

Sanitation in Colombia's low-income settlements: selection, implementation, and evaluation

by Ines Restrepo Tarquino and Margaret E. Ince

In many of the world's large cities, less than two-thirds of the marginal settlers have access to adequate sanitation systems — posing a severe danger to people's health, and to the environment. One programme in Colombia is working in tandem with communities to evaluate and develop the low-cost technologies that *they* want.

AFTER A TWO-YEAR planning process, in 1992, the Colombian agencies CINARA (Inter-regional Centre for Drinking Water Supply) and EMCALI (Municipal Agency of Services), introduced the 'Learning-Process Projects on Water Supply and Sanitation' programme in Cali, a city of 1.7 million people located south west of Bogota, relatively close to the coast. Based on local and regional institution participation with the recipient communities, the programme's objective was to research, develop, and transfer methodologies and technologies for sanitation from low-income settlements in Aguablanca District to Cali.

The core elements of the projects are the processes involved in the selection, implementation, and evaluation of sanitation technologies. The purpose of this article is, following a brief review of the concepts in these processes, to describe a procedure for evaluating household sanitation technologies according to the following criteria: sustainability, effective use, and replicability.

Low-income settlements

Like many other large Latin American cities, Cali contains several marginal settlements suffering from a range of infrastructure problems. Notable amongst these is the excreta and sullage disposal arrangements of low-income slope settlements, where only 33 per cent of the settlement population (120 000) are connected to the EMCALI-managed urban sewerage system, while a further 26 per cent have sanitation systems that discharge directly into surface waters. Geological faults, rapid urbanization, poor health, and economic conditions further complicate the situation. The Learning-Process Projects programme focuses on some of the slope settlements.

Selection

One of the steps in the planning phase of the projects is the process of selecting technologies. The principal criteria are:

- *Evaluations from the International Drinking-Water Supply and Sanitation Decade.* The need for systematic analysis, payment for services, and strengthening of institutional and community capacities.
- *Multi-barrier treatment and integrated-treatment concepts.* These concepts are based on the work of

Galvis and colleagues,¹ who state that more than one stage of treatment, or a combination of stages, are required to treat water effectively. The combination of physical sanitary barriers to excreta-contamination, together with an emphasis on the affordability of treatment systems, guarantees improvements to general sanitary conditions, public health, and environmental conditions.

- *The 'three circles' theory.* According to the CINARA analysis, the best technological options should fulfil the following requirements: effectiveness, sustainability, and risk-minimization.

In Cali, the selection of appropriate sanitation systems is complicated by the serious physical risks posed by the presence of mining industries, and the geological faults that cross the area. On-site sanitation systems increase the potential environmental risk through infiltration of sewerage to groundwater

Table 1. Evaluating sanitation technologies: concepts and criteria.

Concept	Criteria	Parameters
Sustainability	● Cost	Capital and O&M cost should be affordable by the community. Affordable by the family.
	● Environmental	No negative effects on the environment. No permanent alteration to ecological balance. Little or no water used.
	● Operational	Only locally available tools and knowledge. No use of mechanical equipment. Little supervision.
	● Management	Must function continuously. Guarantees correct O&M. Efficient collection of tariffs. Direct and honest.
Effective use	● Cultural	Compatible with common hygiene behaviour. Compatible. Smells, aesthetic considerations, privacy, and comfort acceptable.
	● Educational	Users should know how to use the system. Users should know how the system functions.
	● Health	No possibility of pathogens spreading to users or the environment. Minimal handling of excreta. No access for insects or animals. Adequate disposal of wastewater.
Replicability	● Cost	See sustainability.
	● Knowledge	Construction and O&M maintained in community. Design, construction and O&M maintained by institutions, constructors, and universities.
	● Operational	Flexible and suitable for incremental extension.

Table 2. The Cali community's evaluation of their sanitation technologies.

Parameter	Information source	Body responsible
<i>Technical evaluation</i>		
Blockages (a), (b)	Maintenance book Complaints book	Caretaker M.C.
Damages (a), (b)	Maintenance book Complaints book	Caretaker M.C.
Connections (%) (b)	Sanitary-inspection forms Design Construction inspector's minutes	M.C./Health Secretary Design/constructor M.C. or EMCALI M.C.
Real number of beneficiaries (c)	Users' register Users' register General meeting minutes Blocks meeting minutes	M.C. M.C. M.C. M.C.
Sullage and excreta on the roads (a), (b)	Sanitary-inspection forms	Block Committee M.C./Health Secretary
Functioning and use in the household (a), (b), (c), (d)	Users' sample Questionnaire	Work team
<i>Social evaluation</i>		
Community satisfaction (a), (b), (c), (d)	Users' sample Complaints books	Work team M.C.
Time between a complaint and action (b), (c)	Maintenance book Complaints book	Caretaker M.C.
Bad debtor (%) (b), (c)	Users' register	M.C.
<i>Health evaluation</i>		
Diarrhoea cases (b), (c), (d)	Consultation registers Health promoter's Kardex	Health post Health promoter
Hygiene behaviour (washing hands, cleanliness in the sanitation facility and in the kitchen) (c), (d), (e)	Users' sample	Work team
<i>Economic evaluation</i>		
Construction cost/ household (including on-plot facilities) (a)	Design Construction inspector's minutes Accountant's books	Designer/constructor M.C. or EMCALI M.C.
Real revenues/ household (b), (c)	Accountant's books	M.C.
Tariffs (b), (c)	Users' register Tariff regulation	M.C. M.C.
Bad debtor (%) (b), (c)	Users' register	M.C.
Management staff/ beneficiaries (b)	Users' register	M.C.
Real revenues — O&M cost* (b)	Management regulation Accountant's books	M.C. M.C.
Salary/household (b), (c)	Local statistics	DANE

Notes

M.C.: Management Committee.

*This parameter changes if the capital cost is recovered.

(): Parameter related to this question.

supplies, whereas off-site sanitation technologies are more environmentally friendly, but are expensive and less affordable for the community to maintain.

From a review of these concepts and examples, the selection of options such as low-cost sewerage systems for the slope settlements, as well as low water consumption devices for individuals, are advocated.

Implementation

Important factors to consider during the implementation stage are:

- Community and institutional roles should be clarified;
- regulations governing communal services should be known among the community;

- communities should have the opportunity to choose sanitation technologies appropriate to their conditions;
- agreements governing the construction of on-plot sanitation facilities must be made to guarantee their implementation;
- the selection of materials and the construction process must be supervised carefully to prevent sewerage failure;
- adequate disposal of anal-cleaning material must be taken into account;
- women's participation must be strengthened, but this should not mean even more work for women;
- encouraging male participation in the community should be considered as important as fostering female participation;

- schools, nurseries, and health clinics must be involved in sanitation planning — this has proved more successful than organizing the 'whole' community.

Evaluation

Three basic concepts are used to evaluate the success of sanitation technologies: sustainability, effective use, and replicability. Table 1 illustrates the application of these concepts in the sanitation sector.

The specific questions to be addressed when carrying out any evaluation are:

- Is the technology in good condition?
- Is the technology working adequately?
- Is the technology used?
- Is the technology used effectively?
- Has hygiene behaviour improved?

The relationship between these questions and the concepts above is illustrated in Table 2 which indicates the possible parameters, information source, and the body responsible for maintaining the information that can be used in the evaluation process. The parameters were selected because they represent the relevant concepts (see Table 1), they address the evaluation questions, and they are easy and cheap to use.

Evaluation takes place at both area and household level. At area level, the answers are collated from information registered by the management committee and the health clinics; at the household level, conclusions are reached from the answers given to a set of standard questions, and from people's observations.

Household evaluation

The specific elements of the Cali household-evaluation methodology are:

Interview: Family members are asked if they are satisfied with the available sanitation facility, and people's general hygiene practices in relation to anal-cleaning material, children's faeces, and hand-washing.

Observation: The type and condition of the sanitation facility, the distance between sanitation and hand-washing facilities, and the cleanliness of the facility, the kitchen, and within general household areas.

Characteristics of use: Individuals' reasons for use, access to sanitation and hand-washing facilities, privacy, protection, and preference.

In general, the questionnaire focuses on use and hygiene behaviour, while the project workers' observations re-

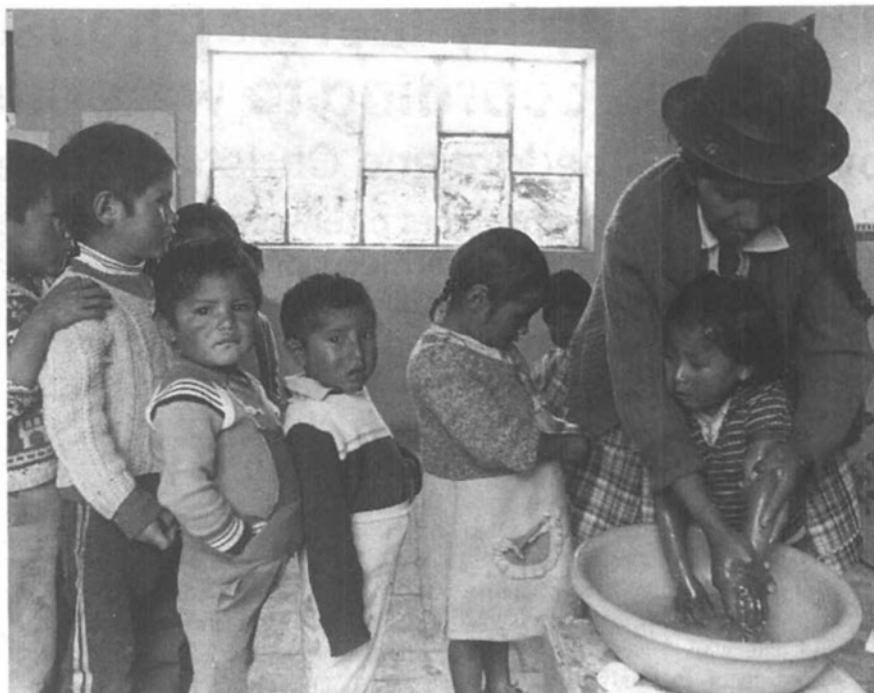
late to the physical condition and functioning of sanitation systems. A scoring system provides results at both the individual level (specific question or household), and at the community level. These results can be compared with the expected scores from the start of the project. The evaluation process provides guidelines for the improvement of the sanitation system, and for a hygiene-education component.

The evaluated parameters form part of the community's surveillance of their sanitation system. The management committee, caretaker, and other relevant individuals and groups can all be trained to carry out the evaluation procedures outlined above.

The future

The key to success for Cali's sanitation projects rests with the implementation of 'software', rather than 'hardware'. If the general objective of improving health conditions is to be achieved, it is crucial that integrated projects — those which combine water-supply, sanitation, and hygiene-education components — are planned, developed, and pursued.

The technical options for sanitation in low-income urban areas have not been evaluated to the same extent as the community-management and community-participation options. In particular, little is known about the



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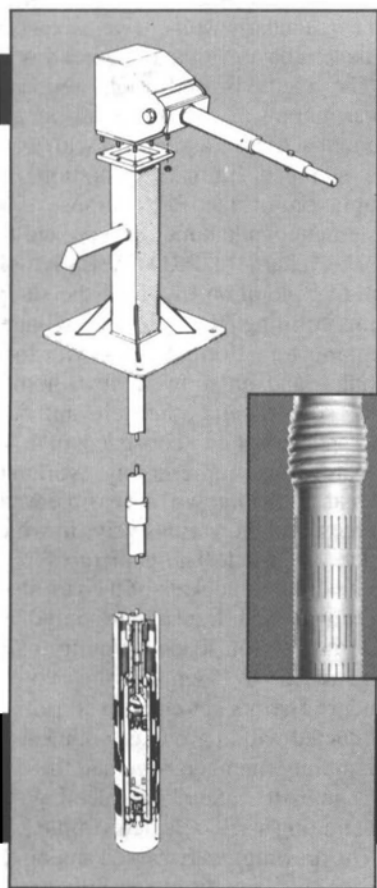
Community hygiene education: Children must also be taught why hand-washing is a necessary evil.

convenience and relative affordability of on-site or off-site sanitation. The success of the project has depended crucially on, not only good construction processes, the high number of connections, adequate operation and maintenance etc., but also on the effective co-operation and participation of the different actors involved, including institutions, communities, and politicians. ●

References

1. Galvis, G., Visscher, J.T., Fernandez, J., and Beron, F., 'Pre-treatment alternatives for drinking-water supply systems', IRC Occasional Paper No.22, The Hague, The Netherlands, 1993.

Ines Restrepo Tarquino is a Sanitary Engineer at the Centro Inter-regional de Abastecimiento y Remocion de Agua, A.A.25157, Cali, Colombia.



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