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Review

A comparative study of faecal sludge management in Malawi and Zambia: Status, challenges and opportunities in pit latrine emptying

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This review paper covers the issues of pit latrine emptying national policies and regulations with a focus on Malawi and Zambia. With 2.4 billion people worldwide still lacking improved sanitation facilities, developing countries need to look at policy, regulation and practice for household sanitation service provision with a new lens. What happens “next,” when improved sanitation facilities eventually become full? An emphasis on faecal sludge management has multiplied this important issue in the past few years. The authors compare the pit latrine emptying situation in Malawi and Zambia with a focus on status, challenges and opportunities. To build this comparison, a desk review of national policies, local regulations and peer-reviewed journal papers was conducted. The paper concludes that existing national policies and regulations taking faecal sludge management into account are weak and have wide gaps in the two study countries. For the future, it is recommended, first, that household pit latrine emptying should be seen as an opportunity to address national sanitation gaps and, second, national policies and regulations need to be evaluated and updated.

Key words: Faecal sludge management, pit latrine, policy, private sector, sanitation.

INTRODUCTION

With 2.4 billion people worldwide still lacking improved sanitation facilities (WHO and UNICEF, 2015) developing countries need to look at national policy and practice for household sanitation service provision with a new lens. What happens “next,” when improved sanitation facilities eventually become full? Even for developing countries which have met the Millennium Development Goal (MDG) for sanitation, improved sanitation facilities once full will

require pit latrine emptying to maintain MDG status or will over time revert back to the ways of 1990. Pit emptying is a key to sustainability of the MDGs in developing countries. Yet, regionally, faecal sludge management (FSM) is largely absent in policy and legislation in Botswana, Ethiopia, Kenya, Malawi, South Africa, Uganda, Zambia and Zimbabwe (Water Research Commission, 2015).

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Full sanitation facilities globally are not the same, and Rose et al. (2015) has shown the dietary intake of food and fluid are the primary links to faecal and urine composition entering sanitation facilities, with faecal wet mass variation between developing versus developed regions. Although, Todman et al. (2015) reported pit latrine fill rate modeling is complex, and may not provide an accurate prediction of individual household pit latrine fill rates. This may make local regulatory planning difficult. Faecal sludge management is both an urban and rural problem in developing countries, but the greatest opportunity for addressing full sanitation facilities lies in urban, and peri-urban, areas where pit latrines still dominate household sanitation facilities (Strande et al., 2014). Additionally, Still and Foxon (2012a, b, c) outlined that most pit latrine emptying services target improved (with a cement slab), lined, pit latrines due to technology limitations.

The objective of this paper was to present a management review related to pit latrine emptying in two Southeastern African countries, Malawi and Zambia (Figure 1). Although geographically close, key environmental and policy characteristics in some cases differ. Malawi is a country which has shown moderate progress towards meeting the MDG target, whereas Zambia is classified as having had limited or no progress (WHO and UNICEF, 2015). Faecal sludge requires collection, transport, treatment and use/disposal (Strande et al., 2014). As the FSM sector grows, a policy and regulation review and comparison for each of these steps provides a focus to sector efforts in developing appropriate and scalable legal and regulatory approaches, norms and standards. This paper presents problems and opportunities, a review of how FSM business is conducted, and finally, policy support and gaps. The results of this review may guide future policy creation for faecal sludge on a regional level. The next section of the paper presents the methods used, followed by analysis of whether pit latrine emptying is a problem or an opportunity, a review of pit latrine emptying business, and details on national policies and regulations. The paper concludes with outlining key challenges and solutions for policy makers.

METHODOLOGY

National policies, local regulations and peer-reviewed journal papers were included in this review. The review was focused on sanitation, but with an emphasis on pit latrine emptying. Accepted papers had reference to national policies or local regulations of faecal sludge collection, transport, storage, treatment and reuse. Bibliographies from peer-reviewed journals were also searched for relevant papers. The method specifically targeted drawing recent, strong, evidence to orientate future management within the context of enabling pit latrine emptying.

Is pit latrine emptying a problem or opportunity?

Criteria such as regional location, elevation, temperature, rainfall, soil type, population, urban population distribution, dominant religion and government may play a role in regional FSM. Table 1 provides key characteristics of Malawi and Zambia as a background to pit latrine emptying problems or opportunities.

Malawi has seen an increase of the population living in urban areas, moving from 12% in 1990 to 16% in 2015. Urban improved sanitation facilities have also been increasing while open defecation is seen decreasing over this same period of time (WHO and UNICEF, 2015). While 9.4% of the urban population has a flush toilet (Malawi Government, National Statistical Office and ICF Macro, 2011), pit latrines still dominate household sanitation facilities especially in peri-urban areas. Sewer systems are only present in two cities of Malawi, Blantyre and Lilongwe. Although covering a full pit latrine has historically been common practice, now, when a pit latrine is full, households are challenged to dig a new pit due to tight spaces in high density urban settlements. Another problem is that pit latrines fill quicker than anticipated, when in addition to household faecal inputs, a lack of municipal solid waste collection at a household level makes pit latrines to be used as garbage pits.

The status of current household urban sanitation in Malawi is also closely tied to politics. Urban migration was discouraged by the first President, H. Kamuzu Banda (1964-1994), during a time where rules supporting sanitation, hygiene, and waste were dually enforced by chiefs and party officials (Cammack, 2012). An interview conducted by Cammack (2012) noted "People feared the fine that a person had to pay for not following orders so people got used to practicing hygiene. It became part of people's habits and the Malawi Congress Party (MCP) did not have many problems in implementing sanitation rules." With the second President, Muluzi (1994 to 2004), urban migration spread quickly into vacant lands and nearer to towns, resulting in the need for urban water and sanitation with a larger footprint (Cammack, 2012). These spaces of high population density, and unplanned land use, on the sprawling edge of an urban city spread into Malawi's peri-urban areas. Similar to Malawi, Zambia has a growing population, although a much higher urban population density than Malawi, reported in 2015 at 41% (Zambia Government, 2012; WHO and UNICEF, 2015). Historically, sanitation and FSM in Zambia has been part of the water sector. But, the 1991 Local Government Act decentralized services, and transferred water supply and sanitation responsibility from the national government to the Ministry of Local Government and Housing. Commercial utilities were formed to manage water and sanitation in their respective areas of operation (World Bank, 2002). The National Water Supply and Sanitation Council (NWASCO), was established by the Water Supply and Sanitation Act of 1997 to be responsible



Figure 1. Study Area, Malawi and Zambia, Africa.

for regulating water and sanitation services offered by commercial utilities. Management of faecal sludge from pit latrines in the context of desludging, transportation and utilization is a new sector in Zambia.

Historically, the norms were that faecal sludge in pit latrines, once full, were covered over and forgotten. A

World Bank (2002) report on low income urban settlements found up to 50 households sharing one latrine in some areas. While improvements have been made in the water supply services, it has been seen that sanitation has not kept pace. Emptying of pit latrines in urban Lusaka is further complicated by frequent flooding

Table 1. Key characteristics of Malawi and Zambia applicable to pit latrine emptying.

Characteristic	Malawi	Zambia
Location	Landlocked in Zambezi Basin	Landlocked in Zambezi Basin
Elevation	Mostly 760 m to 1370 m	Variable up to 2164 m
Temperature	11.7 to 37 °C	5 to 35 °C
Rainfall	Average precipitation 1,181 mm/year depth (2008), mostly months of November to April	Average precipitation 1,020 mm/year depth (2008), mostly months of November to April
Soil	Mostly suitable for cultivation	Variable, with large areas of soils poor for cultivation and some areas with seasonal waterlogging
Population in 2015 (estimated)	17,309,000	15,520,000
Urban population distribution	16%	41%
Gross national income per capita, 2012 (USD\$)	350.0	1402.6
Dominant religion	Christianity	Christianity
Government	Stable democracy	Stable democracy
Met the Millennium Development Goal sanitation target	No	No

Sources: Malawi Government, National Statistical Office and ICF Macro (2011); Routledge (2014); United Nations Environment Programme (2010); WHO and UNICEF (2015); United National Statistics Division (2015a); United National Statistics Division (2015b).

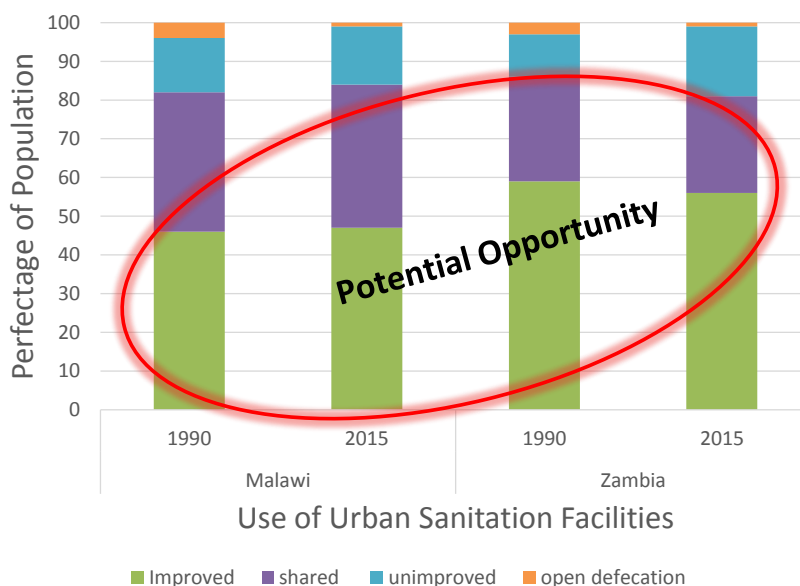


Figure 2. Potential for Urban and peri-urban pit latrine emptying in Malawi and Zambia (data from WHO and UNICEF, 2015).

in peri-urban, unplanned settlements, even in years of normal rainfall (Nchito, 2007).

WHO and UNICEF (2015) data on the progress on sanitation situation indicates, when considering the combination of Malawi and Zambia urban sanitation facilities, there is a large opportunity for pit latrine emptying services (Figure 2). While the use of improved sanitation facilities in urban Zambia is higher than

Malawi, as a proportion of the urban population, interestingly Zambia has decreased slightly over the period from 1990 to 2015. As shown in Table 1, the elevation, temperature and rainfall make the environmental conditions for pit latrines mostly ideal in both Malawi and Zambia. The soil conditions in many areas of Malawi are easy to build a new pit latrine, whereas the soil in some areas of Zambia makes burying

pit latrines when full difficult and may offer a larger opportunity for pit latrine emptying. Also in both countries, the dominating religion of Christianity leads most pit latrine users to be wipers, who do not add water during pit latrine use. As such, most pit latrines are considered dry, operating without flush water. Pit latrine emptying needs to focus on removal of a dense solid material, with low water content. The gross national income per capita is higher in Zambia than in Malawi, which is an indication of ability to pay for pit latrine emptying services and may indicate an easier market for sanitation business in Zambia than Malawi.

Who is making household pit latrine emptying a business?

Until recently, FSM has not been a global priority in addressing improved sanitation in developing countries (Strande et al., 2014). Investment in urban sanitation has instead concentrated on either household toilets or sewer system construction, leaving out FSM and pit latrine management from comprehensive sanitation plans (Strauss et al., 2002). In both countries, FSM especially in low income areas, is a matter normally dealt with at a household, rather than policy maker level.

Work by Chowdhry and Kone (2012) outlines financial challenges of pit latrine and septic tank emptying providers for FSM in 30 cities across 10 countries in Africa and Asia, noting emptying services are often a supplemental business funded through informal funding, rather than commercial loans. Unfortunately, most informal pit latrine emptiers dispose sludge indiscriminately into the environment (Strauss et al., 2002). The pit latrine contents end up buried or in the nearby open environment, such as open drains to avoid high transportation costs if the sludge was transported to designated disposal sites. According to the FSM Score Card for the city of Lusaka, 47% of sludge from onsite facilities ends up within the residential environment (Ministry of Local Government and Housing, 2014). This compares with rates of faecal sludge discharged untreated to the environment reported at 74% in Senegal, and 18% in Uganda (Williams and Overbo, 2015). Data from faecal sludge discharged untreated into the environment for Malawi is not available.

Currently, Malawi is more into research as opposed to practical application in pit latrine emptying. Research is currently being conducted by non-governmental organizations including Water for People, Waste Netherlands and the Red Cross, as well as educational institutions (Mzuzu University and the University of Malawi). The private sector participation in pit latrine emptying countrywide is limited to a few medium to high level businesses/operators, though there are also informal providers. Despite the difference between the market potential and the numbers of operators, customers do not

have many alternatives. Two FSM businesses are Mr. Clean Malawi in Mzuzu and WES Management in Blantyre. Mr. Clean Malawi is the primary FSM operator in northern Malawi operating a private company emptying septic tanks and pit latrines of household and commercial customers largely with a fleet of vacuum trucks. Prices are set based on volume removed. Waste is transported to regional municipal sludge ponds. Manda (2009) reports new pit latrines cost less than USD\$72 to construct as compared to USD\$64-79 for pit latrine emptying services. In two northern cities, Mzuzu and Karonga, the Peri-Urban Sanitation and Hygiene Project (PUSH) funded by the European Union, includes the aim to facilitate the creation of small-scale FSM enterprises before the end of 2017 which may mean formal household pit latrine emptying as a business could expand quickly in the coming years.

In Zambia, although challenges remain, FSM in low income areas is seeing positive advances. Recently, Lusaka Water and Sewerage Company, with support from the Water and Sanitation for the Urban Poor (WSUP), introduced a FSM project in a peri-urban area of Lusaka, Kanyama compound. The project aims at addressing desludging, transportation, treatment and ultimately utilizing faecal sludge. The project formed a Community Based Enterprise, the Dream Team, in 2013 as part of the Kanyama Water Trust with delegated responsibility from the Lusaka Water and Sewage Company. The Water Trust is one of eleven trusts in Lusaka. Two teams each consist of five members (Linyama et al., 2014). The project had the advantage to utilize already experienced informal pit latrine emptiers. Payments to the emptiers is on a commission basis. From the time it was launched till date, the demand for the enterprise's services has continued to increase (WSUP, 2014). This demand increase can be attributed to the physical environments within the low income area of the project: high population densities, small plots which do not allow for burying of full pits, and harsh geology.

In the Kanyama Area of Lusaka, there are nearly 250,000 households, most using pit latrines, combined with a reported 50% of residents willing to pay for pit latrine emptying services (Linyama et al., 2014). Although originally formed to service individual household customers with pit latrines, the customers for the Dream Team, have, over time, evolved to include commercial and public toilets. The enterprise has also diversified into septic tank emptying. Presently, the enterprise has a backlog of customers to service despite working in two teams with each team normally desludging two latrines per day.

The desludged material was planned to be fed into digesters for biogas generation after which the stabilized sludge was supposed to be dried and sold as fertilizer.

However, the sludge composition has a very high content of inorganic matter which renders it useless in both biogas generation and as a soil conditioner or

Table 2. National policies and regulation supporting pit latrine emptying as a sector in Malawi.

Title	Date	Relation and gaps to pit latrine emptying
Environment Management Act	1996	Controls the handling, storage, transportation, classification, importation, exportation and destruction of waste; monitors waste disposal sites; no pit latrine emptying reference.
National Environmental Policy	2004	Sets national priority for management, sustainable utilization, and protection of the environment; no pit latrine emptying reference.
National Water Policy	2005	Overall national guidance on water; setting minimum distance from a groundwater source to pit latrines and waste disposal facilities; no pit latrine emptying reference.
National Sanitation Policy	2008	Overall national guidance on sanitation; limited pit latrine emptying reference.
Malawi Growth and Development Strategy	2012	Set a national focus on actions and activities to introduce ventilated improved pit latrines to address sanitation goals; no pit latrine emptying reference.
Water Resources Act	2013	Storage, treatment, discharge and disposal of waste which may pollute water; setting of penalty fines; no pit latrine emptying reference.

fertilizer in agricultural activities. Such sludge thus is normally buried. It is hoped with sensitization, which is an integral component of the emptying services by the Dream Team, high solid waste content in the faecal sludge will reduce.

As the case is with the emptying enterprises in Malawi, the Dream Team also charges according to the volume emptied. 60 L barrels are used in the pricing as follows:

- a) US\$40 for 12 60-L barrels,
- b) US\$60 for 24 60-L barrels, and
- c) US\$70 for 32 60-L barrels (WSUP, 2014).

With 700 pits emptied by the Dream Team (as of June 2014), the demand for sludge removal only amounts to a fraction of the opportunity as compared to the number of households in the area (WSUP, 2014). When comparing the price for pit emptying services in Malawi and Zambia, they are similar, despite Gross National Income per capita in Zambia four times higher than Malawi (Table 1).

Sugden (2013) points out, due to the nature of the work, most pit latrine emptiers are characterized as being low-income, have a poor education, and are prone to occupational alcoholism. This indicates national policies and regulations are needed to promote improved sanitation, but also industrial worker safety. National policy and regulations need to be friendly though to the public health nature of sanitation service providers doing pit latrine emptying. Diener et al. (2014) looked at resource recovery from FSM treatment processes which may generate a profit in Accra, Ghana; Dakar, Senegal; and Kampala, Uganda. It was found that FSM products have a potential market value. This is an important note to policy makers whom should recognize the potential profitable business approaches to FSM. This may lead to further review of national and business taxation rates,

even waiving taxes to sanitation businesses as a public health service.

In conclusion, for both Malawi and Zambia, pit latrine emptying is an issue handled by individual household customers. As a business, the sector is dominated by few formal emptiers. Recent trends in both countries show there is a steady increase in formal service provision in the sector and demand for the services is high.

What are the national policies and regulations supporting pit latrine emptying as a sector?

In Malawi, parliament makes laws and also gives power to local Assemblies and/or City Councils to regulate pit latrine sludge through local by-laws. The legal framework for pit latrine emptying in Malawi is not explicit and there is no independent piece of legislation which clearly regulates FSM. The key national Malawian water, sanitation and hygiene policies are included in Table 2. But, the most implicit policy reference to pit latrine emptying in the National Sanitation Policy (2008) are:

- a) Section 3.3.5.16: "Encourage the provision of septic tank and latrine emptying equipment in cities, municipalities and towns."
- b) Section 3.5.3.19: "Ensure regular maintenance to latrines and toilet facilities" (at health care facilities), and
- c) In Section 4.16.9: "Provide septic tank and pit latrine emptying services and sludge disposal" (by private sector).

Pit latrine emptying businesses which are registered currently fall under the general National Construction Industry Council of Malawi, there are no special business licensing requirements. This is an especially large gap to

Table 3. National policies and regulation supporting pit latrine emptying as a sector in Zambia.

Title	Date	Relation and gaps to pit latrine emptying
National Water Policy	1994	Overall national guidance on water; no pit latrine emptying reference.
Public Health (Drainage and Latrine) Regulations	1994	Sets ratio of pit latrines to users; pit latrine installation standards; no pit latrine emptying reference.
Water Act (CAP 198)	1994	Management of waste to prevent pollution of public water; setting of penalty fines; prohibits pollution of water resources but no pit latrine emptying reference.
Water Supply and Sanitation Act No. 28	1997	Treatment and disposal of waste; sets National Water and Sanitation Council (NWASCO) as regulator for water and sanitation services. No specific reference to pit latrine emptying.
National Decentralization Policy	2004	Moves sanitation service oversight function to elected councils; no pit latrine emptying reference.
Local Government Act (CAP 281).	2006	Designates City Councils to be in charge of water and sanitation functions; no pit latrine emptying reference.
Public Health Act (CAP 295)	2006	Sanitation services for prevention of disease; no pit latrine emptying reference.
Environment Management Act	2011	Regulates discharge and disposal of waste which may pollute the environment; setting of penalty fines; prohibits pollution of water resources; no pit latrine emptying reference.
Sixth National Development Plans	2011	Sets sanitation as overall national target but with no pit latrine emptying reference.

group this service sector together and does not acknowledge the public health and safety standards needed for pit latrine emptying business.

As an example, in the Malawi city of Mzuzu, Assembly By-laws (Mzuzu City Assembly, 2002) cover the day to day oversight of sanitation services. Yet, the Refuse and Rubble Section is not followed, or enforced, and does not include any reference to pit latrine emptying.

Zambia presents a similar situation with very few policies directly referring to pit latrine emptying management. Most policies and legislation applies to FSM when it is considered under a general reference of sanitation. There are no specific policies and legislature dealing with FSM in urban areas. The key national Zambian water, sanitation and hygiene promotion policies are shown in Table 3. Pertinently, within the Water Supply and Sanitation Act, services are decentralized to water utilities. However, until recently, the water utilities were only operating in urban areas, and peri-urban areas had no institution mandated to take charge of water and sanitation service delivery.

In Zambia, Local Authorities are mandated through the Local Government Act (Cap 281), to provide sanitation services to areas within their jurisdiction. With the enactment of the Water Supply and Sanitation Act, most Local Authorities devolved the functions of sanitation provision from that of water utilities. Sanitation provision focused on water borne sewerage systems, leaving out on-site sanitation systems. However, there are no by-laws on FSM in urban or peri-urban areas of Lusaka resulting in the sector instead operating according to cited national policies and legislature similar to Malawi. Additionally, inadequate enforcement of urban planning has also led to construction of residential dwellings with

low quality sanitation facilities, and in some cases none at all. These challenges are also very similar to Malawi. It is very clear in both cases that inadequate policy and consequently, disjointed legal provisions are to be blamed. Why both the utilities and the private enterprises lack interest in servicing, these areas can ultimately be blamed on lack of incentives for provision of FSM services in these areas which is aggravated by a lack of enabling policy.

Except for a few sections in Malawi, there is limited clear guide on pit latrine emptying in national policies and regulations. In both Malawi and Zambia, there is not yet any single specific policy or regulation compassing FSM for collection, transport, treatment and use/disposal.

What are the key challenges?

Strande et al. (2014) argues challenges to pit latrine emptying includes technology, lack of baseline data sets, poor transportation access into disposal facilities, and poor pit latrine design and placement. Each of these challenges needs to be addressed by national policies and regulations for sustainable FSM. For example, modeling has shown filling time of pit latrines could be extended from 15 years to over 25 years if pit latrines are used for only faecal material and not solid waste (Brouckaert et al., 2013).

In other areas of Africa, such as Kumasi, Ghana, local District Assembly regulations for dumping of faecal sludge indicate specific sites (Williams and Overbo, 2015). Yet, management of disposal site and/or treatment facilities hours of operation must lean towards long operating hours, as closure, such as on weekends, may

increase illegal dumping (Williams and Overbo, 2015). Linked to this, Nyirenda and Holm (2015) reported in Mzuzu, Malawi, after multiple visits to the city sludge ponds, at no point did the researchers find fresh faecal sludge in the ponds. Further investigation with in-depth interviews from surrounding households revealed a demand for untreated sludge from vacuum tankers for use in nearby gardens. This shows at a grass roots level, an awareness of the beneficial use of faecal sludge. The major challenges relating to pit latrine emptying management in Malawi and Zambia includes:

1. Implementation of existing national policies and regulations
2. Education of individual informal pit latrine emptying businesses to follow environmental and health standards
3. Presence of non-faecal waste in pits latrines and solid waste management
4. Most pit latrine emptying businesses in Malawi and Zambia are small, less than five members
5. Transportation and use of disposal sites, which may encourage illegal disposal methods
6. Access to nearby treatment/disposal facilities.

What needs to change to overcome the key challenges?

According to Murungi and Meine (2014), the factors at the core of the crisis in the sanitation sector include institutional fragmentation and poor coordination among various authorized bodies. These are issues that can be ironed out with a well-focused policy on sanitation management aspects.

What then is the solution to overcome these challenges? Formulation and implementation of effective and responsive policies towards the issue of FSM is cardinal (Hasan et al., 2004). Such policy and legislation should aim at promoting incentivizing factors in FSM. Aspects beyond collection, transportation and disposal of faecal sludge need to be seriously considered if FSM is to improve. Policy should therefore embrace resource oriented initiatives applicable to FSM and should also aim at creating awareness among stakeholders. Kvarnström et al. (2011) argues national policies and regulations should be based on a function-based approach versus a technology-based approach, where a function-based approach promotes innovative sanitation ladder technologies. It is even noted that pit latrine emptying services are needed to keep a sanitation ladder functioning. Murray et al. (2010) also notes in a review of national policy for India, China and Ghana, overly ambitious targets of 100% compliance may not be reasonable. Moving forward, the model chosen by Ghana to stair step sanitation legislation between 2008 and 2024 may be an ideal model of momentum for both Malawi and Zambia to follow rather than the model in India where a

2002 National Water Policy with 100% urban wastewater treatment target has major gaps in enforcement (Murray et al., 2010). Furthering this Linyama et al. (2014) reports on a Lusaka monitoring process under WSUP for pit latrine emptiers, including a job card, customer data sheet, field log book and global monitoring sheet. While such a monitoring system may help sanitation service providers increase efficiency, such a monitoring program also provides valuable data for policy makers.

Schaub-Jones (2011) argues that to make sanitation service a business, sanitation service providers need to market dignity and comfort rather than health reasons because households do not always make sanitation a priority. This is an aspect that can potentially be reversed with incentivisation of the FSM sub-sector beyond just collection and disposal which until recently has been the focus in both Malawi and Zambia.

Placing an economic value on faecal sludge has the potential to improve the practice of collection and ultimate disposal (Daniel and Reed, 2010). The jobs created for pit emptiers is supplemented by businesses seeking economic value from faecal sludge. Incentivisation may also foster innovative local initiatives on harnessing faecal sludge for economic benefits which would in turn have spin-off benefits on health, hygiene and the environment (Bates, 2007). However, in both countries, limited measures, if any, have been put in place to promote the reuse of faecal sludge as a resource. In Zambia, it is only recently that faecal sludge has been used as a resource on a pilot scale (WSUP, 2012).

Awareness of perceived benefits of resources recovered from excreta is also cardinal for the success of FSM. Lack of community knowledge can be blamed for unwillingness to embrace resource oriented technologies (Strauss and Montangero, 2002). Another important consideration for enhanced acceptance of new FSM technologies is community involvement in the complete project cycle to develop a sense of ownership, without which the community will not feel obliged to be part of the system or solution (Bates, 2007). Where faecal sludge is being promoted as a resource, socio-cultural issues also need to be addressed. In both Zambia and Malawi, faecal sludge reuse is a new paradigm and hence will bring a different dimension to the already known norms and practices with respect to excreta disposal. In their paper on whether biogas is a solution to the disposal of latrine waste, Daniel and Reed (2010) concluded cultural implications are among the critical deciding factors on whether the technology will be a success followed by the way the project is implemented. Schertenleib and Morel (2003) and Heymans et al. (2004) both alluded to the fact for any sanitation concept to succeed, it should also be embraced by the beneficiary communities within which it is being implemented. These factors each need to be considered in the formulation of enabling policy and legislature for overcoming challenges in FSM in Zambia and Malawi and pit latrine emptying research.

Comparatively, FSM aspects for the household pit latrine emptying situation are overall very similar in Malawi and Zambia, in summary, what needs to change to overcome the key challenges includes:

1. Develop a function-based management approach, versus a technology-based approach
2. Enhance enforcement of existing national sanitation and waste policies and regulations
3. Incentivisation of faecal sludge as a resource
4. Promote systems for implementing an improved regulatory framework, including monitoring and evaluation
5. Foster pit emptying management policies in the context of collection, transport, treatment and reuse/disposal, and worker safety, friendly to both business situations of small scale pit latrine emptying businesses and larger formal groupings
6. Establish household pit latrine design construction criteria suitable for emptying, which promotes low-cost solutions and innovation
7. Regulate FSM service providers through licensing thereby ensuring desludging can be carried out in a manner that does not compromise the environment or put the emptiers at risk
8. Promote education and awareness creation on the operations and maintenance of latrines bearing in mind faecal sludge may ultimately be used as a resource
9. Encourage formal groupings of pit latrine emptying businesses
10. Build-in a business tax credit for pit latrine emptying
11. Collaborate efforts in solid waste management and FSM.

CONCLUSION

Challenges exist in Malawi and Zambia, FSM policy and regulation is not separate but rather part of the overall sanitation management. There is a need for effective and responsive policies and regulations by policy makers in the respective countries, and Africa at large, for faecal sludge collection, transport, treatment and use/disposal. There is especially a missing link in FSM for the niche of pit latrine emptying. During our study, we found it difficult to match the national policy and regulation with pit latrine emptying. In no cases was industrial safety for pit latrine emptying workers supplied.

In conclusion, analysis found national policies and regulations taking FSM into account were weak and had wide gaps in the two study countries. In some cases, waste regulations seem to imply faecal sludge, but are not clear. As shown in the examples of Mr. Clean and the Dream Team, there is a potential for FSM business opportunities which should be promoted in an enabling environment. But, 'how' pit latrine emptying businesses work in line with national policies and regulations is weakly established. This new topic needs continued

attention and updating of policy and legislation which is assumed to cover this topic in the years to come. For the future, we recommend, first, that household pit latrine emptying should be seen as an opportunity to address sanitation gaps and, second, that the national policies and regulations be evaluated and updated.

Conflict of interest

The authors did not declare any conflict of interest.

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