacteriological content of the effluent. The water depth is usually limited to less than 0.6 meter for sunlight penetration.

Comparison of Treatment Systems

There is no single waste treatment system that can be selected as the best for all conditions, but it is possible to select a technology that provides the best cost/benefit outcome under given circumstances. For example, the anaerobic processes have some advantages over the aerobic processes as they produce low volumes of sludge, have no energy consumption, and have simpler construction requirements.

If the objective is to use a treatment that is efficient in removing nutrients and pathogenic organisms at low cost, then a battery of stabilization ponds (anaerobic, facultative and maturation) is the best option. However, they are not always feasible as they require large areas of land, and the cost of sewage transportation to its final destination may be high. In such cases, if the reception conditions permit, the communal septic tank is a compact alternative. The success of the communal septic tank in Brazil has been due to its simple construction and operation. Its construction does not demand special procedures or equipment, and its operation does not require specialized workers. However, its effluent still contains high concentrations of pathogenic organisms and soluble organic loads, which cause bad odors. Post-treatment may be necessary depending on its destination and on the capacity of the receiving body. Table 4.2 shows a comparison of the estimated efficiency of the various types of treatment used under PROSANEAR I.

Table 4.2 Comparison of Various Types of Treatment

Characteristics	Septic Tank	Communal Septic tank with Anaerobic Filter	UASB	Pond (single)	Pond (series)
BOD removal (percent)	50-70	75-85	70-80	80-90	85-95
SS removal (percent)	60-85	80-90	55-70	70-75	75-90
Coliform removal (percent)	<90	<90	<90	<99	<99.999
Sludge disposal	yes	yes	yes	no	no
Resistance to shocks	low	low	medium	high	high
Costs (US dollars)/per capita		100-80	70-120	5-20	20-50

CONSTRUCTION COSTS

PROSANEAR I aimed to provide water and sanitation to low-income communities for no more than US$140 per capita for sanitation and US$98 per capita for water. By having informed community members select from a menu of low-cost options tailored to each neighborhood, all but a very few of the project designs fell within the cost limits.

Table 4.3 Construction Costs

States	Cities	Water			Sewerage		
		Investment (US$000)	Beneficiary Population	Per capita costs (US$)	Investment (US$000)	Beneficiary Population	Per capita costs (US$)
Amazonas	Manaus	5,325,618	102,516	52	75,312	3,523	21
Pará	Belem	11,880,858	126,411	94	29,361,583	126,411	232
Pernambuco	Recife	343,423	6,816	50	1,791,318	8,590	209
Ceara	Fortaleza, Crateus, Quixada, Juazeiro do Norte	191,899	36,925	5	14,492,447	186,452	78
Mato Grosso do Sul	Campo Grande Dourados	1,173,938	10,523	112	876,319	17,146	51
Minas Gerais	Juiz de Fora	1,427,373	17,672	81	620,197	12,122	51
Rio de Janeiro	Rio de Janeiro	47,085,000	471,035	100	38,848,000	445,285	87
	Angra dos Reis	1,326,483	48,534	27	4,286,930	69,744	61
Santa Catarina	Florianópolis, Lages, Chapecó, Joinville	58, 524	1,674	35	1,176,005	25,896	59
	Total	68,754,591	822,106		91,528,110	895,169	
	Average			84			104

CHAPTER V - WHAT PROSANEAR ACHIEVED

PROSANEAR delivered the benefits of water and sanitation services to one million *favela* dwellers who badly needed them. It also delivered harder-to-measure benefits, such as a heightened sense of citizenship among residents, better relations between neighborhoods and local governments, and stronger local leaders. In many ways, these simple water and sewerage projects were starting points for much broader individual and community development.

Some achievements of PROSANEAR I:

Water and Sanitation Services

PROSANEAR I brought water and sewerage connections to about 1 million people in 60 low-income settlements in 17 cities. This is more people than the project was expected to reach when it began in 1988. The number of people obtaining water connections (900,000) will be more than four times the original target of 200,000 people. The number of people obtaining sanitation services (1,000,000) will be 43 percent more than the original estimate of 700,000.

PROSANEAR I connected more people than expected because project costs were substantially lower than estimated thanks to the innovative use of cost-effective technologies. The project started with per-capita investment ceilings of US$98 for water and US$140 for sewerage. By project's end, creative technical designs had pushed actual costs to just US$84 for water and US$104 for sewerage.

The communities themselves played a key role in keeping costs low. Aware that they would be largely responsible for paying for the new systems, residents systematically chose the lowest-cost alternatives. Moreover, when projects required the purchase of household sanitary equipment, as in Angra dos Reis, people chose low-cost items initially, and later upgraded the equipment with their own money.

Additionally, PROSANEAR I's infrastructure improvements particularly benefited women. Water and sanitation projects are particularly relevant for women's traditional tasks, such as cooking, cleaning, and caring for children and the sick. Having safe water piped directly into the house and sewage safely removed made it possible for women to spend more time on income generating activities or leisure. Women were often active in community meetings; they made decisions, and often led various community activities.

Community Cleanliness and Hygiene

PROSANEAR I communities reported a decline in the number of mosquitoes, rats, cockroaches, and fleas. Residents were pleased that the bad smell of sewage disappeared from the streets and backyards. The hygiene education component of the projects improved people's hygiene standards and made them aware of the connection between hygiene and health, especially in crowded urban neighborhoods.

Community Ownership

By paying for the services they receive—and by participating in all stages of planning, building and operating the new systems—communities achieved an important sense of ownership that leads to long-term care and maintenance of infrastructure.

PROSANEAR I did not have an overall cost-recovery strategy. Instead, individual projects adopted strategies appropriate to the community. In Rio de Janeiro, for example, the team organized tours for the communities to visit water treatment plants, making them aware that producing water costs money. Before the construction started, communities signed an agreement with the water company endorsing the water supply plans, and agreeing to pay for them.

In Campo Grande and Ceará, the communities were given the choice to contribute their own labor in exchange for lower (or no) connection fees. In many cases, materials were provided by the water companies for septic tanks, condominial sewerage pipes, bathroom walls, toilet seats, and tanks. Water companies then collected monthly fees from the communities to cover the costs of the materials, in addition to monthly tariffs. Some communities collected money and bought the materials themselves. In such cases, water companies provided technical assistance, and taught the communities how to build the systems or bathrooms.

Community Organizations

PROSANEAR I teams worked with neighborhood groups and even organized them in areas where they did not exist. These groups provided community members with a means of getting their ideas across to the project teams, and vice versa. Informal groups often became stronger as a result of their involvement in PROSANEAR's outreach efforts, allowing them to evolve into proper civic organizations.

Citizenship

Beneficiaries interpreted PROSANEAR I as a signal that public institutions recognized and served them as citizens, rather than marginals. Additionally, PROSANEAR I showed *favela* residents the importance of using their own initiative in demanding, designing, and managing their own services.

Community Identity

People who previously conceived their needs as individual problems learned through the PROSANEAR experience that they could more effectively solve their problems as a community. In Campo Grande, after the completion of the water and sanitation system, community members went on together to build brick houses in places of their tin dwellings.

As the water and sewerage projects progressed, the project teams grouped and classified the houses into neighborhoods for the logistical purpose of designing—and eventually operating—the new systems. These areas needed unique names and residents named the new neighborhoods with great pride choosing names such as "Hope" and "Meeting Point." The identification of the neighborhoods gave people a sense of affiliation to a formal community.

Community Effectiveness

As a result of PROSANEAR's participation process, communities felt empowered to obtain further urban services such as street pavement, electricity, trash collection, day care centers, and health posts from local, state, and national agencies. Community members discovered the value of community meetings, choosing leaders to represent their expectations and opinions, and mobilizing neighbors to obtain the services needed. Communities learned how to organize themselves, how to demand services, and how to tailor those services to their needs.

Community Enterprise

The associations created from—or strengthened by—PROSANEAR I's participation process also played a role in helping the *favelas* find new ways to generate revenue. Many associations and women's groups that had worked on the water and sewerage projects went on to organize income generating activities such as producing handicrafts in Manaus and producing herbal shampoos in Campo Grande.

Government Cooperation

Sanitation projects can be jeopardized when infrastructure agencies do not cooperate. When a municipality fails to supply proper drainage, rain water may flood the new sewerage system. In crime prone areas, the street lighting and police patrols provided by local governments are necessary for people, especially women, to attend evening meetings. When a lack of coordination among governments and agencies jeopardized the functioning of the new sewerage and water supply systems, PROSANEAR teams helped community members learn how to request these necessary services. The companies informed the communities regarding which office to contact and how to request the service. In other instances, the state companies and the construction firms directly pressured the municipalities to provide the services needed.

Housing

Once the water and sewerage systems were constructed, people used their own savings to improve their houses further. They built individual bathrooms, installed kitchen sinks, replaced precarious tin and wood panels with brick walls, and performed other basic home improvements.

Jobs

Construction of the water and sanitation systems created temporary jobs for *favela* residents. PROSANEAR I encouraged local people to take part in building the systems as a way of lowering investment costs. As a result, people gained a temporary additional revenue source and, in some cases, new skills. In the communities where residents themselves built the sewer systems or bathroom units, water companies usually provided technical assistance and training. In addition, the program created a few permanent jobs in maintenance (see Box 3.3).

More Effective State Water Companies

PROSANEAR I projects developed a whole new business area for Brazilian water companies: low-income settlements. During the early stages of PROSANEAR I, state water companies were not convinced of the benefits of combining community participation and low-cost technology. PROSANEAR I proved that when fully informed and fully involved, poor people were willing to pay reasonable fees for water and sewerage services. PROSANEAR I demonstrated that although low-cost systems may require more on-site maintenance than conventional ones they can be sustainable at an acceptable maintenance cost, provided the community shares the responsibility of basic on-site maintenance. After a painstaking learning process, most of the water companies adopted the principles of PROSANEAR I as the best way to work in low-income areas.

More Effective Construction Companies

Construction firms also changed their approach on the basis of their work with PROSANEAR I projects. Most contractors hired community participation professionals on a permanent basis or worked closely with the community participation consultants. In Belem a large Brazilian construction company created Community Service Bureaus within the community where contract management teams gathered information and suggestions that might influence the course and design of the project. After the Belem project, when given other sewerage extension contracts for low-income communities, the firm applied the participatory methodology it adopted under PROSANEAR I, even though the contracts did not specifically ask for such an approach.

CHAPTER VI - LESSONS LEARNED, NEW CHALLENGES

Lessons Learned

PROSANEAR I's "learn by doing" approach produced many innovative ideas and best practices, as well as a number of lessons. The main lessons were:

Community Participation must start at the very beginning of project preparation.
In the initial years of PROSANEAR I, the community was consulted about the projects only after the technology was selected and the blueprints were drawn. As a result, there were substantial delays and cost overruns as final project designs had to be reworked to fit the communities' real demand.

Cost recovery and subsidy rules must be set in a clear and transparent manner.
Although PROSANEAR I promoted cost recovery through tariffs and connection fees, it did not indicate how much of the cost the communities should pay, and how much should be shouldered by water companies or local governments.

Furthermore, although water companies charged monthly tariffs for the water and sewerage services, these weren't high enough to cover the real cost of building, operating, and maintaining the new systems. PROSANEAR I tariffs were often set lower than the subsidized tariff already charged to poor users of conventional water and sewerage systems. Since the previous tariff had been set too low, the subsequent PROSANEAR tariff was also too low for full cost recovery and sustainability of the new services.

In these cases, three solutions were tried: cross-subsidizing the PROSANEAR tariff from the water agencies' other customers, subsidizing directly from local governments, or thoroughly reviewing the existing tariff structure. The first two solutions were the most common, but these solutions in general lacked transparency. The third option was beyond the scope of the project, and rarely happened.

Formal, long-term arrangements for operating and maintaining the systems must be an integral part of the design.
Low-cost sanitation systems require more maintenance efforts than conventional systems, because they use smaller diameter pipes that are more shallowly laid. Communities must share the responsibility of maintaining the system, and local water companies or other agencies must carry out periodical maintenance work.

All feasible technical options and their costs must be discussed with the communities.
Many of the PROSANEAR I projects did not explain the whole range of technical options available to the communities. This happened in part because certain options were ruled out for technical reasons or because some of the options were still being developed and tested. And in some cases, maintenance arrangements were not explained to the communities. In other cases, the cost implications for each of the options were not well explained and communities were often surprised by the amount they had to pay.

The projects should coordinate with the local government's urban development plan from the very outset of preparation.
Many PROSANEAR I projects needed to work closely with local government institutions to be fully effective. Sewerage systems, for example, won't work for long unless local governments provide rain water drainage and solid waste collection. Future PROSANEAR projects must systematically encourage this coordination from the beginning.

The local government must have a strong commitment to the project and to poverty alleviation.
Local governments played a key role in several stages of the PROSANEAR projects, from identifying communities where PROSANEAR would work, to promoting the project, to mobilizing local government agencies. Thus, the local government's understanding of the project's basic concepts was important in gaining its support and making the project viable and more sustainable.

The Challenges Ahead

Encouraged by PROSANEAR I's success, the Brazilian government, is redesigning PROSANEAR I's project criteria and guidelines to implement them on a national scale. The executing agencies will choose from various institutional arrangements tried and tested through the pilot program, and they can select the community participation methods that worked best.

PROSANEAR has also caught the attention of governments in other parts of the world, including Indonesia and the Philippines. The challenge is to tailor PROSANEAR to local conditions that may be very different from those in Brazil. In the Philippines, for example, it is still widely believed that existing storm water drainage systems alone can handle household sewage. Also, utility engineers there have had little exposure to innovations around the world and are reluctant to experiment with new technologies.

PROSANEAR began slowly and improved with experience. This experimental phase clearly demonstrated the power of combining community participation and low-cost technology. Residents learned they could work to improve their own communities, water companies learned that *favelas* make good customers, and governments learned that innovative solutions can work. The next round of projects will be even stronger thanks to the knowledge gained in the first round. There is every reason to hope that PROSANEAR's pragmatic combination of low-cost technology and community participation will enable water agencies to serve millions more of the urban poor, in Brazil and around the world.

Morro União: 500 thousand liter metal reservoir