Small-Scale Sanitation in South Asia: 4S Progress and Challenges

The Bill & Melinda Gates Foundation-funded research project "Small-Scale Sanitation Scaling-up (4S)" in South Asia was launched in January 2016 and ends early 2018. This article looks back at 15 months of data collection and is an analysis of challenges and preliminary insights. Lukas Ulrich[1], Rohit Chandragiri[1], Marius Klinger[1]

Background

In 1992, the Indian Ministry of Environment and Forests stated: 'For a country like India, conventional [wastewater] treatment plants are costly. In fact, these are beyond the financial means of many small towns' [1]. In 2004, the same ministry issued a notification which required on-site sewage treatment plants (STPs) to be built for new, large construction projects (including residential, institutional or commercial projects). This triggered the installation of thousands of privately-owned, small STPs in Indian cities and the development of an important market with hundreds of companies that design, build and service a wide range of treatment technologies.

The benefits of small-scale (often called decentralised) sanitation systems that prioritise local water re-use, cost-effectiveness and stage-wise implementation have long been recognised. As a result, these systems are increasingly considered all over the world in both rural and neighbourhood-level urban planning. It is noteworthy that in India most small STPs are not an outcome of concerted urban infrastructure planning, but of innovative national and, partly, state-level policies aimed at protecting the environment and bridging the gap in (waste)water infrastructure.

While the number of small-scale sanitation systems in South Asia is growing, the list of reports on failed or poorly performing installations is also increasing. Efficient institutional frameworks are needed to monitor the systems' design, establishment and long-term operation and maintenance (O&M). A sound understanding of how small-scale sanitation can be systematically and effectively planned, implemented and managed at a scale that optimises their role in urban sanitation service delivery is lacking. The 4S project aims to assess the current status of small-scale sanitation (serving 10 to 1 000 households) in South Asia and generate evidence-based policy recommendations for sustainable scaling-up.

Allie Davis

Photo 1: Primary treatment component of a community treatment plant in Tamil Nadu.

Methodology

The project has five main components:

1. A desk-based landscape study. This has compiled available information on small-scale systems in South Asia, private sector actors, related policies and findings from previous research.
2. A basic assessment of a large number of existing installations. The aim is to understand the performance of existing systems and the factors that influence sustainability, such as design, O&M, management, and socio-cultural as well as financial aspects. More than 300 units (30 in Nepal, 10 in Pakistan and the rest in India), treating between 5 and 700 m^3/day, have been inspected (Photo 1) and interviews conducted with stakeholders, i.e. managers, operators and beneficiaries (Photo 2).
3. A detailed performance assessment of selected systems. To gain a substantiated understanding of treatment performance and make comparisons with relevant standards, a sampling campaign is being carried out in more than 40 units (including five in Nepal). A representative range of treatment capacities, technologies and applications is being covered. Composite sampling of inlets and outlets over 24 h (complemented with grab samples every 6 h) is being done three times at each site (Photo 3), and key water quality parameters are being analysed.
4. An institutional and governance analysis. This is identifying the elements of an enabling environment required for the successful management of small-scale sanitation systems. A social network analysis (SNA) is looking at stakeholders, their influence, interests and relationships, to understand the current frameworks and potential gaps. Interviews are being conducted with stakeholders, who deal with policy development, monitoring and enforcement. The SNA is focusing on four cities in Karnataka and Tamil Nadu (Bangalore, Mysore, Chennai and Coimbatore).
5. A financial analysis. This is delineating economies of scale and financial flows

between system stakeholders. The life-cycle costs of seven main treatment technologies at six relevant scales between 40 and 700 m^3/day are being collected, mainly from private sector actors. Identifying the financial reasons for underperforming STPs will aid the development of improved financial and management mechanisms.

Progress and challenges

The landscape study has compiled a list of 9200 small-scale systems in India and 260 private players implementing and servicing them. It has also collated the relevant national and state-level policies and previous research.

The project team has developed a set of questionnaires and checklists for the basic assessment and field work started in April 2016. Contacting system owners, organising interviews and obtaining access to systems has been a major bottleneck, especially in India where small STPs are mostly privately owned and operated. The team dealt with such challenges as outdated or lack of information and contact details, and little interest, trust and availability on the part of interview partners. Unannounced visits and visits made through personal contacts and design and O&M companies worked better than trying to make arrangements through phone calls and emails. The 4S team was finally able to do 8–10 basic assessment site visits per week and after 15 months, more than 280 systems have been studied.

Getting information from the interviewees, especially managers, was often difficult; inquiries about costs, for instance, regularly went unanswered. The interviewers were repeatedly trained and questionnaires and processes for data collection monitoring and prompt data validation were often revised to ensure good data quality.

Rohan Sunny

Photo 2: Residents interviewed during the evaluation of a treatment system in Tamil Nadu.

The sampling campaign is in progress since August 2016. Findings from the basic assessment, distances to laboratories as well as local conditions, for example, accessibility of sampling points, determined the site selection.

Preliminary insights

In India, sanitation is a state responsibility; states even have the freedom to tighten the limits of national policies and standards. This has led to big regional differences in how small STPs are enforced and regulated. Karnataka, Tamil Nadu, Maharashtra and the National Capital Region are among the leaders with the biggest numbers of STPs, most of which are conventional activated sludge processes, sequencing batch reactors (SBR) and moving-bed biofilm reactors (MBBR). State pollution control boards (PCBs) face the challenge of monitoring the implementation and performance of all the systems. Unified and comprehensive national- or state-level databases of systems are lacking, however, and while the number of STPs continues to increase, the staffing capacity of PCBs has not [2]. Current mechanisms to enforce and monitor the design and operation of installations are inefficient and fairly easy to circumvent [3].

Interviews with private sector actors show that capital costs and space are the main factors typically considered in technology selection. Once built, STPs are frequently managed by stakeholders, who were not involved in the design phase, and who often must deal with under-designed systems that are costly to operate [3]. Operators come and go, making training difficult, and unskilled labour is often hired to save costs. O&M is also often outsourced to professional service providers or the engineers who designed the systems.

Many experts from engineering firms, civil society organisations, and PCBs agree that a large percentage of systems are poorly performing or non-functional. Water scarcity is a reality in South Asian cities; yet, low water tariffs still do not incentivise efficient reuse. Well-designed and maintained STPs produce high-quality treated water, but typically there is limited capacity to use all of it on-site. Often, water is discharged, sometimes untreated. Planning beyond the installation level is needed to identify the most economical size and location of treatment plants. Despite these issues, good examples of well-performing installations are also found across all types of technologies.

Shreyas Kumar

Photo 3: Field team at work for the 24 h sampling of a treatment system in Bangalore, Karnataka.

Conclusion

Although the data collection has been more time-consuming than planned, a wide variety of systems have been assessed, and in order to complete all the objectives, the project received an extension until March 2018. As the field work ends, data processing and analysis has started, and a cause-effect framework is being developed to understand the conditions that determine the performance of installations. Analysis will highlight the bottlenecks hindering small STPs from sustainably contributing to water conservation and pollution abatement. Technical, financial and management recommendations will be devised for different stakeholders. A regional dissemination event will take place in India to mark the end of 4S. Stay tuned to Sandec's website and social media for announcements of project publications and events.

[1] MoEF (1992): Policy Statement for Abatement of Pollution. Ministry of Environment and Forests, New Delhi.

[2] Sahu, G. (2013): Environmental Regulatory Authorities in India: An Assessment of State Pollution Control Boards. Tata Institute of Social Sciences, Mumbai.

[3] Kuttuva, P. (2015): An integrated analysis of the economic, social, institutional and environmental factors affecting decentralized urban wastewater reuse systems: insights from Bengaluru, India. MSc Thesis.

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