

The Efficacy of Low-cost Technologies to Improve Traditional Sludge Practices in Madagascar

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Context





- 22 million inhabitants, 7.5 million in urban areas
- 81% sanitation coverage in urban communities
- Sludge removal done by informal day laborers
- No public treatment plants, dumping and burial the norm







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Ambositra: 2012 - 2013



Population: 40,000

Toilets : 3.520

Dry Pits : 82%

Septic : 18%

Demand : 600 pits/year







Tools and Transport

Desludging Tools

- The Gulper: clogged in 70% of cases, 0.8 m3/h (when working)
- Diaphragm handpump: relatively costly ($ 1,000) but more efficient than the gluper, 0.8 m3/h yield
- Diaphragm motor pump: high up-front investment, 2 m3/h yield
- Shovels or rope and bucket: adaptable to all pit types, handling is messy, 1.2 m3/h yield

Containment and Transport

Trailer: 1,000 liter capacity, local fabrication, ideal for septic systems adjacent to the road



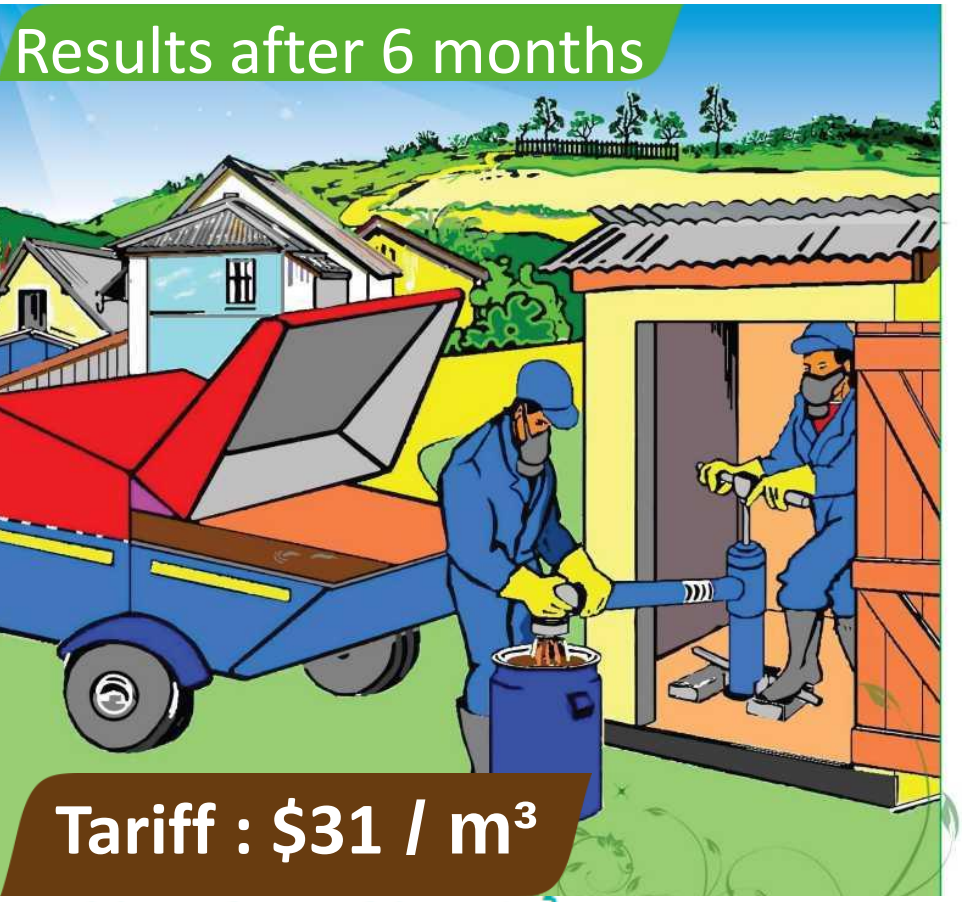
Barrel: 60 liter
Advantages >
Disadvantages:



Cart: Proved to be an important tool when using the barrels

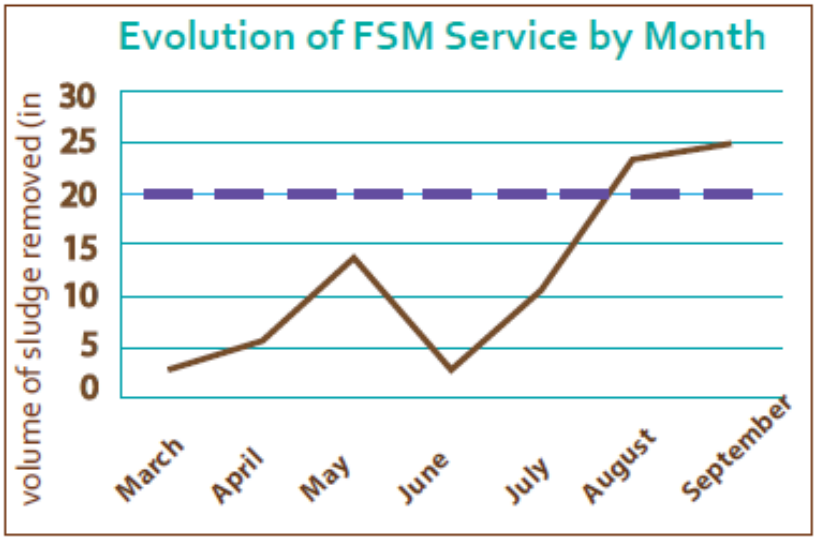


Results after 6 months



Tariff : $31 / m³

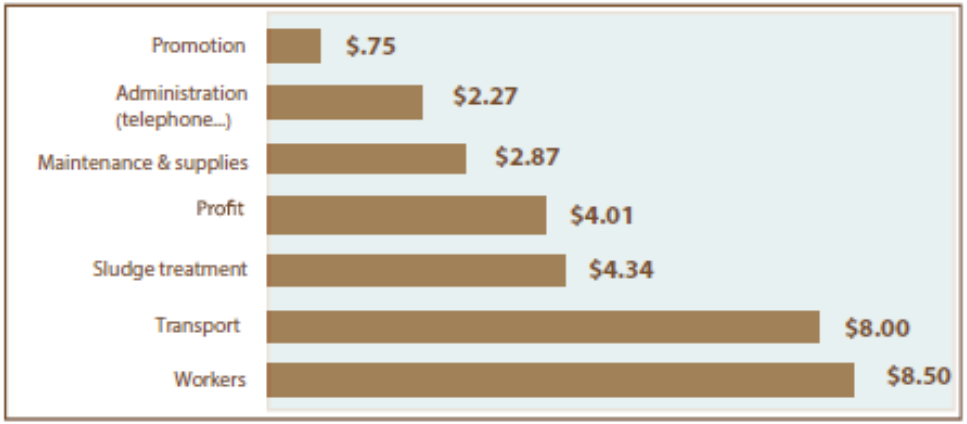
84m³ treated



Note: The dashed line indicates profitability.

- **Demand confirmed**
- **Technical solutions tested**
- **Business tracking tools developed**
- **Sludge characteristics identified**

Breakdown of Costs of the $31/m³ Fee



Service not maintained...

protos
it all begins with water

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Tamatave



Population: >300,000

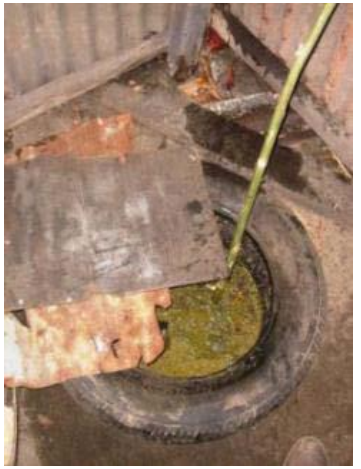
Toilets: 22,900

- **Drum latrines: 20%**
- **Dry Pits: 24%**
- **Pour-flush: 18%**
- **Septic: 38%**

Demand: 2,380 pits/month

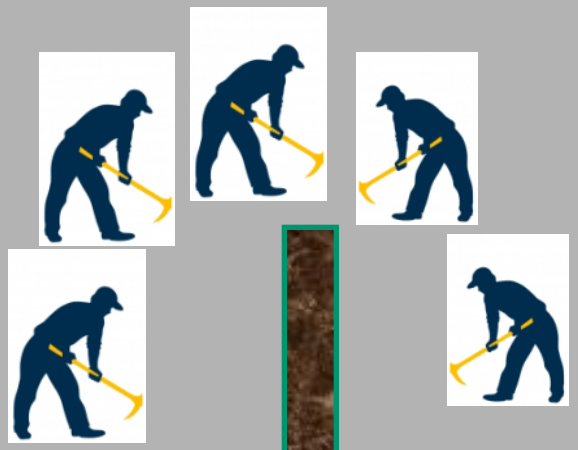
Sludge Production: 15,000 m3/yr





Situational Analysis: FSM in Tamatave

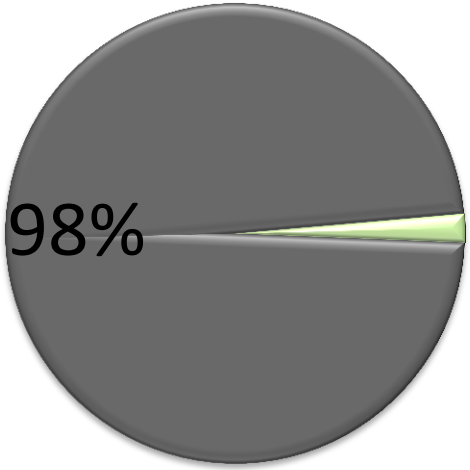
200 – 300 emptiers





On site burial
14,700 m^3

Volume of Sludge Treated per year



1 Private operator







300 m3

Transport

- Approach: Collect sludge from different latrine types and transport to centralized location in town for transport to private treatment plant

Parameters	Truck (4x4)	Kubota	Tricycle
Capacity (m3/trip)	1.0	1.0	0.2
Accessibility to the yard	28%	36%	32%
Type of Pit	Septic	All	Drum
# of operators	3	3	2
Type of equipment	Motor pump	Diaphragm /hand tools	hand tools
Removal speed (m3/h)	0,5 - 0,9	0,4-0,5	0,4-0,5
Speed when full (km/h)	30	17	2
Investment Cost ($)	15,000	5,000	500

Truck: 4x4 with trailer, 1m3 of barrel capacity, motor pump 4kW and diaphragm pump



Light tractor with Cart: Equipped with a diaphragm pump and 25 barrels (1m3 capacity)



Tricycle: Equipped with 5 barrels (200L capacity) and rustic extraction tools



Centralized collection is not yet possible…

Business model: The organization of 4m3/day in Tamatave

- Pre site visit
- Aggregated demand
- Multiple sites emptied simultaneously
- Sludge is stored temporarily in barrels on the property of the client
- All sludge collected is transported to the dumping site using a rented truck (3 ton) (or tractor 5 ton)

Tariff : $30 / m³










Results: Tamatave

221m³ treated in six months

	June	July	Aug	Sept	Oct	Nov	Total
Total Volume Treated	26.3	29.8	38.2	43.1	42	42.2	221.58
Average Volume / visit	1.0	0.8	1.0	1.6	1.3	1.4	-
Number of clients	26	37	40	27	33	30	184
Days Worked	11	18	20	18	22	17	-
Volume / day worked	2.4	1.7	1.9	2.4	1.9	2.48	-
clients/volume Septic	11/13.8	22/22.7	22/25.6	14/28.8	19/31.4	11/26.4	94/122.2
clients/volume Pour-flush	5/7.4	4/3.7	7/8.1	11/13.2	7/6.95	9/8.79	32/39.3
clients/volume Dry Pit	1/0.2	2/1.7	-	1/1.0	2/2.44	5/4.15	8/3.8
clients/volume Drum Latrine	8/1.6	9/1.6	11/2.0	-	5/1.1	5/1.35	49/9.0

- **Current business model: service requires an average of 4m3/day for at least 11 days per month to become profitable**

Takeaways…

Rustic tools are required for FS removal; the standardization of toilets to allow for the simplification of FSM operations would increase efficiency

Equipment and transport options are available locally to start a FSM business without heavy up-front capital costs; profitability depends on market aggregation and the organizational capacity of the entrepreneur; more innovation in the business model is needed

Septic tank users are the primary clients of professional FSM services; policy changes (i.e. targeted subsidies or other incentive structures) may be required to encourage adoption by the poorest quintiles