

Urine Diversion Dry Toilets for Urban Towns

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ABSTRACT

The Uganda population census of 2014 indicated that 6.4 million people live in urban centres. This is about 18% of the total population. With the annual urbanisation rate estimated at 5.74%, population growth puts enormous pressure on the water and sanitation services with the recent urban coverage being just at 77.8% and 6.4% for water supply and sewerage respectively. Household sanitation solutions within the urban areas comes with many challenges such as inadequate funds, insufficient space, accessibility, land ownership, limited technology choices, among others.

In the precolonial times societies in Uganda were organised around tribal kingdoms and early urban centres were initiated by this setup. During the British protectorate government (1894-1962), urban residential homes were set up on land measuring about an acre and housing policies catered for only Europeans and to a lesser extent Asians. At the moment, with high population growth and the emergence of real estate's business in most urban centres, the popular and most preferable plot sizes have been reduced to about 450m². Within this size of land, most homeowners like to optimise the space usage to at least accommodate large rooms, and an outdoor garden, hence leaving them with limited space to construct a reasonable septic tank as an on-plot treatment unit. The use of other on-site latrine types is also popular as an alternative to the flush toilet in cases where there is unreliable running water to operate.

This paper examines how to promote the use of Urine Diversion Dry Toilets (UDDTs) as a sanitation option in the urban areas with all the associated benefits relative to other sanitation options like reduced construction cost, minimal space requirement, saving water, reduced ground water pollution meanwhile producing soil-conditioners that could be used for urban farming. The Government of Uganda in the national sanitation policy has already embraced this sanitation approach and its promotion is mainly targeting the poor and those in rural areas. This pro-poor approach has brought about the perception that UDDT is sanitation for the rural areas making the relatively affluent class ignore the underlying benefits that could address the challenges being faced to achieve sustainable sanitation in the urban areas.

Key words: urban/ urine diversion dry toilets/ water / sanitation/ households

Introduction

In Uganda, the definition of urban areas has been changing over time. The 1969, 1980 and 1991 Censuses defined urban areas to include gazetted urban centres (City, Municipalities and Town Councils) and ungazetted Trading Centres. The 2002 and 2014 Censuses defined urban areas to include only the gazetted urban centres (City, Municipalities, Town Councils and Town Boards). The urban portfolio is dominated by Kampala; however, the proportion of Kampala city to the total urban population has declined steadily from 41% in 1991 to 25% in 2014 (UBOS 2014). This change in trend indicates that the small emerging centres are growing faster yet the services such as water supply and sewerage are lagging and ways to address it at scale remains elusive.

Table 1: Number of urban centres by type, census year and urban population (1969-2014)

Index	1969	1980	1991	2002	2014
Number of gazetted urban centres	na	41	150	75	197
City	na	1	1	1	1
Municipality	na	2	13	13	22
Town council	na	34	33	61	174
Town Boards/ Township	na	4	18	20	na
Urban population	634,952	938,287	1,889,662	2,921,981	6,426,013

Source: UBOS, 2014

The provision of safe and sustainable sanitation in the urban centres is one of the daunting challenges for the rapidly growing towns in Uganda. Even when improvement in urban sanitation has occurred, little has been done in technology choices in order to address the recurrent problem of water scarcity, variability of house income, housing types and ownership, land tenure, and ground conditions. In this circumstance, the poorest urban population in the informal housing areas are worse affected. The public health and environmental outcomes of improper sanitation practices in urban areas is more significant in contrast to rural areas where population is sparsely distributed. Robert Muhereza (2015) reported that Kabale Municipality is set to demolish 10 out of 20 protected water springs in the area after a survey indicated that they are contaminated with faecal matter and 15 districts where reported to have been hit by typhoid (New Vision, 2015).

Basically there are two main approaches for urban sanitation, on-site/plot (drop & bury) and off-site (flush & forget). The latter, for cities/ towns requires a centralised sewer and waste treatment plant which mostly have a large suck cost for new urban centres that deters the investment. In Kampala, for instance, 46.6 and 25.2 million euros is required to build a new Bugolobi treatment plant and upgrade sewer lines within the city respectively (African Review, 2010). This cost in total of about 71.8 million euros is almost an equivalent to the yearly budget of KCCA-2014/15 projected at 267.8 Bn UGX (KCCA, 2014) yet the population planned to serve is less than 15%. Additionally, large scale treatment system needs highly skilled personnel to correctly maintain the facility and has high demand for water and energy. Innovative approach to sanitation is, therefore, required to front toilets such

as UDDTs which are entirely free from services connections (e.g. water supply, sewerage, energy), easy to maintain and could benefit a million people emerging in the urban centres.

Sanitation Practices in Urban Uganda

In the Annual Medical and Sanitary Report, Kampala sewerage system was first built in the 1930s when the medical authorities had found out that the ground water was contaminated and unsuitable for human consumption (David. N, 2006). Kampala Township Authority had an elaborate system for collecting solid waste and excreta even before the public water supply. Simple buckets were used prior to introduction of sewerage where all households simply emptied their buckets into ox-driven carts and later, Lorries (Sanitary Report, 1926). The excreta were transported outside town at night and later buried in deep trenches. In 2005 Juuti, Petri and Tapio reported that introduction of the sewerage system came at the time of technological paradigm when large scale sewerage was synonymous to modernity.

Before looking at the practices in the current urban areas, it is also important to identify the various kind of waste generated within households that needs proper handling to mitigate any adverse pollution and contamination. First, *greywater* is wastewater which is generated from domestic activities such as laundry, wash hand basins, bathing and kitchen, which can be recycled on-site for uses in landscaping or in filtered in a soak pit. Second, *Blackwater* is wastewater that contains faecal matter and urine; this always originates from flush toilets. In an event that there is no water borne toilet, black water is eliminated and the excrement can be treated jointly or independently. It is important to note that black water contains pathogens that should decompose before they can be released to the environment.

The on-plot sanitation commonly used in the urban centres includes the following among others; unimproved pit latrines, ventilated improved pit latrines, pour flush latrines, flush to septic tanks, ecosan toilets such as dry toilets and composting. On plot systems are appropriate to majority of urban centres irrespective of income levels but the reliability of water and plot sizes could influence technology choice. To have a successful intervention therefore, decision makers and reformers should look at the problem of today in comparison with the history of a place in order provide a comprehensive picture of long lasting and sustainable solutions.

Urine Diversion Dry toilets (UDDT) and how it works

UDDTs are commonly called Ecosan toilet in Uganda, a name which is limiting since Ecosan (ecological sanitation) is not a type of toilet but rather an approach of addressing sanitation (human excreta) with aim to close the gap between sanitation and agriculture. According to [wiki#akvopedia](#), Urine Diverting Dry Toilet (UDDT) is define as, a toilet that operates without water and has a divider so that the user, with little effort can divert the urine away from the faeces.

The UDDT is built such that urine is collected and drained from the front area of the toilet, while faeces fall through a large hole in the back. After defecating, drying material such as ash, sawdust, lime or earth should be added into the faeces collected in a bucket or basket beneath the slab. Urine is collected separately into a Jerrican or central storage.

The separating pans are commonly made of ceramic and plastic and local made types can be made from concrete, wire mesh. Galvanised pipes should be avoided for piping works as they then to rust due to aggressive nature of urine. Design of the separating pans can be made to suit the needs of the population for example small for children, seating or squatting, provision

for washing, etc.

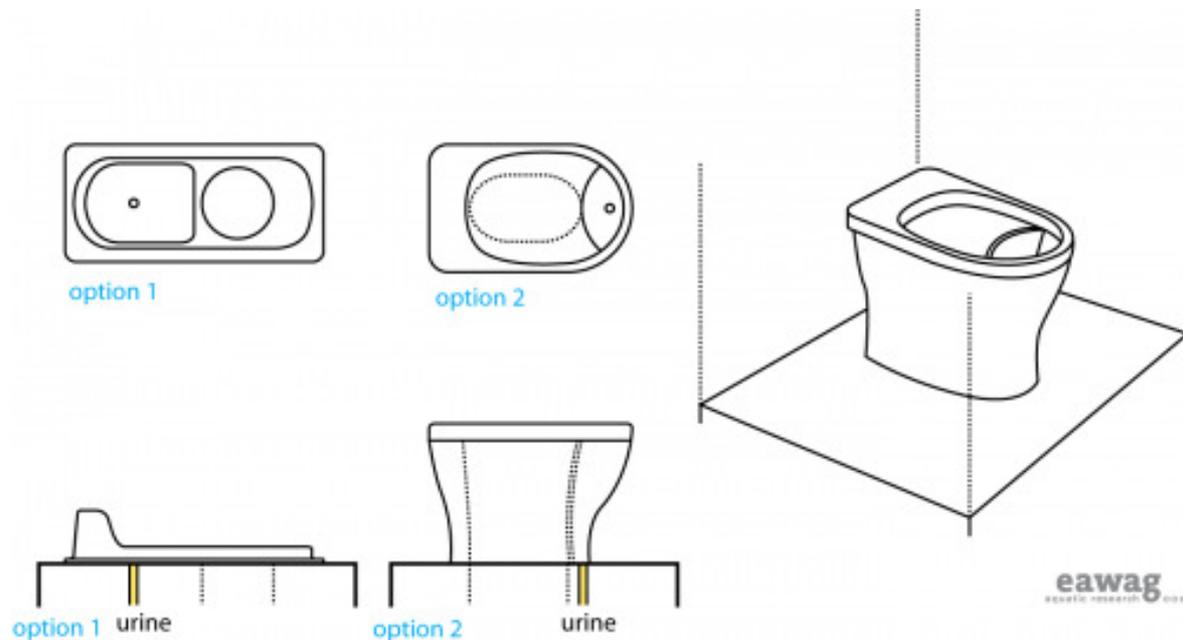


Figure 1: Illustration of squatting and seating separation pans (Elizabeth, Lukas, Christoph, Philippe and Christian, 2014)

There are also 3-hole separating toilets that allow anal cleansing water to go into a third, dedicated basin separate from the urine drain and faeces collection. Both a pedestal and a squat slab can be used to separate urine from faeces depending on user preference.

Health Aspects/Acceptance

The UDDT is not immediately obvious to some users and may be hesitant about using it, and mistakes made (e.g., faeces in the urine bowl) may deter others from accepting this type of toilet as well (Elizabeth et al., 2014). Demonstration projects and training are essential to achieve good acceptance with users. For better acceptance of the system and to avoid urine in the faeces collection bowl, the toilet can be combined with a urinal, allowing men to stand and urinate. A well use UDDT neither smells nor attracts flies. Like with flush toilets and others, routine cleaning is required.

Operation & Maintenance

The lack of water and the need to keep separate the solid faeces and liquid urine makes first time user to experience slight difficulty. The design of separating is in such a way that it works for most people although some users may have difficulty keeping separate both streams perfectly, which may result in extra cleaning and maintenance. The urine outlet can routinely be flush with water to clear any blockage and in an event that faeces is accidentally deposited in the urine section, unblocking is required.

All of the surfaces should be cleaned regularly to prevent odours and to minimize the formation of stains. Water should not be poured in the faeces hole during cleaning, instead, a damp cloth may be used to wipe down the seat and the inner bowls. In event that thorough

cleaning is needed, the faeces container can be removed and the separating pans can be cleaned more thoroughly. It is important that the faeces remain separate and dry in order to eliminate smell and flies. The interconnection pipe to the separating pan needs to be checked during emptying just to avoid that no urine leaks to the bucket.

Socio cultural barriers

One of the most important aspects of on-plot sanitation is how to deal with end-users perception (MWE-DWD, 2013). Perception rigidity poses the biggest barrier to use of on-plot sanitation especially ecological sanitation (UDDTs). Most societies in Africa look at handling human waste as a dirty job if not taboo and beliefs have been clouded around to discourage contact with faeces. For instance, the Acholi's in Northern Uganda, believe that when you apply ash onto someone's faeces the person will die. In Western Kenya, the Bukusu (Luhya) believe that sexually active youth should not touch human waste. Handling human waste is left for the elderly people who are considered less sexually active. Actually, they believe so strongly that when one is from prison, he or she is cleansed before being allowed in a home because they associate inmates with human waste handling. According to George (1940), in the early colonial days communities in Uganda were afraid to use latrines for the belief that their fixed location would provide sorcerers easy access to the excreta for hostile purposes, and faeces of another on top of one's own could bring about contamination.

These beliefs, when looked into keenly were introduced to avoid some circumstances, for instance, the Acholi belief about ash was intended to create fear in those that would go to defecate in the others' garden. Precisely, they were discouraging open defecation. The British Medical Services in response to people's fears persuaded people to bore latrines of such depth that excreta would be out of reach for sorcerers and to cover faecal matters after defecation to avoid contamination.

In the urban centres now, majority of the people in the semi-formal/formal housing areas are educated and can easily adjust their perceptions but after addressing several questions. In the case of UDDTs it is not whether it can be constructed in or out of the house but common questions are; doesn't it smell? We use gas/electricity, where do we get the ash? Who carries the buckets when full and where will the waste be disposed? Except for the first concern which can be addressed through users' discipline, the later concerns offer an opportunity for business for urban authorities and the locals. Ash can be sieved and bagged from institutions/homes for sale to those who use gas/ electricity. There can be a faecal waste composting facility for processing excreta from UDDT and as for emptying the buckets; collection and subsequent reuse can be managed in two string systems like "pure" household model and institution model like the one being used for solid waste management.

Institution and legal framework to enabling environment

In social marketing, policies and legislations play an important role in influencing the context within which sanitation market can operate. The mandate for providing services to urban areas is scattered among the following entities which have been successful in some instances and not so successful in others.

Table 2: The current Institutional Framework for urban development

Entity	Main responsibility
1. Ministry of Land Housing and Urban Development	Physical planning of urban centers
2. Ministry of local government	Overseeing activities of local authorities and administration of policies
3. Ministry of Finance, Planning and Economic Development	Overseeing the overall management of national economy and development. In this respect providing physical transfers to urban authorities
4. Urban authorities and local governments	Day to day management of the urban localities
5. Local government Finance commission	Advice government on the distribution of revenue between central and LGs and between the LGs
6. Ministry of Public service	Develop policies to attract, retain and motivate workforce for effective implementation of decentralization and services delivery at local government level

The government has provided several legal frameworks in support of sanitation; however, gaps exist on how to coordinate the different roles of actors. From Table 2 above, the three line ministries who are signatories to the sanitation memorandum of understanding of 2001 are not included. National Water and Sewerage Corporation which is a government parastatal mandated to provide urban water and sewerage has been limited to only waterborne systems. Actually, the word “sewerage” needs to be revise to “sanitation” to enable the corporation to provide other sanitation services in areas that sewerage systems can be afforded as yet. This approach would still make urban centres achieve the targeted clean environmental sanitation.

In some cases building plans submitted for approval to local authorities have been rejected for reasons of not having a drainage system or latrine. The Public Health Act (1935) only provides for latrine and waterborne system which pose a challenge for other technologies not clearly recognised by the law.

Cost benefit analysis for a UDDT in a home

Let us consider a residential home for a family of five with a unit UDDT in house. The assumption is that the local authorities have already constructed a central composting facility to dispose the excreta as a treatment plant.

Table 3: Cost benefit outlook for a household

	Cost UGX	Remark
Construction/Investment		
Space/ land	1.2x1.5m	The cost defers per location.
Separating pan (squatting)	50,000	Ceramic high quality
Fittings (pipes/ door)	100,000	Urine collection/ closure of chamber
Storage container	80,000	20 litres Jerrican/ 60 litres bucket
Operation/maintenance		
Water	5 litres/week	Use for cleaning pan only.
Logistic/ emptying	325,000/ yearly	Adapted from solid waste collection fee by private operators in Kampala. Cost includes liner for buckets.
Other Benefits		
<ul style="list-style-type: none"> • The toilet last as long as the building exist • No need of water for flushing • No need to construct sewerage/ septic tank • Ground water pollution eliminated • Affordable • Nutrient recovery for agricultural use 		

Bench marking project at St Joseph's Hospital Kitgum

In 2007 to 2013, HORIZONT3000/BBM Austria with support from Austrian government and other donors made a total ecological rehabilitation of the Hospital infrastructures. During the war in Northern Uganda, the Hospital was overwhelmed with high population of patients and night commuters that over stretched their facilities (water, sanitation, electricity, accommodation, etc.). Latrines could get filled in a matter of weeks and there was no more space to bore additional latrine blocks and the cost for emptying the drainable toilets were staggering high. The Hospital after a thorough consultation and discussions adapted ecological sanitation. As a trial demonstration units were built which after successful use were scaled up to the entire Hospital.

The approach in the rehabilitation was to categorize each group of users to suit their pattern of operation within the hospital. Patients and their attendants were constructed composting toilets because it does not need separation of urine and faeces during use and this suited their

fluctuating patterns in the hospital and reduced any need for continuous training. The interface of composting toilets is the same as that of latrines popular in homes and is easily adaptable. Staff and their family who are resident within the Hospital were constructed UDDTs because they were considered permanent and would reduce the need for continuous training. Flush toilet blocks which were in existence in Administration block and others wards were retained and a treatment wetland plant constructed to purify wastewater prior to discharging to the environment.

This intervention changed the whole outlook of the Hospital; the once dry dusty compound is now filled with grass and flowers all seasons courtesy of compost manure. The saving on water from more than 200 users a day for not flushing a toilet is huge. The Hospital reduced their budget on sanitation by about 3 folds and now it is limited to operator's salary and minimal repairs. Such achievements come not only for funds injected in the project but rather the determination by the management to address their challenge innovatively and provide a conducive environment to those who operate the system.

Conclusion

In a society where sanitation issues are only discussed openly when an emergency has occurred, promotion of unique sanitation technologies does come with many challenges. The success in a project like in St. Joseph Hospital Kitgum can be replicated at both household and institutional levels. Users should lead on how best they intend to address their problems. As income levels of people steadily grow within the urban centres, basic needs like sanitation should be put on the priority list and by saving a cent through adapting to innovative approaches it gives an opportunity to redirect investments to millions of the poor to receive services they lack. The lifestyles of affluent urban population influence the behaviours of their rural counter parts and any level of success registered in use of UDDTs in town can have a high multiplier effect to the rural areas. The telecommunication industry has already demonstrated successful this approach.

The effort from government to promote ecological sanitation should be reinforced by paradigm shift by engineers and planners to other approaches to sanitation instead of the popular centralised and conventional wastewater system for urban centres. UDDTs can be developed to obtain functional, easy-to use, and hygienic standards to compete with flush toilets at a relatively affordable cost to both new homeowners and those that intend to remodel the existing systems.

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