TWO VIABLE MODELS FOR RURAL FECAL SLUDGE MANAGEMENT

SUMMARY

Basic sanitation coverage in rural areas and progress toward Sustainable Development Goal 6.2 has advanced significantly over the last decade in several low- and middle-income countries. Sustaining this progress, though, requires safe fecal sludge management (FSM). Policies, interventions, and research on safe FSM have largely focused on urban areas. But as rural access to latrines has increased, so has the need for safe FSM services. Currently, safe FSM services in rural areas are nascent, and less than 2 percent of fecal sludge is treated in South and East Asia and sub-Saharan Africa. As toilets become full, rural households risk adopting unsafe FSM practices or reverting to open defecation. USAID WASHPaLS #2 conducted a desk review to understand the market, suitable methods along the sanitation value chain, and viable business models involving the private sector for safe FSM in rural areas. The desk review contributes to the knowledge base on area-wide FSM solutions, which would include household-managed and government-operated services.

WHY THIS MATTERS

With increasing encouragement and use of on-site sanitation facilities to end open defecation, there is an increasing need to manage waste in these facilities. Few safe FSM options currently exist in rural areas, and without increasing effective interventions, recent gains in environmental and community health in low- and middle-income countries will suffer as toilets get full.

As governments and development partners embark on increasing safe FSM in rural areas, there is a need to build knowledge on appropriate solutions and management models. WASHPaLS #2's research found that public-private partnership (PPP) business models are necessary for safe FSM through the private sector in rural areas. PPP FSM business models aim to be more affordable, have faster response time, and be safer and cleaner than the informal FSM providers common in rural areas. WASHPaLS #2's desk review aimed to improve understanding of rural FSM, including the demand for FSM services, the potential suitability of various methods for treatment and emptying based on conditions in rural areas, and effective business models for rural FSM.

How does this research connect to USAID's Global Water Strategy Action Research Initiative?

This research contributes to USAID's Global Water Strategy Implementation Research Agenda on solutions for safe excreta management in peri-urban areas, towns, and rural growth centers (RQ 2.2.1).

It addresses the U.S. Government's Global Water Strategic Objective 2 (SO2), which aims to increase equitable access to safe, sustainable, and climate-resilient drinking water and sanitation services (IR 2.1).

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Definition: Fecal Sludge Management

The system for collecting, transporting, and treating fecal sludge from onsite sanitation such as pit latrines and septic tanks.

This Learning Brief is based on research conducted by USAID WASHPaLS #2

FINDINGS

Demand for paid, recurring FSM services exists and will likely increase

Households, many with new toilets built over the last 10 years, prefer hiring over self-emptying. They often pay more than their stated willingness-to-pay for urgent desludging.

Basic treatment methods are better suited for rural areas than treatment plants, which involve more investment and more risk of closure

Treatment through plants requires more consistent sludge quantity and quality than low-cost methods (e.g., burial, deep row trench.)

Business models for safe FSM tend to be implemented by public bodies

Private sector-only services tend to practice unsafe FSM. Public body service provision, directly or in partnership with the private sector, is necessary to ensure safe FSM.

Despite early indications of profitability, long-term viability is a major concern

While some models appear to be profitable in the short term, they may not be taking all otheir long-term costs into account, which raises concerns about long-term viability.

Grouping several rural settlements is an experimental approach to improve the viability of rural FSM services

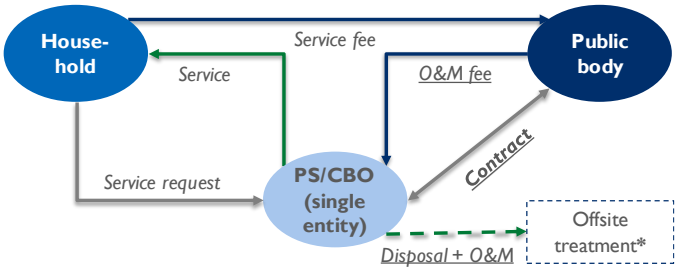
Grouping rural settlements within viable distance of a treatment site is one way to address the constraints of low population density in rural areas.

POLICY IMPLICATIONS OF DUAL-PIT TOILETS AS AN FSM STRATEGY

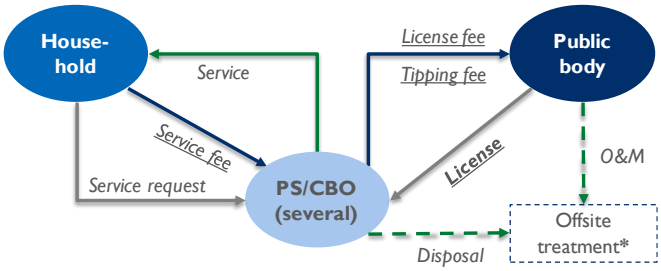
In markets where wet containment technologies are predominant, primarily in Asia, governments and development programs promote alternating dual pit toilets to eliminate the need for households to hire recurring FSM services. However, in practice, alternating dual pit toilets are rarely operated properly by households and fail to perform as intended. Until innovations to address these challenges are implemented, FSM planners should expect sustained demand for recurring emptying services from households with existing (dual) pit toilets and those who upgrade to alternating pit pour flush toilets.

THE STUDY IDENTIFIED TWO PPP MODELS FOR SAFE FSM: PUBLIC BODY-MANAGED AND PUBLIC BODY-FACILITATED

Public body-managed PPP model



Public body-facilitated PPP model



Legend: Service Information Finance * = applicable where an off-site treatment facility is necessary

Source: FSG Analysis

O&M = operations and maintenance; PS = private sector; CBO = community-based organization

GROUPING RURAL SETTLEMENTS: AN EXAMPLE FROM DHENKANAL, INDIA

The study found two instances (India and South Africa) of grouping several rural settlements to improve the viability of PPP FSM business models. The relatively lower population and population density in rural areas affect the demand for and the viability of serving a given catchment area. In India, several public bodies, in collaboration with sub-national governments, are experimenting with grouping several rural settlements based on the capacity of and viable distance from a treatment facility. The approach requires spare capacity if using existing infrastructure (e.g., in a nearby urban area), similar sludge and toilet characteristics within a group, and formal agreement among the relevant public bodies in the rural settlements.

Urban-rural (UR1-UR4) and rural-only (R1-R5) clusters formalized in Dhenkanal, India

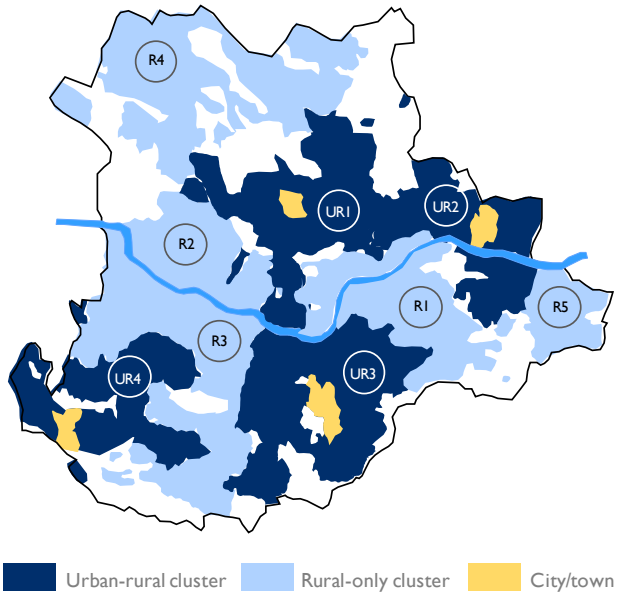


Figure recreated from Dhenkanal District Administration. 2021. District-level FSM Plan for Dhenkanal.

METHODOLOGY

This study analyzed nine examples of rural FSM for wet and dry toilets in Asia and sub-Saharan Africa. Few examples of rural FSM exist, so the study team widened the scope to peri-urban or small towns for lessons that could apply to rural contexts. The criteria for case study selection were: target market is either rural-mixed, consisting of peri-urban or rural growth centers, or rural on-road settlements; the private sector or community-based organizations provide the last-mile service delivery (i.e., emptying, at a minimum) and their selection in a PPP is competitive; and FSM methods are designed to safely manage fecal sludge across the value chain. The study explored five examples as detailed case studies, developed through a literature review and key informant interviews, and crafted four others as "caselets" using secondary data to validate the findings or dive deeper into a specific business model element.

CASE STUDY COUNTRIES

Case Studies

India: Dhenkanal
South Africa: eThekwini
Zambia: Chazanga, Kanyama
Nepal: Khadak

Caselets

India: Leh, rural Ganjam
Bangladesh: Sakhipur
Rural Cambodia

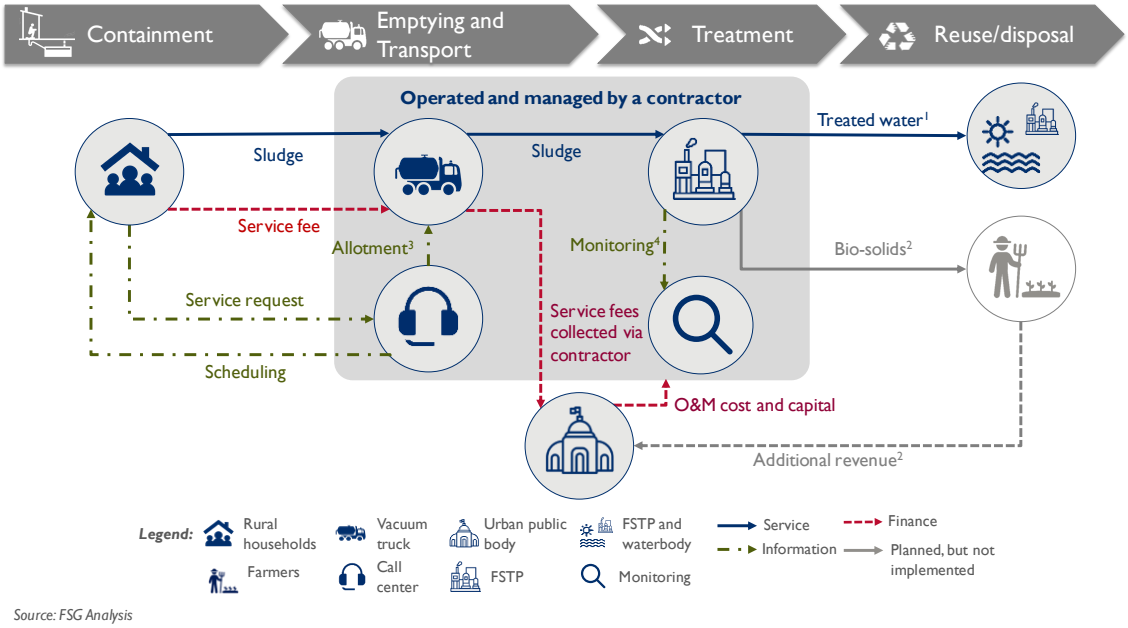
CASE STUDY: DHENKANAL, INDIA

Dhenkanal is a small town in the eastern state of Odisha, India. The town and surrounding rural on-road settlements of the same district have shallow water tables and a propensity for flooding.

In 2017, with donor and government funding, the Dhenkanal municipality set up a 27 cubic meter (m^3) per day capacity fecal sludge treatment plant (FSTP) using unplanted drying beds and a decentralized wastewater system, a pit/septic tank desludging service using small vacuum trucks, and a call center to register and schedule service requests. The municipality contracted Practical Action Foundation (PAF), an NGO, to manage the integrated emptying, transportation, and treatment operations while training local community-based organizations (CBOs)—women self-help groups—to take over operations.

In 2020–21, the municipality extended its FSM service to several surrounding rural areas under an urban-rural convergence model facilitated by the district administration and the provincial government. Rural settlements were selected based on their distance from the FSTP (less than 20 km). This was necessary to ensure service viability and customer affordability because rural households bear the additional fuel costs. The selection also accounted for the spare capacity of the FSTP, vacuum truck fleet size, and several administrative factors.

After taking over from PAF, the current CBO contractor now manages day-to-day operations and maintenance, including the call center, except for major repairs and capital expenditures, which the municipality bears. In exchange, the CBO contractor receives a monthly fee to put toward wages and expense reimbursement and a pre-determined performance-linked share of revenue/fee collected by the municipality. The CBO receives desludging requests from households at the public body-owned call center, collecting relevant details, such as location and estimated pit capacity, to schedule the service. Requests are assigned to either of the teams operating the two desludging vehicles. For the municipality's convenience, the CBO collects the service fee from customers after job completion and deposits it in the municipality's bank account, which is ring-fenced for the FSM service. The municipality's performance monitoring and payments are based on records of the call center logs, customer-attested service receipts, and FSTP logs maintained in simple spreadsheets.



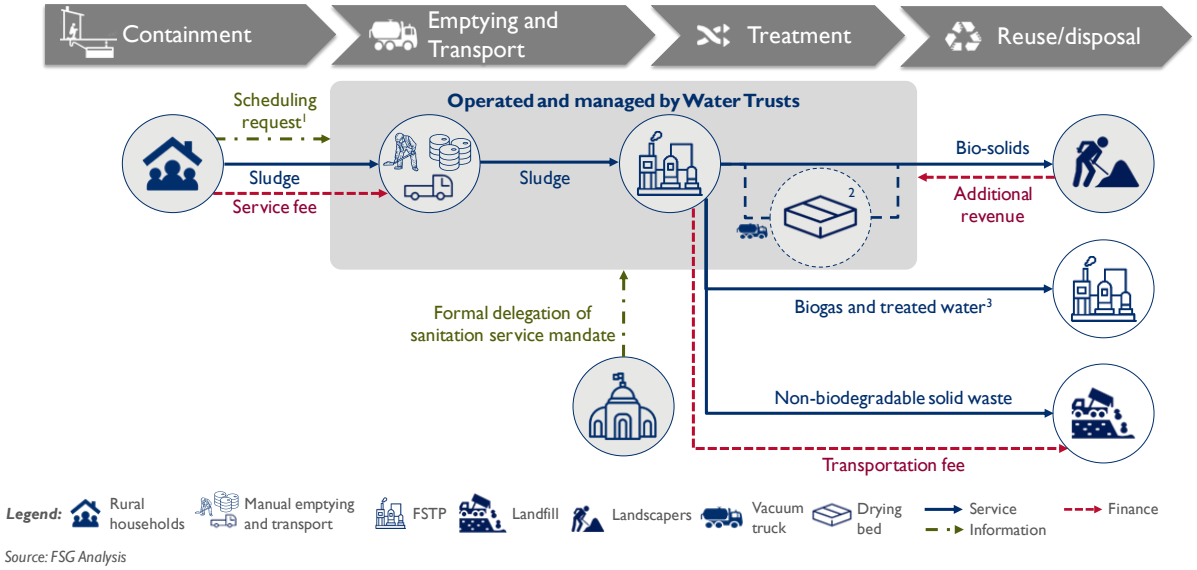
Source: FSG Analysis

Notes: 1. Treated water used to irrigate land at the FSTP facility and recharge a nearby water body; 2. Sale of bio-solids was planned but not implemented; 3. Emptying jobs are allotted to either one of the two trucks; 5. CDD Society, a technical partner, monitors the FSTP for compliance with national effluent standards. Sources: Centre for Policy Research. 2020. Operation and Maintenance (O&M) Aspects of Faecal Sludge Management in Small Towns; FSG interviews.

CASE STUDY: CHAZANGA AND KANYAMA, ZAMBIA

Chazanga and Kanyama are peri-urban settlements in Lusaka with large populations (86,000 and 170,000, respectively) and high population density. Both settlements consist of primarily low-income households and experience frequent disease outbreaks (e.g., cholera). Heavy rains and shallow water tables compound the risks associated with unimproved, unlined pit toilets and the on-site sludge burial practice that dominate these settlements. As per the Water Supply and Sanitation Act of 1997, the national regulator for water and sanitation licensed the Lusaka Water Supply & Sanitation Company (LWSC), a commercial utility formed by the local authority, to provide water and sewerage services in Lusaka city and surrounding peri-urban areas.

LWSC licensed community-based Water Trusts to provide FSM services in Kanyama and Chazanga in 2012 and 2014, respectively. The licensees' mandate included manual pit emptying, transporting sludge, and operating a treatment plant built with donor funding. The construction of two philanthropy-funded FSTPs using biogas digesters and unplanted drying beds formalized pit-emptying services in Chazanga and Kanyama. Pit-emptying teams employing existing informal manual emptiers were formed, professionalizing their services and improving safety. Emptying teams were equipped with modified garden tools, cleaning agents and disinfectants, barrels, and a cart (subsequently replaced by a truck) to transport sludge to the FSTP. Staff at the FSTP managed day-to-day treatment operations, including generating biosolids (Chazanga) and biogas (Kanyama). A tiered pricing structure that was substantially below prevailing market rates was designed for households to select an option depending on their pit size and budget. However, partial emptying and the unavailability of a full-emptying service (offered by informal manual emptiers) led to customer dissatisfaction, low service uptake, and losses. The Water Trusts cross-subsidized the sanitation service with revenue from their core water services business line.



Notes: 1. Households can contact either LWSC or the Water Trusts; 2. The drying beds were located at a different location in Kanyama due to land availability issues; 3. Biogas and treated water are consumed on-site; Sources: ISF-UTS and SNV. 2021. Anaerobic Respiration for Faecal Sludge Treatment and Reuse; FSG interviews.

CONCLUSIONS

SPOTLIGHT: BASIC TREATMENT METHODS VERSUS FECAL SLUDGE TREATMENT PLANTS

Operating fecal sludge treatment plants effectively and sustainably in urban has been challenging because of issues such as inconsistent sludge quantity and quality, inadequate local skills, insufficient finances for operations and management, and their need for sizeable capital investments. These issues would likely be exacerbated in rural areas. Instead, basic treatment methods, such as on-site burial and off-site land application and trenching, would be better suited to rural areas. Properly designed land application and modified trench methods can overcome hydrogeological constraints (e.g., shallow water tables) to mitigate contamination risks. Basic treatment methods are also a cost-effective way to realize the environmental benefits of reusing fecal sludge.

1 PPP FSM models are likely applicable in a subset of rural contexts where basic treatment methods are possible.

The treatment methods that are feasible determine the other value chain stages (e.g., need for transport or off-site treatment) and the appropriate business model options in a particular type of location. PPP FSM models are most applicable in rural settlements with favorable conditions for basic treatment methods (e.g., land availability, hydrogeological conditions) and in a subset of peri-urban areas that are close to large cities with available treatment capacity and sludge compatibility. Rural settlements that do not meet the above conditions are not suitable for PPP FSM models, and need alternative solutions, such as household- or community-managed FSM.

Treatment methods by geographic type and PPP feasibility:

Treatment methods		Rural on-road	Rural growth center	Peri-urban
	Settlement size *(inhabitants range)*	Small-medium *(500-5,000)*	Medium-large (5,000-50,000)	Medium-large (5,000-50,000)
	Population density *(inhabitants per km² range)*	Low-medium *(50-300)*	Medium-high *(300-1,500)*	Medium-high *(300-1,500)*
On-site	Burial	Scattered housing with space available on-site	Possible congestion but space largely available on-site	Congestion likely; inconsistent availability of space on-site
Off-site	Land application	Several large land parcels, away from human habitations, are likely available		Large land parcels likely a challenge
	Trench			
	New FSTP	Low feasibility		
	Existing treatment plant[1] with capacity, within 20 km[2]	Very low probability	Very low probability	Low probability[3]

Legend: Feasible PPP model; Feasible PPP opportunities may exist; Low PPP feasibility/probability

2 Public bodies can take several measures to broaden the applicability of PPP FSM models in rural areas.

The lack of local private sector organizations and CBOs with sufficient operations management capacity can hinder the implementation of the two PPP FSM models. Public bodies can take several steps to address these constraints and shape effective PPPs for rural FSM. These include: engaging local non-sanitation or FSM private sector organizations or CBOs from close by areas as enterprises; collaborating with higher government authorities to formalize rural clusters; monitoring safety compliance and service quality; and implementing sample or model PPP templates by provincial or national governments.

WAY FORWARD

This study identified the different rural contexts with potential feasibility to implement PPP FSM business models and measures to broaden their applicability. At the same time, several significant gaps emerged in the comparative analyses of the two PPP business models for rural FSM. Areas for further research and evidence that would contribute to the development of viable FSM business models in rural areas include:

- The full costs to set up and operate safe rural FSM services through various business models
- The relative effectiveness of FSM business models in maximizing safe FSM
- On-demand affordable service to customers
- Approaches for area-wide FSM
- Improving sanitation workers' safety

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