

Safe faecal sludge emptying and transport: compliance challenges and models for a public good

Claire Grisaffi ^{a,*}, Paul Leinster ^a, Kariuki Mugo^b, Sam Drabble ^c and Alison Parker  ^a

^a Cranfield Water Science Institute, Cranfield University, Cranfield, UK

^b Global Policy and Campaigns Directorate, WaterAid, Nairobi, Kenya

^c Evaluation, Research and Learning Directorate, Water & Sanitation for the Urban Poor, London, UK

*Corresponding author. E-mail: claire.grisaffi@cranfield.ac.uk

 CG, 0000-0001-7038-9849; PL, 0000-0001-6073-0142; AP, 0000-0001-7370-6758

ABSTRACT

In the 81 countries where most urban dwellers rely on faecal sludge (FS) emptying and transport, services are frequently provided by a heterogeneous private sector. Considering the responses of service providers is essential to ensuring that the regulatory frameworks put into place achieve their intended outcomes and safeguard public and environmental health. Combining a literature review and expert practitioner input, we identify priority challenges for scaling safe FS emptying and transport (E&T) services and use these to adapt a holistic model of business compliance. We confirm well-documented challenges such as cost structures for compliance with regulation, the perception of services as low status, and an inadequate enabling environment. We identify the importance of trust in building voluntary compliance as a novel issue for sanitation but widely discussed in the regulation literature. We also identify a distinct role for the regulator as a catalyst for change. The role of disgust as a policy barrier and the application of behavioural theory to building compliance are areas warranting further research. This is the first paper to explicitly consider the regulation of FS E&T through a compliance lens, linking established areas of the regulation literature to new findings in urban sanitation.

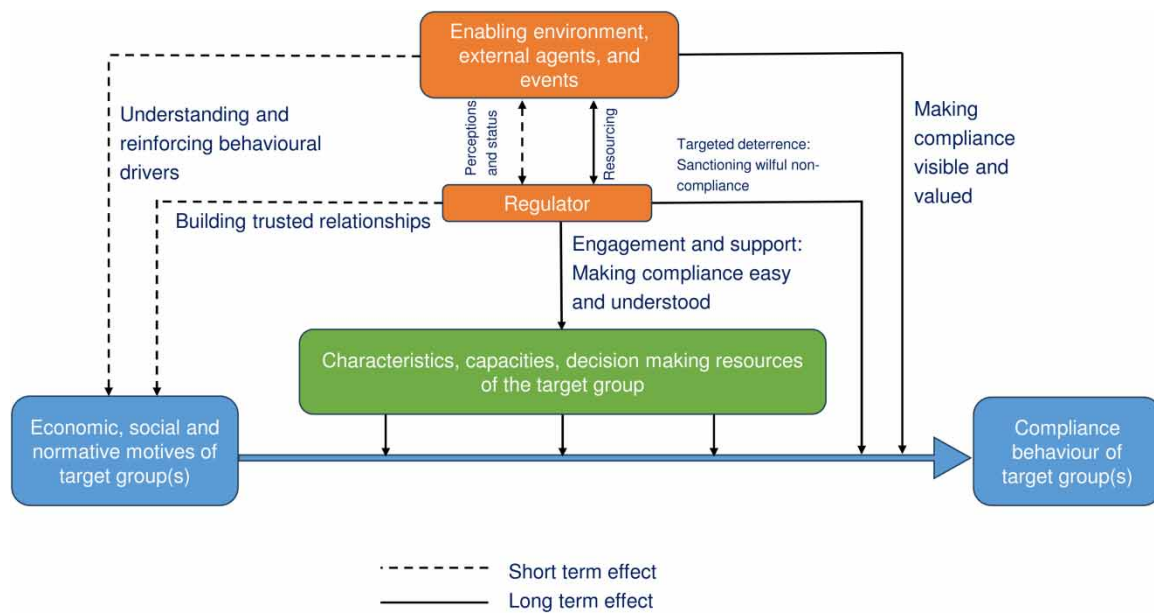
Key words: regulation, sanitation, urban

HIGHLIGHTS

- For sanitation regulation to have an impact voluntary compliance with safe practice must be built.
- One challenge is the low status of the service and the barrier of disgust.
- Another challenge is the cost structures for the service provider, which drive non-compliance.
- There are challenges of trust between the mandated authority and service provider.
- There is a distinct role for the regulator as a change agent.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Licence (CC BY 4.0), which permits copying, adaptation and redistribution, provided the original work is properly cited (<http://creativecommons.org/licenses/by/4.0/>).

GRAPHICAL ABSTRACT



INTRODUCTION

Urban on-site sanitation is increasingly recognised as a public good, and ensuring access to safe services as a government responsibility (Joseph *et al.* 2024). The role being taken by many governments reflects a wider trend of regulatory capitalism, where regulation rather than the direct provision of public services is the expanding role of government (Levi-Faur 2005; Lerebours *et al.* 2021b). This shift occurs alongside the privatisation of services and expectations that market mechanisms would finance sanitation service coverage (Levi-Faur 2005; Rosenqvist *et al.* 2016).

The significant negative externalities of unsafe sanitation are difficult to quantify and attribute. Unsafely managed faecal sludge (FS) pollutes ecosystems and creates a disease burden that disproportionately affects low-income neighbourhoods (Peal *et al.* 2020; Wolf *et al.* 2022). Effective regulation is essential to address market failures and protect public goods across the 81 countries where most of the urban population relies on FS management (Baldwin *et al.* 2011; JMP 2022).

FS emptying and transport (E&T) is considered part of the sanitation chain, which could be more easily outsourced and regulated (Kone & Chowdhry 2014). FS E&T services in low-income urban areas are frequently delivered by a heterogeneous private sector, ranging from sizable formal enterprises running vacuum tankers to individuals informally servicing their local community with shovels and buckets (Lerebours *et al.* 2021b; Dutton *et al.* 2022).

National regulatory frameworks for FS E&T are rapidly evolving. At least 65% of countries now have some form of regulations and mandated authorities in place, reflected in a growing body of literature (Lerebours *et al.* 2022; WHO 2023a). In many cases, a multi-level regulatory system is created, with mandated authorities regulated by a national body, explicitly or implicitly delegating service delivery to the private sector and acting as local regulators. Despite this rapid and positive evolution, legal or regulatory frameworks may still be partial and fragmented (WHO 2020). Drivers and barriers to compliance in the provision of safe FS E&T are not well documented or understood (Lerebours *et al.* 2021a).

Understanding the compliance responses of FS E&T service providers is critical to ensuring that these regulatory frameworks are translated into practice and achieve their intended outcomes to safeguard public and environmental health (Parker & Nielsen 2017; IWA 2022). The Organization for Economic Cooperation and Development (OECD) *Regulatory Policy Outlook* (2021) reflects compliance research, evidencing the complex responses of individuals and organisations to regulation, with deterrence and interest offering only a partial explanation (Kagan *et al.* 2011). If regulation does not take a bottom-up compliance perspective, then individual acts by service providers ‘...of foot dragging and evasion ... may, in the end, make an utter shambles of the policies dreamed up by their would-be superiors’ (Scott 1985).

Parker & Nielsen’s (2017) holistic model of business compliance, shown in Figure 1, is one framework for understanding how compliance can be built or eroded. The model combines the everyday motives and

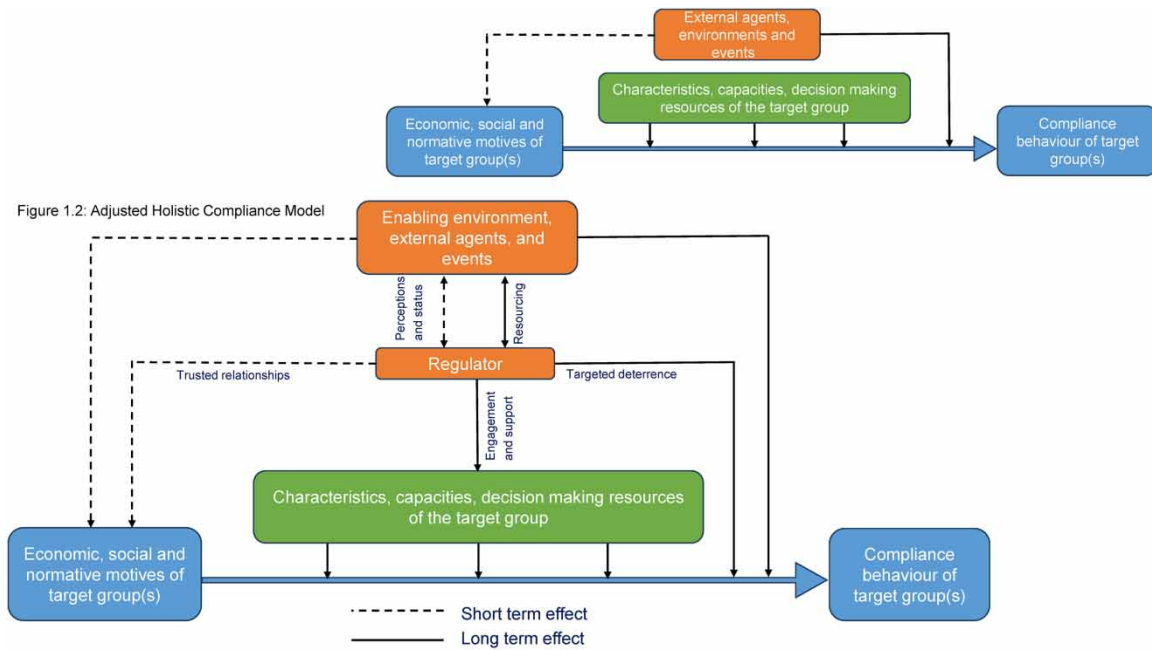


Figure 1 | (a) Original and (b) adjusted holistic compliance model.

characteristics of businesses and individuals and how these interact with the environment. It incorporates a series of questions to understand how compliance is or is not produced. The model takes a pragmatic but nuanced approach to understanding compliance. It incorporates social and normative motives and moves away from assumptions of businesses or individuals as purely rational economic actors (Ostrom 2000). The model has been used to inform research across multiple sectors, from pandemic responses to cannabis farming, environmental protection, and renewable energy (Susilawati & Kanowski 2020; Bodwitch *et al.* 2021; Lee *et al.* 2021).

In this study we aim to understand the challenges, in order to develop a framework to build compliance of FS E&T service providers. The research extends and adapts the holistic model of business compliance developed by Parker & Nielsen (2017) to be appropriate for FS E&T services.

MATERIALS AND METHODS

Overall

An initial literature review was used to develop a series of statements on challenges and good practice. These were expanded and evaluated through a two-stage Delphi study (Beiderbeck *et al.* 2021). The Delphi study findings were then used to structure a review of the academic and practitioner literature on urban sanitation. Complete findings were assessed against the wider regulation and the compliance literature and used to adapt and extend the holistic model of business compliance.

Definitions

This study looks at provision as defined by Ostrom *et al.* (1993), addressing the problem through consideration of policy and regulation. There are a wide range of possible definitions of regulation, ranging from a narrow view of a specific set of commands to incorporating all forms of social control or influence (Baldwin *et al.* 2011). Regulation is defined in this study as ‘a process involving the sustained and focused attempt to alter the behaviour of others ... [to reach a] defined outcome’ (Black & Kingsford Smith 2002). The ‘outcome’ is achieving national policy goals for universal access to safe sanitation (ESAWAS 2022). The definition centres on deliberate state influence, but with a wide range of formal and informal sources contributing to, or impeding, the process.

In line with the above definition, compliance within the context of this study is with policy goals for universal access to safe sanitation, rather than with a given regulatory framework. Safe sanitation includes safe emptying for sanitation workers and the household and safe transport for the wider public and the environment.

The terms 'FS E&T' and 'faecal sludge management' ('FSM') are used for conciseness and ease of communication in this study. However, we recognise that road-transported sanitation is a more precise and less pejorative term (Strande *et al.* 2023).

'Wider enabling environment' includes the six components as described by Strande & Brdjanovic (2014): government support, legal framework, institutional arrangements, skills and capacities, financial arrangements, and socio-cultural acceptance. Regulation is itself part of the enabling environment but is considered separately here.

Reflecting the multi-level systems of regulation outlined in the introduction, 'national regulator' is used for whichever national authority has the primary responsibility for regulating sanitation service provision. Utilities and municipalities, or the municipal department, which are responsible for sanitation, are referred to as 'mandated authorities'. It is recognised that mandated authorities may also be directly providing FS E&T services and/or monitoring and controlling the activities of a local private sector. Where they are acting as regulators, they are referred to as 'local regulators'. 'Service provider' refers to the individuals or businesses directly involved in FS E&T.

The holistic model of business compliance, in Figure 1, shows the economic, social, and normative motives of the target group (here either the mandated authority or the service provider) and how their characteristics, capacities, and decision-making resources are impacted by external agents, environments, and events, and thereby impact compliance behaviours, considering both short- and long-term effects. The model is accompanied by a set of questions to understand each element.

Delphi study

A conventional (sequential) eDelphi study was used, with data collected through an online tool (Hasson & Keeney 2011), aiming for wide expert input to generate ideas and understand the level of consensus (Steinert 2009). The Delphi study design incorporated the recommendations of Beiderbeck *et al.* (2021) and common quality control measures, as identified by Diamond *et al.* (2014).

The Delphi questionnaire included fixed statements, to be scored in terms of relevance or importance, and open-text responses to add statements or provide commentary. Experts were engaged and retained with non-monetary motivation, primarily their interest in the topic area. A two-round Delphi study was used to minimise time demands and improve retention (Landeta & Barrutia 2011). The expert selection was a combination of a predefined panel and expert nomination (Okoli & Pawlowski 2004), with snowball sampling used to expand the panel until the saturation point was reached in nominations. The expert panel aims to have 'deep level diversity' (Spickermann *et al.* 2014). The panel was heterogeneous, with experts selected across multiple locations, stakeholder groups, and perspectives. No exclusion criteria were defined.

Delphi statements, given in Table 1, were developed based on established drivers and barriers for regulation and compliance (Parker & Nielsen 2017; Lerebours *et al.* 2022). The survey was piloted as recommended by Sheatsley (1983) and administered through Qualtrics (2020).

Complete first-round responses from 152 experts, based across 25 countries, including academics, regulators, mandated authorities, service providers, and non-governmental organisations (NGOs). The findings were summarised for the second-round survey. The retention rate was 75%, above the minimum level to consider this a valid dataset (Keeney *et al.* 2011). The questionnaires and the first-round summary are provided in the Supplementary Materials.

The minimum level for consensus was taken as 70% agreement across two points on a five-point Likert scale (Diamond *et al.* 2014). Challenge statements with consensus on agreement, and ranked within the top four challenges overall, were identified as priorities. Additional statements and commentary were coded; the results are reported for all issues raised by 10% or more of respondents. The results were checked for stakeholder subgroups of at least 20 respondents (Green & Thorogood 2004; pp. 102–104).

This study uses a subset of the data collected through the Delphi survey, using both challenge and good practice statements.

Literature review

The literature review was structured using the Preferred Reporting Items for Systematic Literature Reviews and Meta-Analyses (PRISMA) statement (Page *et al.* 2021). Minimum requirements from Bramer *et al.* (2017) were supplemented using online literature mapping tools to source peer-reviewed literature. Practitioner literature was sourced from expert panel recommendations. Following screening, a total of 262 articles were reviewed and analysed, including 173 peer-reviewed papers and 89 practitioner reports.

Table 1 | Abridged first- and second-round statements and results

Challenges				
First-round challenge statement	% Agree or Strongly agree	Average (modal) ranking 1 = most important	Second-round challenge statement	% Agreement overall plus % included as part of the review
<i>The cost, to the service provider, of providing a SAFE service is greater in low-income areas, due to difficult access, poor quality containment, etc.</i>	72	3.6 (2)	<i>The costs of compliance for service providers: high operating costs, largely in (hard to monitor) transport and disposal, which increase in low-income areas.</i>	85% (21% included all three points on cost)
<i>Safe transport and disposal of faecal sludge from pit emptying is expensive. Unsafe disposal is cheap and hard to detect</i>	61	3.1 (1)		
<i>There are typically low levels of trust between the utility/municipality and workers or enterprises providing services</i>	70	4.4 (3)	<i>There are typically low levels of trust between the utility/municipality and workers or enterprises providing services</i>	87%
<i>The service is viewed as low status (and in some places – disgusting), impacting pit emptiers and also managers and leadership in utilities/municipalities</i>	72	4.4 (4)	<i>The service is viewed as low status (and in some places – disgusting), impacting pit emptiers but also managers and leadership in utilities/municipalities</i>	89%
<i>It is difficult to demonstrate the link between individual unsafe pit emptying practices and the impacts (poor public health and environmental damage)</i>	30	4.7 (6)	<i>Enabling environment: Additional challenges included</i>	32% of the total (100% of those reviewing the full list of challenges)
<i>External pushes (e.g. development banks, INGOs) and internal (e.g. national or city) drivers are often different</i>	64	4.1 (6)		
Good practice				
First-round statement	% Rated as highly or extremely useful	Second-round statement	% Agreed – no changes	% Agreed, with additions/ commentary
<i>Building widespread expectations for safe practices and minimum service standards</i>	80	(1) Smarter and more responsive regulation, with targeted sanctions; (2) Supporting Co- and self-regulation, through professionalisation and capacity building, working with and through local governance structures; (3) Economic instruments largely targeted public subsidies addressing high operational costs, safe disposal, and safe services in low-income areas; (4) Information-based instruments to incentivise change through public awareness and enable more targeted and visible rewards or sanctions; (5) Support mechanisms for service providers, making compliance easier (6) Changing social norms, both raising expectations for safe practices and minimum service standards and shifting the provision of the service to be seen as a government responsibility and a public good; (7) Clarifying and extending the policy framework to support change.	82	18
<i>Aligning threats and penalty levels with enforcement capacity</i>	54			
<i>Direct public contracting of services (not just enabling the private sector) – paid for through subsidies – government taking direct responsibility</i>	58			
<i>Making compliance easier: Transfer stations/proximate disposal points, greater public expenditure</i>	88			

An adapted Critical Appraisal Skills Programme Qualitative Studies checklist (CASP 2018) was used for quality assessment of the papers and reports. A thematic analysis to synthesise the full texts in Nvivo (v14, 2023) used the Delphi study results as the coding framework.

The PRISMA flow diagram and the full set of the literature reviewed are given in the Supplementary Materials. The results section includes key literature, prioritising recent academic papers with a wider geographical scope.

RESULTS

The results from the Delphi study and the literature review are given in Table 1, structured by each challenge, and overall good practice.

Cost structures create regulatory and business plan challenges, for safe service provision and scaling into low-income areas.

Delphi study

The costs of compliance for service providers: high operating costs, largely in (hard-to-monitor) transport and disposal, which increase in low-income areas.

Cost structures of service delivery were ranked as the most important barrier to increasing safe FS E&T. Responses specified that cost structures should be considered across three areas: operations and maintenance making up the bulk of expenditure and also being more difficult to finance than capital expenditure; the cost of providing safe services typically increasing in lower-income areas; and safe transport and disposal being the greatest cost and also the least visible part of the chain. Agreement with this combined cost challenge was high (85%).

There was no consensus on good practice to address this challenge, with 58% agreement on the usefulness of direct contracting of service providers by public agencies. Substantial minorities considered that the FS E&T business should be run for profit (48%) and financed through user fees (35%). A minority (<5%) considered that these challenges could be addressed through technical innovations in service delivery.

Literature review

The literature largely reflects the issues raised through the Delphi study; compliance may not be feasible without material support for service providers. Despite a strong market narrative around service provision, public subsidy is necessary for universal access to safe sanitation.

Operational costs frequently make up the main cost for FS E&T services (Sainati *et al.* 2020). These costs are likely to increase in the future given the inherent fragility of road-based systems in the context of climate change and rapid urban development (Hyde-Smith *et al.* 2022). Recurrent costs are ‘an afterthought’ for policy-makers (Muzenda *et al.* 2022). Funding, if available, is channelled into capital expenditure, such as treatment works (Peal *et al.* 2020).

Viable sanitation business models are presented in the literature (Rao *et al.* 2016; Schmitt *et al.* 2017). However, profit margins are noted to be low, and businesses may only be viable if low-income areas are excluded (Wilcox *et al.* 2023). The additional costs to a service provider to be compliant have not been well documented in the literature and may be beyond the capacity of the small or informal businesses that make up the majority of service providers (Holm *et al.* 2015; Singh *et al.* 2022).

The challenges of difficult access, poor latrine construction quality, and solid waste disposal in low-income areas are well documented (Greene *et al.* 2021; Conaway *et al.* 2023). These challenges extend emptying time and may necessitate manual emptying, which has a higher cost than mechanised approaches, due to the greater labour requirements (Igarashi *et al.* 2023; Muoghalu *et al.* 2023). The expectation of some Delphi respondents to develop low-cost, safe sanitation services may be unrealistic (Igarashi *et al.* 2023). Households in low-income areas would not be able to cover these costs; public subsidy would be required in most contexts for safe services to be affordable for all (Carrard *et al.* 2024).

Unsafe disposal is reported as common practice, often linked to the costs of transport and disposal (Muoghalu *et al.* 2023). Safe disposal of FS often requires payment, contributing to economic disincentives for the service provider (UN-Habitat 2023).

The mix of incentives, pro-poor mechanisms (such as dedicated funds, tariff restrictions, or specific targets for low-income areas or households), and sanctions are recognised as sectoral good practices (Strande & Brdjanovic 2014; ESAWAS 2022). However, policy-maker reluctance to invest in sanitation and the tension between

reaching universal access and operational cost recovery from user fees are widely discussed in the literature (Car-rard *et al.* 2024; Joseph *et al.* 2024). There are increasing calls for greater public finance, as highlighted in the sub-section ‘Financing’.

Trust and the role of the regulator are central to building compliance but contentious in practice

Delphi study

There are typically low levels of trust between the utility/municipality and workers or enterprises providing services.

In the Delphi study, the lack of trust between service providers and mandated authorities was identified as an important barrier, with 70% agreement overall in the first round and 87% agreement on it being a key challenge in the second round. It was ranked within the top four challenges.

There was consensus (82% full agreement, 18% in agreement, but with additional commentary and suggestions) around the description of responsive regulation representing good practice in building compliance. This approach requires regulators to engage with trust and for the first regulatory responses to be non-coercive and based on support and relationship building with the target group (Nielsen & Parker 2009).

However, this appears to be a contentious point as the largest area of disagreement in good practice was around the balance of sanctioning and supporting service providers. Some respondents (7%) highlighted that sanctions and penalties should be applied more widely by the regulator, but a further 5% considered sanctions too heavily weighted in comparison to the support to service providers.

Literature review

The literature largely reflects the importance of relationship building and the potential of responsive regulatory approaches but does not explicitly include trust as a decisive factor. Literature typically focuses on national regulators, rather than mandated authorities acting as local regulators.

The guidance from IWA (2021) and WHO (2018) highlights the importance of local and national regulators understanding service providers and noncoercive means, with a stepped approach taken that allows for redress and sanctions applied as a last resort. Regulators can have a critical role in building relationships with service providers (Lerebours *et al.* 2022; Valette & Colon 2024). Service providers have stated a desire to be regulated if they perceive the process to be fair and flexible (Christopher & Beal 2022) and studies have emphasised the importance of recognising the service providers as knowledgeable contributors rather than subjects of regulation (Gautam *et al.* 2021; Lawhon *et al.* 2023).

A gradual shift in national regulators’ role, towards social and technical, in addition to economic, regulation has been noted alongside the recognition of their importance in going ‘beyond mere policing’ and supporting incremental change (UN 2017; ESAWAS 2022; WHO 2023a). More delegated and participative approaches are recorded in some locations (IWA 2022).

In documenting this evolving role of the regulator, the ‘trust’ between service providers and regulators is explicitly referenced in only a handful of articles (Lerebours *et al.* 2022; IWA 2022; ESAWAS 2022). In these articles, the reference to trust is included as part of a much wider discussion, for example, noting that it is a requirement for effective regulation or can build compliance, but not discussing it in depth. Similarly to the Delphi study questionnaire used in this study, trust is considered a simple concept and is not defined. Looking more widely, the literature on public health appears to consider trust as a central tenet of ways of working (UN 2017; WHO 2023b).

Disgust and status; potential social and normative drivers

Delphi study

The service is viewed as low status (and in some places – disgusting), impacting pit emptiers and also managers and leadership in utilities/municipalities.

In the Delphi study, disgust and status as a challenge for compliance reached 72% agreement in the first round and 90% in the second round. It was ranked within the top four challenges. A minority of mandated authorities and service providers highlighted that ‘disgust’ was too strong or limited only to those directly involved in emptying.

Literature review

The literature reflects the findings from the Delphi study; status is highlighted as important, and disgust is alluded to, but the challenge is largely limited to front-line service providers. There are isolated examples of the wider effects of disgust in rendering sanitation less visible.

‘Acceptance’ of FSM is part of the enabling environment outlined by [Strande & Brdjanovic \(2014, p. 369\)](#), and the perception of sanitation as ‘disgusting’ is noted by [UN-Habitat \(2023\)](#) as a block to provision of safe services. Case studies indicate how disgust can shape FS service delivery, reducing visibility ([Prasad & Ray 2019](#)), making manager positions less desirable ([Grisaffi et al. 2022](#)), and affecting service legitimacy ([van Welie et al. 2019b](#); [Cookey et al. 2020](#)). Other papers allude to taboos that prevent stakeholder engagement ([Hyun et al. 2019](#)).

The marginalisation and social stigma faced by sanitation workers, including but not limited to pit emptiers, are well documented ([UN 2012](#); [Bhatkal et al. 2024](#)). Alongside the challenges of stigma are examples of service providers as deeply embedded social actors and informal providers as essential to reaching the most vulnerable ([Muoghalu et al. 2023](#); [Chumo et al. 2024](#)).

The positive effects of professionalism and service status in building compliance have been noted for both service providers and mandated authorities ([Mumssen et al. 2018](#); [Valette & Colon 2024](#)). The wider literature incorporates making compliance visible and valued ([Mason et al. 2020](#); [ESAWAS 2021a](#)).

Research into the motivations and priorities of pit emptiers is largely centred on occupational health risks and financial drivers, with limited literature on wider social and normative drivers ([Zaqout et al. 2020](#); [Bhakta et al. 2022](#); [WHO 2022](#)).

The links between poor services and public health or environmental degradation are known, and not a driver of change

Delphi study

It is difficult to demonstrate the link between individual unsafe pit emptying practices and the impacts (poor public health and environmental damage).

Only 30% of respondents agreed, and 31% strongly disagreed, that it was difficult to link safe practices and impact. This challenge was also low-ranked in terms of importance.

Literature review

The literature reflects the findings in the Delphi study; the links are clear but do not lead to change.

A number of trials have demonstrated the difficulty of linking sanitation interventions to health impacts, and some literature posits that this is a barrier to change ([Winters et al. 2014](#); [Pickering et al. 2019](#)). However, many studies indicate high awareness of health risks from faecal contamination for both households and mandated authorities without any resultant change, due to the prioritisation of other benefits or services or lack of resources and capacity ([Kwiringira et al. 2021](#); [Conaway et al. 2023](#)).

External pushes are recognised to be different from local priorities, but may not be a barrier to compliance

Delphi study

External pushes (e.g. development banks, INGOs) and internal (e.g. national or city) drivers are often different.

The initial wording for this challenge was ‘*There is a strong external push (e.g. development banks, INGOs) for expanding safe faecal sludge services, however, it is a lower priority for local actors*’. More than 10% of respondents disagreed and highlighted that safe sanitation was important for all actors, but there was a misalignment in priorities for implementation. Including the adapted wording, the majority of respondents (64%) agreed with this statement. However, this percentage is below the 70% required to consider it a consensus. This challenge was also low-ranked in terms of importance.

Literature review

The literature appears to give a greater weight to external actors than is reflected in the Delphi study. Donor prioritisation is identified as a key driver for increased investment into FSM and the development of related policy and regulation ([Hutchings et al. 2018](#); [Sinharoy et al. 2019](#); [Heidler et al. 2023](#)). External drivers are identified as a barrier to the implementation of regulation due to reduced local ownership ([Lerebours et al. 2022](#)). However, local variables may be a greater determinant of access to sanitation ([Francois et al. 2021](#); [Beard et al. 2022](#)).

The wider enabling environment may be more important than the specific drivers of the target groups

Delphi study

A number of additional challenges linked to the wider enabling environment were identified, aligning closely with the City Service Delivery Assessment developed by [Blackett & Hawkins \(2019\)](#). Four additional challenges were identified by at least 10% of respondents and ranked as the most important barriers; (i) *resources are insufficient and not allocated equitably*, (ii) *public expectations of a safe service, and willingness to prioritise this safe service, are low*, (iii) *there is an unclear, or actively obstructive legal and regulatory framework*, and (iv) *low political will and prioritisation*. Linked to (ii) there was clear consensus (80%) on the good practice of *changing social norms, both raising expectations for safe practices and minimum service standards*.

Recommendations to add the challenge of '*Lack of integrated planning across sectors and urban areas*', were supported by the majority of respondents who reviewed the full list of additional challenges.

The low capacity of mandated authorities service providers was raised as a challenge by 5% of respondents and reflected in the consensus (88%) around the good practice of *support mechanisms for service providers, making compliance easier*.

Literature review

The literature review confirms the issues raised through the Delphi study. These challenges in the wider enabling environment are well documented in the literature ([Scott et al. 2019a](#); [Valette & Colon 2024](#)). This section is structured by the [Blackett & Hawkins \(2019\)](#) City Service Delivery Assessment.

Policy, legislation, and institutional frameworks. The human right to sanitation (United Nations General Assembly resolution 64/292) has been integrated into law for at least 52 countries ([Brunner et al. 2015](#)). There appear to be stronger normative drives for universal access and an increasing number of policies and plans to reach the poor and other vulnerable populations with sanitation services ([Brown et al. 2016](#); [Rosenqvist et al. 2016](#); [Fuente & Bartram 2018](#)). Despite this nominal shift in political will, incomplete, or actively obstructive, policy and legal frameworks persist, for example, outlawing manual pit emptying where there are no feasible alternatives ([Sinharoy et al. 2019](#); [Bhatkal et al. 2024](#)). Where supportive frameworks are in place, they may not be reflected in practice ([Mumssen & Triche 2017](#); [ESAWAS 2021c](#)).

FSM is considered to require a greater level of regulatory sophistication given the wider distribution of amorphous responsibilities to households and the private sector ([Delaire et al. 2020](#)). Regulators are noted as being positioned to influence policymakers and service providers to catalyse change ([Delaire et al. 2020](#); [ESAWAS 2021a](#); [Muzenda et al. 2022](#)). The lack of pro-poor mechanisms, complexity of regulation, stringency, and inflexibility are all challenges to compliance ([Lerebours et al. 2021a](#); [Narzetti & Marques 2021](#); [Saker et al. 2022](#)).

FS E&T has complex, fragmented, and overlapping institutional structures at the national, city, and local levels ([ESAWAS 2021b](#); [WHO 2022](#); [UN-Habitat 2023](#)). The sector is characterised by a high level of informality and low availability of data ([Sinharoy et al. 2019](#); [ESAWAS 2021a](#); [WHO 2023a](#)).

FSM is not addressed in urban sanitation plans in many locations where it is the majority option, creating a barrier to access ([Scott et al. 2019b](#); [Narayan et al. 2021](#); [Lerebours et al. 2022](#)).

Financing. The estimated costs of reaching universal access to safe sanitation are significantly greater than the resources allocated to the sector ([Joseph et al. 2024](#)). Funding to local governments to support scaling up safe sanitation services is often limited ([Beard et al. 2022](#); [WSUP 2022](#)). Financing allocations may be inequitable, targeting the richest portions of the population or subsidies directed towards sewered areas rather than FSM ([Berendes et al. 2017](#); [Joseph et al. 2024](#)). The position of sanitation as a public, common, or merit good requiring public funding is increasingly recognised, despite the rhetoric around market delivery of services ([Joseph et al. 2024](#); [Mazzucato & Zaqout 2024](#)).

Promotion, user engagement. Multiple studies have identified low levels of demand for safe services, limiting provision and resulting in low political will ([Tsinda et al. 2018](#); [ESAWAS 2021a](#); [Mpanang'ombe et al. 2021](#)). Willingness to pay for services could be as low as 13% of the cost of providing safe services ([Tomoi et al. 2024](#)).

Service provision in low-income areas is often blocked by land tenure and perceptions of informal areas ([McGranahan 2015](#); [Sinharoy et al. 2019](#)). Extending sanitation services may also be blocked due to ethnic, racial, religious, or caste discrimination ([Pierce 2017](#)). Patterns of exclusion may be rooted in stigma and continue historical or colonial inequalities ([McGranahan 2015](#); [McFarlane & Silver 2017](#); [Kithia & Majambo 2020](#)).

Citing market drivers of demand as a barrier may mask this stigma and promote stereotypes of the ‘undeserving poor’ (UN 2012; Bhan 2022).

Capacity, technical assistance, technology. Many service providers have limited capacity to comply, in terms of cost as noted in the sub-section on ‘Cost structures’, and also in terms of time, technical capacity, knowledge, and understanding of the rules and navigating bureaucracy (Holm *et al.* 2015; Mallory *et al.* 2021; Lerebours *et al.* 2022). The capacity to comply is limited by the cost of compliance, as referenced in the sub-section on ‘Cost structures’, lack of access to safe disposal sites, adapted equipment, and the physical feasibility of providing a safe service (Peal *et al.* 2020; Conaway *et al.* 2023).

For mandated authorities, extending FS E&T services requires a new skill set (van Welie *et al.* 2019a; Saker *et al.* 2022). However, decentralised sanitation services delegate responsibility to the city level, without the needed support and resources to deliver on mandates (Samuel *et al.* 2021; Grisaffi *et al.* 2022; Valette & Colon 2024).

Expectations on regulators to improve governance may be high, but they also require support, with even sector leaders reporting resource constraints (Van den Berg & Danilenko 2017; Joseph *et al.* 2024). In turn, there is an important role for regulators in addressing capacity gaps of service providers (WHO 2018; IWA 2021; ESAWAS 2022).

Limitations and generalisability

The major limitation of this study is the attempt to reduce a highly complex issue to a limited number of questions across disparate contexts. A substantial minority of respondents (10%) agreed that *Challenges and responses are context-specific and cannot be generalised*. The literature supports this view to some extent, that good practice is not easily transferred between locations given specific institutional history, capacity, and resource constraints (Camos & Estache 2017; Mumssen *et al.* 2018). This consideration has informed the scope of this study to develop questions rather than postulating good practice.

The expert panel is considered high quality but is not taken to be representative of the whole sector. More than 70% of the respondents were from, or permanently based in, locations where FSM is the majority sanitation solution. Those working for regulators, mandated authorities, and service providers made up only 35% of respondents. Using online survey tools excluded many service providers, and retention of this group was most challenging (41% retention). Mandated authorities and policy-makers also had a lower retention rate of 50 and 42% retention, respectively. Additional expert panel members were invited from these groups to address this potential bias.

Literature or expert input has been collected from 32 of the 81 countries where FSM is a majority urban solution. The literature is largely limited to capital cities or to mandated authorities that are active in addressing FS E&T and where good practice has already been documented.

DISCUSSION

The discussion is structured using the elements of the adapted holistic model of business compliance (Parker & Nielsen 2017). Each sub-section below describes the changes proposed to the revised model, shown in Figure 1, and the linked questions given in Table 2. The proposed changes to the model are discussed in light of the study findings and then contextualised within the wider regulation and compliance literature.

The important role of the regulator and trusted relationships between the (national or local) regulator and service provider

The most significant changes proposed to the holistic model of business compliance are to give a distinct and separate role to the (local or national) regulator in catalysing change, as shown in Figure 1, and emphasising the importance of trusted relationships between the regulator and the service provider.

Under the original model, the role of the regulator is integrated with the wider external environment and largely characterised by questions around enforced compliance factors, whether the regulator is respected, and the risk of inspection, detection, and sanction (Parker & Nielsen 2017; Table 13.1).

The revised model reflects a much greater role for the regulator in making both short-term impacts through capacity building and targeted deterrence and long-term impacts on motives through building trusted relationships with service providers. The influence of the regulator on the wider enabling environment is also emphasised. This influence is both short-term, such as advocacy for greater resourcing, and long-term, through

Table 2 | Summary of additions to the 14 questions accompanying the compliance model**Economic, social, and normative motives****1a. Economic costs and benefits**

What are the important economic motives for the target group? Are they looking for security, comfort, growth, or profit?

1b. Social costs and benefits What are the important social motives for the target group? Are they looking for status, or affiliation with a particular group, to be perceived as more attractive? What would be likely to increase their levels of status, affiliation, or attraction?

Does the target group see any tangible or intangible advantages to them in (i) **providing safe services, for household, community, and sanitation workers?** (ii) **expanding safe services to all areas?**

2. Degree of acceptance of this regulation (normative motives) Does the target group agree with the policy objectives and the principles that underpin the rules surrounding the **provision of safe services?** **Do they think that access to safe sanitation is important? Do they think it is more or less important compared to other basic needs? How do they perceive themselves? How do they perceive other people within the target group? Do they think all people within the target group have the right to protection and support? Is the target group drawn from a particular marginalised group, for example, separated by caste or ethnicity? Do they think everyone has a right to safe sanitation? How do they perceive people who currently do not have access to safe services? Do they agree with how the policy and principles have been put into practice? Do they think particular obligations are unacceptable? Do they think certain modes of provision – such as manual handling of FS – are unacceptable? Do they think particular support is unacceptable?**

3. Respect for the law in general (normative motives) [No change]

Target group: Characteristics, capacities, and decision implementation resources**5. Business model**

How do FS E&T services fit in with the wider business model or livelihoods strategy of the target group?

Is compliance relevant to the target group's business model or is it an 'afterthought', or even irrelevant?

Is compliance physically feasible across all areas? (NB: considering containment quality and access)

How much more will compliance cost? Is compliance possible while still generating the minimum required income, aligning with economic motives in 1a?

What is the financial viability gap in each area, considering operating costs and the ability and willingness to pay?

What is the level of targeted subsidy required to meet the economic motives of the target group? How could that be delivered to incentivise expansion into unserved areas?

6. *Knowledge of the rules* [No change]

7. *Capacity to comply* [No change]

Regulator: Capacities, engagement, deterrence, and relationships

15. **Capacity and resourcing of regulators** Does the regulator (local or national) have the capacity and resources to understand and support the target groups and implement regulations? Are sanitation units or departments perceived as a desirable place to work? Do they attract and train staff with the needed skills? Are regulators able to also influence the enabling environment, including the legal and policy framework and how resources are allocated to and within the sector?

16. **Regulators' understanding of the target group** Are the range of target groups documented and segmented? Are rules adapted to the capacity and resources of the target groups? Are informal and formal service providers considered?

8. **Relationship between the regulator and the target group** Does the target group trust and respect the regulator and how it goes about its tasks? **Do they feel trusted and respected by the regulator? Does the regulator engage the target group in developing and implementing regulations? Is the regulator responsive to the target group, recognising competence and capacity limitations, incentivising incremental change, and sanctioning only wilful non-compliance?**

10. *Risk of inspection* [No change]

11. *Risk of detection* [No change]

12. Selectivity of inspection and detection by the regulator [No change]

13. *Risk of sanction* [No change]

14. *Severity of sanction* [No change]

17. **Engagement and support provided by the regulator** Does the regulator understand the characteristics, capacities, and decision-making resources of the target group?

Are proactive measures taken to build capacity Are incremental improvements recognised and rewarded?

Does the target group perceive that known 'bad apples' are identified and sanctioned, while a lack of capacity is identified and rectified?

Enabling environment: External agents, environments, and events

(Continued.)

Table 2 | Continued

4. Existence of non-official influence over the targeted group's compliance **Do these groups value compliance in providing safe services, for household, community, and sanitation workers? Do these groups value compliance in expanding safe services to all areas?**

Repeat of sub-questions from Question 2.

9. Risk that any violations of the rules will be reported to the authorities [No change]

18. **City Sanitation Service Delivery Assessment Questions taken from the CDSA toolkit (Blackett & Hawkins (2019))**
Allocations of public finance targeting equitable service provision.

19. Wider enabling environment

Other proximate factors and events that may influence the level of political will to make a change and the enabling environment:

- Level of electoral risk or interest linked to FS E&T: The visibility of the health risks of sanitation and the capacity of the target group to prioritise demanding sanitation.
- Influence of international funders.

Amendments and additions to this abridged Table 13.1 in [Parker & Nielsen \(2017\)](#) are given in **bold**. It is intended that these questions could be used at two levels. The 'target group' can be either service providers, regulated by the local regulator, or the mandated authority, regulated by the national regulator. The full Table is given in the Supplementary Materials.

building the prestige of sanitation services and the perception of sanitation as a human right. This change reflects the findings around trust and the role of the regulator, as well as the findings around the wider enabling environment. Questions on the capacity of the regulator and how they are building the trust of service providers are added in [Table 2](#). Existing questions are amended to include a greater focus on building relationships and to check whether sanctions are perceived as justified and proportionate.

The regulation literature highlights the importance of considering local regulators' capacity limitations. Here, we are considering the capacity of mandated authorities to regulate FS E&T service providers. Regulations conceived and designed at the national level may conflict with existing practices and interests at the local level, mandated authorities may be more at risk of capture and cronyism, and local capacity may be weaker ([Asquer et al. 2016](#)). [Sancho \(2017; p. 96\)](#) highlights resources and the capacity of local government as critical institutional variables for any policy objective delivered and regulated at the local level.

Trust in regulation remains a contentious topic. There is a lack of consensus on the definition and how to build trust to support regulation ([Six & Verhoest 2017](#)). In this study, we suggest using the approach of [Dietz \(2011\)](#) that trust is based on perceptions of ability, benevolence, and integrity of both individuals and institutions and a willingness to be vulnerable based on positive expectations of the other.

Despite this lack of consensus around what trust is and how to build it, the importance of trust for voluntary compliance is well established. The positive effect of trust in building compliance is outlined in an extensive body of regulation and compliance literature, covering sectors of corporate compliance ([Cline & Williamson 2020](#)), tax ([Owusu et al. 2021; Resnick 2021](#)), environmental protection ([Lange & Gouldson 2010](#)), and low-status public services, such as care homes and solid waste management ([Six & Verhoest 2017; Davidovitz & Cohen 2022](#)). Trust and voluntary compliance can be undermined by threats of deterrence and sanctions for minor breaches ([Lubell & Scholz 2001; Feld & Frey 2007; D'Amato et al. 2018](#)). However, the development of trust also requires credible sanctions that demonstrate procedural justice and punish 'known bad apples' ([Feldman 2010; Lee et al. 2013; Bowen et al. 2020](#)).

Economic, social and normative motives, of service providers and in the external environment

The second change proposed to the holistic model of business compliance is to widen the range of social and normative motives considered in both service providers and the external environment.

Under the original model, social and economic motives are assessed through the perceived costs and benefits, both material gain and the approval or respect of others. Economic motives, as in the sanitation sector, range from basic livelihoods to profit-making. Normative motives consider the level of acceptance of regulation, both the objectives and how these are put into practice. These motives interact with the external environment in terms of the value placed on compliance by wider society and whether these values are internalised.

The revised model places much greater emphasis on social and normative motives in both service providers and the external environment. This change reflects the findings around cost structures and low service profitability, specifically around low-income areas. It reflects the findings around low status and possibly disgust as significant challenges for compliance. This change also reflects the challenges in the wider enabling environment of stigma against both FS E&T services and unserved areas. Alternative motives valuing the public good nature of a safe service are needed.

The regulation and compliance literature from dispersed and hard-to-control sectors, such as fisheries, environmental pollution, and tax, indicate that social and normative drivers may be more important than economic drivers once basic needs are met (Thomas *et al.* 2016; D'Amato *et al.* 2018; Resnick 2021). The benefits of integrating wider behavioural theory into regulatory approaches have been highlighted by OECD working papers on regulatory policy and postulated in the recent literature (Barak-Corren & Kariv-Teitelbaum 2021; Drummond *et al.* 2021; OECD 2021). There are clear similarities between established behaviour change approaches used in the water and sanitation sector, such as Behaviour Centred Design (Aunger & Curtis 2016), and the social-psychological determinants of compliance identified by Braithwaite & Wenzel (2008), norms, values, identity, shame, guilt, and trust, and the three regulated 'selves' identified by Braithwaite (2017), looking for moral obligation, justice, and benefits or status.

The revised model is extended to incorporate the human motives used in Behaviour Centred Design (Aunger & Curtis 2016), which is in common usage in the water and sanitation sector (De Buck *et al.* 2017; Ross *et al.* 2021). These human motives and the original holistic model of business compliance have seven common aspects: hunger, comfort, and hoarding (analogous to economic motives for basic income and security), fear (analogous to deterrence), affiliation (analogous to respect and approval), status, and justice. The proposed change, therefore, adds the considerations of disgust, attraction, nurture, creation, curiosity, and play. These social and normative motives are expanded in Table 2 and considered for the service providers and for the influence of the external environment.

'Disgust' appears to be the most controversial of these additional motives in both the sanitation literature, as discussed under the 'Results' section, and the regulation literature. Create, curiosity, and play align with the motivational posture of 'game playing' associated with non-compliance (Braithwaite 2003) and also with positive associations of how regulated groups adopt and adapt regulation through implementation (Kagan *et al.* 2011; Pautz 2024). However, disgust is scarcely referenced, and the stigmatisation of individuals can increase non-compliance (Braithwaite 2017; Coker *et al.* 2017).

The possible wider impact of disgust and status in impeding scaling safe practices warrants further research. Given our deeply ingrained responses to faecal matter, it seems reasonable to postulate that disgust may be an inherent barrier to the governance of a sector that requires the visible handling of human waste. Disgust is noted in behavioural theory as an important issue that can create hidden costs for those in the caring and waste management sectors (Curtis 2013). Disgust is also noted as leading to a reluctance to support low-income areas (Weinrib 2018). Some writers have postulated that the lack of literature on the impacts of disgust is evidence of our difficulty in engaging with the topic (Curtis 2013).

Characteristics, capacities, and decision-making resources of service providers

The third change proposed to the holistic model of business compliance is to widen the understanding of characteristics, capacity and decision making resources. This aspect of the model needs to be expanded to be relevant to the wide range of service providers, the high level of informality, and the challenging context.

Within the original model, the key questions for this element included the relevance of compliance to the business, awareness and knowledge of the rules, whether rules are comprehensible, and finally, whether service providers have the capacity to comply. These questions all remain relevant. However, they need to be extended to consider the nature of FS E&T as a public good and as a precarious livelihood.

The questions related to the business plan are expanded to consider the public resources needed to enable businesses to extend into low-income areas. This reflects the finding that compliance comes at a cost likely to put pro-poor service providers out of business. Questions are added to support a focus on the feasibility and ease of compliance, considering the specific challenges for low-income areas. Additional prompts are included to include both formal and informal service providers.

The importance of inclusive regulation, which aims to improve, rather than displace, the informal sector is substantiated in recent literature on the informal economy and possibly analogous sectors such as street food

(Williams 2019; Pulliat *et al.* 2023). The implied acceptance of the informal sector as part of reaching universal access to safe sanitation may be contentious.

Moving from an 'external' to 'enabling' environment

The final change proposed is to extend the consideration of the external environment in the holistic model of business compliance to incorporate the wider enabling environment, as defined in established citywide inclusive sanitation frameworks.

The original model had limited consideration of the external environment beyond the risk of non-compliance being reported and the existence of informal influence over service providers.

The revised model incorporates the City Service Delivery Assessment (Blackett & Hawkins 2019) into the framework and renames the external environment to be the enabling environment. The City Service Delivery Assessment lays out a systematic process, including questions and a scorecard, to assess the wider enabling environment for citywide inclusive sanitation. In addition, further questions are added around perceptions of unserved groups, sanitation services and workforce, and the historical roots of inequality and lack of access. Allocation of public resources is also considered here, reflecting the growing understanding of sanitation as a common, public, or merit good (Joseph *et al.* 2024; Mazzucato & Zaqout 2024).

The importance of considering regulation and compliance within this wider enabling environment is evidenced in the sanitation literature. The wider enabling environment would be more important for FS E&T than for the commercial sector for which the holistic model of business compliance was originally designed (Parker & Nielsen 2017). There are not many regulated sectors where the only practical and feasible working practices are also illegal, as is the case for manual FS E&T in many contexts.

Validating the revised model

The next step in the development of the model would be validation with practitioner experts (Jabareen 2009). Issues for investigation would be the application of behavioural theory to the compliance model and understanding the role of national and local regulators, interrogating and refining the proposals made in this study.

CONCLUSIONS

Understanding the compliance responses of FS E&T service providers is critical to ensuring that the regulatory frameworks put in place achieve their intended outcomes and safeguard public and environmental health. This is the first study to adopt a theoretical compliance model for FS E&T services.

We linked challenges in FS E&T service delivery using a holistic model of business compliance. The revised model integrates the well-known challenges in the sanitation sector of cost structures, enabling environments, capacity, livelihoods, and low status. The revised model also incorporates the less-discussed challenges of trust and disgust impeding the scaling of safe FS services. We identify a critical and distinct role for the regulator and a wider range of social and normative drivers for change. The model extends the scope and depth of questions to be asked in building compliance, rather than dictating good practice. This revised model could be applied to interrogate learning from other sectors, support discussions on compliance, and identify priority challenges with mandated authorities at the early stage of implementation.

We identify four priority challenges for building compliance for safe FS E&T services at scale: low levels of trust between mandated authorities and service providers, the view of the service as low status (possibly disgusting), impacting managers and front-line staff, the costs of compliance for service providers, and the enabling environment. These challenges are not presented as definitive but are expected to be relevant across many locations reliant on FS E&T for sanitation services.

The clearest new finding from this study is around the importance of trust, between the service provider and the local or national regulator, in building voluntary compliance in FS E&T. The importance of trust in regulatory relationships is well established and evidenced in the literature across multiple sectors, including those ordinarily considered as more hard-nosed and punitive, such as taxation. The research also suggests a greater role for the regulator in leveraging these relationships as a catalyst for change, supporting the development of the sector and scaling services, rather than sanctioning non-compliance. From this study, we highlight that local and national regulators should invest in understanding how to build trust with FS E&T service providers as this is likely to reduce the need for resource-intensive enforcement.

We also identify a potentially contentious finding that disgust may be a barrier to scaling FS E&T services, making the service less visible and reducing investment. This issue and the potential of using behavioural theory as part of building compliance warrant further research.

FS E&T is the majority sanitation solution in many urban areas, frequently delivered through complex multi-layered regulation. Taking a bottom-up compliance perspective, considering the local drivers and capacity of mandated authorities and front-line service providers, would support scaling this essential public good.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the support and contributions of all expert panel members. The authors would also like to thank Jamie Bartram and the WaterWISER writing workshop group for their support in the development of the article.

ETHICS

This study was reviewed and approved by the Cranfield University Research Ethics System (CURES/17815/2023). Informed consent was obtained from Delphi survey participants.

FUNDING

This research was funded by the UKRI Engineering and Physical Sciences Research Council (EPSRC grant number EP/S022066/1) through the Center for Doctoral Training in Water and Waste Infrastructure and Services Engineered for Resilience (WaterWISER).

AUTHOR CONTRIBUTIONS

CG was solely responsible for the data collection, data analysis, and drafting of the article. CG, AP, and PL were closely involved in the design of the work and development of the article. CG, AP, PL, SD, and KM input to the conception of the work and critical review process. All authors contributed to the article and approved the submitted version.

DATA AVAILABILITY STATEMENT

The data that support the findings will be available in CORD-CERES Research Repository held by Cranfield University at <https://dspace.lib.cranfield.ac.uk/handle/1826/20712>, following an embargo of 12 months from the date of publication to allow for completion of the linked PhD thesis.

CONFLICT OF INTEREST

The authors declare there is no conflict.

REFERENCES

- Asquer, A., Becchis, F. & Russolillo, D. (2016) *The Political Economy of Local Regulation: Theoretical Frameworks and International Case Studies*. London, UK: Palgrave Macmillan. doi:10.1057/978-1-137-58828-9.
- Aunger, R. & Curtis, V. (2016) Behaviour centred design: towards an applied science of behaviour change, *Health Psychology Review*, **10** (4), 425–446. doi:10.1080/17437199.2016.1219673.
- Baldwin, R., Cave, M. & Lodge, M. (2011) *Understanding Regulation: Theory, Strategy, and Practice*. Oxford, UK: Oxford University Press.
- Barak-Corren, N. & Kariv-Teitelbaum, Y. (2021) Behavioral responsive regulation: bringing together responsive regulation and behavioral public policy, *Regulation & Governance*, **15**, S163–S182. doi:10.1111/rego.12429.
- Beard, V. A., Satterthwaite, D., Mitlin, D. & Du, J. (2022) Out of sight, out of mind: understanding the sanitation crisis in global south cities, *Journal of Environmental Management*, **306**, 114285. doi:10.1016/j.jenvman.2021.114285.
- Beiderbeck, D., Frevel, N., Heiko, A., Schmidt, S. L. & Schweitzer, V. M. (2021) Preparing, conducting, and analyzing delphi surveys: cross-disciplinary practices, new directions, and advancements, *MethodsX*, **8**, 101401. doi:10.1016/j.mex.2021.101401.
- Berendes, D. M., Sumner, T. A. & Brown, J. M. (2017) Safely managed sanitation for all means fecal sludge management for at least 1.8 billion people in low and middle income countries, *Environmental Science & Technology*, **51** (5), 3074–3083. doi:10.1021/acs.est.6b06019.
- Bhakta, A., Cawood, S., Zaqout, M. & Evans, B. (2022) Sanitation work: realizing equity and inclusion in WASH, *Frontiers in Water*, **4**, 177. doi:10.3389/frwa.2022.1022581.

- Bhan, T. (2022) *Deserving poor in public sanitation: tracing the policymaking processes of who gets what, when, how, and why in Delhi*, *Environment and Planning B: Urban Analytics and City Science*, **49** (8), 2151–2167. doi:10.1177/2399808322108932.
- Bhatkal, T., Mehta, L. & Sumitra, R. (2024) *Neglected second and third generation challenges of urban sanitation: a review of the marginality and exclusion dimensions of safely managed sanitation*, *PLoS Water*, **3** (6), e0000252. doi:10.1371/journal.pwat.0000252.
- Black, J. & Kingsford Smith, D. (2002) Critical reflections on regulation, *Australasian Journal of Legal Philosophy*, **27** (2002), 1–46.
- Blackett, I. & Hawkins, P. (2019) *City Service Delivery Assessment for Citywide Inclusive Sanitation – Tool and User Guide*. Ashdon, UK: Inclusive Sanitation in Practice. Available at: <https://www.susana.org/en/knowledge-hub/resources-and-publications/library/details/3700#> (Accessed: 10 June 2024).
- Bodwitch, H., Polson, M., Biber, E., Hickey, G. M. & Butsic, V. (2021) *Why comply? Farmer motivations and barriers in cannabis agriculture*, *Journal of Rural Studies*, **86**, 155–170. doi:10.1016/j.jrurstud.2021.05.006.
- Bowen, F., Tang, S. & Panagiotopoulos, P. (2020) *A classification of information-based environmental regulation: voluntariness, compliance and beyond*, *Science of The Total Environment*, **712**, 135571. doi:10.1016/j.scitotenv.2019.135571.
- Braithwaite, V. (2003) *Dancing with tax authorities: motivational postures and non-compliant actions*, *Taxing Democracy*, **3**, 15–39. doi:10.4324/9781315241746.
- Braithwaite, V. (2017) Closing the gap between regulation and the community. In: Drahos, P. (ed.) *Regulatory Theory: Foundations and Applications*, Canberra, Australia: ANU Press, pp. 25–42.
- Braithwaite, V. & Wenzel, M., (2008) Integrating explanations of tax evasion and avoidance. In: Lewis, A. (ed.) *The Cambridge Handbook of Psychology and Economic Behaviour*. Cambridge, UK: Cambridge University Press. doi:10.1017/9781316676349.
- Bramer, W. M., Rethlefsen, M. L., Kleijnen, J. & Franco, O. H. (2017) *Optimal database combinations for literature searches in systematic reviews: a prospective exploratory study*, *Systematic Reviews*, **6**, 1–12. doi:10.1186/s13643-017-0644-y.
- Brown, C., Neves-Silva, P. & Heller, L. (2016) *The human right to water and sanitation: a new perspective for public policies*, *Ciencia & Saude Coletiva*, **21**, 661–670. doi:10.1590/1413-81232015213.20142015.
- Brunner, N., Mishra, V., Sakthivel, P., Starkl, M. & Tschohl, C. (2015) *The human right to water in law and implementation*, *Laws*, **4** (3), 413. doi:10.3390/laws4030413.
- Camos, D. & Estache, A. (2017) Regulating water and sanitation network services accounting for institutional and informational constraints, *World Bank Policy Research Working Paper*, 8149. Washington, DC: The World Bank. doi:10.1596/1813-9450-8149.
- Carrard, N., Willetts, J., Kome, A. & Munankami, R. (2024) *Sustainable cost recovery principles can drive equitable, ongoing funding of critical urban sanitation services*, *NPJ Clean Water*, **7** (1), 105. doi:10.1038/s41545-024-00399-2.
- CASP (2018) *CASP Qualitative Checklist*. Oxford, UK: Critical Appraisal Skills Program. Available at: https://casp-uk.net/images/checklist/documents/CASP-Qualitative-Studies-Checklist/CASP-Qualitative-Checklist-2018_fillable_form.pdf (accessed: 10 June 2024).
- Christopher, W. G. & Beal, C. D. (2022) *Developing a best-practice model for water and wastewater services in informal urban settlements in Tanzania*, *International Journal of Water Resources Development*, **38** (3), 403–425. doi:10.1080/07900627.2021.1909541.
- Chumo, I., Mberu, B. & Kabaria, C. (2024) *The value of community capitals in sustainable urban development: a qualitative exploration of urban informal workers*, *Challenges*, **15** (4), 44. doi:10.3390/challe15040044.
- Cline, B. N. & Williamson, C. R. (2020) *Trust, regulation, and contracting institutions*, *European Financial Management*, **26** (4), 859–895. doi:10.1111/eufm.12253.
- Coker, E., Ploeg, J., Kaasalainen, S. & Carter, N. (2017) *Nurses' oral hygiene care practices with hospitalised older adults in postacute settings*, *International Journal of Older People Nursing*, **12** (1), e12124. doi:10.1111/opn.12124.
- Conaway, K., Lebu, S., Heilferty, K., Salzberg, A. & Manga, M. (2023) *On-site sanitation system emptying practices and influential factors in Asian low-and middle-income countries: a systematic review*, *Hygiene and Environmental Health Advances*, **6**, 100050. doi:10.1016/j.heha.2023.100050.
- Cookey, P. E., Kugedera, Z., Alamgir, M. & Brdjanovic, D. (2020) *Perception management of non-sewered sanitation systems towards scheduled faecal sludge emptying behaviour change intervention*, *Humanities and Social Sciences Communications*, **7** (1), 1–20. doi:10.1057/s41599-020-00662-0.
- Curtis, V. (2013) *Don't Look, Don't Touch: the Science Behind Revulsion*. Oxford: Oxford University Press. Available at: <https://researchonline.lshtm.ac.uk/id/eprint/2373998>.
- D'Amato, A., Mazzanti, M., Nicoli, F. & Zoli, M. (2018) *Illegal waste disposal: enforcement actions and decentralized environmental policy*, *Socio-Economic Planning Sciences*, **64**, 56–65. doi:10.1016/j.seps.2017.12.006.
- Davidovitz, M. & Cohen, N. (2022) *Alone in the campaign: distrust in regulators and the coping of front-line workers*, *Regulation & Governance*, **16** (4), 1005–1021. doi:10.1111/rego.12396.
- De Buck, E., Van Remoortel, H., Hannes, K., Govender, T., Naidoo, S., Avau, B. Veegaete, A. V., Musekiwa, A., Lutje, V., Cargo, M., Mosler, H.-J., Vandekerckhove, P. & Young, T. (2017) *Approaches to promote handwashing and sanitation behaviour change in low-and middle-income countries: a mixed method systematic review*, *Campbell Systematic Reviews*, **13** (1), 1–447. doi:10.4073/csr.2017.7.

- Delaire, C., Peletz, R., Haji, S., Kones, J., Samuel, E., Easthope-Frazer, A. & ... Khush, R. (2020) *How much will safe sanitation for all cost? Evidence from five cities*, *Environmental Science & Technology*, **55** (1), 767–777. doi:10.1021/acs.est.0c06348.
- Diamond, I. R., Grant, R. C., Feldman, B. M., Pencharz, P. B., Ling, S. C., Moore, A. M. & Wales, P. W. (2014) *Defining consensus: a systematic review recommends methodologic criteria for reporting of Delphi studies*, *Journal of Clinical Epidemiology*, **67** (4), 401–409. doi:10.1016/j.jclinepi.2013.12.002.
- Dietz, G. (2011) *Going back to the source: why do people trust each other?*, *Journal of Trust Research*, **1** (2), 215–222. doi:10.1080/21515581.2011.603514.
- Drummond, J., Daniel Shephard, D. & Trnka, D. (2021) 'Behavioural insights and regulatory governance: opportunities and challenges', *OECD Regulatory Policy Working Papers No. 16*. Paris: OECD Publishing. doi:10.1787/24140996.
- Dutton, P., Blackett, I., Pokhrel, N., Arjan, L., Walder, C., Pascua, E., (2022) Meeting the demand for water and sanitation services in asia's informal urban areas. In: Das, A. & Susantono, B. (eds.) *Informal Services in Asian Cities: Lessons for Urban Planning and Management From the Covid-19 Pandemic*. Tokyo, Japan: Asian Development Bank Institute. doi:10.56506/DYXR6960.
- ESAWAS (2021a) Citywide inclusive sanitation: how can accountability be strengthened?, *Citywide Inclusive Urban Sanitation Series*. Lusaka, Zambia: ESAWAS. Available at: <https://www.esawas.org/index.php/publications/sanitation> (accessed 10 June 2024).
- ESAWAS (2021b) Citywide inclusive sanitation: how can resourcing be managed effectively?, *Citywide Inclusive Urban Sanitation Series*. Lusaka, Zambia: ESAWAS. Available at: <https://www.esawas.org/index.php/publications/sanitation> (accessed: 10 June 2024).
- ESAWAS (2021c) Citywide inclusive sanitation: who is responsible?, *Citywide Inclusive Urban Sanitation Series*. Lusaka, Zambia: ESAWAS. Available at: <https://www.esawas.org/index.php/publications/sanitation> (accessed: 10 June 2024).
- ESAWAS (2022) *The Water Supply and Sanitation Regulatory Landscape Across Africa – Continent Wide Synthesis Report*. Lusaka, Zambia: ESAWAS. Available at <https://esawas.org/index.php/publications/general/download/2-general/61-esawas-report2022> (accessed: 10 June 2024).
- Feld, L. P. & Frey, B. S. (2007) *Tax compliance as the result of a psychological tax contract: the role of incentives and responsive regulation*, *Law & Policy*, **29** (1), 102–120. doi:10.1111/j.1467-9930.2007.00248.x.
- Feldman, Y., (2010) Toward a behaviorally responsive regulation, empirical findings and normative implications of the five models of compliance motivation. In: Levi Faur, D. (ed.) *Handbook of Politics and Regulation*: Cheltenham, UK: Edward Elgar, pp. 335. doi:10.2139/ssrn.1633602.
- Francois, J. N., Kakeu, J. & Kouame, C. (2021) *Do better institutions broaden access to sanitation in Sub-Sahara Africa?*, *Contemporary Economic Policy*, **39** (2), 435–452. doi:10.1111/coep.12512.
- Fuente, D. & Bartram, J. (2018) *Pro-poor governance in water and sanitation service delivery: evidence from global analysis and assessment of sanitation and drinking water surveys*, *Perspectives in Public Health*, **138** (5), 261–269. doi:10.1177/1757913918788109.
- Gautam, M., Wankhade, K., Sarangan, G. & Sudhakar, S. (2021) *Framework for addressing occupational safety of de-sludging operators: a study in two Indian cities*, *Journal of Environmental Management*, **289**, 112243. doi:10.1016/j.jenvman.2021.112243.
- Green, J. & Thorogood, N. (2004) *Qualitative Methods for Health Research*. London: Sage.
- Greene, N., Hennessy, S., Rogers, T. W., Tsai, J. & Francis III, L. (2021) *The role of emptying services in provision of safely managed sanitation: a classification and quantification of the needs of LMICs*, *Journal of Environmental Management*, **290**, 112612. doi:10.1016/j.jenvman.2021.112612.
- Grisaffi, C., Oluoch, P., Hamuchenje, E. M., Phiri, J., Salano, G., Hawkes, L. & Parker, A. (2022) *Transforming citywide sanitation provision: utility voices on pit emptying and transport services in Kenya and Zambia*, *Frontiers in Water*, **4**, 1055227. doi:10.3389/frwa.2022.1055227.
- Hasson, F. & Keeney, S. (2011) *Enhancing rigour in the delphi technique research*, *Technological Forecasting and Social Change*, **78** (9), 1695–1704. doi:10.1016/j.techfore.2011.04.005.
- Heidler, A., Nesi, M., Nikiema, J. & Lüthi, C. (2023) *Multilateral development banks investment behaviour in water and sanitation: findings and lessons from 60 years of investment projects in Africa and Asia*, *Journal of Water, Sanitation and Hygiene for Development*, **13** (5), 362–374. doi:10.2166/washdev.2023.004.
- Holm, R., Tembo, J. M. & Thole, B. (2015) *A comparative study of faecal sludge management in Malawi and Zambia: status, challenges and opportunities in pit latrine emptying*, *African Journal of Environmental Science and Technology*, **9** (11), 783–792. doi:10.5897/AJEST2015.1971.
- Hutchings, P., Johns, M., Jornet, D., Scott, C. & Van den Bossche, Z. (2018) *A systematic assessment of the pro-poor reach of development bank investments in urban sanitation*, *Journal of Water, Sanitation and Hygiene for Development*, **8** (3), 402–414. doi:10.2166/washdev.2018.147.
- Hyde-Smith, L., Zhan, Z., Roelich, K., Mdee, A. & Evans, B. (2022) *Climate change impacts on urban sanitation: a systematic review and failure mode analysis*, *Environmental Science & Technology*, **56** (9), 5306–5321. doi:10.1021/acs.est.1c07424.
- Hyun, C., Burt, Z., Crider, Y., Nelson, K. L., Prasad, C. S., Rayasam, S. D., Tarpeh, W. & Ray, I. (2019) *Sanitation for low-income regions: a cross-disciplinary review*, *Annual Review of Environment and Resources*, **44**, 287–318. doi:10.1146/annurev-environ-101718-03327.
- Igarashi, J., Evans, B., Sleight, A., Tarkash, D. N., Kennedy, R., Rosenberg, R. & Zakaria, F. (2023) *Does 'Low cost' urban sanitation exist? lessons from a global data Set*, *Environmental Science & Technology*, **57** (45), 17237–17245. doi:10.1021/acs.est.3c05731.

- IWA (2021) *A Call to Action: Regulating for Citywide Inclusive Sanitation*. London, UK: International Water Association. Available at: https://iwa-network.org/wp-content/uploads/2015/12/R_CWIS_call_to_action_final_dark_WEB_July-05.pdf (Accessed: 10 June 2024).
- IWA (2022) *Lessons Learnt Regulating for Citywide Inclusive Sanitation*. International Water Association. Available at: https://iwa-network.org/wp-content/uploads/2022/02/R_CWIS_Lessons_Learned_WEB_central.pdf (Accessed: 10 June 2024).
- Jabareen, Y. (2009) Building a conceptual framework: philosophy, definitions, and procedure, *International Journal of Qualitative Methods*, **8** (4), 49–62. doi:10.1177/160940690900800406.
- JMP (2022) *Progress on Drinking Water, Sanitation and Hygiene in Africa 2000–2020: Five Years Into the SDGs*. New York, NY: United Nations Children's Fund (UNICEF) and World Health Organization.
- Joseph, G., Hoo, Y. R., Wang, Q., Bahuguna, A. & Andres, L. (2024) *Funding A Water-Secure Future: an Assessment of Global Public Spending*. Washington, DC: World Bank.
- Kagan, R. A., Gunningham, N., Thornton, D., (2011) Fear, duty, and regulatory compliance: Lessons from three research projects. In: Parker, C. & Nielsen, V. L. (eds.) *Explaining Compliance: Business Responses to Regulation*, Cheltenham, UK: Edward Elgar, pp. 37–58. doi:10.4337/9780857938732.
- Keeney, S., McKenna, H. A. & Hasson, F. (2011) *The Delphi Technique in Nursing and Health Research*. Hoboken, NJ: John Wiley & Sons. doi:10.1002/9781444392029.
- Kithia, J. & Majambo, G. (2020) Motion but no speed: colonial to post-colonial status of water and sanitation service provision in Mombasa city, *Cities*, **107**, 102867. doi:10.1016/j.cities.2020.102867.
- Kone, D., Chowdhry, S., (2014) Profitability of private fecal sludge emptying businesses in Africa and Asia. In: Cross, P. & Coombes, Y. (eds.) *Sanitation and Hygiene in Africa: Where do We Stand?*, vol. 77, London, UK: International Water Association.
- Kwiringira, J. N., Kabumbuli, R., Zakumumpa, H., Mugisha, J., Akugizibwe, M., Ariho, P. & Rujumba, J. (2021) Re-conceptualizing sustainable urban sanitation in Uganda: why the roots of 'Slumification' must be dealt with, *BMC Public Health*, **21** (1), 992. doi:10.1186/s12889-021-11029-8.
- Landeta, J. & Barrutia, J. (2011) People consultation to construct the future: a Delphi application, *International Journal of Forecasting*, **27** (1), 134–151. doi:10.1016/j.ijforecast.2010.04.001.
- Lange, B. & Gouldson, A. (2010) Trust-based environmental regulation, *Science of The Total Environment*, **408** (22), 5235–5243. doi:10.1016/j.scitotenv.2010.07.052.
- Lawhon, M., Nsangi Nakyagaba, G. & Karpouzoglou, T. (2023) Towards a modest imaginary? Sanitation in Kampala beyond the modern infrastructure ideal, *Urban Studies*, **60** (1), 146–165. doi:10.1177/00420980211064519.
- Lee, E., Lejano, R. P. & Connelly, R. J. (2013) Regulation-by-information in areas of limited statehood: lessons from the Philippines' environmental regulation, *Regulation & Governance*, **7** (3), 387–405. doi:10.1111/regg.12013.
- Lee, J. K., Bullen, C., Ben Amor, Y., Bush, S. R., Colombo, F. & ... Gaviria, A., (Lancet COVID-19 Commission Task Force for Public Health Measures to Suppress the Pandemic) (2021) Institutional and behaviour-change interventions to support COVID-19 public health measures: a review by the lancet commission task force on public health measures to suppress the pandemic, *International Health*, **13** (5), 399–409. doi:10.1093/inthealth/ihab022.
- Lerebours, A., Scott, R. & Sansom, K. (2021a) Private emptiers' perspectives on the regulation of faecal sludge emptying services in Sub-Saharan Africa, *Journal of Water, Sanitation and Hygiene for Development*, **11** (5), 785–793. doi:10.2166/washdev.2021.026.
- Lerebours, A., Scott, R., Sansom, K. & Kayaga, S. (2021b) Regulating sanitation services in sub-saharan Africa: an overview of the regulation of emptying and transport of faecal sludge in 20 cities and its implementation, *Utilities Policy*, **73**, 101315. doi:10.1016/j.jup.2021.101315.
- Lerebours, A., Scott, R., Sansom, K. & Kayaga, S. (2022) Barriers and enablers to the regulation of sanitation services: a framework for emptying and transport services in Sub-Saharan African cities, *Frontiers in Environmental Science*, **408** (10), 869403. doi:10.3389/fenvs.2022.869403.
- Levi-Faur, D. (2005) The global diffusion of regulatory capitalism, *The Annals of the American Academy of Political and Social Science*, **598** (1), 12–32. doi:10.1177/0002716204272371.
- Lubell, M. & Scholz, J. T. (2001) Cooperation, reciprocity, and the collective-action heuristic, *American Journal of Political Science*, **45**, 160–178. doi:10.2307/2669365.
- Mallory, A., Omoga, L., Kiogora, D., Riungu, J., Kagendi, D. & Parker, A. (2021) Understanding the role of informal pit emptiers in sanitation in Nairobi through case studies in Mukuru and Kibera settlements, *Journal of Water, Sanitation and Hygiene for Development*, **11** (1), 51–59. doi:10.2166/washdev.2020.193.
- Mason, N., Oyaya, C. & Boulenouar, J. (2020) Reforming urban sanitation under decentralization: cross-country learning for Kenya and beyond, *Development Policy Review*, **38** (1), 42–63. doi:10.1111/dpr.12408.
- Mazzucato, M. & Zaqout, M. (2024) *Rethinking the Global Water Challenge Through A Common Good Lens*. Working Paper 24/06. London: Institute for Innovation and Public Purpose, UCL.
- McFarlane, C. & Silver, J. (2017) The political city: 'Seeing sanitation' and making the urban political in Cape Town, *Antipode*, **49** (1), 125–148. doi:10.1111/anti.12264.
- McGranahan, G. (2015) Realizing the right to sanitation in deprived urban communities: meeting the challenges of collective action, coproduction, affordability, and housing tenure, *World Development*, **68**, 242–253. doi:10.1016/j.worlddev.2014.12.008.

- Mpanang'ombe, W., Bray, B. & Tilley, E. (2021) Pit emptying subsidy vouchers: a two-phased targeting and structuring experiment in Blantyre, Malawi, *International Journal of Urban Sustainable Development*, **13**, 448–463. doi:10.1080/19463138.2021.1981910.
- Mumssen, Y. & Triche, T. A. (2017) *Status of Water Sector Regulation in the Middle East and North Africa*. Washington, DC: World Bank.
- Mumssen, Y., Saltiel, G., Sadik, N. & Marques, R. (2018) *Regulation of Water Supply and Sanitation in Bank Client Countries*. Washington, DC: World Bank.
- Muoghalu, C., Semiyaga, S. & Manga, M. (2023) Faecal sludge emptying in Sub-Saharan Africa, south and Southeast Asia: a systematic review of emptying technology choices, challenges, and improvement initiatives, *Frontiers in Environmental Science*, **11**, 1097716. doi:10.3389/fenvs.2023.1097716.
- Muzenda, D., Sadik, N., Boex, J., Makino, M., Heymans, C., Saltiel, G. & Misra, S. (2022) *Water Supply and Sanitation Policies, Institutions, and Regulation: Adapting to A Changing World-Synthesis Report*. Washington, DC: World Bank.
- Narayan, A. S., Maurer, M. & Lüthi, C. (2021) The clean plan: analysing sanitation planning in India using the CWIS planning framework, *Journal of Water, Sanitation and Hygiene for Development*, **11** (6), 1036–1047. doi:10.2166/washdev.2021.130.
- Narzetti, D. A. & Marques, R. C. (2021) Access to water and sanitation services in Brazilian vulnerable areas: the role of regulation and recent institutional reform, *Water*, **13** (6), 787. doi:10.3390/w13060787.
- Nielsen, V. L. & Parker, C. (2009) Testing responsive regulation in regulatory enforcement, *Regulation & Governance*, **3** (4), 376–399. doi:10.1111/j.1748-5991.2009.01064.x.
- OECD (2021) *OECD Regulatory Policy Outlook 2021*. Paris: OECD Publishing. doi:10.1787/38b0fdb1-en.
- Okoli, C. & Pawlowski, S. D. (2004) The Delphi method as a research tool: an example, design considerations and applications, *Information & Management*, **42** (1), 15–29. doi:10.1016/j.im.2003.11.002.
- Ostrom, E. (2000) Collective action and the evolution of social norms, *Journal of Economic Perspectives*, **14** (3), 137–158. doi:10.1257/jep.14.3.137.
- Ostrom, E., Schroeder, L. & Wynne, S. (1993) *Institutional Incentives and Sustainable Development: Infrastructure Policies in Perspective*. Boulder, CO: Westview Press.
- Owusu, G. M. Y., Bekoe, R. A. & Mintah, R. (2021) Predictors of tax compliance intentions among self-employed individuals: the role of trust, perceived tax complexity and antecedent-based intervention strategies, *Small Enterprise Research*, **30**, 49–70. doi:10.1080/13215906.2021.1989622.
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D. & ... Moher, D. (2021) The PRISMA 2020 statement: an updated guideline for reporting systematic reviews, *PLOS Medicine*, **18** (3), 1–15. doi: 10.1371/journal.pmed.1003583.
- Parker, C. & Nielsen, V. L., (2017) Compliance: 14 questions. In: Drahos, P. (ed.) *Regulatory Theory: Foundations and Applications*, Canberra, Australia: ANU Press, pp. 217–232.
- Pautz, M. C., (2024) Recognising the Social Nature of Regulatory Compliance and Focusing on Front-Line Interactions. In: Le Coze, J. C. & Journé, B. (eds.) *The Regulator–Regulatee Relationship in High-Hazard Industry Sectors: New Actors and New Viewpoints in A Conservative Landscape*, London, UK: Springer Nature, pp. 63–70. doi:10.1007/978-3-031-49570-0_7.
- Peal, A., Evans, B., Ahilan, S., Ban, R., Blackett, I., Hawkins, P., Lars, S., Scott, R., Sleight, A., Strande, L. & Veses, O. (2020) Estimating safely managed sanitation in urban areas; lessons learned from a global implementation of excreta-flow diagrams, *Frontiers in Environmental Science*, **8**, 1. doi:10.3389/fenvs.2020.00001.
- Pickering, A. J., Null, C., Winch, P. J., Mangwadu, G., Arnold, B. F., Prendergast, A. J., DPhilg, H., Njenga, S. M., Rahman, M., Ntozini, R., Benjamin-Chung, J., Stewart, C. P., Huda, T. M. N., Moulton, L. H., Colford, J. M., Luby, S. P. & Humphrey, J. H. (2019) The WASH benefits and SHINE trials: interpretation of WASH intervention effects on linear growth and diarrhoea, *The Lancet Global Health*, **7** (8), e1139–e1146. doi:10.1016/S2214-109X(19)30268-2.
- Pierce, G. (2017) Why is basic service access worse in slums? A synthesis of obstacles, *Development in Practice*, **27** (3), 288–300. doi:10.1080/09614524.2017.1291582.
- Prasad, C. S. & Ray, I. (2019) When the pits fill up:(in) visible flows of waste in urban India, *Journal of Water, Sanitation and Hygiene for Development*, **9** (2), 338–347. doi:10.2166/washdev.2019.153.
- Pulliat, G., Block, D., Bruckert, M., Nussbaum-Barberena, L., Dreyse, C., Dupé, P. & Perrin, C. (2023) Governing the nurturing city: the uneven enforcement of street food vending regulations, *Urban Geography*, **45**, 1148–1172. doi:10.1080/02723638.2023.2279872.
- Qualtrics (2020) *Version 2024*. Provo, UT, USA: Development Company: Qualtrics. Available at: <https://www.qualtrics.com>.
- Rao, K. C., Kvarnstrom, E., Di Mario, L. & Drechsel, P. (2016) *Business Models for Fecal Sludge Management (Vol. 6)*. CGIAR Research Program on Water, Land and Ecosystems (WLE). Resource Recovery and Reuse Series. Colombo, Sri Lanka: International Water Management Institute (IWMI).
- Resnick, D. (2021) Taxing informality: compliance and policy preferences in urban Zambia, *The Journal of Development Studies*, **57** (7), 1063–1085. doi:10.1080/00220388.2020.1841171.
- Rosenqvist, T., Mitchell, C. & Willetts, J. (2016) A short history of how we think and talk about sanitation services and why it matters, *Journal of Water, Sanitation and Hygiene for Development*, **6** (2), 298–312. doi:10.2166/washdev.2016.118.
- Ross, I., Cumming, O., Dreibeilbis, R., Adriano, Z., Nala, R. & Greco, G. (2021) How does sanitation influence people's quality of life? Qualitative research in low-income areas of Maputo, Mozambique, *Social Science & Medicine*, **272**, 113709. doi:10.1016/j.socscimed.2021.113709.

- Sainati, T., Zakaria, F., Locatelli, G., Sleigh, P. A. & Evans, B. (2020) [Understanding the costs of urban sanitation: towards a standard costing model](#), *Journal of Water, Sanitation and Hygiene for Development*, **10** (4), 642–658. doi:10.2166/washdev.2020.093.
- Saker, A., Bernal Pedraza, A. & Narayan, A. S. (2022) [Regulating citywide inclusive sanitation \(CWIS\) in Colombia](#), *International Journal of Environmental Research and Public Health*, **19** (9), 5669. doi:10.3390/ijerph19095669.
- Samuel, K. J., Agbola, S. B. & Olojede, O. A. (2021) [Local governance and the crisis of water and sanitation provision in medium-sized urban centres: evidence from three cities in Nigeria](#), *Local Economy*, **36** (2), 164–177. doi:10.1177/02690942211035359.
- Sancho, D., (2017) The impact of institutional and organisational factors in the efficiency and effectiveness of local regulatory systems. In: Asquer, A., Becchis, F. & Russolillo, D. (eds.) *The Political Economy of Local Regulation: Theoretical Frameworks and International Case Studies*, London, UK: Palgrave Macmillan, pp. 95–112. doi:10.1057/978-1-137-58828-9.
- Schmitt, R. J., Morgenroth, E. & Larsen, T. A. (2017) [Robust planning of sanitation services in urban informal settlements: an analytical framework](#), *Water Research*, **110**, 297–312. doi:10.1016/j.watres.2016.12.007.
- Scott, J. C. (1985) *Weapons of the Weak: Everyday Forms of Peasant Resistance*. New Haven, CT: Yale University Press. <https://www.jstor.org/stable/j.ctt1nq836>.
- Scott, R. E., Ross, I., Hawkins, P., Blackett, I. & Smith, M. D. (2019a) [Diagnostics for assessing city-wide sanitation services](#), *Journal of Water, Sanitation and Hygiene for Development*, **9** (1), 111–118. DOI:10.2166/washdev.2018.113.
- Scott, R., Scott, P., Hawkins, P., Blackett, I., Cotton, A. & Lerebours, A. (2019b) [Integrating basic urban services for better sanitation outcomes](#), *Sustainability*, **11** (23), 6706. doi:10.3390/su11236706.
- Sheatsley, P. B. (1983) Questionnaire construction and item writing. In: Rossi, P. H., Wright, J. D. & Anderson, A. B. (eds.) *Handbook of Survey Research*, vol. 4(1), Cambridge, MA: Academic Press, pp. 195–230. doi:10.1016/B978-0-12-598226-9.50012-4.
- Singh, S., Laker, F., Bateganya, N. L., Nkurunziza, A. G., Semiyaga, S. & Brdjanovic, D. (2022) [Evaluation of business models for fecal sludge emptying and transport in informal settlements of Kampala, Uganda](#), *Water*, **14** (18), 2914. doi:10.3390/w14182914.
- 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**, 100957. doi:10.1016/j.jup.2019.100957.
- Six, F. & Verhoest, K. (2017) Trust in regulatory regimes: scoping the field. In: Six, F. & Verhoest, K. (eds.) *Trust in Regulatory Regimes*, Cheltenham, UK: Edward Elgar Publishing, pp. 1–36.
- Spickermann, A., Zimmermann, M. & Heiko, A. (2014) [Surface-and deep-level diversity in panel selection – exploring diversity effects on response behaviour in foresight](#), *Technological Forecasting and Social Change*, **85**, 105–120. doi:10.1016/j.techfore.2013.04.009.
- Steinert, M. (2009) [A dissensus based online Delphi approach: an explorative research tool](#), *Technological Forecasting and Social Change*, **76** (3), 291–300. doi:10.1016/j.techfore.2008.10.006.
- Strande, L. & Brdjanovic, D. (2014) *Faecal Sludge Management: Systems Approach for Implementation and Operation*. London, UK: IWA Publishing. doi:10.13140/2.1.2078.5285.
- Strande, L., Evans, B., von Sperling, M., Bartram, J., Harada, H., Nakagiri, A. & Nguyen, V. A. (2023) [Urban sanitation: new terminology for globally relevant solutions?](#), *Environmental Science & Technology*, **57** (42), 15771–15779. doi:10.1021/acs.est.3c04431.
- Susilawati, D. & Kanowski, P. (2020) [Cleaner production in the Indonesian pulp and paper sector: improving sustainability and legality compliance in the value chain](#), *Journal of Cleaner Production*, **248**, 119259. doi:10.1016/j.jclepro.2019.119259.
- Thomas, A. S., Milfont, T. L. & Gavin, M. C. (2016) [A new approach to identifying the drivers of regulation compliance using multivariate behavioural models](#), *PLoS One*, **11** (10), e0163868. doi:10.1371/journal.pone.0163868.
- Tomoi, H., MacLeod, C., Moriyasu, T., Simiyu, S., Ross, I., Cumming, O. & Braun, L. (2024) [Determinants of willingness to pay for fecal sludge management services and knowledge gaps: a scoping review](#), *Environmental Science & Technology*, **58**, 1908–1920. doi:10.1021/acs.est.3c06628.
- Tsinda, A., Abbott, P., Chenoweth, J., Pedley, S. & Kwizera, M. (2018) [Improving sanitation in informal settlements of East African cities: hybrid of market and state-led approaches](#), *International Journal of Water Resources Development*, **34** (2), 229–244. doi:10.1080/07900627.2017.1310090.
- UN (2012) A/HRC/21/42, *Stigma and the Realization of the Human Rights to Water and Sanitation*, Report of the Special Rapporteur on the Human Right to Safe Drinking Water and Sanitation. New York, NY: United Nations General Assembly.
- UN (2017) A/HRC/36/45, *Service Regulation and the Human Rights to Water and Sanitation: Report*, Report of the Special Rapporteur on the Human Rights to Safe Drinking Water and Sanitation. New York, NY: United Nations General Assembly.
- UN-Habitat (2023) *Global Report on Sanitation and Wastewater Management in Cities and Human Settlements*. Nairobi, Kenya: UN-Habitat. Available at: <https://unhabitat.org/global-report-on-sanitation-and-wastewater-management-in-cities-and-human-settlements> (Accessed: 10 June 2024).
- Valette, H. & Colon, M. (2024) [Institutional change for the development of urban sanitation in the global south: a social science review](#), *Utilities Policy*, **88**, 101755. doi:10.1016/j.jup.2024.101755.
- Van den Berg, C. & Danilenko, A. (2017) *Performance of Water Utilities in Africa*. Washington, DC: World Bank.

- van Welie, M. J., Truffer, B. & Gebauer, H. (2019a) *Innovation challenges of utilities in informal settlements: combining a capabilities and regime perspective*, *Environmental Innovation and Societal Transitions*, **33**, 84–101. doi:10.1016/j.eist.2019.03.006.
- van Welie, M. J., Truffer, B. & Yap, X. S. (2019b) *Towards sustainable urban basic services in low-income countries: a technological innovation system analysis of sanitation value chains in Nairobi*, *Environmental Innovation and Societal Transitions*, **33**, 196–214. doi:10.1016/j.eist.2019.06.002.
- Weinrib, L. (2018) Class and classification: the role of disgust in regulating social status. In: Hasan, Z., Huq, A., Nussbaum, M. & Verma, V. (eds.) *The Empire of Disgust: Prejudice, Discrimination and Policy in India and the US*, Oxford, UK: Oxford University Press. doi:10.1093/oso/9780199487837.001.0001.
- WHO (2018) *Guidelines on Sanitation and Health*. Geneva, Switzerland: World Health Organization.
- WHO (2020) *State of the World's Sanitation: an Urgent Call to Transform Sanitation for Better Health, Environments, Economies and Societies*. Geneva, Switzerland: World Health Organization.
- WHO (2022) *Sanitation Safety Planning, Second Edition*. Geneva, Switzerland: World Health Organization.
- WHO (2023a) *Strong Systems and Sound Investments: Evidence on and key Insights Into Accelerating Progress on Sanitation, Drinking-Water and Hygiene: uN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) 2022 Report*. Geneva, Switzerland: World Health Organization.
- WHO (2023b) *Health for All – Transforming Economies to Deliver What Matters. Final Report of the WHO Council on the Economics of Health for All*. Geneva, Switzerland: World Health Organization.
- Wilcox, J., Rutayisire, B., Kuria, N., Evans, B., Bartram, J. & Sklar, R. (2023) *Developing formal pit-latrines emptying businesses for hard-to-serve customers: resources, methods, and pricing structures*, *Journal of Water, Sanitation and Hygiene for Development*, **13** (12), 941–951. doi:10.2166/washdev.2023.110.
- Williams, C. C. (2019) *Explaining and tackling the informal economy: an evaluation of competing perspectives*, *Open Economics*, **2** (1), 63–75. doi:10.1515/openec-2019-0007.
- Winters, M. S., Karim, A. G. & Martawardaya, B. (2014) *Public service provision under conditions of insufficient citizen demand: insights from the urban sanitation sector in Indonesia*, *World Development*, **60**, 31–42. doi:10.1016/j.worlddev.2014.03.017.
- Wolf, J., Hubbard, S., Brauer, M., Ambelu, A., Arnold, B. F., Bain, R. & ... Boisson, S. (2022) *Effectiveness of interventions to improve drinking water, sanitation, and handwashing with soap on risk of diarrhoeal disease in children in low-income and middle-income settings: a systematic review and meta-analysis*, *The Lancet*, **400** (10345), 48–59. doi:10.1016/S0140-6736(22)00937-0.
- WSUP (2022) *Mind the Gap: How Can We Address the Shortfall in Urban Sanitation Finance?* London, UK: Water & Sanitation for the Urban Poor. Available at: <https://wsup.com/publications/mind-the-gap-how-can-we-address-the-shortfall-in-urban-sanitation-finance/> (Accessed: 10 June 2024).
- Zaqout, M., Cawood, S., Evans, B. E. & Barrington, D. J. (2020) *Sustainable sanitation jobs: prospects for enhancing the livelihoods of pit-emptiers in Bangladesh*, *Third World Quarterly*, **42** (2), 329–347. doi:10.1080/01436597.2020.1810560.

First received 29 August 2024; accepted in revised form 17 February 2025. Available online 14 March 2025



DSPACE

<https://dspace.org/>

Safe faecal sludge emptying and transport: compliance challenges and models for a public good

Grisaffi, Claire; Leinster, Paul; Mugo, Kariuki; Drabble, Sam; Parker, Alison

2025-05-01

IWA Publishing

<https://doi.org/10.2166/h2oj.2025.041>

Grisaffi C, Leinster P, Mugo K, et al., (2025) Safe faecal sludge emptying and transport: compliance challenges and models for a public good. H2Open Journal, Volume 8, Issue 3, May 2025, pp. 157-177