

## Research Paper

# Private emptiers' perspectives on the regulation of faecal sludge emptying services in Sub-Saharan Africa

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## ABSTRACT

Using a two-round Delphi study, 15 faecal sludge emptiers from 11 cities in Sub-Saharan Africa have expressed views on the regulation of faecal sludge emptying services. Their responses identify the regulatory mechanisms in place where they operate, their opinions of these mechanisms, and prioritisation of those considered most useful to enable safe emptying services for all urban residents. All respondents (100%) support regulation, with 80% finding the regulation they encounter useful. However, all also state that regulatory mechanisms should extend beyond only rules and sanctions, to incorporate support, incentives and pro-poor mechanisms. This study is the first to provide a first-hand account of Sub-Saharan African private emptiers' willingness to accept clear regulation. In that regard, regulation should be flexible and adapted to the context in order to facilitate fair competition, safe and satisfactory service for customers and workers alike, and to alleviate the public and environmental health risks.

**Key words:** enabling environment, onsite sanitation, private sector participation, pro-poor measures, sanitation chain, urban

## HIGHLIGHTS

- This research investigates emptiers' perspectives on the regulation of their services in Sub-Saharan Africa.
- Emptiers are keen to be regulated, providing regulation is flexible, adapted to the context and enforced on all.
- This study highlights the importance of support and incentive mechanisms and of pro-poor measures for safe emptying services to be both regulated effectively and accessible to all.

## INTRODUCTION

Less than 40% of the world's population has access to safely managed sanitation (WHO & UNICEF 2017), with serious public health risks (Fewtrell *et al.* 2005), as well as economic and social consequences (Jenkins *et al.* 2014; Rusca *et al.* 2018). Effective management of the sanitation chain requires a combination of services, stakeholders and technologies (Thye *et al.* 2011; Rusca *et al.* 2018). In Sub-Saharan Africa (SSA), over 80% of the population uses onsite sanitation facilities (WHO & UNICEF 2017), requiring adequate emptying and transport services of the faecal sludge contained in pits and tanks to be safely managed.

In SSA, emptying and transport services are typically provided by mechanical, semi-mechanical and manual operators, using vacuum tankers or trucks, devices such as the Gulper, or very basic manual tools (Thye *et al.* 2011). Manual operators are affordable, easy to hire and can access dense settlements, although they often deliver unhygienic services (Jenkins *et al.* 2014). Mechanical operators can provide faster, more hygienic services and are able to reach disposal or treatment sites, but are limited by road infrastructure and accessibility of some areas (Parkinson & Quader 2008; Thye *et al.* 2011). Most service providers are small private operators, often limited in scale and profitability (Kone *et al.* 2014). They pose a threat to public and environmental health when they do not dispose of collected sludge adequately, or work in a hygienic manner (Parkinson & Quader 2008). They also face personal risk of diseases and injuries when good working procedures or the use of personal protective equipment (PPE) are not adopted (Jenkins *et al.* 2014; Murungi & van Dijk 2014).

In order to protect the workers, the population and the environment, several cities in SSA regulate emptying and transport services. This regulation covers five main aspects: design and construction of onsite facilities; demand of emptying and

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transport services; operators through licences and permits; operations, transport and disposal of faecal sludge; and service tariffs (Trémolet 2012; Kone *et al.* 2014; Rao *et al.* 2016). Implementation of policy and regulatory frameworks has been found to be difficult, due to the lack of capacity of stakeholders to abide by or enforce the regulation (including technical and financial capacity, knowledge of the regulations and regulatory process) (Mulumba *et al.* 2015; Kohlitz *et al.* 2018), the inadequacy of regulations (Sinharoy *et al.* 2019; Weststrate *et al.* 2019), limited monitoring and enforcement capacities to ensure fair and predictable incentives and penalties (Kone *et al.* 2014) and the lack of data available on sanitation facilities, service providers and their operations (Sinharoy *et al.* 2019). Incentives and support are needed to ensure enforcement of rules (Parkinson & Quader 2008; Trémolet 2012; Rao *et al.* 2016).

While the need for regulation of emptying and transport services for faecal sludge has been established by the literature (Murungi & van Dijk 2014; Sinharoy *et al.* 2019), the views of those regulated have not been widely studied. Their opinions of regulations and factors that directly influence them to remain absent in the literature. Effective participation and buy-in of service providers is key to ensuring the adoption and implementation of regulations. This research addresses the gap by exploring the perspectives of emptiers on the regulation of their services, giving voice to their opinions on the regulation they currently have to work with, as well as the regulatory options they would support.

## METHODS

To gather and analyse emptiers' perspectives, an online Delphi study was conducted. The Delphi process, developed as a forecasting tool, is increasingly used in research to consult experts and gain consensus in a range of disciplines, including basic urban services (Dalkey & Helmer 1963; Scott *et al.* 2019). Through rounds of structured or semi-structured questionnaires, participants identify their 'most important', 'most likely' or 'most true' variables. Delphi studies are characterised by anonymity, iteration, controlled feedback and quantitative synthesis of findings (Hasson *et al.* 2000). The number of emptiers across the region being both unknown and likely too high to use representative methods, this method allowed participants working across SSA to be consulted on regulatory mechanisms.

Delphi studies participants vary across studies, but they are generally considered to be experts in their field, with a minimum of 12 considered necessary (Murphy *et al.* 1998). This study consulted emptiers from SSA as experts in their services, those 'regulated', who were reached through emails and phone calls. The criteria for selection were that respondents: (i) provide faecal sludge emptying services in SSA and (ii) are able to answer several rounds of an online survey. The study was run in French and English, with each round open for several weeks. Between May and October 2020, 15 emptiers participated in round 1, from which 12 participated in round 2.

Delphi studies' first rounds are usually open and qualitative; subsequent rounds ask for the ranking or rating of a reduced number of elements resulting from previous rounds (Dalkey & Helmer 1963; Hasson *et al.* 2000). This study consisted of only two rounds, as the number of elements to be ranked was relatively small and responses to the second round showed agreement among them. Both rounds were piloted and amended to ensure questions were clear, well-targeted and as unbiased as possible.

In the first round, the respondents were asked about their emptying operations, the regulatory framework they are working under and their opinions of it. They were presented with lists of regulatory mechanisms, grouped into five categories of regulatory 'tools' identified from the literature (rules, sanctions, monitoring, support and incentive mechanisms, and pro-poor measures) to cover all potential aspects of the regulation (Evans *et al.* 2009; Vedung 2017). Each category was briefly explained and respondents asked to select those mechanisms relevant to their operation, to add others they felt were missing, and to give reasons behind their selection. They were then asked to select the mechanisms they deemed useful to help achieve adequate emptying services in their cities.

In the second round, respondents were presented with mechanisms selected or added in round 1, maintaining the original wording of these additions as far as possible. Within each category, they were asked to select the five most useful mechanisms for their cities (top 5) and to explain their selection.

A link to the first-round questionnaire was widely shared through the Sustainable Sanitation Alliance platform, the Pan-African Association for Sanitation Workers, local emptiers' associations, development partners and researchers. The link to the second-round questionnaire was shared only with the respondents of the first round.

A frequency and thematic analysis was run at the end of the first round, to feed into the second round and again after the second round.

Ethical approval for the survey was given by Loughborough University (DT\_10496). Written informed consent was obtained from all respondents.

## RESULTS AND DISCUSSION

### The respondents

Fifteen respondents participated in the first round of the study, and 12 in the second round. Most provide mechanical emptying services (87%), although some also provide manual or semi-mechanical services (33%). The majority own or work for medium-sized companies with two to five trucks (69%), the remainder for small (15%) or large (15%) companies. Companies were formed fairly recently, with 73% less than 10 years old. They all provide services to households and almost all also to private businesses and public buildings (87%). All respondents are private operators.

Respondents are all located in SSA, operating in the following cities: Cotonou, Benin (3); Ouagadougou, Burkina Faso (2); Freetown, Liberia (1); Dakar, Senegal (1); Kampala, Uganda (2); Lusaka, Zambia (1); Mbeya City, Tanzania (1); Kigali, Rwanda (1); Mzuzu and Lilongwe, Malawi (1); Yaounde, Cameroon (1) and Durban, South Africa (1).

### Results

The following subsections present responses given to rounds 1 and 2, for the mechanisms presented (or added by the respondent) within each category of regulatory tools. Tables 1–5 show the responses, together with the level of agreement among respondents in each round.

Notes applying to Tables 1–5:

- In round 1 of the survey, respondents answered questions regarding which mechanisms are in place in the cities they work in (Column 2). They were presented with a list and asked to select the elements they felt would contribute to adequate emptying services in their cities. They could also add other elements to the list (Column 3).
- In round 2, respondents were asked to choose the top 5 most useful mechanisms for their cities (Column 5).
- Level of agreement (Columns 4 and 6) corresponds to the percentage of respondents selecting the mechanism in question.
- The results are ordered by the tools considered most useful in response to round 2.

### Rules

Most respondents said that some legal requirements (rules) are in place in their city relating to their services (87%).

**Table 1** | Rules in place and prioritisation of rules

	Round 1			Round 2	
	Rules in place	Useful	Level of agreement	5 most useful	Level of agreement
<i>Number of respondents (n =)</i>	14	15		12	
Mandatory use of protective equipment	8	13	>75%	12	>75%
Mandatory site(s) for disposal	13	12	>75%	10	>75%
Licence for operators	8	13	>75%	9	>75%
Standard operating procedures	4	12	>75%	5	>25%
Licence for the trucks	8	8	>50%	5	>25%
Mandatory use of specific emptying tools	4	9	>50%	4	>25%
Mandatory tariffs or range of tariffs	3	5	< 25%	3	>25%
Mandatory regular (scheduled) emptying	0	10	>50%	2	< 25%
No rules in place	2	0	0%	N/A	N/A
Mandatory financing options	N/A	Added by respondent		2	< 25%
Mandatory membership of an emptiers' association	N/A	Added by respondent		6	>50%
Allocated zones of operations	N/A	Added by respondent		2	< 25%

Fifty-three percent of respondents said that not all emptiers in their city operate within the rules, 13% said that emptiers don't, and 13% that they do. Examples given of non-compliance are linked to illegal sludge disposal, non-use of PPE and not having the right licence.

Most respondents think that the rules in place in their cities are useful (62%) or could be if they were enforced (23%). They find rules help to protect public health, the environment and sanitation workers, help provide better services, improve the image of their business and increase demand for safe services. However, one respondent implied that the rules are not flexible enough to account for operational circumstances: 'I have different volumes of trucks, but the price for discharge is uniform. If people want to maximise the profit, they might not go to the dumping site' (respondent D09). Another highlighted that public operators not abiding by the rules create unfair competition (respondent D08). Several reported the rules being abused by officials to demand bribes.

The 'most useful rules' identified were consistent across both rounds and correspond mostly to what respondents already experience, with the exception of Standard Operating Procedures, which were felt to bring uniformity and guidance, backed by scientific evidence.

### Sanctions

Most respondents said that there are some sanctions in place in their city in case emptiers do not comply with the rules (87%).

Sixty-seven percent of respondents have, or know an emptier who has, faced sanctions. Examples reported are fines, arrest, or confiscated trucks and emptying equipment when faecal sludge is illegally dumped; and fines for the use of a non-authorised truck. Examples align with the most common rules in place and lead to a change of practice in 80% of cases.

Most respondents think that sanctions are very useful (64%) or could be if they were applied (21%). They identified that sanctions help to protect the environment and the workers, improve the image of their work and their company, and increase demand and supply of safe services.

### Monitoring and control mechanisms

Most respondents said that there are some monitoring and control mechanisms in place in their city to check that emptiers comply with the rules (78%).

Thirty-three percent of respondents report on their work to an institution, either relating to service indicators or for tax purposes. Most think that these requirements are useful (80%) as it helps them keep records and monitor their staff and operations, while helping authorities understand the services provided and the sanitation sector, and plan adequately for the future.

**Table 2** | Sanctions in place and prioritisation of sanctions

	Round 1			Round 2	
	Sanctions in place	Useful	Level of agreement	5 most useful	Level of agreement
<i>Number of respondents (n =)</i>	15	14		12	
Fine(s)	10	10	>50%	11	>75%
Loss of licence	7	7	>50%	8	>50%
Loss of access to disposal site	7	8	>50%	6	>50%
Loss of contract with the institutions	3	6	>25%	6	>50%
Arrest	7	5	>25%	1	< 25%
No sanctions in place	2	1	< 25%	NA	NA
A warning for first offenders	N/A	Added by respondent		9	>75%
Loss of association's membership	N/A	Added by respondent		7	>50%
Negotiations	N/A	Added by respondent		5	>25%
Confiscation of truck or emptying equipment	N/A	Added by respondent		4	>25%

**Table 3** | Monitoring and control in place and prioritisation

	Round 1			Round 2	
	Mechanisms in place	Useful	Level of agreement	5 most useful	Level of agreement
<i>Number of respondents (n =)</i>	14	15		12	
Inspection of the trucks and vehicles used	7	10	>50%	8	>50%
Customer satisfaction surveys or follow-up call	2	11	>50%	8	>50%
Inspection of the emptying equipment and tools used	3	8	>50%	7	>50%
Inspection made on arrival to disposal site	7	12	>75%	6	>50%
Self-reporting by emptiers on key quality indicators (safety incidents reports, operating protocol checklist, etc.)	2	8	>50%	6	>50%
Self-reporting by emptiers on key service indicators (number of customers served, amount of sludge emptied or delivered to disposal, emptying fee collected, etc.)	3	8	>50%	6	>50%
Audits or inspection of the paperwork of the company	3	8	>50%	5	>25%
Site inspections during emptying operations	1	9	>50%	5	>25%
No monitoring and control mechanism in place	3	0	0%	NA	NA
GPS monitoring of the trucks	N/A	Added by respondent		8	>50%

### Support and incentive mechanisms

Most respondents said that there are no support and incentive mechanisms in place in their city to support and encourage emptiers to comply with the rules (67%).

**Table 4** | Support and incentive mechanisms in place and prioritisation

	Round 1			Round 2	
	Mechanisms in place	Useful	Level of agreement	5 most useful	Level of agreement
<i>Number of respondents (n =)</i>	15	9		12	
Help to access credit or financial support	2	6	>50%	11	>75%
Training on how to operate and/or on how to manage a business	5	6	>50%	9	>75%
Workers' health-related support (health insurance, vaccination, etc.)	1	4	>25%	6	>50%
Clearer rules to avoid harassment by police or local authorities	1	6	>50%	5	>25%
Awareness campaign to increase demand for services	3	6	>50%	5	>25%
Training on the rules in place	4	6	>50%	3	>25%
Payment for sludge delivered at the disposal or treatment site	0	3	>25%	1	< 25%
Supply of equipment and/or of protective equipment	1	5	>50%	0	< 25%
No support and incentive mechanism in place	10	0	0%	NA	NA
No tax on emptying fees paid by the customers	N/A	Added by respondent		7	>50%
Benchmark visits to learn from other emptiers	N/A	Added by respondent		5	>25%
Call centres to distribute jobs among emptiers	N/A	Added by respondent		4	>25%
Awareness campaigns explaining to the public how to use and maintain their pits and tanks (e.g. not to throw solid waste in them)	N/A	Added by respondent		4	>25%

There is a high level of agreement among respondents. Most mechanisms (six out of eight) proposed to the respondents in round 1 were seen as useful (above 50% agreement), and several were added. All respondents stated that the support and incentive mechanisms in place are very useful, as they help emptying companies grow their business and provide safe and satisfactory services to their customers.

### Pro-poor measures

Most respondents did not identify measures in their city to enable the poor to access emptying services (67%).

All respondents, however, said that pro-poor measures are useful or could be if they existed. They are seen as able to 'help [both] the customers and the service providers' (respondent D12), 'help the poor to have clean and safe environments' (respondent D14) and help to 'eradicate manual emptying' (respondent D02).

### Summary findings

Results show that all respondents are in favour of some type of regulation in their city. The tables above identify the most common regulatory mechanisms in place across the 12 cities. For each category of regulatory tools, over 80% of respondents stated that the mechanisms existing in their cities are useful, or could be if they were applied.

The acceptance of regulation is also shown by the high level of agreement among respondents to the usefulness of the proposed regulatory mechanisms (80% deemed useful by more than 50% of respondents). Likewise, for all the categories investigated, no participant responded that not having any regulatory mechanism in place would be useful (with the exception of 1 respondent on sanctions).

In selecting useful (round 1) and most useful (round 2) mechanisms, respondents have also said they chose those that enable the better organisation of the sector, fair competition, and an improved image of their work that increases demand for safe services. Selected mechanisms are also those they feel allow them to service poor customers at a reasonable price, provide safer services for workers and customers, gain feedback from their customers and require truck owners to maintain their vehicles.

**Table 5** | Pro-poor measures in place and prioritisation

	Round 1			Round 2	
	Measures in place	Useful	Level of agreement	5 most useful	Level of agreement
<i>Number of respondents (n =)</i>	15	11		12	
Subsidies to build or upgrade toilets so that they are easy to empty	3	6	>50%	11	>75%
Subsidies or contracts given to the emptiers to empty poor households' pits or tanks	4	7	>50%	10	>75%
Transfer stations available in the poorest areas	3	6	>50%	7	>50%
Formalisation of informal emptiers operating in the poorest areas	1	6	>50%	6	>50%
Subsidies or micro-finance loans given directly to the households to pay for emptying their pit or tank	2	6	>50%	4	>25%
Public operators offering emptying services at a reduced rate or for free	3	2	< 25%	2	< 25%
No pro-poor measure in place	10	0	0%	NA	NA
Toll-free calls to emptying services providers	N/A	Added by respondent		6	>50%
Annual emptying operation in the poorest areas with a reduced fee by private operators	N/A	Added by respondent		4	>25%
Cross subsidies for the poor via tariffs (different prices charged to customers based on their income)	N/A	Added by respondent		3	>25%
No fee to discharge pit latrine sludge at a transfer or treatment station	N/A	Added by respondent		3	>25%
Free emptying equipment and/or transport to emptiers working in poor areas	N/A	Added by respondent		3	>25%

## Discussion

Findings suggest that based on their experience, the emptiers consider regulation to contribute to alleviating the risks their services pose to public and environmental health, in agreement with the literature (Parkinson & Quader 2008; Murungi & van Dijk 2014). Where limited regulation exists, they have self-organised and professional associations play an important role in coordinating and overseeing their members' work. The crucial role of these associations is reflected in the fact that most respondents are members (86.7% of respondents), deem mandatory membership to be a useful rule (>50% round 2) and loss of such membership a useful sanction to the business (<50% round 2).

Moreover, respondents see regulation as 'good for business': (i) by forcing all operators to provide safer and more satisfactory services, the image of their work would improve, increasing demand for safe services; (ii) through clearer rules, known by all, the risk of harassment and the official bribes would reduce; (iii) as a result of better employee protection and training, companies would perform better and (iv) through support mechanisms operators would be able to reach more customers and provide safe services at a reasonable price, thus expanding their market. Such statements reinforce previous findings in the literature, where regulation could be a 'positive enabler for businesses' (Renouf 2017).

When asked to select the top 5 regulatory mechanisms for each category (round 2), respondents prioritised those involving some control from authorities: that is, a mandatory site for sludge disposal, licencing and use of PPE, fines, loss of licence and the means to operate, inspections and audits. They also emphasised that regulation should be flexible (e.g. through warnings for first offenders), and appropriate to the context. Indeed, unachievable standards, unaffordable PPE or high disposal fees can dissuade emptiers and households from even trying to comply and encourage unhygienic practices (Mbéguééré *et al.* 2010; Vedung 2017).

Respondents also pointed out that rules and sanctions should be enforced for all operators, including public operators, to provide fair competition. Indeed, emptiers providing unhygienic services usually operate at a lower cost than compliant service providers, thus disturbing the market and putting the financial viability of safe services at risk (Acey *et al.* 2019).

The willingness of respondents to be regulated may seem to contradict the fact that, in most cities, respondents report that rules are not respected by some or all emptiers (66%). With respondents mostly from well-established companies and members of emptiers associations, they may be more keen for the sector to be organised and view the regulations in place as inadequate to enable fair competition. This reflects findings of previous studies highlighting the need for regulatory frameworks to be realistic, achievable, coherent and enabling (Mulumba *et al.* 2015).

This study highlights the importance of regulatory mechanisms other than basic 'command and control' ones (i.e. rules and sanctions). Examples of support mechanisms in the literature include recognition of service providers and their work, formalisation and training, and limits on disposal costs. Few instances of at-scale support mechanisms, however, have been reported in the literature. Respondents identified the value of support mechanisms, prioritising help to access credit or financial support and training (>75% of respondents), tax exemptions for emptying services and workers' health-related support (>50%). Such support and incentive mechanisms would enable them to introduce expeditious improvements for safer services to reach all residents.

Pro-poor measures are seen to increase access to services for the poor, who typically hire unsafe manual emptiers (Jenkins *et al.* 2014). This study emphasises the usefulness and diversity of forms that support safe services for the poor can take and the willingness of private providers to service them. This is reflected in public operators offering emptying services at a reduced rate or for free (pro-poor measures) being among the mechanisms found least useful (<25% agreement in round 1). They can take the form of subsidies to upgrade toilets or to provide and purchase emptying services, transfer stations, formalisation of informal manual emptiers, etc. Previous studies had shown the requirement for subsidies to enable access to safe sanitation to all (Evans *et al.* 2009; Trémolet 2012), however, limited experiences of at-scale subsidisation of emptying services have been reported. eThekweni Municipality, in South Africa, provides free emptying services for low-income households supported by cross-subsidisation (Gounden *et al.* 2019), while utilities in Zambia and Kenya are looking to use a sanitation surcharge to subsidise services (Acey *et al.* 2019).

## Limitations

This study, both in its design and process, did not aim to obtain a representative picture of all emptiers in SSA. Its purpose was rather to ask emptiers, as experts in their trade, their opinion on the regulation of their services. We aimed at recruiting a small but diverse group of participants, enabled through an extended response time, a bilingual approach and outreach efforts. However, required access to a computer or smartphone and internet connection may explain why respondents are

mostly from medium-sized companies. More marginalised, informal emptiers, and non-English- or French-speakers, were likely unable to contribute to this study. No public operators responded, although also invited to participate.

## CONCLUSION

The study has enabled emptiers across SSA to share their perspective on the regulation of their services and identify which regulatory mechanisms they find useful. It shows that private operators offering emptying services in different cities are in favour of regulation of their services, providing that it is flexible, adapted to the context and enforced on all operators. Indeed, 80% of respondents find the regulation in their city useful or potentially useful if implemented.

It also highlights the importance of support and incentive mechanisms and of pro-poor measures for safe emptying services to be both regulated effectively and accessible to all. 'Command and control' regulation should go hand in hand with market-based incentive instruments and subsidies. This study provides an account of those mechanisms emptiers regard as potentially useful and those they view as most valuable to their work. They make a valuable starting point for consideration by regulators when deciding their regulatory strategy while accounting for contextual factors (available resources, ease of implementation, available data, etc.). Further research investigating examples of at-scale support, incentives and pro-poor mechanisms would be helpful to these decision-makers.

Private providers appear keen to share their knowledge and experience about their services. As such, they could be actively involved in setting up regulatory frameworks that enable them to provide adequate services in their cities. Additional research, including hearing from more informal service providers would complement the results of this study. Professional associations, already operating as informal regulators in some cities, provide an entry point for consultation. Research to better understand their role in the development and acceptance of regulation both by and of emptiers, would support more inclusive and evidence-based decision-making processes.

Where regulations are being developed, replicating this study at the local level would help to inform the process by engaging local service providers and ensuring their perspectives are taken into account. As many city authorities are taking steps to regulate sanitation services, this paper should also prove useful to decision-makers and researchers.

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## DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

## REFERENCES

- Acey, C., Kisiangani, J., Ronoh, P., Delaire, C., Makena, E., Norman, G., Levine, D., Khush, R. & Peletz, R. 2019 *Cross-subsidies for improved sanitation in low income settlements: assessing the willingness to pay of water utility customers in Kenyan cities*. *World Development* **115**, 160–177. <https://doi.org/10.1016/j.worlddev.2018.11.006>.
- Dalkey, N. & Helmer, O. 1963 *An experimental application of the DELPHI method to the use of experts*. *Management Science* **9** (3), 458–467. <https://doi.org/10.1287/mnsc.9.3.458>.
- Evans, B., van der Voorden, C. & Peal, A. 2009 *Public Funding for Sanitation: The Many Faces of Sanitation Subsidies*. Geneva, Switzerland. Available from: [http://www.wsscc.org/sites/default/files/publications/WSSCC\\_Public\\_Funding\\_for\\_Sanitation\\_2009.pdf](http://www.wsscc.org/sites/default/files/publications/WSSCC_Public_Funding_for_Sanitation_2009.pdf)
- Fewtrell, L., Kaufmann, R. B., Kay, D., Enanoria, W., Haller, L. & Colford, J. M. 2005 *Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis*. *The Lancet Infectious Diseases* **5** (1), 42–52. [https://doi.org/10.1016/S1473-3099\(04\)01253-8](https://doi.org/10.1016/S1473-3099(04)01253-8).
- Gounden, T., Alcock, N., Mercer, S., Lewis, M. & Wilson, D. 2019 Complexities around PPPs within the circular economy in Durban, South Africa. In: *FSM5*. Cape Town.
- Hasson, F., Keeney, S. & McKenna, H. 2000 *Research guidelines for the Delphi survey technique*. *Journal of Advanced Nursing* **32** (4), 1008–1015. <https://doi.org/10.1046/j.1365-2648.2000.t01-1-01567.x>.
- Jenkins, M. W., Cumming, O., Scott, B. & Cairncross, S. 2014 *Beyond 'improved' towards 'safe and sustainable' urban sanitation: assessing the design, management and functionality of sanitation in poor communities of Dar es Salaam, Tanzania*. *Journal of Water, Sanitation and Hygiene for Development* **4** (1), 131. <https://doi.org/10.2166/washdev.2013.180>.
- Kohlitz, J. P., Rostiani, R., Indarti, N., Murta, J. & Willetts, J. 2018 *Sludge removal enterprises in Indonesia: factors affecting entrepreneurial success*. *Journal of Water Sanitation and Hygiene for Development* **8** (2), 246–256. <https://doi.org/10.2166/washdev.2018.085>.

- Kone, D., Chowdhry, S., Officer, S. P., Foundation, M. G. & North, F. A. 2014 Profitability of private fecal sludge emptying businesses in Africa and Asia. In: *Sanitation and Hygiene in Africa: Where Do We Stand?* (Cross, Y. & Coombes, P., eds). IWA, London, pp. 77–88. <https://www.iwapublishing.com/sites/default/files/ebooks/9781780405421.pdf>
- Mbégué, M., Gning, J. B., Dodane, P. H. & Koné, D. 2010 Socio-economic profile and profitability of faecal sludge emptying companies. *Resources, Conservation and Recycling* **54** (12), 1288–1295. <https://doi.org/10.1016/j.resconrec.2010.04.008>.
- Mulumba, J. N., Nothomb, C., Potter, A. & Snel, M. 2015 Striking the balance: what is the role of the public sector in sanitation as a service and as a business? *Waterlines* **33** (3), 195–210. <https://doi.org/10.3362/1756-3488.2014.021>.
- Murphy, M. K., Black, N. A., Lamping, D. L., McKee, C. M., Sanderson, C. F., Askham, J. & Marteau, T. 1998 Consensus development methods, and their use in clinical guideline development. *Health Technology Assessment* **2** (3). <https://doi.org/10.3310/hta2030>
- Murungi, C. & van Dijk, M. P. 2014 Emptying, transportation and disposal of faecal sludge in informal settlements of Kampala Uganda: the economics of sanitation. *Habitat International* **42** (April), 69–75. <https://doi.org/10.1016/j.habitatint.2013.10.011>.
- Parkinson, J. & Quader, M. 2008 The challenge of servicing on-site sanitation in dense urban areas: experiences from a pilot project in Dhaka. *Waterlines* **27** (2), 149–163. <https://doi.org/10.3362/1756-3488.2008.017>.
- Rao, K. C., Kvarnstrom, E., Di Mario, L. & Drechsel, P. 2016 *Business Models for Fecal Sludge Management (Resource Recovery and Reuse Series 6)*. Colombo, Sri Lanka.
- Renouf, R. 2017 *A Guide to Strengthening the Enabling Environment for Faecal Sludge Management*. London, UK.
- Rusca, M., Alda-Vidal, C. & Kooy, M. 2018 Sanitation justice? The multiple dimensions of urban sanitation inequalities. In: *Water Justice*. Cambridge University Press, King's College London, UK, pp. 210–225. <https://doi.org/10.1017/9781316831847.014>
- Scott, R., Scott, P., Hawkins, P., Blackett, I., Cotton, A. & Lerebours, A. 2019 Integrating basic urban services for better sanitation outcomes. *Sustainability (Switzerland)* **11** (23), 1–17. <https://doi.org/10.3390/su11236706>.
- Sinharoy, S. S., Pittluck, R. & Clasen, T. 2019 Review of drivers and barriers of water and sanitation policies for urban informal settlements in low-income and middle-income countries. *Utilities Policy* **60** (March), 100957. <https://doi.org/10.1016/j.jup.2019.100957>.
- Thye, Y. P., Templeton, M. R. & Ali, M. 2011 A critical review of technologies for pit latrine emptying in developing countries. *Critical Reviews in Environmental Science and Technology* **41** (20), 1793–1819. <https://doi.org/10.1080/10643389.2010.481593>.
- Trémolet, S. 2012 *Sanitation Markets Pathfinder Paper. Using Economics to Improve the Delivery of Services along the Sanitation Value Chain*. London.
- Vedung, E. 2017 Policy instruments: typologies and theories. In: *Carrots, Sticks & Sermons* (Bemelmans-Videc, M.-L., Rist, R. C. & Vedung, E., eds). Routledge, New York, pp. 21–58. <https://doi.org/10.4324/9781315081748-2>.
- Weststrate, J., Gianoli, A., Eshuis, J., Dijkstra, G., Cossa, I. J. & Rusca, M. 2019 The regulation of onsite sanitation in Maputo, Mozambique. *Utilities Policy* **61**. <https://doi.org/10.1016/j.jup.2019.100968>
- WHO & UNICEF. 2017 *Progress on Drinking Water, Sanitation and Hygiene – 2017 Update and SDG Baselines*. Geneva. Available from: <http://www.wipo.int/amc/en/%0Ahttp://www.who.int/about/>

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