GOAL

HIF Humanitarian innovation fund | elrha

What Potential is there for Container Based Sanitation and the Social Enterprise in Urban Emergencies?

Alan Reade
December 2016

Table of Contents

Acronyms

CBS	Container based sanitation
HH	Household
HIF	Humanitarian Innovation Fund
HRA	Humanitarian Response Agencies
IFRC	International Federation of Red Cross and Red Crescent Societies
SE	Social enterprise
SOIL	Sustainable Organic Integrated Livelihoods
UDDT	Urine diverting dry toilet
UNHCR	United Nation's refugee agency
WTV	Waste to value

This report was produced by GOAL as part of the project: Integrating social enterprises into emergency faecal sludge management.

This project is supported by Elrha's Humanitarian Innovation Fund - a grant making facility supporting organisations and individuals to identify, nurture and share innovative and scalable solutions to the most pressing challenges facing effective humanitarian assistance.

The Humanitarian Innovation Fund (The HIF) is an Elrha programme is funded by aid from the UK Government, the Swedish International Development Agency (SIDA) and the Ministry of Foreign Affairs (MFA).

Visit **www.elrha.org/hif** for more information about The HIF and Elrha's work to improve humanitarian outcomes through research, innovation, and partnership.

Contact

Alan Reade, Email: **areade@goal.ie** or
Ammar Fawzi, Email: **afawzi@goal.ie**

Introduction

Sanitation response for urban emergencies continues to present serious challenges to Humanitarian Response Agencies (HRAs). Urban environments present their own unique setting and often add multiple constraints which can confound response strategies. Among the biggest challenges are:

a. High population density
b. Limited/lack of open space
c. Inability to excavate (concrete cover/lack permission)
d. Insecurity (night time for women, children and even men)
e. Poor access for latrine emptying
f. Land tenure issues

On top of these constraints, very often the pre-existing levels of sanitation access and service provision are woefully inadequate with viable permanent solutions yet to be identified or implemented.

In most emergency situations, for both first phase and second phase response, the default sanitation option, where suitable, is the simple pit latrine consisting of an unlined pit and basic superstructure - often a combination of poles, tarpaulin and corrugated galvanised iron sheet. It can be built quickly and cheaply and is usually accepted by most communities. However, even in rural environments there are situations where this technology choice is no longer the most appropriate. For example where there is:

g. Risk of flooding
h. High water table
i. Low infiltration rate
j. Rocky ground
k. Collapsing soil

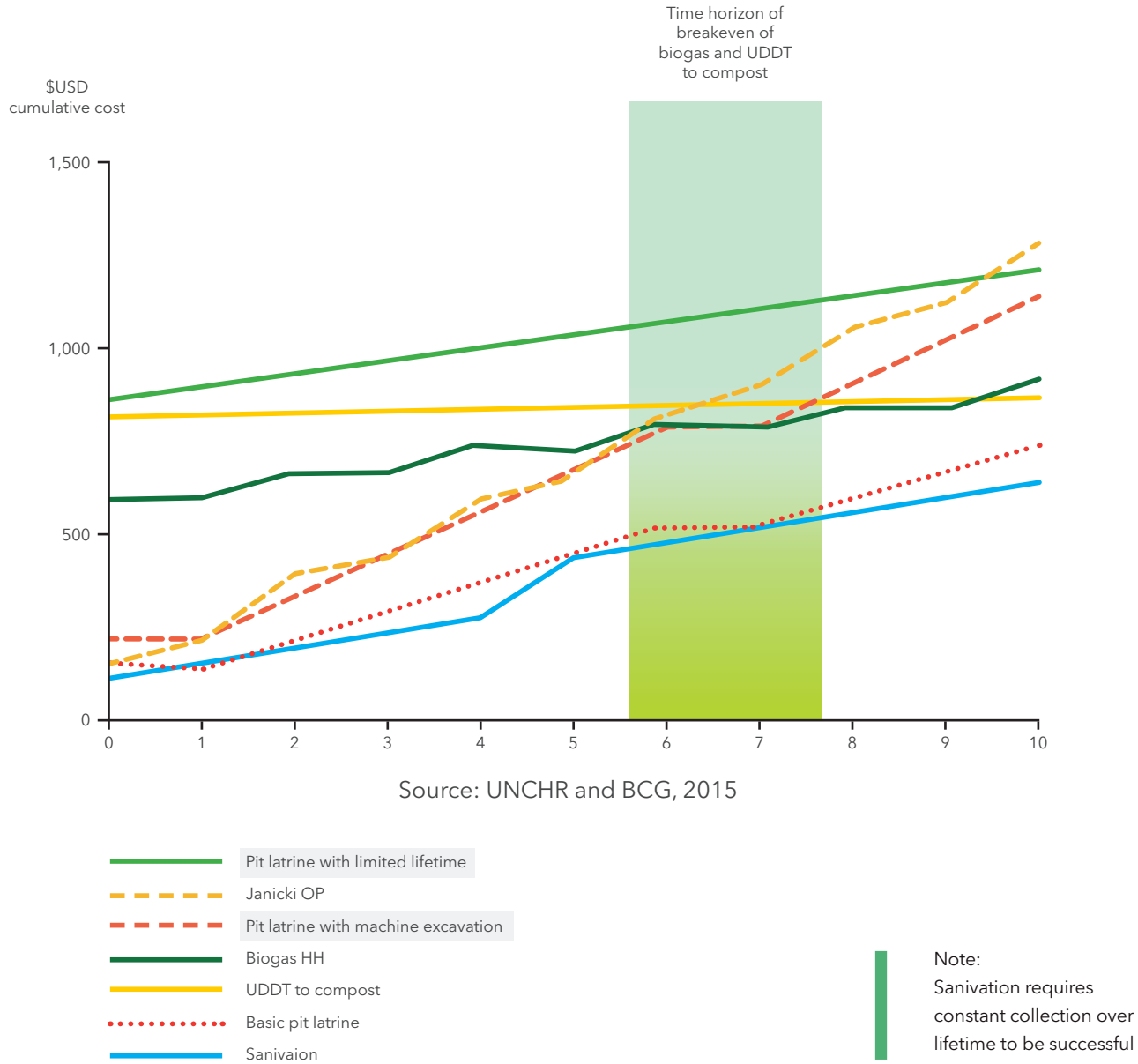
Where any of these constraints exist – from either urban environment or ground/climatic conditions, alternative sanitation technologies to the pit latrine need to be selected.

Technology Choice

Traditional alternatives have included: lined pit latrines, raised latrines and urine diverting dry toilets (UDDTs). These alternatives might be suitable in addressing the unfavourable ground conditions (g-k above), but are not necessarily able to address the constraints encountered in the urban environment (a-f above). For this reason agencies have started to take a closer look at some of the newer container based sanitation (CBS) approaches being developed by social enterprises (SEs), research institutions and the private sector.

In order to address some of the constraints above and also issues of cost and sustainability over a longer time horizon, UNHCR has recently initiated an in-depth research project investigating the potential of available alternative sanitation technologies to be used in camp settings. The project has so far completed a desk based evaluation of some 27 potential alternatives selected from research institutions, social enterprises, private sector and entrepreneurs (UNCHR and BCG, 2015).

Figure 1: Cumulative costs per toilet over 10 years



Source: UNCHR and BCG, 2015

Notes:
Pit Latrine with limited lifetime - small pit and or high user ratio
Janicki OP = Janicki Omni Processor – all in one advanced mechanical waste processing technology
Pit latrine with mechanical excavation – due to rocky ground unsuitable for hand digging
HH Biogas – e.g. B Energy who produce biogas from anaerobic digestion transported in a HH scale flexible bladder.
UDDT – Urine diverting dry toilet – usually double vault. Once 1 side is full it is closed off until converted to compost
Sanivation – HH level CBS service converting waste into charcoal briquettes that can be sold / used in the displacement camps.

The report of Phase 1 of the project attempts to compare initial installation and set up costs as well as ongoing operation and replacement costs (where required) over a 10 year timeframe. In most situations the basic pit latrine proves to be the most economical (with the exception of certain household level UDDT (Sanivation)). However, if any of the constraints discussed above are encountered then alternatives become more cost effective over the long run, despite higher initial costs. Clearly costs associated with the initial construction and ongoing operation of any sanitation intervention will vary from location to location – particularly between countries and often significantly dependant on the level of participation from the displaced community that can be generated – this emphasises the role that the implementing agency has in involving and considering users where possible as a means of increasing ownership. The UNHCR report establishes a range of pit latrine costs from the most basic at approximately $70 each to the upper extreme of $1200 for pre-fabricated complete units. The costs shown in the graph above represent average costs from the range established through the research. It is based on the initial construction and recurring operation and maintenance costs predicted over the 10 years, but does not take into consideration the potential for revenue earned from the waste to value opportunity. If these are considered, the report proposes that there is potential for further savings of up to 39% for BioGas and 22% for briquette production.

Whereas this research highlights that there are exciting possibilities for CBS and other new technologies for refugee settings, it recommends further study to build evidence and learning before they can be considered with equal confidence when making technology choices.

The above graph shows that there are a number of possible technologies that could be cheaper in the long run (mostly when basic pit latrines are not viable), the report also discusses the other benefits that these 'waste to value' technologies can bring. These include the production of energy or fertilizer, livelihood opportunities for residents and host community and greater participation / involvement of the community with the potential to generate greater awareness around sanitation management issues as well as operation and maintenance.

Whereas this research is useful in highlighting some of the longer term benefits of these newer sanitation technologies, it is of limited value when considering the problem of technology choice for more short-lived urban sanitation emergencies. There are some significant differences between a camp setting for people displaced due to conflict, say, compared to a camp setting where people have been temporarily displaced due to a flood or earthquake. One of the biggest differences is the anticipated longevity of the displacement. Refugee camps currently have an average lifespan approaching 20 years compared to typical camp life span of a few months to few years in the case of natural disasters. The incentives for investment into sanitation structures or systems that will last, is therefore (or should be) much greater in a refugee camp.

Technology Choice for Urban Emergencies

In order to assess the possible suitability of the newer CBS technologies, what is needed is a direct comparison of traditional sanitation approaches and CBS in the same, or very similar, setting. Unfortunately many of the new sanitation technologies (CBS and others) are still in relatively early phases of development and have not been piloted in these settings so direct comparison is difficult. Indeed many of the social enterprises, some of which have been operating in relatively stable environments for several years, have still failed to reach significant scale or approach profitability.

In a recent planning exercise with Nairobi City Council, GOAL attempted to develop an emergency sanitation contingency plan for the informal settlements if Nairobi (Mukuru specifically). During the process it became clear that despite having access to considerable experience and expertise from a number of social enterprises in Nairobi (Sanergy, Sanivation, Banza, Peepoople) there were still many challenges foreseen with an emergency CBS system. In particular the ability to quickly reach scale seemed to be the most significant. Then, assuming scale could be reached, and a collection service established, the next issue was concerning the treatment of waste if a waste to value (WTV) model was to be pursued. It seems unlikely however that any significant proportion of the waste could be treated to create a product capable of generating enough revenue to substantially reduce the operating costs of a CBS service. The time required to set up a treatment plant, establish treatment/production and develop supply chains and markets would likely take too long.

Although this contingency planning exercise could be criticized for being somewhat short-sighted, it does highlight some of the issues that might be expected when trying to develop WTV options for and urban emergency in a location where no prior CBS knowledge or WTV experience already existed.

However, in emergency response situations there has already been a gradual move, over the past few years, towards the use of CBS in its simplest form of bag based sanitation. Bag based systems are gaining greater acceptance as a practical response during the initial onset phase of an urban emergency - usually for the first four to eight weeks. This response has tended to see the use of PeePoo bags alone or in combination with ordinary plastic bags (often used by residents as their own solution to the lack of sanitation). The benefits of this technology are in its speed of deployment – enabling safe excreta disposal from the very earliest opportunity and its flexibility which is created by not needing permanent structures in the ground thus enabling neighbourhood approaches as well as camp settings.

Learnings from both early and recent trials of this bag based technology have highlighted critical factors to its success (Forster, 2010; Parsa et al., 2014). The primary one being the importance of a robust and well planned waste collection system being established ahead of the distribution of bags. Others include the existence of appropriate disposal options (including required approvals) and the thorough implementation of hygiene promotion activities to ensure correct use and handling/disposal of the bags.

In the pilots and trials so far conducted the response from users has generally been very positive. One of the most frequent benefits mentioned being the added convenience and safety created through being able to use it in the home and at night. One of the major drawbacks of communal latrines is the lack of access at night for women and children – and even men in some cases (IFRC, 2010).

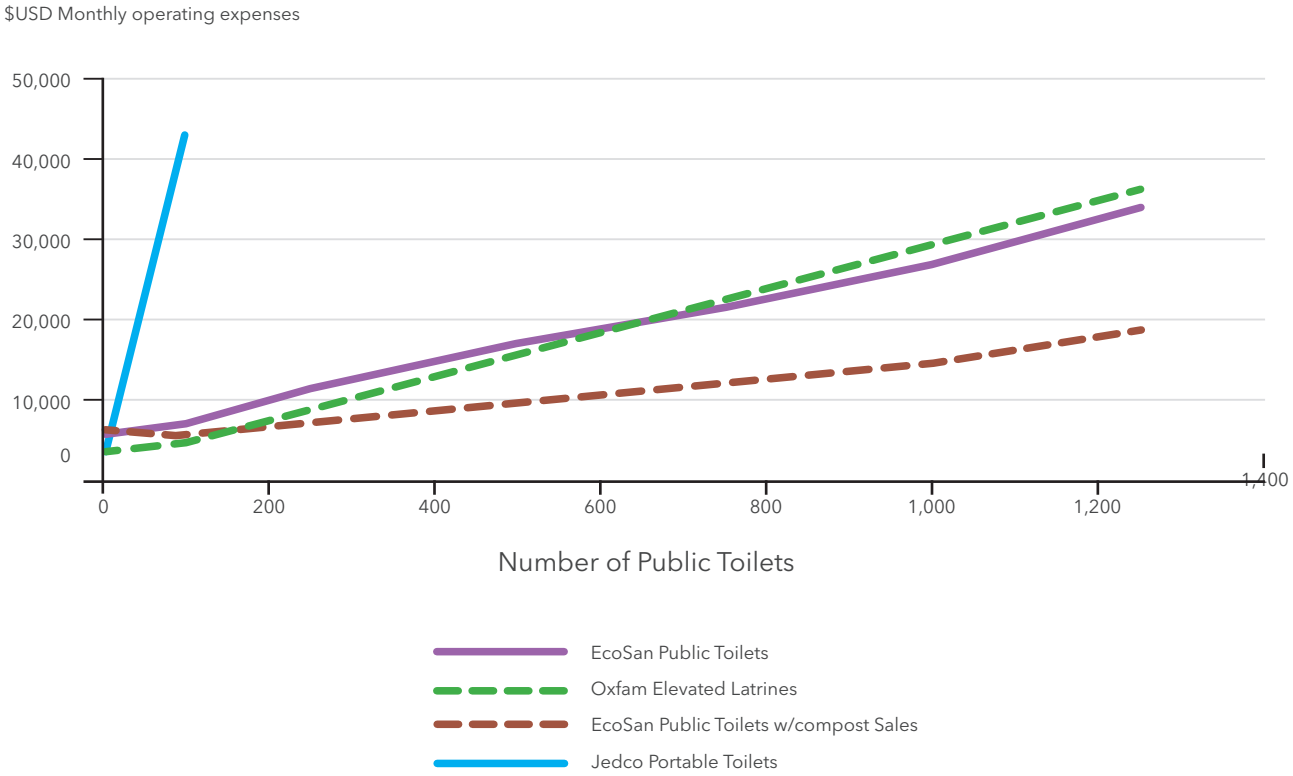
Whereas business models vary considerably between the SE, there are considerable similarities between the toilet designs being used to provide household (HH) level service. A number of SEs have been developing their

own designs over a number of years. In Haiti SOIL found that perfecting the toilet design to suit the community took much longer than anticipated and slowed down their implementation at the beginning of the intervention. One of the projects the Emergency Sanitation Project is looking at (Oxfam, IFRC and WASTE)[1] is to develop plastic modular design toilet for use in informal settlements or emergencies. If this design can be proven in a number of different settings, then it would be possible to plan an intervention quicker by importing large numbers of the required toilets – confident they are suitable for the task in hand.

Pilot studies using PeePoo and bag based sanitation have been reported on a number of occasions, there is still little evidence, that has been reported, comparing CBS / WTV sanitation to more traditional approaches in urban emergencies. Reported experiences from Haiti, however, do offer some comparison data through the work of SOIL and Oxfam. SOIL are a social enterprise who had been working with Eco-San public toilets for a number of years before the earthquake hit in 2010.

SOIL have produced some cost comparisons for public and private latrine operational costs and extrapolated their own costs to demonstrate the potential savings and earnings available from scaling up their service (SOIL, 2011).

Figure 2: Comparative costs of Emergency Toilets in Port-au-Prince, 2011 (SOIL, 2011)



The cost estimates by SOIL for the public toilets clearly show the service costs are comparable to those of the elevated latrines built by Oxfam. However, once the revenue from sales of compost are considered the overall operating costs can be significantly reduced – by approximately 50% - though it is not clear which costs are actual and which are estimated. Table 1 below also gives estimated costs for the provision of household level services.

1 - Emergency Sanitation Project: www.emergencysanitationproject.org

Table 1: Cost analysis of providing EcoSan services in Haiti (SOIL, 2011)

	Cost Per Toilet (Monthly) (USD)*	Cost Per User† (Monthly) (USD)	Cost Per 100 LBS of Compost Produced (USD)
5,000 private EcoSan toilets‡	$2.19	$0.29	$11.23
1,500 private EcoSan toilets	$3.16	$0.42	$16.24
1,000 private EcoSan toilets	$4.18	$0.56	$21.43
500 public EcoSan toilets	$28.61	$0.57	$11.01
500 Oxfam public elevated latrines serviced by Sanco§	$27.50	$0.91	-
500 public portable toilets serviced by Jedco¶	$434.00	$4.34	-

*Cost assessments include all costs associated with the collection and treatment of wastes for a SOIL EcoSan toilet in one of the Port-au-Prince neighbourhoods currently on a delivery schedule including vehicle depreciation, gas mileage and salaries of compost site and collection labourers.

†Per user costs for public toilets are based on an average of 50 users per public toilet.

‡Private toilet costs per user are based on an estimated 7.5 user accessing each household toilet.

§Based on the estimated amount of money Oxfam GB pays Sanco to de-sludge toilets in IDP camps in Port-au Prince. The cost per user is a rough estimation based on 30 people per toilet as predictions for the total number of people using the public toilets vary widely.

¶A portable toilet serviced by Jedco costs $14 USD per day to maintain (figures from Concern).

The public ecosan toilet services that SOIL had operated in the above study were later adapted and piloted at the HH level in Haitien in 2012/13 – starting with 135 HH. Initially the pilot was implemented for three months as a free service. Then, at the end of the pilot phase the service was offered for the monthly fee of $5.00/mth/HH. 127 HH continued the fee paying service and by 2014 this had grown to 300HH. In Table 1 above or in the paper detailing the HH service pilot study results, there is no equivalent HH sanitation service from which to compare costs. Oxfam, however, have produced a paper looking at comparative costs of urban emergency sanitation across five countries (including Haiti) over the first two years of a response (Oxfam, 2014). It should be noted though that beyond ballpark comparisons closer financial scrutiny has not been possible due to the wide range of unknown variables that influence each system and the resulting large differences in costs of apparently similar services.

This issue is illustrated as follows:

Difficulties of Cost Comparisons

When SOIL implemented the HH level sanitation service, there operational costs turned out to be considerably higher than they predicted in Table 1 above.

The actual monthly cost for the HH service during the pilot was $4.47/user/mth compared to a predicted cost of $0.56 /user/month. SOIL point out that these costs are likely to be higher compared with full scale service operation as it was a small scale pilot. However even the costs for the public toilets which had been operated for some 30 weeks prior to the HH pilot have an average cost per user of $2.56/mth. This is some 4.5 times more expensive than the costs given in Table 1 ($0.57/mth),which, considering these are costs for what appear to be similar services (public 'EcoSan' latrines) provided by the same organisation at different locations within the same country emphasise the difficulties of trying to compare costs of different systems.

These differences are not limited to SOIL alone. The costs proposed for Haiti in Oxfam's comparative cost study, suggest recurring costs of $75 annually for desludging raised latrines. This implies a monthly cost per user of $0.30. In the papers by SOIL (who partnered with Oxfam to work on eco San pilots) they give the operating costs for Oxfam to service the raised latrines through a commercial contract at $0.91 /user/mth – more than 3 fold difference. Again this is for apparently similar services by the same organisation in the same country.

There will no doubt be clear reasons why there are these significant differences in costs access to services, opportunistic pricing, etc), however without spending significant time and resources in identifying these reasons, it becomes an almost worthless exercise to try and compare the costs between two separate interventions – even from the same organisations implementing vary similar technologies.

Other CBS pilots at small scale have been carried out in other locations (eg. Sanivation in Kakuma) but as yet details of these pilots have not been published. Direct discussions with Sanivation on the issue of comparative costs has also met with similar concerns over the difficulties in trying to produce representative costs that are not misleading.

Also worth note here, is the cost of the Jedco 'Portaloo' option. For a number of HRAs this seemed like a viable solution early on and a way to get things moving quickly. Unfortunately many were left with an extremely expensive contract and no obvious way out – due to the lack of suitable alternatives. Using the data above to calculate the comparative costs for operating just 50 latrines (SOIL operated 200 eco – san public latrines in Port au Prince (Kilbride et al., 2103) as part of the emergency response), using Jedco would have cost, approximately $21.7k - and extra $20,000 per month. At almost 15 times the costs of the alternatives shown above it was an expensive decision which might not have been made if there was greater awareness and understanding around CBS systems.

Possible Non-Financial Advantages

Following the situation described above, where HRAs were locked into expensive service contracts with no obvious exit strategy, it has been suggested that the CBS systems could offer greater flexibility in terms of operational approach and possible transition to more sustainable business models over the longer term. This was certainly possible in Haiti with SOIL at the HH level, but not at any scale – even when they were operating for several years prior to the earthquake and had existing experience with public ecosan toilets. In other locations, the pre-existence of similar technologies promoted by local NGOs or SEs might not be the case and such transition to a social enterprise may prove more problematic.

Even opportunities for creating WTV products will likely take many years to research, refine and market and as such the revenue potential of a particular CBS system is unlikely to be a significant factor in decision making processes for short to medium term disasters. For longer term interventions it may offer opportunities for reducing costs but this is likely to be an optimistic view unless there is already evidence of existing product demand with an established market.

It would seem from the results of the PeePoo trials that there are certainly advantages in terms of security and convenience for women and children in providing HH level service. A HH level CBS service such as that offered by Sanivation or LooWatt could potentially provide this convenience and security but would undoubtedly be more expensive than public toilets. SOIL indicates that cost per user for private latrines is approximately 60% more expensive than providing a public latrine.

Conclusions

CBS systems are unlikely to take the place of the basic pit latrine as the default option for the foreseeable future. However, as we have seen through the work of UNHCR and multiple agencies in Haiti and the Philippines, where conditions are not favourable for basic pit latrines (often the case in urban emergencies) there are opportunities for CBS and in these situations they can be as cost effective as more traditional approaches – though this will be very location specific.

In addition, the potential for CBS becomes even more attractive as HRAs start to utilise bag based technologies as the first phase response. In establishing a bag based sanitation service there needs to be a robust collection system. This is also the case for any CBS system. The transition from a simple bag based system to a CBS system is not huge but enables the addition of a certain level of dignity, comfort and ease of access for the elderly and disabled who may have difficulty squatting to use a bag. HH or public toilets such as those promoted by SOIL, Sanivation, Sanergy or others are really just a refinement of the bag based sanitation. If a collection system is up and running, then it can be envisioned that the service could be developed further along the same lines – possibly with greater ease than changing from an initial bag response to a more traditional latrine technology.

The portable waste transfer stations (WTSs) being developed by Sanergy as part of the HIF project also have the potential to make operation of these systems easier and safer. The WTSs could be used for both the initial phase bag based approach as well as the more professional CBS phase that was to follow. Equally it could be used for both HH level and public sanitation services. One of the main advantages these WTSs appear to offer, based on the initial prototype trials[2], is an increase in collection efficiency due

2 - Sanergy Blog post - www.elrha.org/hif-blog/reimagining-waste-management-emergency-contexts-pilot

to the elimination (in certain instances) of the need to transport barrels which are either partially full or empty (on return from dumping).

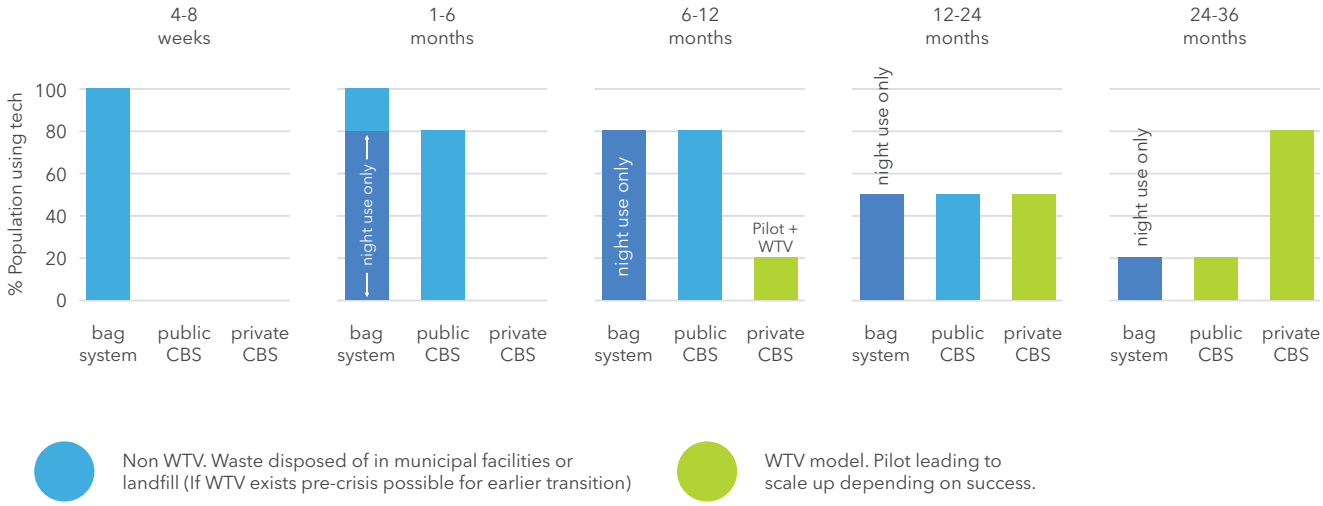
As for establishing comparative costs between more traditional emergency sanitation responses and newer CBS technologies – this seems doubtful – at the current stage of WTV business model development. The significant variations in operational costs highlighted above - for what should be similar services –and discussions with other SEs on this issue lead the author to conclude that at this stage it is not possible to establish meaningful cost comparison in emergency settings between CBS and traditional approaches other than high level ballpark figures such as those shown in Figures 1 and 2 above.

The next Phase of the UNHCR research project is looking to conduct structured pilot scale projects for 2-3 WTV services. These will be tested in refugee camps in the East of Africa (Kenya and Ethiopia)[3] to prove both the acceptability and viability of the service as well as demonstrating the complete WTV chain. This research should produce a tremendous amount of learning for these selected sanitation technologies and CBS in general and will go a considerable way to filling some of the knowledge gaps and operational concerns HRAs have over the current risks associated with piloting these new technologies and approaches in an emergency setting.

Reporting from the Haiti Earthquake response has highlighted that a wide range of sanitation solutions are needed to cope with the variety of physical, social and environmental challenges that were encountered. No one sanitation solution emerged as the ideal or optimum as each displacement camp had to be assessed against its own unique characteristics. With this in mind, as awareness of CBS and their hardware designs improve and become more familiar to HRAs, it is likely that CBS will eventually become an accepted standard sanitation technology that implementing agencies consider when selecting the most appropriate solution to deploy. The flexibility they offer both to users and operators and the opportunities for simple transition from the PeePoo/bag based initial response must be seen as attractive benefits.

Possible transition:

Figure 3: : Representation of the possible transition from Basic Bag based system household toilets and WTV operation



The hypothetical transition shown in Figure 3 illustrates how a transition from bag based sanitation might occur. Progressing relatively quickly to public systems collected (and disposed of into municipal treatment works of landfill) and then, if deemed suitable, a pilot conducted (relatively early) to ascertain the potential demand for a HH level service using WTV operating model. The pilot would need to determine the potential for any WTV business model – in particular assessing the potential market if a HH service was to go to scale (i.e. would there be more fertilizer, say, than the market could absorb or is there enough space to treat all the potential waste?). The decision to pilot HH level service would most likely be made based on the potential viability of a HH level service once the displaced community had returned to their usual environment in non-emergency settings.

In this respect it would appear that the potential involvement of SEs in emergency response is likely to be at the latter stages of the response where exit strategies are being implemented and where the demand for sanitation is moving from displacement camps to places of permanent residence. It seems unlikely that a suitable social enterprise would already be operating in the urban area of the crisis (even though that was the case in Haiti) and so it is possible that existing SEs operating WTV CBS systems might have a role in advising HRAs on the assessment of potential solutions, on setting up a WTV CBS system and establishing the SE to operate it. Given the inherent unpredictability of emergencies, it is unlikely that established SEs will have staff available for long secondments which adds another complication to this approach.

In addition to the technological advantages, the potential for creating significant attitude and behaviour change around a technology that could potentially be used when the population return to their permanent residences (as in Haiti) should also be seen as an opportunity, both for the implementing agencies looking for health outcomes and for the social enterprises looking for markets. In addition the possibility of a feasible exit strategy through the hand over to an existing business, SE or even the government, should also make them worth considering.

It would appear, given the costs reported by SOIL (see box above: monthly charge of $5.00 per HH and a cost of $4.47 per user per month) and the current operating performance of other existing SEs that full cost recovery (i.e. profitability) would be unlikely. It seems more likely that a reduction in costs could be achieved form a longer term WTV operation resulting in potential savings for the HRA responsible for implementation. For shorter term responses (under two years) it seems unlikely that WTV operations would have time to develop into a significant income stream – meaning the costs to the HRA would most likely be comparable to more traditional (non-basic) latrine solutions.

The acceptance of CBS in emergencies is not likely to happen over-night – more has to be learnt from piloting at larger and larger scales. Work Oxfam, IFRC and WASTE are currently undertaking with the Emergency Sanitation Project together with the work of UNHCR and other HIF research projects will all contribute towards strengthening the depth of knowledge in the sector which will in turn build confidence in the risk averse HRAs to consider these new technologies as potential solutions in the future.

Recommendations

- Undoubtedly, there is still further work to be done on understanding the costs of a CBS response – both WTV and Non-WTV. As the decision to implement CBS as a second phase response will be influenced by the potential longer term applicability of a CBS & WTV approach, it would be useful for an HRA to be able to assess the potential viability of a HH CBS service. A tool or tools to identify potential operating costs for different models as well as social acceptability and demand would be useful to aid decision making.

- A number of actors have over the past few years been working on different HH CBS toilet designs. Having a modular unit that can be used in the HH or in public toilets that stacks neatly and can be imported quickly in reasonable numbers – would reduce the initial setup phase which can be quite lengthy as was the case in Haiti. Alternatively having readymade moulds or patterns that can be used to fabricate in country would also be useful.

- In attempting to conduct this analysis it has become clear that the process has been made more complicated by the fact that different organisations use different metrics to monitor and report their interventions. For example cost per toilet, cost per stance, cost per user, cost per HH, cost per kg faeces collected. Given the amount of interest and the number of organisations involved in piloting and developing these services it would be extremely useful if a standard set of metrics could be developed that would be recorded as a minimum for each intervention. This data would need to be requested and managed by one independent body – academic institution, UN body, NGO, GWC, etc. A database could be built up over time that would then be made available for analysis of different intervention types.

References

Forster, Tim (2010). The Use of Poo Bags for Safe Excreta Disposal in Emergency Settings - Oxfam Technical Briefing Note, Oxfam, GB. http://policy-practice.oxfam.org.uk/publications/the-use-of-poo-bags-for-safe-excreta-disposal-in-emergency-settings-136535

IFRC (2010). Haiti - From sustaining lives to sustainable solutions: the challenge of sanitation. International Federation of Red Cross and Red Crescent Societies, Geneva. http://www.ifrc.org/Global/Publications/disasters/199600-haiti-sanitation-report-july-2010-EN.pdf

Kilbride, A., S. Kramer & N. Preneta (2013). Piloting ecological sanitation (EcoSan) in the emergency context of Port-au-Prince, Haiti, after the 2010 earthquake. Briefing Paper. https://www.oursoil.org/wp-content/uploads/2013/07/Emergency-toilets-WEDC.pdf

Oxfam (2014). Comparative Expenses of Sanitation Options in Rapid onset Emergencies. Zulfiquar Ali Haider – Response Resilience Team (RRT). OXFAM, GB

Parsa, H., Berndtsson, M. and Nee, M. Sweden (2014). Human Waste Management in First Phase Response, protecting ground water and human health: Case Study from Haiyan 2013.

SOIL (2011). Can We Sell EcoSan Compost in Haiti? : A Market Analysis Report. Sustainable Organic Integrated Livelihoods (SOIL).

UNCHR / BCG (2015). Improving Sanitation in Refugee Camps Final Deliverable – Phase 1 Part 2; December 17, 2014 (updated May 2015); Boston Consulting Group. http://wash.unhcr.org/download/improving-sanitation-in-refugee-camps/