3. Treatment and end-use or disposal

What is blocking demand creation?

The FaME project has reinforced the knowledge that whilst faecal sludge is already used for urban agriculture, farmers do not have access to a constant supply; there are concerns over odours and the potential health risks of applying faecal sludge to land when it has not been properly treated.

The use of faecal sludge as a dry combustion fuel in industry requires a much drier end product, giving rise to challenges in terms of the space needed for drying beds. Drying beds are not as efficient in tropical or humid climates. Whilst technological challenges are starting to be overcome through ongoing research, the significant remaining challenge concerns the differing characteristics of local market demand.

Market demand and hence market value for faecal sludge varies greatly between cities. The local market potential for faecal sludge as an industrial fuel depends on: faecal sludge characteristics; user perceptions; existing fuels available; local industry requirements; legal arrangements and regulatory restrictions; the use of subsidies; and the local supply of sludge. Some industries would need to change their energy generation processes in order to use faecal sludge as an alternative or replacement fuel source, which can require significant initial investments (Diener *et al,* 2014).

Creating demand for treated faecal sludge products

The market potential for different uses of faecal sludge as a solid fuel, to create biogas, as a protein source, as a building resource and as a soil conditioner (Diener *et al,* 2014) were identified in Kampala, Accra and Dakar.

- A benefit of using faecal sludge as an industrial fuel rather than as a soil conditioner is that there is less need for reducing the pathogen content.
- The greatest demand for faecal sludge as a solid industrial fuel was identified in Kampala where a variety of solid fuels are already in use. In Accra and Dakar, the use of electricity and liquid fuels is more common than solid fuels.
- In Kampala there is an established brick production industry and sludge could be used as a raw material in brick production. However, there proved to be limited interest in this option as the traditional raw materials for bricks are readily available locally. There was much more interest in the potential to use sludge as fuel for the brick kilns themselves. In order to achieve this, there needs to be development of new technologies to bring successful burning trials to full scale testing.

There is little information available about how treatment for end-use can be scaled up. The FaME project has increased our knowledge of faecal sludge treatment and new end-use options and has identified certain key knowledge gaps that can be addressed as the research moves forward.

- Industrial users need to see more evidence of the technology for solid fuel production working at scale (Gold *et al,* 2014).
- For some industries the ash content produced during the burning of dried faecal sludge needs to be reduced (Gold *et al,* 2014).
- Treatment technologies and decision support tools need to be developed for each faecal sludge end product (e.g. solid fuel, biogas, protein). This would allow production to respond to specific market demands and help in determining the most favourable end products for each local context (Diener *et al,* 2014).
- There needs to be extensive training and knowledge-sharing regarding the new technologies available.

Photograph: 3K-SAN

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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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SPLASH

SPLASH Urban Sanitation Research Programme Briefing Note 2

Assessing the drivers of demand sanitation services

Headline findings

- **Awareness and demand.** Sanitation promotion programmes that only focus on increasing household awareness for better quality sanitation facilities, are unlikely to be successful in sustaining demand because there are additional constraints to action. Low demand also reflects issues such as tenure status, (particularly for tenants), the availability of affordable finance, and the lack of a supporting city wide planning culture. Such issues need to be addressed in a context that is broader than the sanitation/WASH sector.
- **Willingness to pay.** Distinct differences were found between locations. In Cameroon, low income groups were willing to invest in high one-off costs to construct a latrine. In Kampala, access to credit had a significant positive effect on household investment in a latrine.
- **Landlord motivations to provide facilities.** Landlords in Kigali, Kampala and Kisumu were motivated to provide sanitation because of existing laws, the potential for increased earnings from higher rental fees and social pressure – provided others in the area were also improving their facilities.
- **Availability of services.** The strongest factor affecting demand for emptying services is the availability of service operators. In many cities, manual emptying of latrines is illegal and, coupled with a lack of mechanical emptying equipment, places a serious constraint on the overall availability of pit emptying services. In Kampala, small businesses are providing both construction and emptying services that is resulting in higher quality latrine construction and more regular emptying.
- **Technical knowledge and evidence on treatment and end-use options.** There is relatively little information about the treatment of faecal sludge for resource recovery options which can be scaled up. Industrial users need to see more evidence of the technology used to produce solid fuel from faecal sludge working at scale. Treatment technologies and decision support tools need to be developed for each faecal sludge end product (e.g. solid fuel, biogas, protein).
- **Market conditions for end products.** An improved understanding of the market conditions for end use products is needed, for example: how do products compete in terms of price, quality or quantity? Which similar products/sources do they compete against? What are the circumstances under which preference and use for each end product can increase?

Photograph: Benoit Mougoué

1. What is demand creation?

This research has investigated two opportunities to create demand: at the beginning of the chain, demand from households to construct and use sanitation facilities; and at the end of the chain, demand for end-use of a waste product that has been treated. Both have different drivers, some of which have been considered within the SPLASH research programme.

A household based demand-led sanitation programme relies on active participation of the users to construct a sanitation facility using their own resources. The widely adopted approach in *rural* areas is to create awareness about the importance of good hygiene and an end to open defecation, for example, Community Led Total Sanitation (CLTS), followed by behaviour-change communication and/or a marketing approach to encourage and enable the uptake of affordable latrines. SPLASH research has reinforced the view that approaches to satisfy demand in urban settings are different to those in rural settings.

2. Capture and storage

Creating demand for sanitation facilities

There has been a lot of focus in recent years on identifying the drivers of demand for household sanitation facilities. Jenkins and Scott (2007) identified a three-stage household decision process applicable to rural and peri-urban areas: preference, intention and choice. This process has been expanded by the work of 3K-SAN in Kampala, Kisumu and Kigali into a five stage process: No preference, Preference, Intent, Choice and Installed. These are illustrated in Figure 1.

Moving from *No preference* to *Preference* requires households to address constraints including their physical environment, income level and knowledge, all of which constrain their motivation for improved sanitation.

Space, cost and knowledge constraints

In Kigali, Kisumu, Kampala, Douala and Yaoundé availability of space to construct a latrine is usually very limited or non-existent because the house generally occupies all of the available space. There are also topographical constraints in Kampala and Douala where water tables are very high or the ground is rocky and difficult to excavate.

In most cases, a lack of household affordability was the major barrier for constructing or improving a latrine. The importance of making finance available to the poorest households is discussed in the Briefing Note in this series on the Enabling Environment.

- The research by U-ACT in Kampala found that offering households micro credit at 20% interest over 18 months to pay for the construction of a latrine had the same effect as reducing the investment required to build a latrine by 25% (Günther and Horst, 2014).

In cases where there are no physical constraints on building a sanitation facility the reluctance to build can extend from a lack of knowledge about the types of facilities available or the perception that materials are difficult to obtain from local markets (Godfrey *et al,* 2006). SPLASH research has again highlighted that the lack of availability of information on the different types of sanitation facilities and services available continues to be a significant constraint when trying to stimulate demand for building and improvements. Knowledge gaps, especially at the household level, are a common theme across the project areas.

Findings from 3K-SAN showed a strong relationship between demand for sanitation and knowledge about the costs and availability of services and markets. However, awareness of the need for a sanitation facility does not necessarily translate into an installed facility; but higher levels of awareness lead to more concerns about the adequacy of sanitation facilities in terms of quality, accessibility, availability, affordability and acceptability. In Kigali in particular, demand for sanitation is high but the levels of installation are still low.

The research by U-ACT in Kampala also found that a programme focused purely on raising awareness of the benefits of improved sanitation facilities through a social marketing approach, had not stimulated demand for installing a latrine (Günther and Horst, 2014).

Relying on awareness raising leading to self-motivated installation is insufficient in urban low income areas. A balance needs to be stuck between adopting highly specific but piecemeal approaches in each settlement and adopting broader city wide approaches that are currently insufficiently targeted to meet their intended objectives. 3K-SAN are addressing this through developing a typology of the barriers to adequate sanitation that characterize the demand challenges in different settlements. These typology characterisations remain a' work in progress', but they will aid the development of more-targeted solutions within the context of better city wide planning, including links to existing planning tools and a more supportive enabling environment.

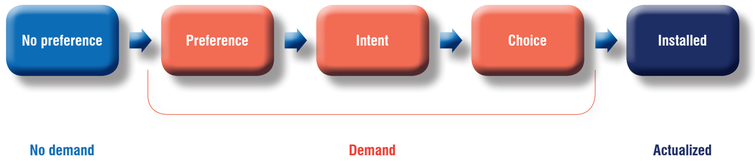

Figure 1. Household demand model [adapted from Jenkins and Scott, 2007]. Okurut and Charles (2014).

Box 1: Knowledge gaps in household technical knowledge, Cameroon

- The quality of technical guidelines for latrine construction is poor and there are not enough qualified technicians or artisans who can construct suitably designed facilities. There are no technical guidelines that consider the impact of sanitation facilities on ground water pollution.
- Current designs for sanitation facilities are too deep and the way they are used further intensifies the problem of groundwater pollution because households discharge large amounts of wastewater into the latrines.
- There is no certification of technicians or artisan builders and the knowledge of users (the households) is very limited which means that they are unable to check that the facilities being built for them are appropriate.

Willingness to build or invest in improvements

The most important motivation factors for sanitation facilities in Kigali, Kisumu and Kampala were privacy, cleanliness, health and hygiene; their relative importance varies between cities. In Kampala, an additional motivating factor is the law, resulting in a general expectation that every household should have a latrine. The research findings reinforce the understanding that levels of willingness to pay for different sanitation services are highly context and location specific, influencing the extent to which demand is likely to be actualised. The following specific insights were gained.

Kigali, Kampala and Kisumu (3K-SAN)

- Willingness to invest in a latrine was generally low, even amongst owner occupiers and resident landlords.
- Having access to a public latrine hinders demand for investment in household sanitation facilities in some areas, despite the common perception that public latrines are not as clean as a private latrine can be.
- Landlords were motivated to provide sanitation as the result of existing laws (in Kampala), the potential for increased earnings from higher rental fees and social pressure- provided that others in the area were also improving their facilities.
- Demand was higher for owners than it was for tenants.
- Vulnerable households reported higher levels of demand, particularly those with females aged 6-17 and households without parents.

Photograph: U-ACT

Photograph: Rebecca Scott

Kampala (U-ACT)

- A male head of household is more likely to initially express a serious interest in purchasing a latrine but will not complete the purchase, whereas a female head of household is more consistent in their purchase intentions and actual purchase behaviour (moving from the *Intent* stage to the *Installed* stage).
- House ownership and property rights were the strongest determinants for the presence of an improved household latrine.
- Tenant households studied in Kampala are not allowed to build on their landlord's property which limits the potential to turn demand into installation.

Douala and Yaoundé (MAFADY)

- Research in Cameroon showed that low income groups were prepared to pay very high one-off costs for the construction of a latrine this was up to 23 times more than the annual cost that high income households pay for their sewerage charges.

Creating demand for pit emptying services

In Cameroon, the current demand for pit emptying services in Douala and Yaoundé provided interesting insights into the operations of small-scale, private sector operators about whom there is still relatively little known compared to other stakeholders in the sanitation service chain.

- The strongest factor affecting demand for emptying services is the availability of service operators. In many cities, manual emptying of latrines is illegal and, together with a lack of mechanical emptying equipment, it places a serious constraint on the overall availability of pit emptying services. This is also the case in Kigali, where the number of emptying trucks is very low.
- In Cameroon, most customers were found to empty their latrine or septic tank once it was overflowing. Only 14% of customers planned the emptying activities in advance (MAFADY, 2014).

In Cameroon, prices for emptying 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. The prices for emptying are lower in Douala than in Yaoundé because there are more operators available and greater competition between them. A majority of customers expressed satisfaction in the prices charged by the tanker operators; however, most of the customers have septic tanks rather than pit latrines so represent households in the higher income districts of both cities. Due to the higher costs of mechanical emptying, manual emptying is generally preferred for household latrines in Cameroon because it can remove more of the waste material for a lower cost.

Photograph: FaME