Scaling-up using condominial technology

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Unlike conventional sewerage, condominial sewers run at shallow depths within the household boundaries. Although they require greater levels of co-operation to install and maintain, they are much less expensive, and they are taking off in a big way in Latin American cities.

The conventional model of sewerage provision has been shown to be inappropriate for the expansion of services to areas where chaotic occupation and complex topography constrain the installation of regular sewerage layouts.

Traditionally, conventional sewerage implementation has focused primarily on infrastructure works without the participation of future customers, resulting in low levels of connections to the network. Service providers assume the willingness and capacity of dwellers to complete their connection to the network. In fact, a combination of hefty connection fees, costly internal household devices and cheaper – even if unsanitary – alternatives for sanitation constitute barriers to access.

Condominial systems have been utilized in Brazil since the 1980s when they were first employed in the city of Natal. In Brasilia, since 1995 the condominial technology was adopted by CAESB, the local utility, as the only option for sewage collection, with more than 120,000 condominial connections built by the year 2000. The condominial technology had been used to expand sewerage connections to peri-urban areas of cities like Salvador, Petronila, Recife and Rio de Janeiro among others. By 2000, 13.6 per cent of the sewerage connections in Brazil were condominial.

The technology has been expanded from Brazil to other Latin American countries in the last few years. In Bolivia, it was employed to expand sewerage services to more than 50,000 households in the city of El Alto. In Peru, SEDAPAL, the Lima utility, is implementing a programme to expand condominial sewerage to 25,000 families. Pilot experiences are or will be underway in small towns in Paraguay and Ecuador. The City of Durban, South Africa experimented with this technology in 2000 and is introducing adaptations for scaling it up.

Experiences in various countries show that an increasing number of utilities and local service providers are using this technology to reach the Millennium Development Goals, due to its significantly lower costs, with identical levels of service, to conventional sewers.

What is it?

The condominial technology – also called 'shallow sewerage' – is different from the so-called 'small bore technology' or 'simplified sewerage' because there is no retention of solids in the systems in the former. Consequently, there is no need to construct household retention boxes and no need for periodic sludge removal.

The condominial system attempts to overcome difficulties of actually reaching users in the following ways. From the technical point of view, it simplifies the design and characteristics of pipelines, making it physically easier to connect households. Condominial sewerage considers the network divided into a private part (the condominial lines) and a public one (the main sewers). The condominial lines are built in areas with no road traffic, such as gardens, sidewalks, etc., and are laid at a shallow depth (see Figure 1). The diameter of these lines is usually 100 mm, with much smaller inspection chambers.

The condominial model also proposes the development of new relations of co-responsibility for services between the service provider and the user. From a social perspective, the model introduces a participatory component in the implementation phase and this is intended to motivate users to connect to the system and to generate a commitment to keep to good-use practices. Consequently, one of the user's responsibilities is the maintenance of the condominial lines, especially when pipes are laid within the household area. In this case, the beneficiaries must receive the necessary training to perform the maintenance tasks. However, the utility remains responsible for the O&M of the overall system at the city level.

Technical benefits

The flexible condominial layout works in irregularly distributed urban settlements, very steep slopes and rocky terrains. In fact, in many locations it may be the only feasible technical option.

Condominial systems also have a better hydraulic function. The use of the shear stress boundary concept for design instead of the minimum velocity, allows the use of lower minimum slopes. Similarly, and counter-intuitively, smaller diameters allow greater buoyancy and more efficient transportation of solids, especially in densely populated areas.

Financial benefits

The lower cost of this technology is one of its more appealing characteristics, since it allows the provision of services to significantly more people from a given financial resource. Cost reductions stem mainly from:

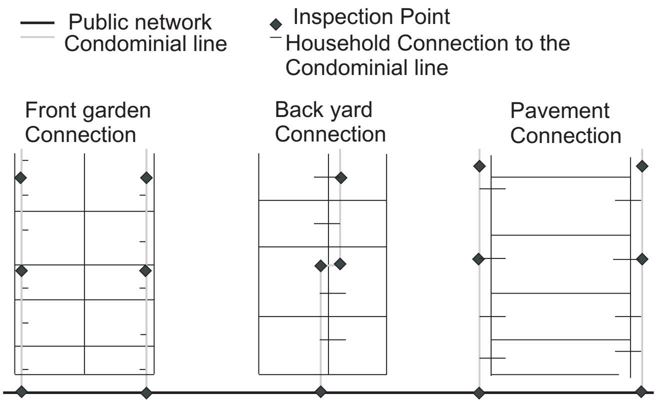


Figure 1. Layout options for condominial sewerage systems (each small rectangle represents a house, front and back garden).

Condominial sanitation works in very hilly terrains

- lower excavation volumes due to the shallower depth of the pipes
- use of simplified inspection chambers instead of costly manholes
- reduced pipe diameters and layout length
- ease of construction, which reduces the need for heavy machinery.

The overall cost savings of implementing the condominial technology are well documented, with some examples presented in Table 1.

In terms of recurrent costs, the positioning of the system at depths varying from 60 to 150 cm allows for easier access for manual maintenance. In case of breakage, system components are much easier and cheaper to replace.

Social benefits

The involvement of users during the overall process creates an understanding of how the system works and the consequences of improper use. The messages – centred on the appropriate choice of personal cleansing material, the proper disposal of garbage and the use of kitchen grease traps – contribute to better functioning of the sewer pipes.

In addition, since users know and 'own' the system, condominial connection uptake rates are higher than conventional ones. The user's capacity for self-construction (when training is provided) and the lower prices obtained from buying materials in bulk result in more sanitation facilities built and used. In many interventions, toilet construction is an integral part of the project.

Usually, the implementation of projects contributes to the empowerment of marginalized communities. The negotiations between neighbours, management of conflicts, the shared responsibilities, the identification of leaders and a common vision contribute to construction of social capital that becomes an asset and an engine for solving community problems.

The social promotion also highlights the purpose of service fees and generates the users' commitment to punctual payment.

The costs of this social intervention are not as well documented in the literature, and are perhaps more difficult to compare, since duration and scope vary greatly. Table 2 presents some reported social intervention costs.

O&M challenges

Even though the system of O&M by the communities is at the cornerstone of the conceptual condominial model, the inability of communities to deal with blockages in sewerage systems, and therefore the continuous support from the utility or other agency is one of the most significant constraints to scaling up.[1] These problems are seen to be aggravated in communities with changing occupancy, where new

Table 1. Estimated cost savings for water and sanitation per connection (in US$)

	Community name	*Conventional*	*Condominial*	*Savings*	*Service*
La Paz-El Alto, BOLIVIA(2) (based on the average connection cost for each water and sewerage connection)	Caja Ferroviaria	229	109	**52%**	Water
	San Juan	229	134	**41%**	Water
	Villa Ingenio	276	119	**57%**	Sewerage
	German Bush	276	176	**36%**	Sewerage
Durban, SOUTH AFRICA (3) (not including costs of primary network)	Emmaus	1006.9	443.8	**56%**	Sewerage
	Briardale	389.8	253.4	**35%**	Sewerage
Small towns, PARAGUAY(4) (includes construction of treatment plants and labs, based on estimated average per capita connection cost for a family of five)	Villeta	1250	279	**78%**	Sewerage
	San Pedro	1250	758.9	**39%**	Sewerage
Lima, PERU (5) (based on construction costs)	Kawachi	430.1	242	**44%**	Sewerage
	Virgen del Pilar	576.3	325.3	**44%**	Sewerage
	Ramiro Prialé	594.3	408	**31%**	Sewerage
	Las Lomas Panorama	668.2	408.3	**39%**	Sewerage
	Los Girasoles	418.2	289.9	**31%**	Sewerage
	Virgen del Rosario	465.6	318.9	**32%**	Sewerage

Note: for numbered notes see reference list

Table 2. Costs of social intervention

	Community name	US$/connection	% of total cost
La Paz-El Alto, BOLIVIA(2),(5)		Caja Ferroviaria	17.2
	San Juan	23.8	
	Villa Ingenio	37.8	
	German Bush	20.5	
***Selected Sample*, BRAZIL(6)**	Dourados	-	50%
Cerro de la Unión		-	27%
Craetús-Quixadá		-	5%
Conjunto Palmeira		-	7%
Lima, PERU (5)	Potable water systems		28
(*)	Sewerage systems		27

(*) SEDAPAL considers a total cost of US$ 55 per connection for social intervention in condominial systems, divided as indicated above.
Note: For numbered notes see reference list

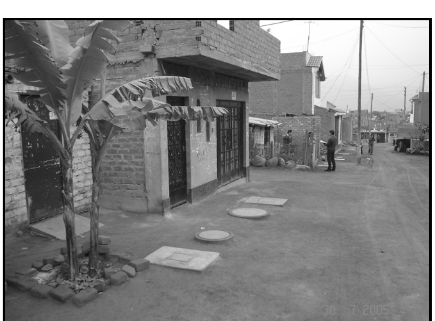
residents are unwilling to take on the O&M responsibilities.

Even in the most successful and mature cases of scaling-up at the city level, i.e. Brasilia and La Paz, the beneficiaries, as part of their decision-making process at the implementation phase, preferred for the responsibility for the O&M of the network to remain with the utility. Dwellers are more accustomed to paying for services, especially in urban settings, and they also expect to be paid for services they perform. Thus, volunteering for O&M tasks is often not feasible in many communities.

These reasons, however, do not necessarily mean that the community cannot get organized to undertake the O&M works, but perhaps under a slightly different model in which they form microenterprises.

Legal constraints

Construction standards. As in many innovative systems, the adoption of condominial technology encounters much resistance among practitioners. Common obstacles are the rigidity of the national standards for engineering design, materials and appurtenances as well as building construction codes.



Inspection holes are at the front of these houses

In Bolivia and Peru, changes in the national norms have been implemented to allow the scaling-up of this technology. The examples of these countries illustrate, however, that the initiative for using the technology comes from the realization by the service provider that it needs to change its approach to increase coverage, rather than triggered by a modification of norms.

Ownership issues. Another obstacle for scaling-up comes from the legal ramifications of a neighbour's joint ownership of infrastructure (underground pipes). Also, the presence of the underground network imposes limitations on property use. However, these problems may be lessened with the use of the sidewalk layout option, in which the pipe is located in common or municipal property.

Implementation challenges

When evaluating the condominial technology, it is important to separate the intrinsic drawbacks of this approach from those related to either poor project management or poor construction quality. Extensive training in both the engineering design and construction and the social aspects is paramount to project success.

Characteristically, the condominial approaches require intensive social work with the communities. These costs – along with the steep learning curve – can be quite onerous for small pilot projects, even threatening to render the system's savings negligible. The greater the scale the easier it is for service providers to administer the condominial system.

The key challenge for scaling-up is to maintain a social mobilization process on a large scale that brings about the benefits described above, while maintaining the per capita costs at a reasonable level.

Institutional issues

Utilities in large metropolitan areas are better equipped with human, financial and technical resources to install and maintain the condominial system. In small towns, a model can be implemented under which a national or regional authority creates the market for companies to implement the condominial technology, with technical assistance offered to service providers to oversee the system O&M.

Notes

1 Eslick, P. et al. 'Lessons and Experiences from the Ethenkwini Pilot Shallow Sewer Study'. WRC Report No. 1146/1/04. Water Research Commission. Republic of South Africa.

2 Water and Sanitation Program. ' 'Condominial Water and Sewerage Systems – Costs of Implementing of the Model – Economic and Financial Evaluation' Washington, D.C. 2002. The costs shown represent the reported costs plus half the uncertainty value range, as reported in Table 4-1 and 4-2.

3 Eslick, P. et al. 'Lessons and Experiences from the Ethenkwini Pilot Shallow Sewer Study'. WRC Report No. 1146/1/04. Water Research Commission. Republic of South Africa.

4 Consultores e Ingenieros, 'Paraguay Proyecto BIRF IV – Sistema de Alcantarillado Condominial – Resumen de Datos Técnicos y Financieros' Asunción, 2004. Information on average costs for conventional connections from Eng. Juan Pereira from the National Sanitation Service Office in Paraguay.

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6 DIAGONAL URBANA, et al. 'Evaluation of the Use and Management of Technology, PRONASEAR PROGRAM'. Summary prepared for the Fifth Global Forum of the Water Supply and Sanitation Collaborative Council. Foz de Iguacu, Brazil, 24-29 November 2000.

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