



**School of Civil Engineering**

**Tropical Public Health Engineering Research Group**

**Low-cost Sanitation Improvements in Poor Communities:**  
Conditions for Physical Sustainability

A thesis submitted in fulfilment of the requirements for the award of the degree of

Doctor of Philosophy

by

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*To my Family and Friends, for all their love, support and encouragement.*

*The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others.*

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## **Abstract**

During the last decades of the twentieth century, alternative solutions for provision of sanitation were put into practice in Brazil. These unconventional programmes, which embrace not only innovative technologies but also new social approaches, raised concerns about community/institution participation in both the implementation and the operation & maintenance (O&M) of low-cost sanitation systems.

The aim of the study reported herein was to identify and assess factors likely to influence the long-term sustainability of these low-cost sanitation programmes. For this, six sanitation programmes were studied regarding: the selection and design of the systems technologies; affordability and participation of the institutions on the management of the programme; acceptability/satisfaction of the users; and, possible social/health improvements brought to the communities. Data on these parameters were obtained by studying the documentation of the programmes, via interviews with stakeholders, observation of the systems' O&M schemes, technical inspection of the units and household questionnaire surveys.

The capacity of institutions in complying with the O&M requirements of the sanitation technologies was of major importance for the sustainability of the programmes. As to the strategies for O&M, the six case studies provided a rich scenario with different administrative levels (community or state companies) and maintenance schemes (centralised, decentralised or participatory). Regardless of the solution adopted, the lack of commitment of the institutions involved in the O&M scheme was among the main factors negatively influencing the sustainability of the programmes.

The four case studies based on condominial sewerage showed that enough experience had been accumulated for the reliable implementation of this technology. However, two important aspects of vulnerabilities were the lack of efficacy of the O&M schemes and deficiencies in users' awareness for the adequate utilisation of the systems.

Educational programmes are essential for the process of implementation of the sanitation systems, and these were included in all programmes studied. Nevertheless, the continuity in the delivery of educational messages was frequently neglected, in spite of its importance for both the maintenance of the implemented systems and the improvements in the social and health conditions of the poor communities.

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## Abbreviations

ABES	Brazilian Association of Sanitation Engineering
BMS	Brazilian Minimum wage
BNH	National Housing Bank
CAERN	Water and Sanitation Company of Rio Grande do Norte
CAESB	Water and Sanitation Company of Brasília
CAGECE	Water and Sanitation Company of Ceará
CEF	Brazilian Federal Savings Bank
COMPESA	Water and Sanitation Company of Pernambuco
DALY	Disability-adjusted Years of Life
DFID	Department for International Development
EMLURB	Municipal Company for Urban Refuse Collection
FECOMO	Federation of the Olinda Residents Association
FIDEM	Foundation for Municipal Development
IBGE	Brazilian Institute of Geography and Statistics
KfW	Kreditanstalt für Wiederaufbau
MEP	Minimum Evaluation Procedure
O&M	Operation and Maintenance
ORS	Oral Rehydration Solution
PAHO	Pan American Health Organization
PHAST	Participatory Hygiene and Sanitation Transformation
PLANASA	National Plan of Sanitation
PREZEIS	Plan for the Regularization of the Special Zones of Social Interest
R\$	Brazilian Reals
SANESUL	Water and Sanitation Company of Mato Grosso do Sul
SI	Sustainable Indicators
SISAR	Rural Sanitation Integrated System
STW	Sewerage Treatment Plant
SUDENE	Superintendence for the development of the Northeast
TIL	Tubs for Inspection and Cleansing
UN	United Nations
UNESCO	United Nations educational, Scientific and Cultural Organization
URB-Olinda	Urbanisation Company of Olinda
URL	Universal Resources Identifier
URB-Recife	Urbanisation Company of Recife
USAID	United States Agency for International Development
US\$	United States Dollars
VDR	Reduced Flush Toilet Bowls
VIP	Ventilated Improved Pit
WCED	Water, Engineering and Development Centre
WHO	World Health Organisation
ZEIS	Special Zones of Social Interest