



City wide planning to support effective sanitation service chain operation

Headline findings

- Very little is known about the transport and treatment stages of the sanitation service chain and these gaps in knowledge make effective city wide planning challenging.
- An underlying difficulty is to develop a planning framework that does not rapidly become irrelevant in the face of high urban growth.
- The lack of effective land-use planning in relation to security of tenure for tenant households is a major constraint to the uptake of latrines. Consequently, there is a need to adapt citywide planning approaches to address sanitation solutions that are appropriate for the specific de facto tenure-mixes that exist.
- Financing of both the capital infrastructure and recurrent operation and maintenance costs for faecal sludge management (FSM) remains a challenge. The SPLASH research findings provide a useful starting point for developing a funding plan for faecal sludge management (FSM), including capital and operational expenditure and income.
- Poor households are willing to pay for sanitation services including latrine construction and emptying services. Revenue has been generated from the sale of treated faecal sludge beyond its more common use in agriculture; however, the current supply of faecal sludge is insufficient to meet the potential demands for these alternative uses.
- This research programme has developed tools to support city wide planning which provide evidence to planners concerning highest risk areas most in need of immediate action.
- There are important interactions between sanitation and other service sectors, particularly solid waste management. Sanitation service planning has to be approached as part of the totality of city wide planning.
- The research findings reinforce a deeper problem concerning *the lack of a planning culture* within certain tiers of government which constrains efforts directed at strategic planning; this is rarely recognised as a constraining factor that needs to be addressed.
- Effective city wide planning requires a positive enabling environment so that economies of scale can be achieved even in highly dispersed systems involving on-plot sanitation. Improving city wide planning is progressive in nature; it often requires time for 'things to happen', which can be seen as part of the improvement process.



Photograph:
Stephen Pedley

1. City-wide planning and sanitation

The research in Cameroon (MAFADY), Kenya, Uganda, Rwanda (3K-SAN) and Mozambique (CLASS-A) specifically addressed the notion of systematic planning and decision making at the city level. The projects focused principally on excreta capture and storage; and treatment and end-use. This Briefing Note draws on findings from these projects to consider: how planning for sanitation services needs to be considered in the context of planning for the whole city; how different aspects of city wide planning can influence the different stages of the sanitation service chain; and, drawing on previous experience, the wider implications for city wide planning.

Existing planning approaches are, broadly speaking, either 'domain-based' e.g. Household Centred Environmental Sanitation (HCES) and Sanitation-21, or 'system-based' as adopted by the SPLASH programme, where decision-making is built around the constituent components of an effective city-wide sanitation service. SPLASH research findings have confirmed the central importance of wider issues such as tenure status (Scott *et al*, 2015) that are not widely incorporated into urban sanitation planning.

An underlying difficulty is how to develop a planning framework that does not rapidly become irrelevant in the face of high urban growth, which will be significantly higher in East Africa than the average for all of Africa. East Africa is projected to double its 2007 urban population by 2025 in just 17 years (UN HABITAT, 2008).

The pace of urbanization, not in itself a negative concept, tends to slow down as the population becomes more urbanized. The challenge arises when this urban growth remains unplanned, and is in the absence of essential infrastructure development. Without these infrastructures, people are left living without access to essential services including health, education, water, electricity and sanitation. Conditions are often very poor: in Kigali and Kampala, the number of slum households as percentages of each city's total is 52.4% and 49.3% respectively (UN HABITAT, 2008).

Insufficient access to services by the urban poor has long been recognised, but as rapid urbanisation continues, the problems become more acute. Cotton and Franceys (1991) outlined a list of sectors where improvements in citywide, systematic planning were needed in order to support better access to services.

- **Ground preparation** to provide the foundation for the construction of shelter, including the protection of low-lying land from inundation by floodwaters and the prevention of soil erosion and movement on steep hillsides.

- **Drainage** to permit both stormwater and household wastewater to drain away without creating stagnant pools.
- **Access and roads** to define a site layout with clear boundaries for housing plots, access routes, rights of way and emergency vehicle access.
- **Water supply** to provide clean water in adequate quantities to cope with basic needs.
- **Sanitation** to remove and dispose safely of human wastes; this is an essential component of environmental health.
- **Solid waste management** to ensure that refuse which is generated on the site is collected and disposed of.
- **Power supply** for security/street lighting, cooking, and to run other electrical appliances.

The lack of adequate budgets for the full range of sanitation activities in Mozambique led to the selective prioritisation of investments which did not necessarily contribute to a successfully functioning sanitation system. An unsurprising finding is that in cases where there is no budget available, the interest in planning activities that require a budget is diminished from the outset because it is considered a wasted effort.

This illustrates a deeper problem concerning the lack of a planning culture within certain tiers of government that constrains efforts directed at strategic planning. Whilst this has been previously identified in relation to city-wide planning (Tayler *et al*, 2003, based on Bharatpur, India) and system maintenance (Sohail *et al*, 2001, based on 11 case studies across South Asia), it is otherwise rarely recognised as a constraining factor which has to be addressed.

In South Africa, planning only became a recognised profession in 2002 and the planning profession still appears to be weaker than more established professions such as law, engineering and medicine, which can leave them working in isolation rather than as part of the system (Coetzee, 2012).



Photograph:
CLASS-A

This gives rise to a difficult balance between implementing some highly localised actions (that is, doing something) which results in a somewhat piecemeal approach, and being paralysed by the size of the problem across the city and doing nothing.

2. Land use planning

The main challenge concerns the lack of effective land-use planning in relation to security of tenure for tenant households.

- 80% of Douala (one of the research locations in Cameroon) is unplanned, which emphasises the scale of the problem faced in trying to adopt better land use management practices in cities.
- The findings from Douala, Yaoundé, Kigali, Kisumu and Kampala all concluded that a lack of formal tenancy agreements between tenants and landlords has a detrimental effect on the financial and social status of tenant households. The Briefing Note in this series on Demand Creation considers the issue of tenancy in greater detail and the Briefing Note on Vulnerability highlights the additional problem that only around 20% of landlords in Douala own the land title on which their property is built.
- Illegal occupancy of land is a politically difficult topic and in many countries people living in illegal settlements are simply ignored. Maps of the area show blank or open spaces instead of the settlements that are actually there.

This lack of recognition for informal settlements relates to the enforcement of municipal by-laws and regulations regarding some aspects of sanitation. Current legislation and regulations in the study cities are ineffective: this can be attributed to a lack of capacity for those organisations whose responsibility it is to enforce the regulations. However, even if that capacity were in place, actually enforcing them in informal and illegally occupied areas is tantamount to formal recognition leading to potential entitlement to the level of service mandated e.g. that landlords provide latrines for tenants in Uganda.

The risk assessment in Maputo highlighted that high population density and poor access for desludging are key exacerbating factors of sanitation risk and concludes that these problems need to be addressed through stronger regulation of land use and development.

- This has a greater potential to be enforceable than regulation that specifically targets either landlords or tenants, which is more likely to be regressive in nature.

- If the land used by dumpsites is properly protected and demarcated, it would be a small step towards more effective land management. In the case of Douala, it could stop further encroachment onto the dumpsite by residents.

Box 1: Useful planning tools from Cameroon

- A useful tool for one aspect of city wide planning is the development of groundwater vulnerability maps for Douala. These maps currently provide visual representations of levels of pollutants at the surface and sub-surface levels. By making the information on groundwater pollution available, it will be possible to plan for the implementation of groundwater protection perimeters. Douala is particularly vulnerable to groundwater pollution because of its low-lying, coastal geography which give it a high water table. There are also extensive mangrove areas.
- The maps created by the MAFADY project can become an important part of the knowledge base in Douala, Cameroon and can be adapted to provide maps of other areas.
- The Rapid Participatory Sanitation System Risk Assessment (RPSSRA) tool developed by CLASS-A in Maputo, Mozambique. The main function of the RPSSRA is to support the development of city sanitation plans by providing a systematic assessment of public health risks. The methodology is based on the premise that an improved understanding of sanitation risks can help to target interventions and develop strategies to reduce risks where sanitation systems are most deficient and local residents are at greatest risk.

Box 2: Links to Environmental Planning in Rwanda

- Experience from Rwanda in wetland conservation has shown that initiatives aimed at wetland conservation must be recognised as a long term process that includes activities to help build a strong knowledge base. Despite the fact that planting and construction distances along rivers and around marshlands have been in effect for some years people still continue to build and plant crops in these areas so the educational messages about protecting the wetlands are ongoing.

(Rwanda Environment Management Authority, 2013; 2009)



Photograph:
Rebecca Scott

These findings, can be placed within the broader context of city-wide planning identified by previous research and practice.

- There exists a whole spectrum of tenure types across cities. The tenure conditions required as a precondition for household expenditure on sanitation are not straightforward to define (Scott *et al*, 2013).
- An underlying problem is that existing planning frameworks are unable to cope with the complex tenure-mix that exists in urban areas of sub Saharan Africa; thus large segments of the urban population are excluded from planning processes.
- Tenure reform is politically and legally complex, it transcends the requirements of specific service sectors and is, at best, a medium to long term aim. Without political support at the highest level it is unlikely to be realistic to use sanitation as a single entry point for driving desirable tenure changes.
- The overall implication is the need to adapt citywide planning approaches to recognise and address the sanitation solutions that are appropriate for the specific *de facto* tenure-mixes (Scott *et al*, 2015); that is, in the short and medium term, working with what is encountered in practice.

3. Faecal sludge transport

The majority of costs for emptying and transportation are borne by service users, for example households and institutions such as schools. The emptying and transportation of faecal sludge is dominated almost entirely by private sector operators and as such receives very little attention by city authorities. The exception is when operational licences or permits are supposed to be obtained or dumping fees need to be paid. There is relatively little known about tanker operators and how they work and the following findings are drawn principally from the MAFADY project in Cameroon which considered the current role of these operators and their capacities to offer services.

- In Cameroon, co-operative organisations of emptiers have never been sustainable, so they are therefore not represented at the administrative level of the

cities and cannot actively participate in decision making processes affecting their businesses.

- Prices for services are set according to the volume of the tanker, the distance between the household and the dumpsite and ease of accessibility to the latrine or septic tank. Emptying time is about 35 minutes for a septic tank and 55 minutes for a latrine but that depends on the type of access and the physical state of the faecal material. The prices for emptying are lower in Douala than they are in Yaoundé because more operators are available and there is greater competition.
- Travel time to the dumpsites is approximately 1 hour in both Douala and Yaoundé but services are slowed down by heavy traffic, the poor state of the roads and police check points.
- There are very few emptying tankers available in Kigali, which causes particular problems for urban residents because manual emptying of latrines is technically illegal in the city.
- Findings from Douala, Yaoundé and Kigali highlight the problem of handling solid waste that is intermixed with faecal sludge.

Box 3: Faecal sludge collection in Cameroon

There are 49 tankers in Douala owned by 16 enterprises and 9 individuals. In Yaoundé there are 18 tankers belonging to 9 enterprises, 3 of which are owned by hotels but there is a severe shortage of parking for such large vehicles. The average volume of a tanker is 8-16m³ so when emptying a latrine or septic tank a single empty can fill up to 77% of the tanker, which means that the household is charged for the entire volume of the tanker because the tanker is unable to travel to a second job before discharging the waste. Most of the tankers in use are second hand and in a poor state of repair. The average period of use in Cameroon is 4 years. In Douala, some of the individual operators have invested in new trucks and they supplement their domestic services by providing emptying services for hazardous and dangerous materials.

The issue of solid waste interacting with FSM is an example of the need to consider the totality of city wide service planning¹. Without access to solid waste removal services, people resort to disposing of their waste in alternative ways, usually burying it, burning it or throwing it into a latrine.

¹ *A discussion of interactions of sanitation planning with housing density, settlement pattern and six other infrastructure sectors is given in Cotton, A.P. and Franceys, R.W.A. (1991) Services for Shelter, p115-118 Liverpool University Press*

- In Rwanda, the burning of waste is illegal and, without space to bury it on individual plots, the latrine becomes an obvious option. This overcomes the short term problem of solid waste disposal but creates serious medium term difficulties when emptying latrines.

The FaME research showed that there are potential markets for treated faecal sludge beyond its more common use in agriculture: however, the current supply is too low to meet the potential demands for its use. In response, the research proposes the following options to boost the collection and transport of faecal sludge that could be incorporated into city wide planning.

- Assist mechanical faecal sludge collection and transport companies to increase the quality and efficiency of their businesses through;
 - access to credit
 - effective licensing
 - zonation of the city
 - truck routing or a centralized bidding system.
- Develop and implement faecal sludge collection and transport technologies to service low income households and difficult to access on-site technologies (latrines and septic tanks).
- Subsidize faecal sludge collection and transport services for poor households. This is considered further below.
- Build functional treatment plants with affordable discharge fees.

4. Treatment, end-use and disposal

A lack of physical infrastructure for treatment

Faecal sludge treatment facilities were found in very few locations. Where the private sector has stepped in to provide services, the local and national authorities have tended to step back in terms of providing and maintaining city infrastructure. Raw faecal sludge is high in pathogens and faecal sludge treatment is necessary to reduce the public health risk prior to end-use. Through field trials of treatment options the FaME project has shown that non-agriculture based marketable products can be produced including; solid fuel; biogas; protein resources and building resources (Diener *et al*, 2014).

- In Yaoundé, Cameroon, the dumpsite for faecal sludge was created by the tanker operators after negotiating use of the land with the owner. It has since become the official dumpsite for the city and is jointly managed by Nomayos village and the Mbankomo council. 'Management' activities are limited to the collection of 5000 FCFA per tanker discharge (approx. 9.5 USD), with the fees collected by local youths. The fees are split between the council and the village but none of it is re-invested into other management activities or into keeping the road in a passable condition. Annual discharge fees amount to 21.6 million FCFA (approx. 41,000 USD).
- In Douala, the dumpsite is situated in a mangrove area on the Wouri estuary. A tank was built to receive the sludge but the capacity was exceeded almost immediately and raw sludge now discharges into the mangrove area below the site. Construction is forbidden but in 2009 people began to move into the area. The site was created and originally managed by Douala City Council before the management was contracted out to a private operator. Disposal fees are much lower than in Yaoundé at 1,500 FCFA, with the fees split between the operator and the council. The council retained responsibility for maintaining access roads but this has lapsed. The site in Douala generates approximately 15 million FCFA (approx. 26,000 USD) per year but the tanker operators often refuse to pay the fees given that the access roads are not maintained. Neither site has been improved since they were first created.



Photograph:
Rebecca Scott

Box 4: Sanitation safety planning

The research in Maputo noted that treatment and disposal of faecal sludge needs to be in accordance with appropriate standards because illegal dumping and improper treatment will not reduce the risks associated with faecal sludge. They also cautioned about setting those standards too high to be achievable. Achieving a balance between what is needed and what is manageable is one of the most important aspects of city wide planning.



Photograph:
3K-SAN

Operation and maintenance is a major challenge. Where treatment plants exist they are invariably either broken down or unable to function at full capacity.

- In Yaoundé, approximately 25% of the inhabitants of district 6 (a higher income district) are connected to a semi-collective sewerage network. However, there are no functioning treatment plants so most sewers discharge directly to the environment. In the areas of Biyemassi and Mendong, some households have disconnected from the system and have constructed septic tanks because of the non-functioning sewerage system.
- FaME demonstrated that drying beds can be made 20% more efficient which is important when planning the construction of facilities in urban areas where space is at a premium. Treatment plants requiring large amounts of space situated on the outskirts of towns lead to higher transportation costs, higher operational costs for the tanker operators and consequently higher emptying costs for households.

Lack of finance for treatment infrastructure

Financing of both the capital infrastructure and recurrent operation and maintenance costs (O&M) for FSM and the question of who pays for what is a challenge in terms of city wide planning. It is very difficult to assess the levels of government financing for sanitation as governments rarely have separate budget lines for sanitation— although data is available for Mozambique and Uganda².

² *Government spending on urban sanitation investment is available for Uganda and Mozambique as part of a detailed three-country study, although the data cannot be disaggregated to the programme level. See: Cotton, A.P., van Maanen, P., Scott, R.E., and Valfrey Visser, B. (2010) Mapping EU support for sanitation in Africa, Full text: http://www.euwi.net/files/Mapping_EU_Support_for_Sanitation_in_Africa.pdf*

- 3K-SAN noted that there is currently no financing available for FSM infrastructure in Kenya, Uganda or Rwanda.
- In Yaoundé, MAFADY recommends a 3 stage treatment process consisting of drying beds and lagoons. The estimated capital cost is 910 million FCFA (approx. 1.7 million USD) with annual running costs of 30 million FCFA/year (approx. 56,000 USD), which is expected to be covered by the disposal fees. At current fee levels this requires disposal at the site to increase by at least 30%.
- MAFADY noted that staff who are tasked with the operation and maintenance of treatment facilities receive little or no training on the management of these facilities which results in abandonment long before the end of the design life.

Sohail *et al*, (2001) showed that poor urban communities are willing to be involved in the operation and maintenance process as long as they receive the necessary technical and institutional support. Delegating responsibility for operation and maintenance to decentralised or local organisations cannot be taken as an excuse for district or central governments to entirely relinquish their responsibilities.

There is clearly considerable potential for revenue generation from the sale of treated faecal sludge assuming that the collection and treatment infrastructure is in place and the demand side (market) is well-understood. Large-scale sales of faecal sludge are hampered by a lack of treatment facilities, shortages in raw material supply and a currently limited market for end products because awareness about alternative (non-agricultural) uses of faecal sludge is low.

Lack of data for planning treatment facilities

The research in Kenya, Uganda, Rwanda, Cameroon and Mozambique found information sharing between the different organisations involved in FSM was low to non-existent. The following major information and data gaps were identified;

- There is no consideration of downstream activities in Cameroon; planning only ever addresses a part of the problem.
- There is a lack of data on the amounts of faecal sludge produced, treatment costs and the costs to industries of converting their processes to allow for the use of treated faecal sludge as a solid fuel.
- The lack of financial information makes it difficult to prepare comparative costs for sewerage versus FSM.

- There are no standards applicable to Sub-Saharan Africa for the end-use of faecal material. It is therefore difficult to advocate to potential users that the treatment is adequate in creating a safe product.

The research by MAFADY and CLASS-A try to address the issue of limited information for city wide planning; the tools referred to in boxes 1, 3 and 4 can support city wide planning by providing evidence to planners concerning highest risk areas that need the most immediate actions.

5. City wide planning: financing improvements

Options for financing urban improvement works is an important aspect of city wide planning. SPLASH research has identified important aspects of willingness to pay, of potential income sources and of major funding gaps.

- Service users cannot reasonably be expected to finance the entire service chain; collection, transport and treatment infrastructure could thereby receive public subsidy.
- The precedent for comparison is with sewerage infrastructure (which is no more than a physical network for the transport of faecal matter) that exists in high income areas and central business districts of a number of cities. This is usually financed by general taxation, with cost recovery (at least theoretically within policies and regulations) for O&M and possibly for capital repayments through user charges.
- These and other research findings (Scott *et al*, 2015) show that poor households are willing to pay for sanitation services including latrine construction and emptying services; there is also evidence from this research of the market potential for treated faecal sludge.
- It is important not to leap to incorrect conclusions, for example that income from faecal sludge sales will cover the costs of FSM. The income sources are better treated as welcome but inherently unpredictable additions that contribute to the overall financing of urban sanitation management.
- This provides a useful starting point for developing a funding plan for FSM, including capital and operational expenditure and income.



Photograph:
MAFADY

Key references

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It is a synthesis output of the SPLASH urban sanitation research programme which was managed by WEDC.

The research programme comprised 5 projects which aimed to contribute to the understanding and implementation at scale of sustainable sanitation service chains in low-income urban areas in Sub-Saharan Africa. It was jointly funded by: ADA (Austria), MAEE (France), SIDA (Sweden), SDC (Switzerland), DFID (UK), BMGF (Bill and Melinda Gates Foundation).

The briefing notes in this series each focus on one of the key thematic areas that has emerged as a result of the research conducted under the SPLASH Sanitation Research Programme. These are;

- 1) Enabling environment;
- 2) Demand creation;
- 3) Vulnerability;
- 4) City wide planning.

Further details on the work from each project can be found at: www.splash-era.net

Projects and cities (countries) where research took place:

3K-SAN: Lead organisation – University of Surrey, Robens Centre for Public and Environmental Health, UK
Kampala (Uganda), Kigali (Rwanda), Kisumu (Kenya)

CLASS-A: Lead organisation – International Water Association (IWA), the Netherlands
Maputo (Mozambique)

FaME: Lead organisation – Swiss Aquatic Research Institute, Department of Water and Sanitation in Developing Countries (SANDEC), Switzerland
Dakar (Senegal), Accra (Ghana), Kampala (Uganda)

MAFADY: Lead organisation – Ecole Nationale Supérieure Polytechnique de Yaoundé, Cameroon
Douala and Yaoundé (Cameroon)

U-ACT: Lead organisation – Swiss Federal Institute of Technology Zurich, Centre for Development and Cooperation, Switzerland
Kampala (Uganda)

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How to reference this document

MEDLAND, L., COTTON, A.P. and SCOTT, R.E., 2015. *SPLASH Urban Sanitation Research Programme Briefing Note 4: City wide planning to support effective sanitation service chain operation*. Loughborough, UK: Water, Engineering and Development Centre (WEDC), Loughborough University.