

Balancing financial viability and user affordability: An assessment of six WASH service delivery models

Topic Brief | August 2017



Introduction

This Topic Brief presents assessments of the financial performance of six WSUP-supported WASH service delivery models in Bangladesh, Madagascar, Mozambique and Zambia. Each model has been developed in partnership with locally mandated service providers to facilitate sustainable, at-scale improvements to low-income urban populations.

Balancing financial viability with affordability for the low-income customer

The delivery of water and sanitation services which adequately serve everyone in a city is a major undertaking: essential, challenging and resource-intensive. It requires locally mandated service providers (such as water utilities and municipalities) to have commitment, capacity, technical expertise and recourse to finance. While it is expected of these service providers to fulfil their mandates by extending services to low-income areas, this is not satisfactorily achieved in a majority of cases due to a host of challenges, including the key challenge of financial viability. At-scale urban WASH services provision is made possible by the development of financially viable service delivery models, which underpin long-term sustainability by generating ongoing revenues to facilitate cost recovery for the service provider. At the same time, it is critical that services remain affordable for low-income households and reach the city's most vulnerable residents.

Locating the appropriate balance between financial viability and user affordability is at the core of WSUP's programmatic activities. The approach is characterised by a number of important nuances specific to the contexts in which WSUP and partner institutions operate:

Long-term cost recovery is the goal

For the purposes of this publication, the term 'financial viability' refers primarily to long-term cost recovery - taking account of diverse expenditures including public or municipal finance, and external support for access to credit - and is distinct from the narrower concept of 'commercial viability' (i.e. profitability). While some of the models featured in this publication are already generating a profit for the provider (e.g. SWEEP), and others are projected to generate profits in the long term, a default expectation

that all WASH services and products should be profitable is unrealistic.

Urban sanitation service provision is uniquely challenging: ongoing public investment is typically required

It is important to recognise fundamental differences in water and sanitation services provision. While water services provision also requires significant capital investments, and is immensely complex in its own right, sanitation is the more challenging sector. Sanitation service provision is more likely to be impacted by significant constraints including unclear institutional frameworks, and variance in consumer willingness-to-pay; and will typically require a greater level of external support, adaptation and iteration for new service delivery models to develop and become sustainable. Institutional commitment is pre-requisite and will typically need to be backed-up by some form of public investment or subsidy: for example, the featured Faecal Sludge Management (FSM) service in Kanyama (p.12) has been supported by a cross-subsidy from water revenues. In WSUP's view - and as illustrated by the example of communal sanitation provision in Maputo (p.14) - the wider health, social and economic benefits of improved sanitation adequately justify public and municipal finance support on the basis of contributing to a public good; and sustainable water and sanitation service provision targeted at low-income customers has a citywide benefit.

Eventual uptake of new models is determined by the wider enabling environment

Innovative WASH service delivery models are not developed from distance: successful models will fit with their particular context, and uptake is contingent on the local enabling environment. Institutional and regulatory weaknesses present key barriers to achieving sustainability and scale. For sanitation in particular, markets and consumer demand are likely to require development, though the potential is often significant. For both consumer and institution-related challenges, a phased, demonstration approach to achieving scale can be effective, helping to gradually trigger demand and to build the political will required for regulatory and institutional reform. Barriers to investment should not be underestimated. Fluid and flexible Public-Private Partnerships (PPPs) can play an important role in helping to share risk, to secure institutional buy-in for challenging markets and to address the wider issues resulting from weak enabling environments.¹

¹ For more information on PPPs, see WSUP's publication series 'Public-Private Partnerships explained' featuring case studies from Bangladesh, Kenya and Zambia. Available at www.wsup.com.



Image: Customer at water kiosk, Lusaka. Credit: Gareth Bentley

About the case studies

The Topic Brief features six service delivery models - three focused on water and three focused on sanitation - that are currently being implemented in WSUP programme countries. In each case the aim has been to develop a fit-for-purpose model that responds effectively to the needs and capacities of local service providers and populations. The majority of examples relate to the direct provision of services to low-income customers, with the exception of Non-Revenue Water reduction (NRW reduction directly enhances the financial viability of a utility and improves service delivery to existing customers, and can enable extending water services provision to low-income areas of the city).

The models are at various stages in their development from pilot project to established service. Each has been through a process of trial and adaptation, and has demonstrated a base level of financial viability to justify continued resource. The models could potentially be replicated elsewhere if the necessary adaptations are made to suit the individual circumstances of a city, its institutions and the characteristics of its low-income areas. An overview of the six models is presented in Table 1.

Financial assessments were conducted by WSUP based on operational data provided by country teams and institutional partners. Each assessment incorporates data on actual service performance to date; in four cases, future cash flow is projected to indicate the long-term trajectory of the service. Key assumptions informing future projections are stated for each case study. WSUP will continue to support and track the progress of these delivery models and their financial performance. More information is available from WSUP on request.



Image: SWEEP FSM service, Dhaka. Credit: WSUP

Table 1: Key characteristics of service delivery models.

Service delivery model	Start date	Development phase	Lead institution	People reached (approx.)
Household water connections, Maputo	2009	Established	AdeM	148K
Kiosk water supply, Antananarivo	2008	Established	JIRAMA	235K
NRW reduction, Antananarivo	2010	Established	JIRAMA	713K
FSM service, Dhaka	2015	Emerging	DWASA	108K
FSM service, Lusaka	2013	Emerging	LWSC	33K
Communal sanitation facilities, Maputo	2009	Established	CMM	5K

Household water connections for low-income customers in Maputo

Maputo has an extensive water network that covers most of the central part of the city, including low-income districts (known locally as 'bairros'). Until recently, only 1 in 5 households living in these bairros had a water connection through the utility, Águas da Região de Maputo (AdeM): the remainder purchased water from a neighbour, water vendor (at exorbitant rates) or the limited and inadequately managed water kiosks. Low levels of tertiary network coverage in the bairros were constraining the spread of house connections, exacerbated by the relatively high initial connection cost (MZN 4300, equivalent to US\$ 73 in today's currency). AdeM and the asset owner FIPAG have since made huge strides to address the situation with WSUP's support.

The service delivery model

WSUP began working in close partnership with AdeM and FIPAG in 2009 to improve water services to the bairros. The initial aim was two-fold: 1) to demonstrate to the utility that supplying water via household connections is commercially viable in low-income districts; and 2) to demonstrate to households that connecting to the network is an affordable way to improve access to water services and quality of life. A critical step was the reduction of the connection fee by 50% (to MZN 2100), with the option of payment by instalment over a 12 month period: changes that aligned with the government's pro-poor policy. This connection fee subsidy was managed through tariff increases to other customers including bulk water supplied to shops. Another important step was the strengthening of AdeM operational arrangements for service delivery to low-income customers, leading to reduced delays in new connections and improved billings and revenue collection.

Service uptake and affordability

From 2009 to 2015, WSUP supported FIPAG and AdeM to extend networked water access in 13 bairros, including the installation of about 100km of new tertiary networks. A summary of outcomes is described in Table 1. Of the 15,400 customers connected to the new network, about 3,000 were existing customers who were receiving a substandard service. A total population of approximately 148,500 have benefited with access to safe water supply through the programme (a number that will increase with time). Affordability for low-income customers has been a



Image: Tertiary network construction in Chamanculo, Maputo. **Credit:** WSUP

major strength of the programme: combined with WSUP-led awareness campaigns, the reduced connection charge and option of staged payments contributed to a surge in demand, bringing about a 100% increase in water coverage in the target bairros from approximately 36% to 73%.

Financial assessment

In researching this report, financial outcomes were assessed and forecasts produced for the programme in three bairros - Chamanculo B, Chamanculo D and Unidade 7 - using data collected during 2014 to 2015. These bairros were a priority for AdeM as they lacked tertiary networks and were unable to meet demand for individual house connections. The programme in the three bairros benefitted approximately 3,630 households (each household connection is an AdeM 'customer'), resulting in improved water access to about 18,900 people, but is also expected to generate significant revenues for AdeM in the long term. This is reflected in key findings from the financial assessment, detailed below:

- **Projected net cumulative cash flow is positive from Year 5 (i.e. 2019).** This is based on 1) actual investment costs (US\$ 261K); 2) estimated operation and maintenance costs (US\$ 87K); and 3) revenue from water consumed by new and existing customers transferred to the new networks. The cash flow analysis adopts current consumption rates, tariffs and allows for inflation.

Table 2: Summary of outcomes from the WSUP supported programme (2009 to 2015).

Bairro	Year	New tertiary network (km)	New connections & transfers*	Direct people reached**	Indirect people reached**	Total people reached	Household coverage**** %
Maxaquene "A"	2009	12.7	3,178	16,526	5,609	22,134	76
Maxaquene "B"	2010	20.9	2,615	13,598	9,230	22,828	70
Maxaquene "C"	2010	8.2	2,953	15,356	4,607	19,962	77
Liberdade	2011	8.3	420	2,184	NA	2,184	NA
Xipamanine	2011	4.5	352	1,830	7,375	9,205	63
Maxaquene "D"	2012	3.4	240	1,248	11,122	12,370	50
Mafalala	2012	7.0	340	1,768	10,945	12,713	61
Chamanculo C	2013	6.6	1,124	5,845	10,182	16,026	61
Chamanculo B	2014	5.9	760	3,952	1,852	5,804	87
Chamanculo D	2014	5.4	1,233	6,412	3,755	10,167	72
Unidade 7	2015	5.0	1,277	6,640	1,590	8,230	82
Boane	2014	5.1	540	2,808	NA	2,808	NA
Minkadjuine	2015	7.1	368	1,914	2,115	4,028	75
Totals		99.9	15,400	80,080	68,379	148,459	

Note: NA – information currently not available.

*Transfers refer to existing customer connections transferred to the new network

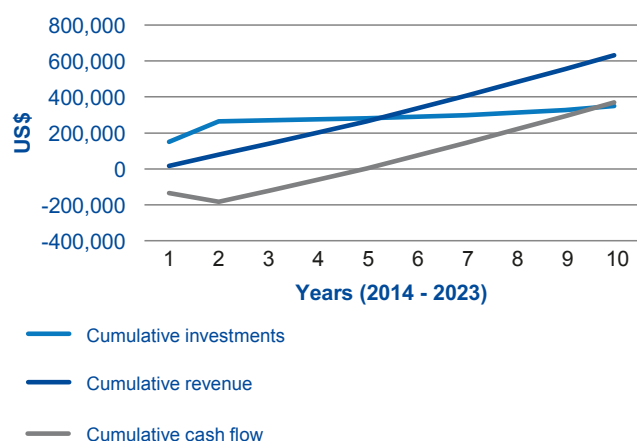
**Direct people reached are the population with access to water from new connections

***Indirect people reached are the population with improved access after transferring to the new network

****Household coverage is the percentage of population in the bairro with access to AdeM supply after installation of new network

- **Projected revenue over the 10-year period is estimated at US\$ 630k with a net gain of approximately US\$ 369k.** As such, the assessment confirms the financial viability of the model: this is also reflected in a Net Present Value (NPV) of US\$ 22k over the 10-year period based on a 21.5% discount rate² (on a capital investment of US\$ 261k); and an Internal Rate of Return (IRR)³ of 25.6% based on capital expenditures.

Figure 1: Forecast cost-benefit analysis of water supply through tertiary networks (Chamanculo B, Chamanculo D and Unidade 7 bairros).



Conclusion

Programme outcomes in Maputo show the importance of developing service delivery approaches that are affordable to potential customers and financially attractive to the service provider. The development of the model was made possible by two key decisions: firstly, to bridge the initial gap in service delivery through new tertiary networks requiring relatively low capital investments; and secondly, the political decision to lower the connection charge. The charge was previously set at a level that disincentivised new customers, resulting in loss of potential revenue for the utility, as well as undermining the Government's pro-poor policies. The positive engagement and consultations between the service provider and the households enabled designing appropriate and cost effective layouts for the tertiary networks within the bairros, key to the sustainability of service delivery.

The decision to lower the connection charge was taken by the government resulting from the dialogue between civil society actors, AdeM, the regulator (CRA) and the asset owner (FIPAG), illustrating the power of collaboration and consultation in the water sector. Also evident is the value of awareness-raising campaigns in low-income communities, aimed at giving households a better understanding of utility services, including payment options and contractual arrangements for new customers. Many low-income households already pay high prices for water from an informal supplier: the programme reflects WSUP's broader experience that such customers are willing to pay by instalment for a cheaper, formal utility connection if given the opportunity.

² The Central Bank's benchmark interest rate at July 2017.

³ IRR is a frequently used financial performance indicator in development projects and is the discount rate that makes the Net Present Value (NPV) of all cash flows from a particular project equal to zero.

Kiosk water supply for low-income customers in Antananarivo

Madagascar is among the poorest countries in Africa, with an estimated 92% of the population living on less than \$2 per day, and correspondingly low levels of water and sanitation coverage.⁴ Access to safe and affordable water services is a high priority for rapidly expanding cities such as the capital Antananarivo (Tana), where water of good quality is supplied by the national utility JIRAMA via an established pipe network. However, access to water in Tana is limited or unavailable in many parts of the central municipal area (Commune Urbaine Antananarivo, CUA) and the surrounding 43 peri-urban Communes (municipalities) that comprise the city; and where water is available, many low-income households cannot afford the cost of a connection.

In response to the above challenges, WSUP has worked in partnership with key stakeholders to demonstrate and scale-up a sustainable model for water access for a large population of low-income consumers in Tana, the key features of which are listed below.

The service delivery model

- Access is achieved through a network of purpose built water kiosks connected to the city water supply network operated by JIRAMA.
- Water User Associations (WUAs) operate the water kiosks through a formalised Delegated Management Contract with the Communes (the asset owners).
- Each kiosk serves up to 500 persons (100 households) living within a radius of about 100-150 metres, at the affordable water tariff of 1 Ariary per litre (a 20-litre Jerry can of water costs the equivalent of US\$ 0.7 cents).
- Consultations and partnership between the beneficiary communities, JIRAMA and the Communes underpin the model.
- A consultative market research procedure is applied for identifying and selecting preferred locations for the kiosks (termed Community Infrastructure Location Assessment procedure, CILA).⁵



Image: Collecting water at water kiosk, Antananarivo. Credit: WSUP

Programme outcomes

The WSUP programme began with an initial pilot of 10 water kiosks in 2008 and has achieved significant scale-up: in the period to 2016 the programme helped install and operate a network of 472 water kiosks and laundry blocks (the latter provide washing facilities in addition to water supplies). The facilities cover the central CUA and 16 peri-urban communes, providing access to good quality affordable water to over 47,000 households (a population of about 235,000): an analysis by PwC indicates the programme has made a significant contribution to their quality of life including improved health due to a reduction in water borne diseases as well as economic and social benefits.⁶ The water delivery model is now being replicated in other cities in Madagascar and helping to contribute to the Ministry of WASH target to achieve universal access to water by 2025. The coverage of water kiosks and laundry blocks is summarised in Table 3.

⁴ World Bank (2014) Appraisal Document: Second Integrated Growth Poles and Corridor Programme.

⁵ WSUP (2011) Practice Note #006: Location is everything: optimal placement of community water and sanitation service.

⁶ <http://www.wsup.com/2016/03/21/water-sanitation-investments-create-jobs/>.

Financial assessment

The kiosks yield a gross margin of 640 Ariary per m³ of water sales (US\$ 21 cents) to the WUAs, while providing significant water supply tariff revenue to JIRAMA (see Table 3). Although the net margins per kiosk are relatively small, many of the WUAs manage several kiosks within their Commune, giving them the opportunity to generate reasonable levels of cash flows and profits. These net profits are ploughed back into community development projects including drainage and solid waste as well as investing in new kiosks.

While established WUAs are positioned to support construction of new kiosks from their own profits, capital costs for kiosks provided under the programme are not typically recovered. In WSUP's view this is clearly justifiable: the kiosks are public assets and investments in the long term are expected to be mobilised through public and municipal finance with the private sector also being involved (WUAs and local enterprises). In order to provide support with financing, WSUP contributed the cost of infrastructure works undertaken under the WSUP programme (about US\$ 3,000 per water kiosk) with the Communes contributing the cost of connections to JIRAMA's water network (at an average of about US\$ 2,000 per water kiosk).

An analysis of actual operational data for a sample of eight water kiosks is summarised in Table 3. The final column is included to illustrate the financial outcomes a WUA can expect if operating at a representative scale of 10 water kiosks.

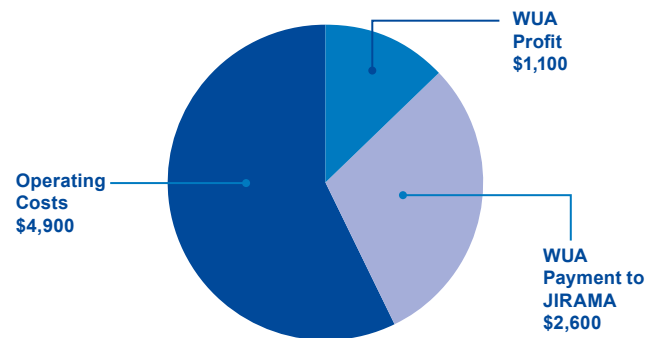
Table 3: Financial outturn from water kiosk operations.

Item	Per Kiosk per Year			Per 10 Kiosks Per year (US\$)
	Ariary (MGA)*	US\$	% of WUA revenue	
WUA Revenue	2,580,000	860	100%	8,600
Payment to JIRAMA	780,000	260	30%	2,600
Gross margin to WUA	1,800,000	600	70%	6,000
Operating costs (of WUA)**	1,470,000	490	57%	4,900
Net margin to WUA	330,000	110	13%	1,100

*Malagasy Ariary (US\$1 = MGA 3000)

**Includes salary of operators, WUA establishment costs and maintenance of water kiosks

Figure 2: Financial outcome from operation of 10 Water Kiosks (gross revenue: US\$ 8,600).



Conclusion

WSUP's experience in Tana demonstrates that utility service delivery to underserved communities can yield satisfactory returns on investment. The financial viability of the model is underpinned by the partnership approach involving JIRAMA, communes and target communities. Structuring the service delivery as a business model motivated the WUAs to manage the operations effectively to achieve net financial return; and helped deliver a safe water supply to thousands of low-income consumers who would otherwise pay more than utility customers for water from an informal (and often polluted) water source.

As the model continues to be refined, there is a case to undertake a consultation for a small increase in the water tariff to provide a contribution to the capital costs for new water kiosks (as well as enhancing greater private sector participation), while maintaining affordability for the poorer segments of the population. Nonetheless, in WSUP's view the value of 'public good' investments such as water kiosks - in this case equating to approximately US\$ 10 per consumer - cannot be overstated. Such capital investments help to bridge gaps for essential services, and as demonstrated by a recent analysis commissioned by WSUP, bring innumerable benefits in terms of improved health, economic and social outcomes.⁷

The success of the service delivery model is reflected in the increasing network of water kiosks in Tana; and in the model's adoption in other cities across Madagascar. This scale-up already underway is helping to leverage further investments as the model continues to build momentum.

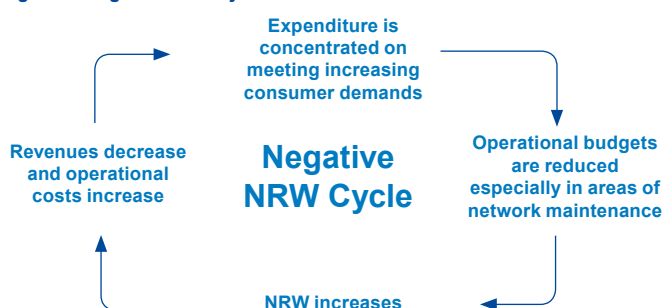
⁷ In order to better understand the social and economic benefits of programme reforms, WSUP commissioned PricewaterhouseCoopers (PwC) to apply the Total Impact Measurement & Management (TIMM) framework to WSUP-supported JIRAMA activities in Antananarivo. The analysis estimated that between 2013 and 2025, the total health benefits from reduction in diarrhoeal disease among users of (WSUP-supported) JIRAMA water kiosks are estimated to be US\$ 36 million. Net time and monetary savings associated with shorter journeys to collect water as a result of water kiosks provided under the programme are estimated to be US\$ 0.8m and US\$ 21,000 respectively. Earnings generated as a result of JIRAMA water kiosks and laundry blocks between 2013 and 2025 were estimated at US\$ 5.1m. Of this total, 70% is earned by women as a result of the high proportion of female laundry block operators.

NRW reduction to enhance the financial viability of the utility in Antananarivo

Non-Revenue Water (NRW) is water that does not generate revenue for the utility from its point of processing to its endpoint. NRW is usually assessed under physical and commercial losses and can be caused by infrastructural problems (such as leaking pipes) or commercial issues such as incorrect billing, faulty meters and illegal connections to the water network. Utilities with high NRW rates cannot provide a sustained and reliable service for their customers, and often lack the capacity to fix problems or extend the network. Customers can then become reluctant to pay for a poor service, further reducing the revenue available for network improvements (the negative NRW cycle is conceptualised in Figure 3).

WSUP has been supporting the water utility JIRAMA in the capital Antananarivo (Tana) since 2010 with their NRW reduction programme, aiming to improve the utility's financial efficiency and overall performance. Leakages from the city's ageing water pipe network, coupled with the lack of a planned NRW approach, were losing the utility an estimated 19-20 million m³ of water per year⁸; JIRAMA struggled to provide an adequate service to its existing customers and was unable to extend services into new areas.

Figure 3: Negative NRW cycle⁹



Source: USAID (2010) *The Manager's Non-Revenue Water Handbook for Africa*.

The NRW programme

JIRAMA's priority was to establish greater control over Tana's water flows, to curb leakages and reduce NRW. Key features of the NRW programme were as follows:

⁸ JIRAMA water balance analysis, 2015.

⁹ For more information on planning and implementing NRW reduction programmes, see WSUP (2017) *A guide to Non-Revenue Water reduction: how to limit losses, strengthen commercial viability and improve services*.

¹⁰ For more information on JIRAMA's NRW reduction programme in Tana, see WSUP (2017) *Non-Revenue Water reduction: a critical step towards commercial viability*.



Image: JIRAMA NRW team in the field. Credit: WSUP

District Metered Areas (DMAs) were set up in all peri-urban areas covered by the JIRAMA network and in parts of central Tana: water piped to these zones can be measured and isolated, so JIRAMA staff can identify leaks and undertake active leakage management. This vital information on water flow enables continuous monitoring through water balance analyses and helps to control water loss. The remaining areas of central Tana uncovered by DMAs will be covered over the next few years.

Pressure Reducing Valves (PRVs) were introduced to deal with pressure management including reducing nightly leakage rates and improving water delivery.

Capacity building and institutional reforms within JIRAMA saw the establishment of a strategic unit dedicated to NRW, a leakage detection and reparation service and a low-income consumer unit. These structural changes led to the embedding of NRW management within JIRAMA's service delivery process and enabled staged and systematic roll-out across Tana's operating zones.¹⁰

Programme outcomes

The NRW programme has resulted in significant water efficiency savings across Tana which will continue to increase with time (see Table 4), confirming the programme's value to both the utility and existing customers. WSUP's support to JIRAMA was provided in return for a commitment to improve service delivery to the city's low-income areas, formalised through a Professional Services Agreement (PSA). JIRAMA has honoured this

agreement and demonstrated their firm commitment to extending coverage to poorly served low-income areas in Tana: WSUP estimates that more than 710,000 low-income consumers have benefited from the NRW reduction programme since 2010.¹¹

Table 4: Summary of outcomes from JIRAMA's NRW programme from 2012-2015.

	Pre-programme (2012)	Mid-programme (2015)
NRW (South zone)	48%	39%
Total water supplied	Increased by 12 million m ³ from 2012-2015	
Water saved	1.44 million m ³	3.6 million m ³
Continuity of supply	3 hours per day	6 to 24 hours per day

Financial assessment

In researching this report, financial outcomes were assessed and forecast for the NRW programme over the period 2011 - 2020. Figure 4 shows that during the period of analysis, JIRAMA's net cumulative cash flow from the NRW programme will be positive from year 7 (2017). This is based on the actual investment costs, together with the estimated operation and maintenance costs, and revenue from water saved from the recorded flow data and water balance analysis. The attractive financial returns of the programme are presented in Table 5.

Table 5: Summary of financial assessment and forecast for JIRAMA's NRW programme, 2011-2020.

Estimated revenue	US\$ 4.7 m
Net financial gain (allowing for O&M costs)	US\$ 2.4m
Net present value (NPV)⁴	US\$ 323K
Internal Rate of Return (IRR)	16.3%

Figure 4: Forecast cost-benefit analysis for JIRAMA's NRW programme, 2011-2020.

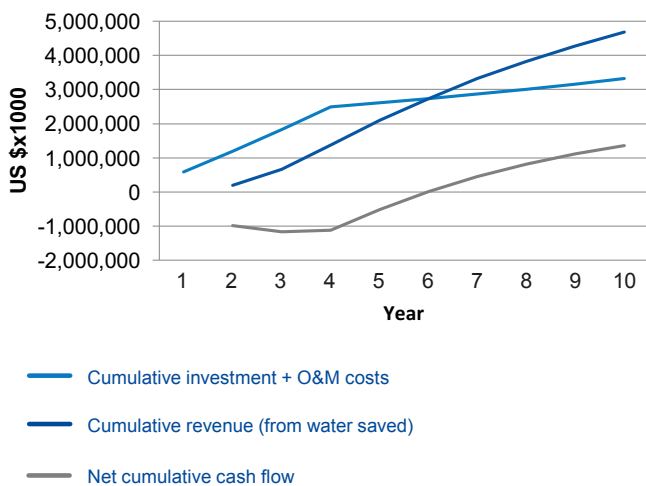
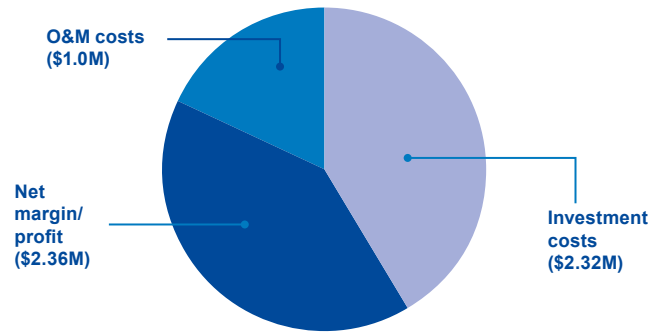


Image: JIRAMA NRW team conducting leak detection and repair. **Credit:** WSUP

Figure 5: Financial outcomes of JIRAMA's NRW Programme, 2012-2015 (US\$).



Conclusion

A high level of water loss is one of the major challenges facing water utilities across the developing world. JIRAMA's experience demonstrates the power of NRW reduction programmes to improve both commercial viability for the utility and outcomes for the consumer: significant reductions in water losses have been achieved in Tana with relatively low levels of investment, resulting in increased revenue for JIRAMA, better services for its customers and the extension of services to underserved areas.

Mainstreaming NRW within the utility's operating processes requires systemic change that includes institutional reform and allocation of resources. For utilities embarking on a structured NRW programme, a phased approach helps to develop sustainability and embed NRW as part of utility operations. Capacity building and training are key to ensuring best practice and long term sustainability. WSUP's experience suggests that NRW reduction programmes should be considered an integral component of utility pro-poor strategies, with part of the water and revenue saved being leveraged to serve underserved areas. Utilities should first invest in NRW reduction prior to making significant capital investments in increasing water capacity.

¹¹ The impacts of NRW programmes are far-reaching and difficult to quantify. The above figure represents the total number of people reached through WSUP programme support to JIRAMA: the NRW programme has impacted positively on JIRAMA's overall financial viability and contributed to improved service delivery in all aspects, including (for example) improved continuity of supply to existing customers, and extension of the network to previously unserved low-income areas.

¹² Calculated on a 10% discount rate on a capital investment of US\$ 2.32m over a 10-year period. Based on capital and operation and maintenance expenditures. The discount rate is based on the current relatively low commercial interest rates in Madagascar following the Central Bank's cut in the benchmark lending rate to 8.3% in May 2015. The commercial interest rate in July 2017 was 9.0% (www.ieconomics.com).

FSM services through Public-Private Partnership in Dhaka

Dhaka is one of the world's megacities, with a population of around 16 million. The clear majority of residents (80%) are dependent on on-site sanitation systems, yet until recently, no private operator existed to provide mechanical emptying services to this vast and largely untapped market. WSUP has worked to address this service gap through an innovative Public Private Partnership (PPP) between Dhaka Water Supply and Sewerage Authority (DWASA) and a local SME (Gulshan Clean and Care - GCC). The FSM service - marketed under the brand name 'SWEEP' - became profitable on an O&M basis within five months of start-up, and provides a replicable model which is already being rolled-out in Bangladesh's second city, Chittagong.

The service delivery model

SWEEP teams use two DWASA-owned vacuum tankers (with 2000-litre capacity), accessed on a subsidised lease agreement, to empty septic tanks in private houses and public and commercial institutions. Waste is disposed of through the sewer network into DWASA's treatment facility in Pagla. The PPP arrangement that underpins SWEEP is designed to incentivise both parties. In return for compliance with regulation, a security deposit, and a monthly lease fee paid to DWASA, GCC did not have to pay for the acquisition of technology at the start-up stage (this would have been prohibitively expensive - an estimated 4 million BDT). Under the lease contract, roles are split between DWASA and GCC (see Table 6).

Service uptake and affordability

Customer septic tanks are grouped by the SWEEP business into three categories: small (6-16 m³), medium (16-32 m³) and large (48-224 m³). During SWEEP's initial phase of operation, large septic tanks accounted for approximately 17% of customers but 60% of SWEEP's revenue (this customer group predominantly consists of middle- and high-income customers, including institutional customers such as hotels). SWEEP customers living in low-income areas are charged a lower tariff of \$6-7.50 per cubic metre, compared to US\$ 10-15 for middle/



Image: Kamrul Islam, owner of Gulshan Clean and Care. **Credit:** WSUP

high-income and institutional customers; these tariffs correspond to service fees ranging from US\$ 60-75 for small septic tanks, US\$ 150 for medium septic tanks and US\$ 250-1000 for large septic tanks. However, the pricing structure is not fixed, given the widespread practice in Dhaka of negotiation over price for services rendered. The services have reached approximately 146,000 people during SWEEP's initial 26 months in operation in Dhaka, with an average 110 tanker loads collected and emptied per month.

Financial assessment

Figure 6 presents an overview of SWEEP's performance during the first 26 months of operation. As anticipated, the untried and innovative service required time to develop customer demand and overcome operational challenges: this was reflected in the low levels of revenue during the first five months followed by the gradual increase in demand. The operator response to the market has been to target a reasonable proportion of medium and large customers who provide a higher financial margin despite requiring more time per customer. The gross revenue generated was approximately US\$ 2,260 per month with a net margin of about US\$ 404 per month. The vacuum tankers are leased from DWASA at a reduced rate, so the model has low capital costs; together with effective management and marketing, this led to positive net cash flow being achieved within five months of start-up.

Table 6: Allocation of responsibilities for the FSM service between DWASA and GCC.

Regular operational activities	Regular maintenance activities	Vehicle maintenance activities	Mobilising and responding to demand	Mass marketing	Regulatory activities	Replacing and increasing fleet	Disposal and treatment
SME	SME	DWASA	SME	DWASA	DWASA	DWASA	DWASA

Figure 6: Overview of SWEEP’s performance (US\$), April 2015 – May 2017. Net Income (Loss) represents total revenue plus total expenditure since inception of the service; Income (Loss) represents monthly revenue plus monthly expenses.

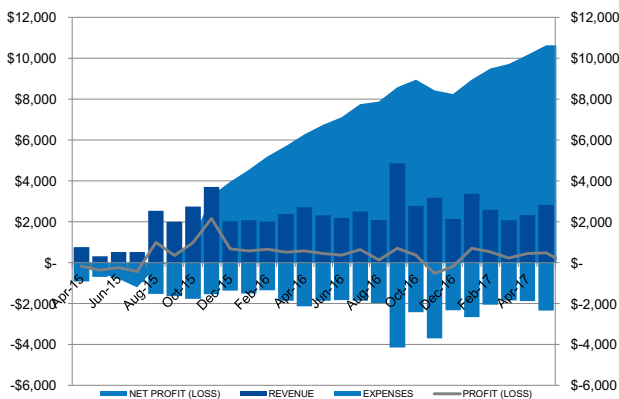


Figure 7 presents the current and projected financial performance of SWEEP based on an internal WSUP analysis using available operational data and stakeholder consultations. The financial performance reflects the actual operational data from April 2015 to November 2016¹³, and projections for the next eight years, which includes the continuation of the current preferential lease arrangement of the two vacuum tankers from DWASA. The customer profile assumes a larger and realistic proportion of medium and large customers (70%) which provides a sustainable revenue stream. The significant untapped market for FSM services underpins the potential for the business to grow and extend, even with relatively modest growth forecasts of 10% per annum. The Net Present Value (NPV) at 15% discount rate¹⁴ is estimated as \$98k over a 10-year period based on operation and maintenance expenditures. If these forecasts are realised, SWEEP would reach over 200,000 people in the year 2025.

Figure 7: SWEEP financial assessment and forecast for FSM services in Dhaka.

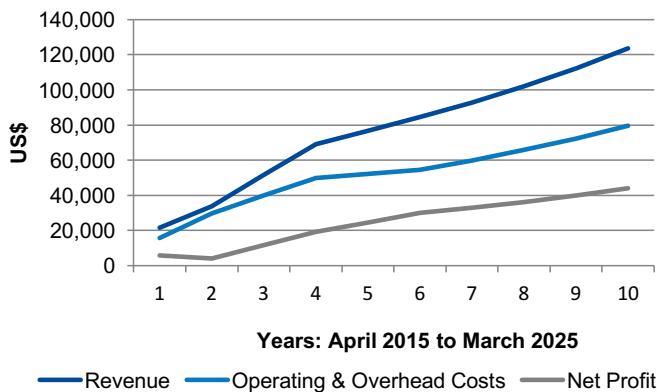
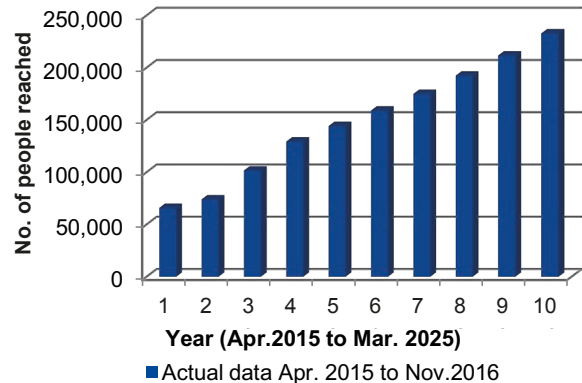


Figure 8: SWEEP forecast for people reached in Dhaka, April 2015-March 2025.



Conclusion

SWEEP’s experience shows it is possible for mechanical FSM services to make a profit on an O&M basis in a large Bangladeshi city such as Dhaka. SWEEP was given the platform to succeed through its partnership with DWASA, who agreed to provide vacuum tankers through a preferential lease agreement; and by initial support from WSUP to develop a profile, revenue stream and overcome operational challenges. The vast and largely untapped market for FSM in cities like Dhaka provides significant potential for private sector services, which SWEEP has shown can be established with relatively low levels of investment (outside of capital expenditures). The success of the service in Dhaka has resulted in the model being adopted by Chittagong City Corporation, with replication in other major cities in Bangladesh a very real possibility.

With SWEEP now established as a commercially viable business, incentivising service provision to low-income areas is a critical consideration. WSUP is currently analysing data from the operator to better understand necessary price points for higher- and lower-income customers that would allow for differentiated pricing in order to target households in low-income areas - currently around 30% of the total customer base - while maintaining a healthy bottom line for the business. Another core area of activity will be strengthening the regulatory framework for onsite sanitation in urban Bangladesh. In a significant step forward, a new institutional regulatory framework for FSM has recently been approved and is expected to provide the long-term foundations for improved regulation and enforcement relating to FSM service provision.

¹³ Updated financial performance reflecting actual operational data to May 2017 will be included in Version 2 of this document (forthcoming).
¹⁴ Term loan interest rates to small businesses, Bangladesh Bank, July 2017.

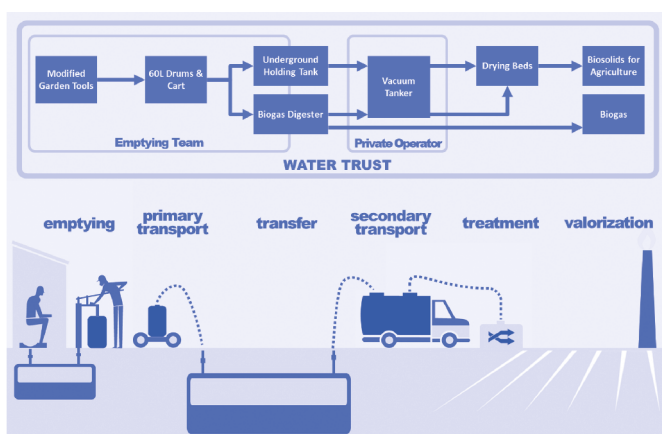
FSM services for low-income customers in Lusaka

In the peri-urban areas (PUAs) of Lusaka (Zambia), 95% of inhabitants rely on pit latrines which are prone to flooding in the rainy season, posing huge health risks to the local population. The largest PUA is Kanyama, with a population of over 200,000 people. Since 2014, Lusaka Water and Sewerage Company (LWSC) has been working with the community-based entity, Kanyama Water Trust (KWT), to introduce one of the first FSM services in Africa targeted at and funded by low-income customers.

The service delivery model

The entire FSM chain is managed by KWT under its delegated contract with LWSC, with the latter responsible for technical support and oversight. The front end of the service - emptying, primary transport and transfer - is undertaken by contract workers, while secondary transport is undertaken by private independent operators of vacuum tankers. Treatment and reuse is managed directly by Water Trust employees (Figure 9): waste is partially treated at a decentralised transfer station, after which it is transported and treated on drying beds, with the resulting manure packaged and marketed.

Figure 9: FSM service chain, adapted from WSUP's Urban Programming Guide, 2014.



Service uptake and affordability

Service offerings were developed using a human-centred design process undertaken by the Behaviour Change Lab, 17 Triggers. In close consultation with LWSC, customers



Image: Drying beds for treatment of sludge collected by the FSM service, Lusaka. Credit: Gareth Bentley.

were offered three initial services: 12 drums at 250 Zambia Kwacha (ZMK) (US\$ 28); 24 drums at 380 ZMK (US\$ 43); and 32 drums at 450 ZMK (US\$ 51). Service uptake and willingness-to-pay surveys indicated the pricing was affordable for low-income customers: in the first 23 months of service, approximately 900 pits serving nearly 25,000 people were emptied. The lowest band of 12 drums proved most popular, with the highest band more likely to be requested by institutional customers (e.g. schools or public toilets).

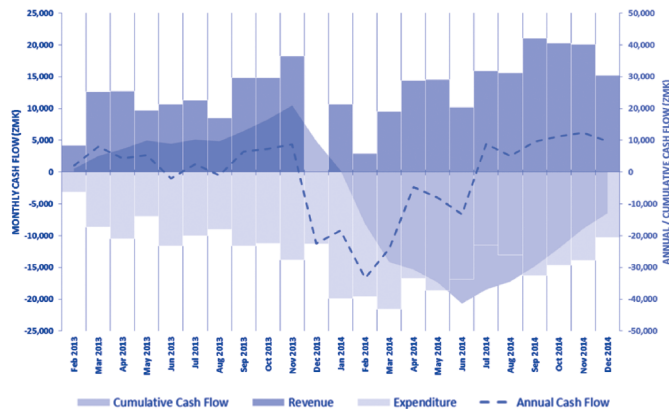
Financial assessment

Performance to date

A rigorous financial analysis of service performance to date has been inhibited by a lack of consistent data. Figure 10 demonstrates that while the first 12 months of operation were characterised by low revenues and high expenditure (for example, the construction of an additional transfer station in Kanyama), a recovery can clearly be seen at the 18-month mark as the service moved into positive net cash flow on an O&M basis. However, significant issues with the bio-digester in June and July of 2015, as well as operational issues at the end of the year, meant that no growth was seen for 2015. In 2016 a cholera outbreak led LWSC to call a halt on any FSM activities in Kanyama district for several months. The system has been up and running effectively since the end of the outbreak in mid-2016 but data is yet to be analysed.¹⁵

¹⁵ Updated data on the financial performance of the FSM service to May 2017 will be presented in Version 2 of this publication (forthcoming).

Figure 10: Snapshot of cash flow of the FSM service (from operating data 2013-2014).



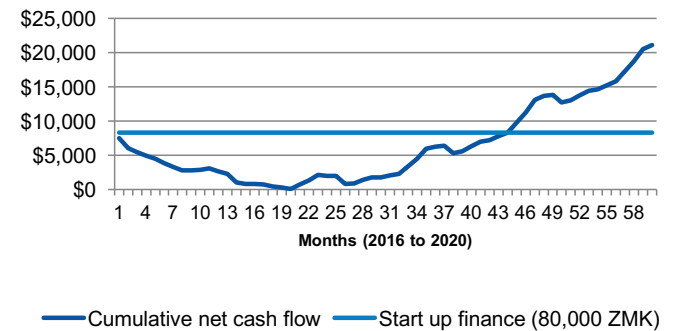
Service improvements to strengthen viability

Notwithstanding a number of operational challenges, the demonstration phase confirmed the viability of the service to meet FSM needs in PUAs. WSUP is currently supporting LWSC and KWT to further strengthen operational efficiency and financial viability, and has recommended the following changes be adopted: 1) increasing the price point (the amount paid by customers) by around 30%, in line with increases that have already been trialled and judged to be acceptable to low-income customers; 2) charging a penalty of 50 ZMK to repeat customers with a high level of solid waste in their pits (this makes emptying the pits more difficult, undermining operational efficiency); 3) using a truck for all emptying services, even when transport distance is less than 500 metres from the bio-digester; and 4) mapping and creating a database of toilets to more effectively target sales and marketing.

Projected cash flow to 2020

Figure 11 shows a cash flow forecast based on the imminent adoption of these changes, with conservative growth rates: decreasing from 15% in year 1 (2017) to 5% by year 5 (2021). The forecast also assumes start-up financing of US\$ 8,300 (approximately 80,000 ZMK) to overcome the initial period of negative net cash flow before the business develops and generates positive net cash flows on an O&M basis. The average gross margin (percentage of revenue retained after allowing for direct costs) during the 5th year is estimated at 37%, a figure WSUP would consider satisfactory for a start-up sanitation business. Given the potential market in Lusaka PUAs, the gross margin is expected to rise in line with an expanding customer base and increasing revenues.

Figure 11: Projected cash flow for the FSM service, 2017 – 2021. This assumes adoption of the recommended changes to the service beginning 2017.



Conclusion

Although improvements can still be made to the institutional and regulatory framework for sanitation in Lusaka, the existing framework provided an environment to develop a FSM model for peri-urban areas. The FSM service is now fully established, having proven itself a viable model with the potential to scale up if key changes are made. Prior to launch the service benefitted from rigorous willingness-to-pay assessments of low-income customers, which continue to be monitored and reflected in revisions to the service. Incorporating a demonstration phase helped to engage customers and develop demand and provided the space to test, assess and identify improvements to critical areas of the business model. The conviction of WSUP and LWSC in the viability of the model is reflected in its replication in a second PUA, Chazanga.

The challenges involved in developing FSM services are widely acknowledged and should not be underestimated: the start-up phase requires targeted support including finance, appropriate technology and capacity development. Once a viable service is established, further challenges await in achieving scale while maintaining affordable services to the required standard. WSUP believes that public-private partnership arrangements can play an important role in providing financing support for capital works investments; these can be justified by the wider economic and health benefits ('public good') and could be provided through municipal finance mechanisms or external funding (e.g. international funding or equity).

Communal sanitation facilities for low-income communities in Maputo

In Mozambique's capital city, Maputo, 90% of the population depend on on-site sanitation facilities ranging from adequate to almost non-existent. Household toilets are difficult to provide in many parts of the city's densely populated and congested low-income districts ('bairros'), making shared toilets the only viable option for addressing the lack of safe sanitation. In 2009 WSUP began trialling a communal sanitation service model to respond to this urgent need: the model has since become embedded within the communities and is actively supported by Maputo Municipality (CMM).

The service delivery model

The first pilot Communal Sanitation Block (CSB) was implemented in Chamanculo C in 2009: it served a community of 49 families whose only sanitation facility previously was an unhygienic single pit latrine. The immediate positive impact created momentum to expand the model into other areas, as a result of which the model was improved and adapted: six standard designs have been developed to serve groups of communities ranging from 4 to 40 households. The model is based on a consultative approach and underpinned by a partnership between the municipality, the district administration and participating communities. Key features of the model are detailed below:

- **Site selection** based on criteria including needs assessment; number of households served; availability of municipal land; and willingness of households to contribute to capital costs and manage the facility.
- **Financial contribution from the municipality**, which provides suitable land free of cost, waives charges for the planning process and approval, and contributes towards the capital costs (see Financial assesment).
- **Accessibility for connection to the city water supply network** operated by the water utility, AdeM; provision of a water storage tank and tap stand.
- **Provision of ramp and separate compartment** to ensure access for people with disabilities.
- **Capacity building of the Sanitation Management Committee (SMC)** formed from the user households. Women's participation in these committees is positively promoted.¹⁶
- **A formal delegated management agreement** between the SMC and the bairro administration for the facility - which is a public asset - including operating and maintaining the facility.



Image: Communal Sanitation Block in Chamanculo, Maputo. Credit: WSUP

Service uptake and affordability

WSUP's programme has supported the implementation of 87 CSBs across 11 bairros during the period 2009 – 2016, providing sanitation access to an estimated 1,071 households with a population of 4,740. Ongoing monitoring activities, including sustainability surveys conducted as part of WSUP Annual Programme Reviews, demonstrate sustained high usage of the facilities and strong performance of the SMCs in maintaining the facilities. WSUP has contributed approximately 90% of implementation costs to date, with support from its funding partners; CMM and household service users contribute the remainder (see Figure 12). User households also contribute a modest monthly contribution of MZN 50 (around US\$ 1): this revenue is collected and used by the SMC to cover the costs of routine cleaning and maintenance, as well as the desludging costs of the septic tank. Table 7 presents a summary of the programme outputs.

¹⁶ For more on Women's leadership role in SMCs, see WSUP (2014) A gender-inclusive approach in practice: communal sanitation.

Table 7: Communal sanitation services 2009-2016.

	Bairro	CSBs	User households	Total people reached
1	Chamanculo C	30	449	2089
2	Xipamanine	8	127	598
3	Mafalala	7	83	396
4	Chamanculo D	13	128	520
5	Chamanculo A	4	34	109
6	Chamanculo B	6	49	172
7	Aeroporto A	1	12	55
8	Minkadjuine	3	39	181
9	Malanga	2	29	110
10	Aeroporto B	12	115	387
11	Munhuana	1	6	25
	Total	87	1,071	4,742

Financial assessment

Table 8 provides high-level costing data for constructing and operationalising the CSBs. Once the blocks are operational, maintenance costs are relatively low as user households undertake cleaning through an agreed rota. Cleaning and desludging costs are fully covered through the monthly user contribution of US\$ 1: the latter is particularly significant in the Maputo context, where it is unusual for households to set aside funds for desludging services. CMM and the relevant bairro administration cover the costs of repairs.

Table 8: Average costs of constructing and operationalising CSBs.

Cost component	US\$
Construction	3840 - 5250
Additional associated costs (planning, design, supervision and capacity building)	384 - 525
Total cost per CSB	3,840 – 5,750
Cost per beneficiary	88

In researching this report, implementation and maintenance costs per CSB were calculated based on the actual implementation costs of the 87 CSBs and estimated maintenance costs. A breakdown of the costs borne is provided in Figure 12. WSP has estimated that inadequate sanitation costs Mozambique MZN4 billion each year, equivalent to US\$ 124 million¹⁷: the accumulated effect of this over a period of 15 years is equivalent to a per capita cost of between US\$ 125 – 150 based on the estimated sanitation coverage by JMP.¹⁸ This supports WSUP's view that the investment cost per beneficiary for the CSB model (US\$ 88) more than counteracts the impacts and costs due to poor sanitation in Maputo, justifying the need for municipal and public finance for CSBs and shared latrines as a public good.

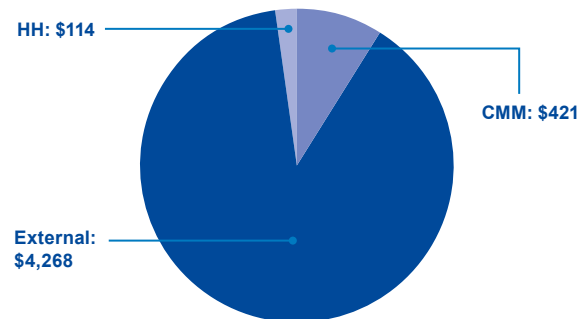
¹⁷ WSP (2012) Economics of Poor Sanitation in Africa.

¹⁸ UNICEF/WHO (2015) 25 Year Progress on Sanitation and Drinking Water: 2015 Update and MDG Assessment.

¹⁹ For more on potential financing models for CSBs in Maputo, see WSUP (2011) Financing communal toilets: the Tchumulane project in Maputo.

Figure 12: Breakdown of average implementation and maintenance costs per CSB.

[HH - household; CMM – Municipality; External – contribution from external agency (NGO/IFI/private sector)]



Conclusion

While WSUP will always advocate for the provision of household toilets where feasible, experience in Maputo has demonstrated that Communal Sanitation Blocks are a necessary and viable part of the mix of sanitation service solutions in the city's densely populated low-income districts. A key strength of the Maputo model is the participatory approach involving households, CMM and the bairro administration: the early involvement of these actors has helped to ensure collective ownership and consensus during implementation. This in turn has contributed to the impressive sustainability of the facilities, underpinned by ongoing financial contributions from households with oversight from SMCs.

WSUP and funding partners have provided the large majority of capital investment to date, though with significant contributions from households and CMM: for sustainable scale-up, it is important to aim for enhanced local financing or part-financing of the capital investment¹⁹ (as noted, analysis of the costs of inadequate sanitation in Mozambique suggests this can be justified on economic grounds, in addition to the manifest social benefits). The planned introduction of a sanitation tariff in Maputo would be a significant step forward in addressing the financing gap for sanitation and working towards the national target of universal basic sanitation and hygiene service provision by 2030. Given the current poor status of sanitation coverage in Mozambique and the increasing levels of urbanisation, there is overwhelming justification for significant investments in sanitation in Maputo: this should include support through municipal and/or public finance, and should be in alignment with the recently completed Maputo Sanitation and Drainage Master Plan.

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