BPD SANITATION SERIES

Sanitation Partnerships: Beyond storage:

On-site sanitation as an urban system

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Introduction

In the last few years sanitation has been making a resurgence on the international development agenda. Calls for partnerships to help those without proper access to sanitation are growing apace. Yet while we increasingly understand the circumstances in which partnerships to provide urban solid waste collection or drinking water can be successful, much less is known about partnerships for sanitation.

This situation prompted BPD to review five cases of urban sanitation in cities in Southern and Eastern Africa. The work served to highlight both the scale and the complexity of the challenge faced. Access to sanitation in poor communities is generally very poor, and while various stakeholders are working to address the situation, there is often little co-operation between them. Efforts are fragmented and there is little debate and even less consensus on the best way to move forward.[1]

While most urban citizens of the developed world rely on waterborne sewerage, this is a privilege enjoyed by very few in developing countries, particularly in Africa. Typically less than 15% in African cities are connected to the sewer network, and networks are usually confined to central districts. Poor communities continue to rely on age-old solutions to managing human waste, such as the standard latrine, or occasionally its modern equivalent, the ventilated improved pit latrine (VIP).

In the foreseeable future it is unrealistic to expect many of those without access to sewerage to attain it, hence the careful wording of statements relating to Millennium Development Goal 7 (that which refers most directly to sanitation) of "access to improved sanitation".

In practice one sees one of three 'levels of facilities' being promoted by sanitation improvement programmes in poor communities. The first is the 'communal facility', where a toilet block is shared by a large group of users, and for which a fee for use is often charged. This may be a true 'public toilet' open to all comers, or may be reserved for exclusive use of a particular community. BPD refers to the second as the 'shared facility', often a VIP or standard latrine, which is shared by several surrounding households. The third is a 'household facility', where households are encouraged or assisted to build or improve private latrines, primarily for the use of that household alone.

1 This paper is one of a series of outputs from BPD's study on sanitation partnerships in Dar es Salaam, Durban, Maputo, Maseru and Nairobi. The concepts draw in particular from trigger papers prepared by Kathy Eales, Linda Tyers and Jaap Rijnsburger in May 2005.

Storage is a temporary solution

These three facilities are all delivered in different ways and valued differently by their users. Yet they often share one crucial characteristic – in many dense urban areas the sheer density of people using a limited number of latrines leads to high loading on each, and reduces the scope for in-site digestion, meaning that these facilities are mostly storing rather than treating excreta. A physical lack of space means people increasingly tend to empty latrines rather than dig a new pit and move any super-structure, whilst large communal facilities cannot be moved. These systems are therefore storing human waste *in situ*, rather than removing it directly for treatment elsewhere. Excreta is stored underground and with the heavy usage that dense urban living brings, over time they all fill up. For the facility to be usable once more, the waste needs to be collected and removed. None of these three facilities on their own fully tackle the challenge of disposing of human waste.[2]

The table provides a brief comparison of the three levels of facility in this respect:

Communal facility	Shared facility	Household facility
Communal facilities, especially where true 'public toilets' (which may be privately run) are more frequently found in busy public areas such as bus stops or markets, but also in poorer neighbourhoods such as in Kibera in Nairobi, or slums in India. One example visited by BPD in Kangemi, Nairobi, charged users a fee for using the toilet or the showers that adjoined it. The toilets linked into a large cesspool beneath the structure. The facility adjoined an informal settlement as well as a main road, and was close to a local taxi stand, which gave it more customers. The road meant that a vacuum truck would be able to gain access for periodic emptying (which is typically how such structures are emptied in poorer areas, although some are connected into sewers). Such facilities are often managed by CBOs (with NGO support) – especially where reserved for a given community – or in busy areas, by the local private sector.[3] They can provide a focal point for ongoing education and awareness campaigns and income from water sales help pay for sanitation maintenance. The communal approach removes the burden of investment and maintenance from household level and delegates it to others (with sometimes mixed results).	A shared facility is typically a latrine shared between multiple households (and often provided by a landlord). A shared key may prevent outsiders from using it, with maintenance (i.e. cleaning and the cost of emptying) shared between the users. This brings the costs of providing the facilities down, but means the toilet is neither necessarily private nor convenient, and cleaning rotas often break down rendering the facility unpleasant to use. Emptying is as for household latrines (see right), typically paid for by the users. More users lead to higher loading and more frequent emptying.	With its greater convenience and privacy, this facility is most in demand, but also costs the most (while increasingly users are expected to pay for it rather than receiving government support). Poor households may choose to spend their limited income on other priorities. If the house is rented or the owner lacks land tenure, there may be strong disincentives to sink money into expensive fixed investments. Emptying can be a challenge; often mechanical pit emptiers cannot reach the household or prove too expensive, so informal manual emptying (or unhygienic 'flushing' into the surrounding neighbourhood) is more likely. Household toilets, with their lower loading, can take longer to fill than the other facilities, and therefore are less likely to be considered regular 'customers' of whomever undertakes the emptying.

2 In settings where there is more space and soil conditions are favourable, latrines can be re-sited, with a new pit dug and the old one covered while the waste within biodegrades. In urban slums, however, there is often no room for such an approach, and superstructures can be considerable affairs that people are little interested in trying to move from one site to another. In the informal settlements BPD visited, most of which are becoming more dense over time, the rural option of digging a new pit and re-siting the slab and top structure is no longer viable. Authorities may also be concerned about leakage from pits contaminating the water table.

3 See WSP fieldnote "*From Hazard to Convenience: Towards Better Management of Public Toilets in the City of Nairobi*" (2004). Communal facilities are often found at public places like markets, bus stations, mosques, etc. Yet these rarely substitute for residential facilities. As people work and travel during the day they need sanitation facilities at different locations (while disease can be transmitted at any point).

Urban pit emptying

There are essentially five options once a pit is full.

1) One can seal the old one and try building a new one, as is common rural practice. However a lack of space and the expense tend to mitigate against it (for instance, even a drum latrine pit – the cheapest and smallest pit type – costs around $30 in Dar es Salaam).

2) One can stop using the pit and hope there is some decomposition and draining of the liquid wastes over time, in the meantime trying to use a neighbour's facility or reverting to 'wrap and throw' (Kibera's famous 'flying toilets') or open defecation. For many, heavy latrine loading, groundwater infiltration, pit clogging and disgruntled neighbours make this option unviable.

3) On hilly ground or where there are seasonal floods one can rely on 'natural flushing'. Here water coming into the pit (whose slab is often raised a metre or more above ground level) washes out some of the contents, either into a nearby watercourse or into the flooded neighbourhood (common practice in Dar es Salaam for instance).

4) A fourth option is to empty the pit manually and either bury the waste in an adjacent hole or dump it nearby (or into a sewer manhole in the unlikely event that one is close to hand). Emptying can be done by the householders themselves or more frequently by informal pit emptiers.

5) The fifth option is to de-sludge the pit mechanically and transfer the sludge from the plots – with a vacuum truck if this can gain access, or with specialised (typically donor) technology such as the Vacutug or Brevac systems.

All of these options apply both to household and shared facilities, while for communal facilities (e.g. public toilets) either option four or five are more likely (although the others are practised). Occasionally facilities are sited over a sewer and are no longer on-site solutions, but given the paucity of sewers in many developing country cities, this option is applicable to very few communities. (Adapted from Steven Sugden, 2005.)

As the above suggests, unless an affordable tanker service can gain access and remove the stored waste (or the facility discharges into a sewer), much of it is disposed of in the immediate vicinity of the facility being emptied. This can pose a significant threat to human health (especially where the waste is not buried) thus drastically undermining the public and community benefit of any sanitation or health education programmes active in the area. This is especially so given the externalities of poor hygiene practice, where disease is readily transmitted through a community.

The emptying of latrines was certainly a major issue for all five cities with which BPD worked. For householders, emptying is often at least as important as the provision or improvement of a latrine – particularly where the water table is high or in areas prone to flooding. The narrow alleys and difficult terrain that characterise many slums often make it impossible for the prevailing emptying technology, vacuum tankers, to gain access to household or shared latrines. Communal facilities are typically easier to reach and thus to empty, but users still need to pay for maintenance, otherwise the facility soon becomes unusable. Often this aspect of public toilets is also sadly neglected. Instances of communal toilets being sited out of the reach of vacuum trucks or the sewerage network are unfortunately not uncommon.

The difficulty of removing waste from thousands of household and shared facilities, and maintaining communal toilets, can therefore greatly jeopardise the public good aspects of sanitation provision (e.g. protection of the environment or public health). The manner in which latrines are emptied (and waste treated or not) is therefore crucial. Yet this aspect is often neglected and the links between providing access to on-site sanitation facilities and maintaining them over time are often not made. For instance, toilet building campaigns commonly provide extensive information on construction approaches and costs without discussing the need for regular emptying, or helping to ensure there is a reliable service to do so.

Keeping sanitation facilities in use

Manual pit emptier at work in a Nairobi slum
© Sabine Bongi / WSP

If urban on-site sanitation facilities are acting more as storage for human waste, rather than as a means of treatment, how is that waste removed and disposed of? For if waste is not removed, the facility can no longer be used. If waste is not treated the environment and public health likely suffer.

The box on the previous page shows how, in East Africa, waste is generally removed from a sanitation facility (pit or toilet block). As cities grow, neighbourhoods become more dense and increasingly unsuitable land is used for shelter. This progressively rules out emptying options one and two. Option three (natural flushing), though widely practised, is hardly to be encouraged, which leaves either manual or mechanical pit emptying. The former is sometimes done by households themselves, but often these services are commissioned. The services are sometimes public (municipal vacuum trucks or labourers), sometimes private (manual emptiers and privately owned trucks) and occasionally community-based (an NGO-run vacutug). In the five cases BPD visited, the challenges of difficult terrain, informal or illegal settlements, and limited access means meant that manual pit emptying was predominant.[4]

Who commissions pit-emptying?

In Lesotho there has been a large influx of people into Maseru in the last five years – the majority of these live in corrugated iron line housing (malaene) and pay short-term rental. Sanitation facilities are typically shared and often rudimentary, in sharp contrast to most owner-occupiers who, thanks to a government awareness and support campaign, have invested in sturdy VIPs for the household. In Dar es Salaam and in Nairobi many people were also renting (single rooms in a shared house) and it was not uncommon to find fifty or more people sharing one pit latrine.

In such shared accommodation, pit emptying is sometimes the responsibility of the landlord, but frequently it is left to the tenants to organise and pay for. Where owner occupiers have a traditional latrine or VIP, they engage the emptier. Both of these often use the services of a middleman, whether emptying is manual or mechanical.

Thus the emptier is often engaged directly by those facing the immediate challenge of the full pit, who have incentives to manage the problem. Whether they seek a long-term solution is a further question – if those commissioning the emptying are transient tenants they may prefer to pay less and have the pit usable for another few months, rather than pay for a tanker that will empty it fully (thereby paying for the waste of previous tenants and subsidising the use of later ones). Owners may base their decision on cash available or whether vehicle tankers can gain access.

Indeed manual and mechanical service providers seldom compete in the same market. The respective service providers serve niche markets, determined by access, latrine content and clients' access to cash. Manual providers, rather than mechanical ones, generally serve poorer urban residents.

4 Manual emptying costs more per unit volume emptied, as demonstrated in the MAPET programme (see box on page 6). This is a well known phenomenon related to the limited purchasing power of poor people, who will buy a cup of sugar at a time rather than a bag, despite it being pro rata more expensive.

Manual emptying is usually undertaken by people who have nothing to sell but their labour and who cannot find other casual jobs – often the elderly or the socially marginalized. Some lack even the most rudimentary tools of their trade and are obliged to rent a spade, bucket, drum and trolley for each job. Slower than mechanical emptying, manual emptying is often the only way of getting the job done. It tends to be more expensive by volume, but offers users the option of buying time by removing increments of sludge for a manageable fee; this often suits poor households who cannot afford to have the entire pit emptied at one time. Shovels and buckets remove waste from pits. It is occasionally buried in a new hole near the existing latrine, but where space is short or the client unwilling, it is transferred to 100 or 200 litre drums which are then carted or trolleyed to the nearest dump site or transfer point. The need to ferry the waste away manually is a key bottleneck for most manual emptiers and constrains their earnings per shift: it is not the volume they can remove from the pit, but how far they must cart each drum of removed waste to a dump site that determines how much they earn. Nairobi is unusual in permitting sludge disposal into the sewer system (such as manholes in Kibera). In contrast, Maputo does not, which has handicapped mechanical emptying as well (see the box on the next page).

Mechanical emptying is generally cheaper to the client than manually desludging the whole pit, extracting the waste far faster and with a large holding tank able to absorb the entire contents of a latrine at one time. Tankers can also manage long-distance haulage, typically depositing their waste either legally (and often for a fee) at public treatment plants, or illegally in local streams (again, dumping in manholes is sometimes legal, sometimes not). Their operations are generally confined to the road network – partly as latrines along the narrow alleys and hilly footpaths of many settlements are inaccessible; partly as the ability to pay in richer areas is better; partly as operators prefer the liquid conservancy and septic tank effluent, and not the heavy sludge and solid waste found in old latrine pits that frequently blocks their pipes.[5]

Occasionally there is a market for private operators to empty latrines, such as in Dar es Salaam, yet they tend to focus on the richer areas of town and play a limited role in poorer communities. Subsidies are important to the tanker market. In Lesotho, the cost of tanker services is held low and the service runs at a loss. This has made private investment impossible (a South African tender was refused as it would have required either significant tariff increases or explicit contractual subsidies) and encouraged 'moonlighting' by tanker operators, where a third of trips are for private gain. In Dar es Salaam there is a thriving private market, but even here the assets were effectively given away when privatised – the depreciation value (i.e. the cost of replacing the trucks once they reach the end of their working life) is not being priced into services. Cut-throat competition thus keeps the prices too low for long-term sustainability and a problem is likely once the existing trucks reach the end of their lifespan. In Kibera, Nairobi, a few trucks were donated by NGOs, however their subsidised (yet limited) operations have driven out the private sector and restricted the size of the market serving poor customers. In Maputo an emptying service run by the CBO ADASBU is similarly undermined by a subsidised, yet limited, public service.

5 The above description of manual and mechanical service providers is taken from a trigger paper prepared by Kathy Eales in May 2005.

The challenge of sludge disposal

In Maputo, MSF helped set up a CBO called ADASBU which works in Urbanização on drainage, water supply and sanitation issues. Much of its financial base comes from an emptying service it offers the neighbourhood, for which it uses a Vacutug (500l) and specially adapted tanker pulled by mini-tractor (1500l).

The original plan was to dispose of the waste into the neighbouring sewer. The municipality gave permission for this, however it was soon retracted by the National Ministry which oversees sewerage. An inadequate and unpopular compromise was for the waste to be transferred from the machines into two plastic tanks in the ADASBU yard (15m3). A municipal suction truck regularly came to collect it, subject to payment for fuel. With the fuel price hike of 2004, the municipal fee to empty the tank rose to US $75, which means the ADASBU now makes no margin on its household service and feels unable to pass on the cost. The Vacutug is thus out of commission while the mini-tractor takes its load slowly along the 4 kms of main road to the treatment plant. Accidents on the road constitute a problem and further financial loss.

In Dar es Salaam, two transfer stations were built to support WASTE's (a Dutch NGO) MAPET programme (which used small hand-pushed tanks and a vacuum pump to assist with manual pit emptying). On-plot burial of sludge was normal practice but impossible during the rainy periods when such transfer became necessary. Neither of the 10,000 litre stations was ever used though, due to problems in leasing the land and poor accessibility (a church group rescinded its permission and turned the tank into a private septic tank, while getting a permit to use the 'road reserve' is a notoriously difficult and often corrupt process). The practical difficulties and cost of a network of fixed transfer stations led to the concept of a mobile transfer station, envisioned as being a tank pulled by tractor (similar to those now used for solid waste in Dar), but lack of donor interest meant this was never realised.

In Durban, a modified waste skip is used for transfer and parked over a sewer or emptied by vacuum truck. It thus overcomes the problems faced in Maputo and Dar es Salaam. Page 10 has more details.

The challenge of disaggregated demand

Manual and mechanical pit emptying share an important characteristic: distances are crucial. Firstly, the distance between emptying the pit and disposing of the waste is vital to profitability. Secondly, and very importantly when carrying part loads, the distance between one job and the next can be decisive.

Comparisons with solid waste are instructive. When solid waste collection in informal settlements is organised, small amounts of garbage are taken either from houses or the end of the 'lane' and gathered at intermediate collection stations, often at the road on the edge of the neighbourhood. This is typically a manual process involving small push carts. The waste is then picked up from this transfer station by truck and taken to the dumpsite. Collection is frequent and demand aggregated – each house in the lane paying a small sum on a regular basis. When the system breaks down the results are visible and immediate (piles of rubbish accumulate) which can act as a prompt for external intervention. This fact has enabled Dar es Salaam to make solid waste collection a political priority, with municipal budgets to match and a series of private franchises where collection in a given neighbourhood (with both rich and poor areas combined) is contracted out. The distance any push cart has to travel is limited and its load small.

Sludge dumped into the neighbourhood, Nairobi © Sabine Bongi / WSP

In dense urban areas this paper argues that on-site sanitation must effectively be viewed as a system (emptying, removal and treatment of waste). This system has parallels with solid waste, but also several crucial distinctions.[6] The long lag times until a pit is filled make frequent and aggregated collection an impossibility; the emptier, whether manual or mechanical, cannot go from house to house along a lane, emptying each in turn. Each 'job' is discrete and often in a different part of the settlement or even a different part of town.

6 Hawkins (2005) points out that the term 'on-site sanitation' itself becomes somewhat inappropriate once systems incorporating transport and off-site treatment are necessary. Would 'unsewered sanitation' be better?

Treating waste in situ

If waste could be treated in situ, the challenge of waste removal and disposal would be eliminated. This logic led to the development of alternating pits with local digestion and to the concept of ecological sanitation (EcoSan). EcoSan proposes separation of solids and liquids at source with separate environmentally-sound removal and disposal paths for each.

The alternating pit system struggles when pits fill too quickly under heavy loading (with waste not having the time to digest) or when the treated waste from the old pit cannot easily be emptied and disposed of locally.

EcoSan produces two streams of waste: a solid one that is dried in situ, and a liquid one that is drained locally or used for agriculture. Yet in practice the complete solution it aspires to deliver is often elusive.

User commitment is needed to maintain the separation of liquids and solids at source, and user resistance to handling even desiccated faeces persists where there is no tradition of using human excreta as an agricultural resource. Accumulated urine is often not transported to urban gardens and can cause significant nitrate pollution in dense settlements. For sanitation management, the accumulation of urine and grey water can be as large a challenge as the accumulation of excreta.

In urban settings, it is perhaps more useful to consider EcoSan as one tool that does not substitute for collection and transfer of waste, but could be integrated into household waste management based on source separation. One of the advantages is a considerable reduction in the fixed costs of a latrine substructure, with no need to invest in deep digging and block lining, nor strong reinforced slabs to span wide pits. This, alongside other "small vault" systems, allows a shift from investment-based sanitation (with high on-site storage volume) to fee-based sanitation (with collection volume important) which may be more appropriate for certain areas (for instance those with high rates of tenancy). (Rijnsburger, 2004.)

Transfer stations rarely exist – there is no intermediate stop where manual emptiers (or for that matter a Vacutug or mini-Brevac) can deposit their load. Direct deposit in a sewer (in the unlikely event that one passes nearby) could be an option, but as the Maputo case (see page 6) demonstrated this is often forbidden (in Maputo due to fears that the heavier pit sludge would block the sewers). Consequently either each and every load is taken to its ultimate destination (legal or illegal) or an interim and often less satisfactory solution found, such as for ADASBU.

So while pit-emptying may solve the problems of some households, barriers such as those above lead to waste dumped around the corner or into a nearby gulley. For similar reasons, waste from communal toilets can end up in the immediate neighbourhood. In such circumstances, emptying provides only a service to a few neighbourhood residents (those directly using household, shared or communal facilities) and not does not benefit the community as a whole. The private good for some can thus undermine the public good for all.

Untangling relationships

On the previous page we refer to on-site sanitation as a system. That system works when human excreta is hygienically and effectively stored, removed and treated, with the waste products appropriately returned to the environment.

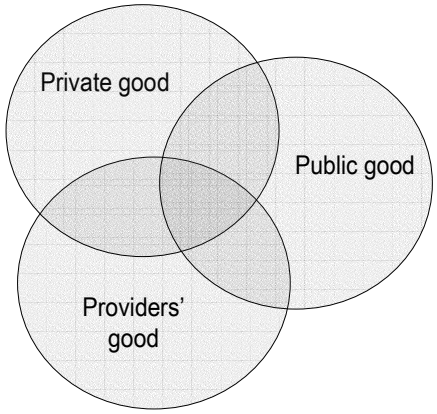
Yet as the preceding pages demonstrate, in many poor communities that system breaks down and the waste is deposited into the environment in a manner that is neither hygienic nor in the broader public interest. Often the technology used or the design employed is not the underlying cause of this breakdown. These factors are clearly important, but also significant in on-site sanitation are how the relationships between stakeholders play out. Especially significant are the perspectives, attitudes and incentives that frame the various stakeholders' interaction. Thus to understand how the system as a whole suceeds or fails, it is helpful to view issues such as technology choice or engineering design through the prism of how they influence stakeholder relationships, rather than as an end in themselves. Accordingly we now turn to analysis of the relationships between the parties, exploring what motivates each to act, or contrains their behaviour, and how this impacts on the functioning of on-site sanitation as an urban system.

The first issue to acknowledge is the sheer diversity of relationships. There is a large range of providers of facilities and services, from the masons who build household latrines to communities that build and run toilet blocks, from manual pit-emptiers to municipal-run vacuum trucks. These are catering for the needs of a varied group of customers, from pay-and-go users of toilet blocks to landlords letting out accommodation, from householders making home improvements to tenants emptying a shared latrine. Often the engagement between the two parties happens more or less organically, with little direct involvement of public authorities and other bodies. Yet when the system works we see that these providers are far from working in isolation. Manual pit emptiers in Kibera make use of sewerage facilities to dump their sludge. Private vacuum trucks in Dar es Salaam take their waste to public treatment.

The main document in the BPD Sanitation Partnership Series, '*Sanitation partnerships: harnessing their potential for urban on-site sanitation*', expounds a simple model to analyse these relationships, outlining three 'goods' that drive interaction between stakeholders. Households' and individuals' immediate interest is the *private good*. For on-site sanitation this is typically the use of a clean, comfortable and preferably private toilet that does not smell and is affordable to access, build, use or maintain. In urban settings such toilets and facilities fill up and need emptying at some stage, and pit emptying is thus one service that households across the continent are willing to pay for to maintain their access to a facility (unless they can resort to 'flushing'). Without emptying, the facility is neither clean nor comfortable, if it is usable at all.

The broader *public good*, which municipalities and other public bodies should be concerned with, includes protection of the environment and ensuring public health. Whether the emptying and removal of waste contributes to this is more in question, depending partly on what happens with the waste that is emptied. If it is flushed into the neighbourhood or dumped around the corner then neither the environment nor public health gain. Alternatively, if the waste is transported off-site and properly treated, a functional emptying service is an indispensable link in delivering the public goods of on-site sanitation.

This justifies the involvement of the public sector in what is otherwise an often private transaction between client and service provider. Such involvement is also diverse (there is a profusion of public bodies with an interest in sanitation) and ranges from support and subsidy to regulation and control. Yet the current dynamic in poor communities is often one of regulation rather than support, especially as regards emptying services.



Successful sanitation partnerships require a delicate balancing act

Linking up a system of on-site sanitation

In Maseru, USIT – the Urban Sanitation Improvement Team – took deliberate steps to link provision of sanitation facilities with their emptying. It advised residents on pit siting, linked them with builders certified in latrine construction who built large lined pits, and provided information on sound pit maintenance. For several years USIT had the resources – mini vacuum tankers – to provide a pit emptying service. In time the mini-tankers fell prey to the perennial spares and maintenance problems of prototype technologies, and the emptying service collapsed.

The link between how sanitation is accessed (the facility) and how the waste is treated (emptying and treatment) is clearly important. Peter Hawkins, a consultant on sanitation to the World Bank, notes that,

> "where excreta are not seen as a resource, as in Africa, the tendency is for large pits which will maximise digestion and make for long intervals between the disruptive and expensive process of emptying. Where excreta are seen as a resource, as in the Far East, frequent emptying is employed to maximise resource recovery, and acts as a strong incentive for the emptying service to function. Similarly, alternating pit technology only seems to work where excreta are seen as a resource."

From the system point of view, small and frequently emptied latrines are likely to have lower overall economic and lifetime costs, and require smaller individual expenditures by users, which are more easy to manage. The need for investment is shifted from the user to the service provider, whether the latter is public or private or a mixture of the two. However, users are unlikely to make the shift unless they can be sure that the (emptying) service will be available whenever they need it. This has two linked consequences: firstly, the need to reach a scale at which it is economic to have spare (standby) capacity, and secondly, the need for transitional support so that early adopters can be reliably served before an economically self-sustaining system is established.

Lower technology forms of sanitation service have some clear advantages: manual emptying for instance costs less and is more flexible – it can cope with areas of slums that higher 'levels of service' cannot necessarily cope with. Bucket systems provide another example. Both are widely practised and allow someone to make a living from removing waste – this keeps the service going and available for poorer communities. Yet such approaches rarely find favour with external support agencies. Specialised equipment they have supported – Vacutugs and Brevacs, for instance – developed specifically to work in such difficult conditions, has suffered both technical and managerial challenges, and is not widespread.

Ghana may be one exception, as Hawkins notes,

> "manual removal and local burial and bucket systems are both unhygienic but are sustainable and provide an overall benefit compared to no service at all. Bucket systems could be easily upgraded to emptiable vaults, and this is now happening on a trial basis in Accra. The first stage was the development of a mini-tanker capable of accessing the existing bucket latrines, and the vaults are now under development. MAPET (in Dar es Salaam) was an attempt to improve the manual pit emptying system, but failed due to the requirement for secondary transport where local burial was not an option." (Hawkins, 2005)

Emptying services are delivered by a range of service providers, both manual and mechanical. For such service providers, the *provider's good* is a prime consideration: the need to be financially, politically and socially viable. Finanically, this means payment for their services needs to more than cover their costs, coming either directly from users or via subsidy from the public purse. Politically they need to be accepted into the system and socially they need to be welcomed by communities.

For any particular delivery system to work the provider's good will have to be met over time. Given sanitation's precarious finances, this is not easy. Households, who are poor and for whom sanitation is rarely a top priority, are prepared to pay for pits to be emptied, but only to the extent that their immediate needs are met (the private good). The full price of the formal service, which includes the often high costs of transporting and treating waste, can be greater than communities are able or willing to pay for themselves. In which case households revert either to informal service providers (who dump illegally, and can include formal providers 'moonlighting') or informal emptying (along the lines sketched out on page 3).

Yet when the system as a whole functions, on-site sanitation can contribute strongly to the public good. This therefore provides a strong argument for public bodies not only to regulate on-site sanitation provision (including emptying), but to support it.[7]

The government (or donors) must be ready to put public money towards the public good and while household resources should be leveraged to the extent possible, subsidies are likely needed. These can be used to pay for hygiene education or help fund public treatment of waste. Subsidies can pay for the provision of infrastructure, such as transfer stations where providers can deposit collected waste, allow cheap credit for private providers to invest in vacuum trucks, or provide basic equipment (handcarts, MAPET-type technology) that can be leased to informal entrepreneurs daily. Such subsidies to support on-site sanitation would be akin to the public financing of primary and secondary water networks, public investment in sewers or the payment for street sweeping that underpins Dar es Salaam's solid waste franchises.[8]

Financial support is not the only assistance that the public sector can provide. A further area ripe for partnership is the transfer of waste into the formal urban drainage network. As the case study on page 6 demonstrated, the interface between primary waste collection and secondary transfer and treatment can be problematic. Difficulties here can not only pose a direct challenge to the viability of service providers, but, by encouraging illicit dumping, endanger the environment.[9] Partnerships between municipalities, drainage authorities and providers can improve upon this: making it easy and affordable for providers to transfer waste into the municipal network and get the waste from poor communities treated. An example of good practice at this interface is the development of a specialised transfer facility by eThekweni municipality in South Africa (see below). This points the way for other authorities to follow; who through urban planning, the provision of communal facilities, and support with sludge transfer and treatment facilities can make valuable investments in the broader public good.

Sanitation Franchising in Durban

Ethekwini metropolitan municipality, whose centre is Durban in South Africa, has roughly 3 million people. An estimated 100 000 pit latrines serve the urban poor or more rural residents, often on hilly ground. The city is committed to providing all residents with an acceptable toilet by 2010 and provides many for free (in line with the government's free basic services policy). However, a growing number of eThekweni's toilets, especially urban ones, are full and pose a significant risk to both public health and the environment.

In response the municipality made a recent commitment to empty every pit latrine in the city, free of charge, once every five years. At 20 000 toilets a year this is a large undertaking, so in late 2003 the municipal water and sanitation utility piloted ways it could be done. Its municipal de-sludging service offers a suction tanker service at a highly subsidised rate, but in the crowded and hilly informal settlements it decided

7 Merely trying to use regulation as a means to protect the public good by imposing strict conditions on providers and controls on households is unlikely to achieve the desired effect. This will drive up costs and reduce the diversity of services available to households, pushing them from away from formal services into self-help and the informal market with probably undesirable consequences for the public good.

8 Municipalities have bundled street sweeping into the contracts: they pay for this out of the public purse – vital to making the franchises financially viable.

9 Where this interface is dysfunctional, waste is dumped into the environment, providers go out of business, or the service to the household becomes unaffordable and they resort to less satisfactory solutions. None of this delivers the broader public good.

(after much testing) that a manual emptying service was more appropriate: cheaper, more robust and job creating.

Working through community structures and local politicians, the municipality identified 500 full or nearly full pits in a given community and using local labourers equipped with gloves and shovels went from house to house emptying pits, transferring the waste to drums and trolleying them to a transfer point. This was a modified skip that screened out the solid waste, with the liquid waste either washed into the sewer system or taken to the treatment plant by suction tanker.

The municipality is now working on a scaled-up scheme whereby a contractor (franchisor) will oversee small franchises, bid upon by small and medium enterprises. These will work throughout the city in conjunction with the municipality, local councillors and a social facilitator. The public utility will set the price structure and monitor performance with bids evaluated based on competence and capacity.

eThekweni's approach thus overcomes some of the problems we have highlighted. The emptying is done manually (and creates local jobs) but the involvement of the municipality ensures that waste is removed and treated. The franchise arrangement ensures that a viable business model is put in place, with regulation from customers via formal complaints mechanisms and surveys (adapted from text by Kathy Eales, 2005).

All three of our goods are delivered: the private (latrines built and emptied), public (public health and environment protected) and provider's (viable businesses created).

Of course South Africa is special; it has the capacity, finance and policy to provide basic services to informal settlements for free. The supply-driven rather than demand-driven schedule enables it to both aggregate demand and create liaison structures within communities. Centralised contracting ensures scale and a viable business model.

Yet if some public money can be made available, such a model could perhaps be adapted to contexts such as Maputo or Dar es Salaam. Marketing and willingness to pay would be larger features of the equation and a way needs to be found to aggregate demand, but the public sector role in encouraging sanitation provision and in assisting with the removal and transfer of waste should be replicable. An acceptance that subsidies are necessary for sanitation but should go towards delivering the public rather than the private good would be the starting point. Households could pay for their latrine and for some of the emptying cost, while the public sector invests in supporting the market, in education and awareness, and contributes to the cost of removal and treatment through providing public infrastructure (such as skips) or offering credit to suppliers (e.g. collateral for private investment in rolling stock).

A blend of the franchise models of Durban and Dar es Salaam would allow franchisees (whether private, community-run or a combination of the two) to be paid for hygienic storing, collecting and removing waste from poor neighbourhoods and delivering it for public sector treatment.10 They should be left to develop much of the detail and innovation on the ground, but could nevertheless be encouraged to market their emptying service alongside new or improved toilets for households. Support for building communal facilities would allow them to cater for renters, poorer individuals and non-residents such as taxi passengers or market-goers. Sidelines in building toilets or paying shower facilities could

10 An explicit subsidy could be paid for quantities of human waste hygienically collected and removed from poor neighbourhoods and delivered for treatment at public treatment works (which would have to be effective for the environment to be protected, admittedly not always the case). This ties in with the concept of Output Based Aid, which directs subsidies towards the provision of explicit outputs. BPD has recently been engaged with discussions about how OBA could be used to engage private entrepreneurs in communal toilets in Delhi's slums and replicate Dar es Salaam's experience in solid waste for liquid waste management.

open up and support the business. Any communal facilities could double as a transfer station for manual emptying (as getting land and approval for stand-alone facilities are not straightforward). Government involvement could open up other avenues for dual usage, such as under car parks, secondary roads and public facilities (Accra has over 50 municipally-owned holding tanks along these lines (Hawkins, 2005).

What role for partnerships?

At the start of this paper, it was noted that BPD was interested in looking at sanitation partnerships. Given the above discussion of an on-site sanitation system and the importance of the stakeholder relationships, what role might there be for partnership? Although successful sanitation partnerships do not appear to be widespread, there is tentative evidence to suggest that partnerships can benefit poor households, both as private individuals and as a public community, by forging four types of linkages:

1) The first linkage is between the various segments of the system (the provision of access to a facility, the removal and transport of waste, and its eventual treatment).

Partnerships can push the building and emptying segments closer together. One way is by linking programmes that aim to improve sanitation *facilities* with support to emptying *services*. The USIT programme in Maseru pioneered this approach in the late 1980s - bringing building and empting together - with the public sector making the links. If providers themselves (rather than the public sector) could be persuaded to diversify across this gap, both building latrines and emptying them, then they could build stronger relationships with householders and communities. This would encourage a more stable and accountable customer relationship. If by doing so, the provider could better aggregate demand they would bring down costs. Decisions about facility design could also take into account the likely need for a continuum of emptying, transfer and treatment.

Partnerships could also foster a more supportive approach from public agencies; encouraging them to recognise the valuable service that emptiers provide. A welcome step would be to assist providers to safely dispose of their product (rather than strangling them with unworkable regulations and red tape).

2) The second role for partnerships is to forge linkages between the public and private sectors and civil society.

The private sector currently offers a range of sanitation services, often with little support from the public sector or civic organisations. Yet they have much to offer each other: the public sector should see private activity as the foundation of a more expansive sanitation system (one that delivers public goods alongside the private goods delivered now). Support to service providers could reduce the barriers that hinder their work. For instance, civic organisations could help market their services and aggregate demand, bringing down costs for both providers and clients.

Blending the different types of facilities on page 2 (*communal*, *shared* and *household*) would enable sanitaiton to better cater to the diverse needs of poor communities (and thus enhance the likelihood of health benefits). Householders who can afford it prefer individual facilities, but a communal block can reach those who are too poor to afford their own toilet or those with fewer incentives to invest, such as renters. Its construction and ongoing physical presence also afford a useful prop for the creation of a local community based organisation. These CBOs can reduce the transaction costs for outsiders of dealing with thousands of households individually, as well as providing a useful route for education and awareness activities.

Linkages to the municipal sphere are also important. When a politician opens a public toilet, a tangible link is forged; the same politician can be pressured to act should the facility fall upon hard times. This promotes political will for sanitation (akin to engaging local politicians in Dar es Salaam over growing piles of rubbish).

3) The third linkage is between formal and informal service provision.

The majority of 'sanitation transactions' in poor communities take place in the informal market, for instance where landlords engage local masons, or renters employ a manual pit emptier. There is much to be said for this; unless such organic relationships undermine the public good (badly pollute the environment, endanger health) then they should be left to operate unhindered. The case for public intervention, which may seek to bring this activity into the formal realm, runs along two lines.

Firstly there may be a case for harnessing these types of existing relationships to further the public good; for instance by encouraging masons to provide rudimentary hygiene education alongside their building work. Secondly the public sector may wish to intervene to improve environmental protection or safeguard public health; for instance by discouraging illicit dumping of waste. Compulsion certainly has a role to play here, but should not be the sole resort. 'Hard' regulation works better when combined with incentives to encourage change; the activities of USIT in Maseru are an example of this in practice.

4) The fourth and last role for partnerships is to create linkages between the sanitation sector and other sectors.

Solid waste management is a prime example here. In Maxaquene B, a Maputo *bairro*, a local entrepreneur manages both liquid and solid waste, thus bringing a holistic approach to tackling the environmental problems of his neighbourhood. For him this handily reduces the cost of marketing each service he provides. From the community point of view it sensitises people to a range of issues. Such combined franchising also exists in Accra and has made the solid waste business there more sustainable, since Ghanain customers are highly motivated to pay for human waste removal (while their other rubbish goes too).

Page 6 highlights how by thinking of solid waste management we can view on-site sanitation as an urban system. More tangible links between the two sectors are also possible. For instance if the sludge transfer stations outlined on page 10 were developed, they could be combined with transfer points for solid waste (burying the sludge tanks beneath solid waste skips). This reduces the footprint of both and can cut costs.

HIV/Aids is another sector with which sanitation professionals could forge stronger links. In Lesotho it was noticeable that today most public health announcements relate to HIV/Aids, displacing some of the sanitation messages seen a few years ago. Yet access to sanitation is extremely important to HIV sufferers, playing an important role in keeping those on anti-retrovirals healthy. This may be a further area for partnerships to explore?

Conclusions

This paper discusses the need for on-site sanitation to work as a system and debates the potential for partnerships. Much of the discussion is therefore forward looking, extrapolating from the existing experience on the ground in five case studies. Yet BPD's observations do suggest some very concrete conclusions:

1) Too little attention is paid to the fact that on-site facilities are typically only one link in a broader chain of waste removal and treatment.
2) For the public goods of sanitation to become a reality, public subsidies will be often be needed. These subsidies need to reinforce rather than undermine the private and provider's goods.

3) Manual latrine emptying needs to become a recognised part of broader solutions and the health risks must be mitigated.
4) Solid waste offers interesting parallels for on-site sanitation but disaggregated demand remains a key challenge.
5) Sludge transfer and disposal are key bottlenecks to delivering a viable sanitation system.
6) Partnerships may offer one way of reconciling the links needed, but sanitation offers challenges distinct from either water or solid waste.

This paper forms a spoke in BPD's 'Sanitation Partnership Series'. For more on the role for partnerships in on-site sanitation, on the importance of tenancy arrangements and on how some of the unique features of sanitation impact partnership approaches, see the other outputs of this work, including the overview document: '*Sanitation partnerships: harnessing their potential for urban on-site sanitation'*. Together with information on the five case studies referred to, these can be found at http://www.bpdws.org.

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Please note that the opinions expressed herein are those of the author and not necessarily those of BPD or its members.

Building Partnerships for Development in Water and Sanitation (BPD) is a not-for-profit membership organisation that supports public, civil society and private sector decision-makers and practitioners engaged in partnerships that provide water and sanitation services in poor communities. Active since 1998, BPD focuses on how best to structure, manage and assess such multi-stakeholder collaborative arrangements.

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