Safely Managed Sanitation Services in the Global Sanitation Fund

Based on research by Andy Robinson and Andy Peal

SHF
The Sanitation & Hygiene Fund

Water Supply and Sanitation Collaborative Council Legacy Publication

The Water Supply and Sanitation Collaborative Council has been advocating and supporting sanitation and hygiene for 30 years. We are now stepping up and transitioning into The Sanitation and Hygiene Fund for a global, transformative and long-term approach to help achieve Sustainable Development Goal 6.2.

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Contents

Tables

Figures

Abbreviations and acronyms

BCC	Behaviour change communications
CLTS	Community-Led Total Sanitation
CPM	Country Programme Monitor
DHS	Demographic and Health Surveys
EA	Executing Agency
E-SHIP	Ethiopia Sanitation and Hygiene Improvement Programme
FSM	Faecal sludge management
FUM	Follow-Up MANDONA approach
GSF	Global Sanitation Fund
IP	Implementing partner
LGA	Local Government Authority
LSMS	Living Standards Measurement Study
MoH	Ministry of Health
MICS	Multiple Indicator Cluster Surveys
OD	Open defecation
ODF	Open defecation free
SFD	Shit flow diagram
SMSS	Safely managed sanitation services
SNV	Stichting Nederlandse Vrijwilligers (Foundation of Netherlands Volunteers)
SSH4A	Sustainable Sanitation and Hygiene for All
STH	Soil transmitted helminth
U5	Children under five years of age
UBS	Universal basic sanitation
UMATA	Usafi Wa Mazingira Tanzania (Sanitation Tanzania)
UNOPS	United Nations Office for Project Services
WCA	West and Central Africa
WSSCC	Water Supply and Sanitation Collaborative Council

Executive Summary

Sustainable Development Goal 6 for water and sanitation calls for the realization of safely managed services for everyone by 2030. Achievement of SDG target 6.2, “access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations”, is measured by the proportion of population using ‘safely managed sanitation services’ (SMSS). This is defined as use of at least a basic sanitation facility and a handwashing facility with soap and water, which is not shared with other households, and where excreta are treated safely either on-site or off-site.[1]

The concept of safely managed sanitation services is relatively new. All governments and development partners now need to consider how human waste is managed across the entire sanitation service chain: from the use of the toilet (‘user interface’), through containment, emptying, transport and treatment to end use or disposal.

The development of rural SMSS is urgent as the number of ‘open defecation free’ (ODF) areas grows, governments and external support agencies look for viable ‘post-ODF’ strategies, and faecal exposure risks from unsafe excreta management become apparent. While there has been significant research and implementation to improve the sanitation service chain in urban settings, little guidance is available on how to achieve and sustain SMSS in rural contexts. Issues such as sustaining safe toilet use and handwashing habits, ensuring that excreta are safely contained in pits or tanks, and establishing systems to safely manage waste when these containment systems fill up are increasingly important.

Working towards the universal use of SMSS also has equity implications, such as ensuring that emptying and disposal options are affordable, the excreta of children is safely managed, the health, safety, and rights of sanitation workers is safeguarded, and negative impacts on disadvantaged and marginalized communities living in areas where unsafe disposal and other unsafe practices take place is prevented.

In 2019, WSSCC commissioned this study to address the above knowledge gap. The study examines how and to what extent Global Sanitation Fund (GSF)-supported programmes have been enabling SMSS in rural areas principally using collective behaviour change approaches, such as Community-led Total Sanitation (CLTS). The objective of this study is to identify SMSS challenges, capacity gaps, learning needs, and programming recommendations, as well as inform other individuals and organisations working in rural sanitation of the generic SMSS issues and recommendations arising from the study.

1 The WHO-UNICEF Joint Monitoring Programme on Water Supply, Sanitation and Hygiene (JMP) agreed with the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDG) that the indicator for SDG 6.2 should be reported and monitored as two separate time series: 6.2.1a Population using safely managed sanitation services and 6.2.1b Population with a basic handwashing facility with soap and water available on premises.

Methodology and process

Rapid desk reviews were conducted on 11 GSF-supported programmes in sub-Saharan Africa and Asia, assessing relevant documentation, evaluations and progress data, supplemented by remote key informant interviews.[2] GSF outcome surveys were available for five of the GSF-supported programmes.[3] An online survey was implemented by the GSF global learning team and four country visits were made in mid-2019 to collect detailed information on the Cambodia, Madagascar, Tanzania and Uganda programmes.

Key concepts and recent research

A literature review highlighted relevant research and considered key issues of safely managed sanitation services, which were then examined across the range of contexts and scenarios found in the GSF-supported programmes.

A recent UNC study (Kolsky et al., 2019) demonstrated that 50%–58% of the excreta hazard from sanitation facilities is likely to be unsafely released into the local environment and that **80%–98% of this unsafe release occurs in the first steps of the sanitation service chain** (user interface—containment—emptying). The proportion of hazard released was higher in urban facilities and in more 'advanced' technologies. **These findings suggest that the sanitation ladder is upside down;** simple technologies on the 'bottom rung' of the ladder are safer than the more advanced technologies at the higher rungs. According to the safe return data, pit latrines are safer than septic tank systems and septic tanks are safer than sewerage.

A broader approach to SMSS is needed. An examination of excreta flows along the sanitation service chain and of pathogen loads in the different excreta flows is required for full assessment of SMSS. However, 'pathogen flow' approaches (such as SaniPath[4]) are complex and require detailed data, expertise, and time. Excreta flow assessments (such as Shit Flow Diagrams) are simpler, but still require information on facility and containment types, excreta outflows and emptying, transport, treatment and disposal practices.

Few current programme surveys, or other monitoring instruments collect these data. Given the absence of detailed data in most contexts, this SMSS review was used to identify key SMSS issues to examine within the GSF-supported programme contexts:

- **Toilet design:** How does this affect safe management?
- **Safe containment:** Are there any outflows from toilet containment systems?
- **Emptying and disposal:** What happens when toilet containment systems fill?
- **Innovations:** Have there been local solutions for safe management?

2 Benin, Cambodia, Ethiopia, Kenya, Madagascar, Nepal, Nigeria, Senegal, Tanzania, Togo, Uganda (India and Malawi have GSF–supported programmes had been completed previously and were therefore not included in this study.)
3 The outcome surveys were designed by University of Buffalo and implemented by local consultants hired by the executing agencies in the following GSF-supported programmes: Cambodia, Kenya, Nepal, Senegal, Tanzania.
4 http://sanipath.org

SDG sanitation target 6.2 also includes the requirement to achieve, by 2030, adequate and equitable hygiene for all. Progress in this goal will be monitored using the SDG global indicator 6.2.1b: "the proportion of the population using a handwashing facility with soap and water", with a basic hygiene service defined as availability of a handwashing facility on premises with soap and water. The use of basic hygiene services is an important part of the SDG 6.2 sanitation and hygiene target. However, while handwashing data from the GSF-supported programmes are reported in this study, hygiene results were not studied in detail for this report.

Sanitation outcomes in GSF-supported programmes

GSF monitoring data report significant ODF populations, with at least 500,000 people living in ODF environments in each GSF programme area, including ODF populations of 2 million to 5 million reported in Ethiopia, Madagascar, Nepal and Uganda. In the 11 GSF-supported programmes studied, around two thirds (68%) of the total target populations live in an ODF environment.[5]

At least 15 million people (47% of the total target population) across the 11 GSF-supported programmes are reported to have gained access to improved sanitation (including households that use shared facilities). However, none of the 11 GSF-supported programmes routinely monitors SMSS indicators, and therefore no estimates were available of the total programme population using SMSS.

Outcome surveys were carried out in five GSF-supported programmes in 2018-2019 (with another six outcome surveys to be finalised in the other GSF-supported programmes in 2020). These GSF outcome surveys examined household, school, health-care facility and ODF outcomes in intervention communities and included structured observations of some household sanitation and hygiene behaviours. The GSF outcome surveys sampled households from both ODF and non-ODF communities, with the average open defecation (OD) rate across the sampled communities reported to vary from only 2.7% in Tanzania up to 16% in Senegal.

The GSF outcome surveys estimated that access to SMSS ranged from 60% to 70% in four GSF-supported programmes (Cambodia, Kenya, Nepal and Tanzania), with lower SMSS access reported in the GSF Senegal programme (34%) due to the much higher proportion of households with shared access to improved sanitation facilities.[6]

As the survey design predated this SMSS study, these outcome survey estimates of SMSS access are likely inflated, since the survey questions did not include certain aspects of a confirmed SMSS system such as unsafe outflows from toilet containment systems (e.g. effluent from septic tanks disposed to the open), or whether faecal sludge was safely emptied or disposed. Additionally, high access to SMSS reported in Cambodia, Kenya, Nepal and Tanzania is due to the relatively high access to basic sanitation services (improved toilets that are not shared with other families) where the majority of pits and tanks have not filled yet and therefore have not yet been emptied. In Asian countries like Nepal and Cambodia, where there is a relatively high use of septic tanks (and smaller 'septic pits'), there is more potential for unsafe outflows and emptying. In sub-Saharan Africa, where dry pit latrines are common, these SMSS data are likely to be more representative of the long-term situation.

5 All figures with respect to national level ODF criteria

6 The JMP classifies shared access to an improved sanitation facility as a lower level of service than private access to basic sanitation, even if it is an improved facility with safely contained excreta and safely managed sanitation services.

Safe containment

The majority of the household toilets in the nine African GSF-supported programmes (Benin, Ethiopia, Kenya, Madagascar, Nigeria. Senegal, Tanzania, Togo and Uganda) are dry pit latrines. There are few SMSS issues in dry pit latrines in rural contexts, as most of the latrine pits are covered and replaced when full. In normal operation, few liquids are added to the pit (other than urine), thus the risk of groundwater contamination is also relatively low. The excreta in a dry pit latrine are therefore generally considered safely managed when retained in the below-ground pit (without emptying)—with a 2-year storage time generally considered sufficient to inactivate pathogens.

In the two Asian GSF-supported programmes (Cambodia and Nepal), most household toilets are pour-flush latrines (98% in Cambodia and 94% in Nepal) connected to lined pits or septic tanks. Pour-flush latrines tend to have more safe management issues than dry pit latrines because more water enters the pit (from flushing, and often also from anal cleansing), which both slows the pathogen die-off rate and increases the risk of pathogens being transported out of the pit. More liquid in the pit also means that the pit tends to fill up faster; outflows from the pit (either through leaching into the soil, or through outlets from the pit) are greater; and the pit contents tend to be wetter and more anaerobic, leading to increased risks of people being exposed to hazardous pit contents.

Household toilets connected to septic tanks are relatively rare in rural areas. The GSF outcome surveys reported common use in only the GSF-supported Nepal programme. Many of the pour-flush toilets connected to septic tanks, septic pits and holding tanks have not yet filled up and therefore—by default—these facilities are often considered to be safely managed (although the JMP recommends that only 50% of septic tanks should be considered safely managed). Current monitoring often does not capture where unsafe outflows—either continuous outlets or periodic overflows—are occurring from these 'wet' containment systems. However, data from other sources suggests that many of these toilet containment systems are not safely managed.

Groundwater vulnerability

Groundwater aquifers can be polluted by leaching of liquids from onsite sanitation containment systems, particularly from wet technologies such as pour-flush pit latrines and septic tanks with soak pits. But when the depth of relatively fine unsaturated soil beneath the base of the latrine is greater than 2 m, recent research suggests that the risk of faecal groundwater pollution by household toilets is minimal as dry soils are generally effective in the removal or inactivation of pathogens.

The GSF-supported programmes reported that households were advised to build toilets a minimum distance away from any water points, and usually a minimum distance above the groundwater table. The minimum distances vary, from 10 m to 30 m horizontally, and from 1 m to 5 m vertically, but these rules of thumb are rarely based on soil conditions or groundwater vulnerability factors. Neither are they regularly monitored or enforced.

A risk assessment can be used to estimate the vulnerability of an aquifer and will help to estimate whether onsite sanitation facilities in the area are safely managed. When groundwater vulnerability is expected to be high, a macro-level risk assessment should include consideration of soil transmissivity, groundwater depth, percentage of sanitation facilities located near groundwater sources, percentage of drinking water that is obtained from groundwater sources, and density of sanitation facilities that could release faecal pathogens into soil.

Importantly, where high groundwater vulnerability is identified, the best solutions are either: (a) to ensure that groundwater is not used for drinking-water supply (as shallow groundwater is easily polluted by other factors); or (b) to consider whether different sanitation technologies might reduce the contamination risk. If these options are not feasible, then undertaking water quality tests and other formative research may be required to determine whether the faecal exposure risk is serious and assess the best long-term options.

Safe emptying and transport

Little information and few reliable data were available on pit and tank emptying and sludge transport practices in low-income rural areas, as these services (both formal and informal) generally operate in more urban contexts.

Faecal sludge management (i.e. the collection, transport, and treatment of faecal sludge from pit latrines, septic tanks, and other on-site sanitation) has rarely been a focus of rural sanitation programmes and the GSF-supported programmes do not routinely monitor emptying of containment systems (or disposal of faecal sludge). This makes it hard to estimate the safety of current practices. However, in the African programmes, the widespread use of unlined pit latrines that are covered and replaced when full suggests that emptying rates are likely to remain low for some time. Where data were available, the low rates of emptying reported are also attributable to the young age of these toilets (and the large pits dug by some households).

The GSF outcome surveys in the two Asian programmes found higher rates of pit emptying—18% in Cambodia and 13% in Nepal—which correlate with the higher use in these programmes of pour-flush toilets connected to lined pits and tanks (that households prefer to empty and reuse). However, these emptying rates are still considered low, which may suggest widespread use of unsafe practices that reduce the need for emptying (such as flooding out or connecting an outlet pipe directly to an open drain).

In summary, the few data available confirm the following.

- **Formal emptying services** (e.g. using vacuum trucks) **are generally unaffordable** for most low-income households.
- **Service providers often struggle to access rural toilet facilities with emptying vehicles** (due to poor road access and difficult placement of the facility). Thus, where practiced, emptying in rural areas is often by informal mechanised or manual services (e.g. tractors with farm pumps and tanks, or workers with buckets).
- **Private service providers (and informal emptiers) in rural areas are rarely trained in** safe emptying, transport and disposal practices (and rarely use appropriate personal protective equipment).
- **Few safe treatment or disposal options are available locally,** thus faecal sludge is often disposed unsafely.
- **Little monitoring of emptying, transport, disposal or use takes place,** thus there are few incentives or mechanisms to promote, regulate or enforce safe practices.

Safe treatment, disposal and end use

Functioning treatment facilities are extremely rare in rural programme areas and, even where available, are rarely located close enough to the emptying point to be a viable option for service providers. Where long travel distances are required to reach scattered and remote households, service providers charge high fees (and may be reluctant to drive to approved treatment or disposal sites), which can be a major disincentive to low-income populations. Furthermore, there is rarely any regulation or monitoring to encourage safe treatment, end use or disposal in rural areas. Consequently, faecal sludge is often dumped nearby in open drains, water bodies, or on open ground, rather than safely buried or taken to safe treatment and disposal sites.

While emptying rates are monitored in outcome surveys, none of the GSF-supported programmes routinely monitor whether households use an emptying service provider that delivers faecal sludge to treatment plants (or safe disposal) and there were only anecdotal reports of the operation of such services, which makes it hard to estimate the level of safe management at this step of the sanitation chain.

Trenching has been used for faecal sludge disposal in several countries and appears effective in inactivating pathogens. Trenching may also provide nutrients for improved tree and crop growth. Where toilet containment systems must be emptied, local services for the burial of faecal sludge in nearby pits or trenches may offer the best medium-term option for safe disposal of faecal sludge. A community-based and local-government-led process may be useful both to encourage safely managed emptying, transport and disposal processes, and to monitor and regulate local sanitation management practices.

Implementation approaches for SMSS

The SMSS study did not include a detailed evaluation of the implementation approaches used by the GSF-supported programmes. However, the study suggested that market-based sanitation interventions had failed to achieve significant sales or scale up in the African programmes. Market-based sanitation was introduced to encourage the use of more sustainable and safely managed sanitation facilities, but the programmes found that few households were willing or able to invest in market-bought sanitation goods or services, and sanitation businesses often struggled to maintain demand and generate profit.

As a result, several of the African programmes (e.g. in Madagascar and Tanzania) adjusted their approaches to adopt more community-based approaches to toilet upgrading and improvement. Greater success was reported from community-based technical support that encouraged more durable and hygienic facilities to be built using local techniques and low-cost materials (e.g. jointly purchased bags of cement). The programme visits suggested that this type of non-market technical support had been generally more effective in achieving widespread toilet upgrades and improvements than the market-based interventions.

Monitoring SMSS

The current GSF-supported programmes were not initially designed to achieve SMSS. Established during the Millennium Development Goal era, they focused on ending open defecation and increasing access to improved sanitation. Consequently, monitoring SMSS has not been a priority. In order to improve understanding of SMSS practices and priorities, new monitoring approaches are required, including observation of the following household and service indicators:

- **Toilet type:** flush or dry, water seal, squat hole cover, slab materials, superstructure materials and presence of walls, roof, lockable door
- **Containment:** number of pits or tanks, location, lining (none, leaching or sealed), size, unsafe outflows (e.g. leaks, overflows and effluent outflows) and safe outflows (e.g. to soak pits, leach pits or sewers)
- **Pit-emptying or replacement history:** who empties or replaces, when (e.g. timely emptying threshold), how (e.g. use of personal protective equipment) and (if replaced) what is used now
- **Transport and disposal:** when, how and where disposed (on or off-site) and by whom
- **Service providers:** monitoring of service providers (and local authorities) may be required to track offsite transport, treatment, disposal or use
- **Potential groundwater contamination:** soil type, depth of groundwater, distance to water points, use of groundwater for drinking, density of leaching pits or tanks

Rural SFDs

Shit-flow diagrams (SFDs) are an effective tool used in the urban sub-sector for understanding excreta flows and for advocacy to decision-makers, as they indicate visually to what extent sanitation systems deliver, or fail to deliver, safely managed services. Adapting the process for the rural context would be beneficial for GSF-supported programmes and for the rural sector as a whole. Such rural SFDs could lead to improved monitoring of key SMSS indicators, which would, in turn, increase the credibility of the rural SFDs produced.

Data from two of the GSF-supported programmes (Cambodia and Tanzania) were used to produce rural SFDs suggesting that 42% of excreta are safely managed in Cambodia, and 60% of excreta are safely managed in Tanzania (where a high proportion of latrine pits are assumed to be covered and replaced when full). Importantly, the SFDs assumed higher unsafe outflows and unsafe disposal practices (based on other data sources) that resulted in estimates of lower levels of use of safely managed sanitation services than those suggested by the GSF outcome surveys.

Recommendations:

1. Improve monitoring the use of safely managed sanitation services.

Investments should be made in developing, testing, improving and scaling up reliable SMSS monitoring systems.

2. Collaborate with sector for national SMSS assessments.

Advocate for and support efforts to produce reliable national assessments of SMSS through coordination, finance, and capacity and monitoring systems development.

3. Analyse SMSS challenges at national (or programme) level.

Use SMSS data to prepare Shit Flow Diagrams (including child excreta flows) and use these SFDs to identify critical unsafe excreta flows and inform national policy.

4. Address unsafe excreta return before containment.

Prioritise interventions to address unsafe excreta return (including unsafe child excreta disposal) before excreta enters containment.

5. Use non-market technical support to upgrade unimproved toilets.

Non-market technical support is recommended to encourage both new and upgraded toilets with safe containment, provision for safe management when containment systems are full and—where necessary—more durable and easily cleaned toilet slabs.

6. Undertake groundwater vulnerability mapping.

Conduct macro-assessments to map groundwater (and water supply) vulnerability to contamination from on-site sanitation.

7. Conduct formative research in critical areas.

Where solutions are not apparent, formative research to identify and design interventions to improve access to SMSS should be conducted.

8. Keep excreta in the ground.

Where space and groundwater conditions allow, excreta should be stored and left in the ground to encourage pathogen die-off and limit the risk of faecal exposure.

9. Bury fresh faecal sludge.

Where faecal sludge containing fresh excreta (or any excreta stored for les/s than two years) has to be emptied, and suitable land is available, encourage burying of faecal sludge in pits or trenches (as close to the emptying site as possible).

10. Test communal emptying and disposal processes.

Test and promote collective emptying and disposal processes (with the support and involvement of private service providers wherever possible).

11. Raise household awareness of SMSS costs and requirements.

Programmes should make households aware of SMSS costs and requirements before investment in new or upgraded sanitation facilities.

12. Determine strategies for challenging environments.

Work to develop specific strategies and approaches for SMSS in challenging environments and ensure that SMSS progress in these areas is carefully monitored (including progress among key disadvantaged groups in these areas).

13. Raise awareness of the risks of agricultural use of faecal sludge.

Raise awareness of the risks of direct application of faecal sludge to fields.

14. Don't forget handwashing with soap.

Handwashing with soap at critical times blocks faecal exposure routes that are not addressed by other safely managed sanitation services. However, the GSF outcome surveys confirmed that handwashing outcomes were considerably lower than sanitation outcomes. More rigorous and more frequent monitoring of handwashing should be encouraged (to provide regular feedback to policy and programming on what works) and more attention paid to find and develop more effective approaches to behaviour change for the sustained practice of handwashing with soap at critical times.

Pit latrine with raised seat in Narok, Kenya. © Jason Florio

1 Introduction

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1.1 Background

The Global Sanitation Fund (GSF) was established in 2008 by the Water Supply and Sanitation Collaborative Council (WSSCC) to address the needs of 2.4 billion people who lacked access to basic sanitation at that time. In 2010, the first five GSF-supported programmes were launched, with the aim of encouraging collective behaviour change to both increase the use of sanitation at scale and improve hygiene behaviours. GSF-supported programmes have now been implemented in a total of 13 countries (Benin, Cambodia, Ethiopia, India, Kenya, Madagascar, Malawi, Nepal, Nigeria, Senegal, Tanzania, Togo and Uganda).

GSF-supported programmes were all designed and launched before 2015, in the Millennium Development Goal (MDG) era. As a result, the main goal of these programmes was to increase access to basic sanitation and hygiene services and to develop capacity to promote and support these services in line with the MDG sanitation target. Since then, the Sustainable Development Goals (SDGs) have been introduced, including the SDG global sanitation target (6.2) which aims to: "by 2030, achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations". The indicator for SDG sanitation target 6.2.1 is the **percentage of the population using safely managed sanitation services, including a handwashing facility with soap and water.**[7] Use of safely managed sanitation is defined as "the population using an improved sanitation facility which is not shared with other households and where excreta is safely disposed [on site] or treated offsite".

In 2016, the GSF elaborated a theory of change to describe how GSF-supported programmes will contribute to the achievement of SDG target 6.2. The GSF Results Framework was updated to include new indicators designed to track performance and progress towards this SDG target. Now, with national outcome indicators to assess progress in the national enabling environment and delivery mechanisms for achieving SDG 6.2, GSF-supported programmes have to report the number of people who use 'safely managed sanitation services' (SMSS).

The concept of 'safely managed sanitation services' (SMSS) is relatively new to the sector and is more familiar in the urban sanitation sub-sector where research and implementation to improve faecal sludge management (FSM) has expanded significantly in the last decade. However, most GSF-supported programmes operate in largely rural contexts, where people generally use pit latrines, and where few faecal sludge management services exist.

In 2017, when the GSF introduced its new results framework, little work had been done on SMSS in rural areas, and it became apparent to the GSF management and programme teams that there was little guidance available on the requirements of safely managed sanitation services in different rural contexts, or on how to achieve these safely managed services. The GSF commissioned this study on the use of SMSS to fill this gap for GSF-supported programmes.

7 JMP agreed with the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDG) that this indicator should be reported and monitored as two separate time series: 6.2.1a Population using safely managed sanitation services and 6.2.1b Population with a basic handwashing facility with soap and water available on premises.

1.2 Study objectives

The main objectives of this SMSS study are to:

1. clarify the nature and requirements of safely managed sanitation services in different rural contexts (notably in GSF-supported programmes),
2. identify challenges, capacity gaps and learning needs relating to the delivery of SMSS in rural areas, and
3. determine how GSF finance and its country programmes can better increase access and use of SMSS at scale (to contribute to achievement of SDG 6.2).

1.3 Methodology

Rapid desk reviews were conducted of 11 GSF-supported programmes through review and assessment of relevant documentation and data, supplemented by remote key informant interviews (see Annex 2). In addition, an online survey on SMSS was implemented by the GSF global learning team, with data collected from key staff and partners in most of the 11 GSF-supported programmes (see Annex 3).

The rapid reviews summarised the available monitoring, evaluation and learning material for each programme as well as feedback from key informants. The key informants suggested potential (or observed) SMSS issues and related recommendations. These suggestions were summarised in the reviews, but it was often hard to assess their relevance or reliability given variable progress on SMSS by the different country programmes and national WASH sectors, and scarce reliable data or solid evidence of SMSS outcomes.

The original design of the study assumed that GSF-outcome-survey data—including data on whether household sanitation services were safely managed—would form an important source of information available to the study on the quality, equity and sustainability of current GSF efforts to improve the delivery and use of SMSS. Unfortunately, only five of these GSF outcome surveys had been completed when the study was finalised: Cambodia, Kenya, Nepal, Senegal and Tanzania. Few data were available on the use of safely managed services in the other six GSF-supported programmes, limiting the reliability of the reviews and analysis in these contexts.

Four visits were undertaken to GSF-supported programmes (Cambodia, Madagascar, Tanzania and Uganda) between June and September 2019, providing more detailed information on SMSS challenges, capacity gaps and learning needs in each of these different contexts. This report summarises the findings, conclusions and recommendations that emerged from the analysis of all these different elements of the study.

Each programme visit incorporated a study orientation meeting attended by representatives of the GSF executing agency. Additional meetings with senior officials from relevant government departments and other sanitation stakeholders were also held. Key informant interviews took place with sub-national government institutions and implementing partners. Field visits were made to villages where focus group discussions were held with community leaders and community members, as well as with sanitation service providers, including masons and pit emptiers (where available). 'Transect walks' (participatory walks across a community to observe, ask, and listen) enabled visits to households and observation of sanitation and hygiene outcomes. Where possible, visits were also made to observe faecal sludge emptying, transport, treatment and disposal sites and activities. Each country visit concluded with a feedback meeting where preliminary findings were shared, discussed and confirmed with key stakeholders.

An improved latrine in Benin. © MCDI Benin

2 Safe sanitation

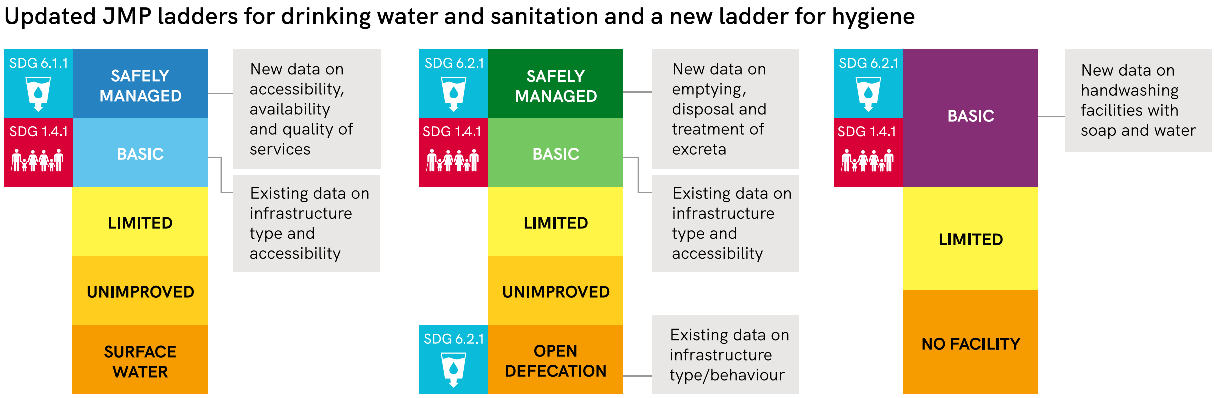
2. Why study safely managed sanitation services?

Progress towards SDG target 6.2 is measured by the proportion of the population using safely managed sanitation services, including a handwashing facility with soap and water. This indicator builds on the previous MDG indicator of the proportion of the population using an improved sanitation facility[8], adding new elements addressing aspects of hygiene, and faecal waste and wastewater management that were not previously required. These changes are reflected in new JMP service ladders for post-2015 global WASH monitoring.

The JMP's sanitation and hygiene ladders also support monitoring the indicator for SDG target 1.4: "proportion of the population living in households with access to basic services"

Figure 1 highlights how the post-2015 JMP service ladders link to SDG targets 6.2 for sanitation and target 1.4 for access to basic services.

Figure 1: Updated JMP ladders with safely managed service levels



Source: JMP (2017).

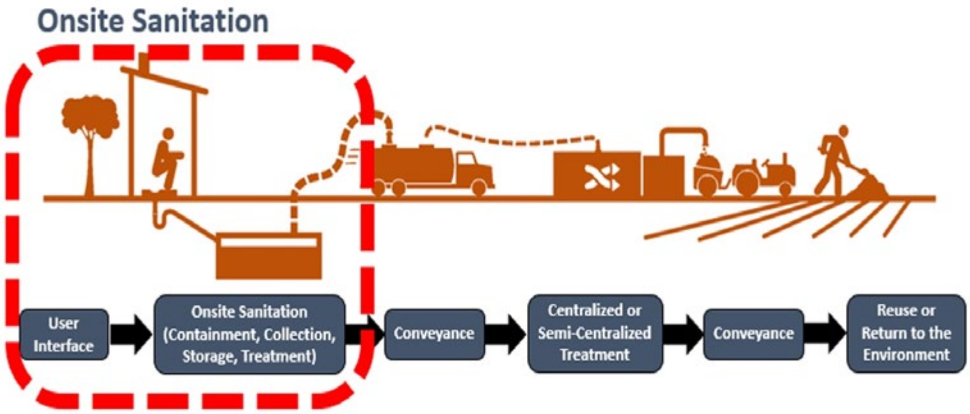
As noted in Figure 1, reporting on the use of safely managed sanitation services requires new data on emptying, disposal and treatment of excreta.

2.1 Implications of SDG sanitation target

The global SDG targets are "aspirational", meaning that individual countries are expected to set their own targets adapted to local contexts and resources. Governments and their development partners need to consider whether human waste is safely managed across the entire sanitation service chain including the following phases: user interface, containment, emptying, transport, treatment and disposal or use (see Figure 2). While it is clear that some countries will take time to achieve safely managed sanitation services, the SDG sanitation target makes clear that **all countries should be monitoring whether sanitation services are safely managing excreta** and working towards this 2030 target.

8 Improved sanitation facilities are those designed to hygienically separate excreta from human contact.

Figure 2: Categorisation of sanitation services



Source: Waterpathogens.org website: https://www.waterpathogens.org/book/pit-toilets-latrines

The need to consider the whole sanitation service chain when assessing the use of safely managed sanitation services (SMSS) requires that monitoring, regulation and programme support cover households, service providers (formal and informal), local authorities and users of faecal sludge and its products. These requirements change the role that sanitation programmes and their partners should play. Large support agencies, such as the Water Supply and Sanitation Collaborative Council (WSSCC), need to re-assess their programme support through the Global Sanitation Fund (GSF), including related capacity development, learning mechanisms and funding for all of these activities. This study represents a first step towards the incorporation of safely managed sanitation services into WSSCC policy, programmes and practices.

2.2 Safely managed sanitation services

This section summarises recent research on safely managed sanitation services (SMSS) based on a literature review and highlights the factors that influence SMSS outcomes. This review was used to identify key SMSS issues that were then examined in a range of contexts through the subsequent GSF-supported programme reviews and country visits.

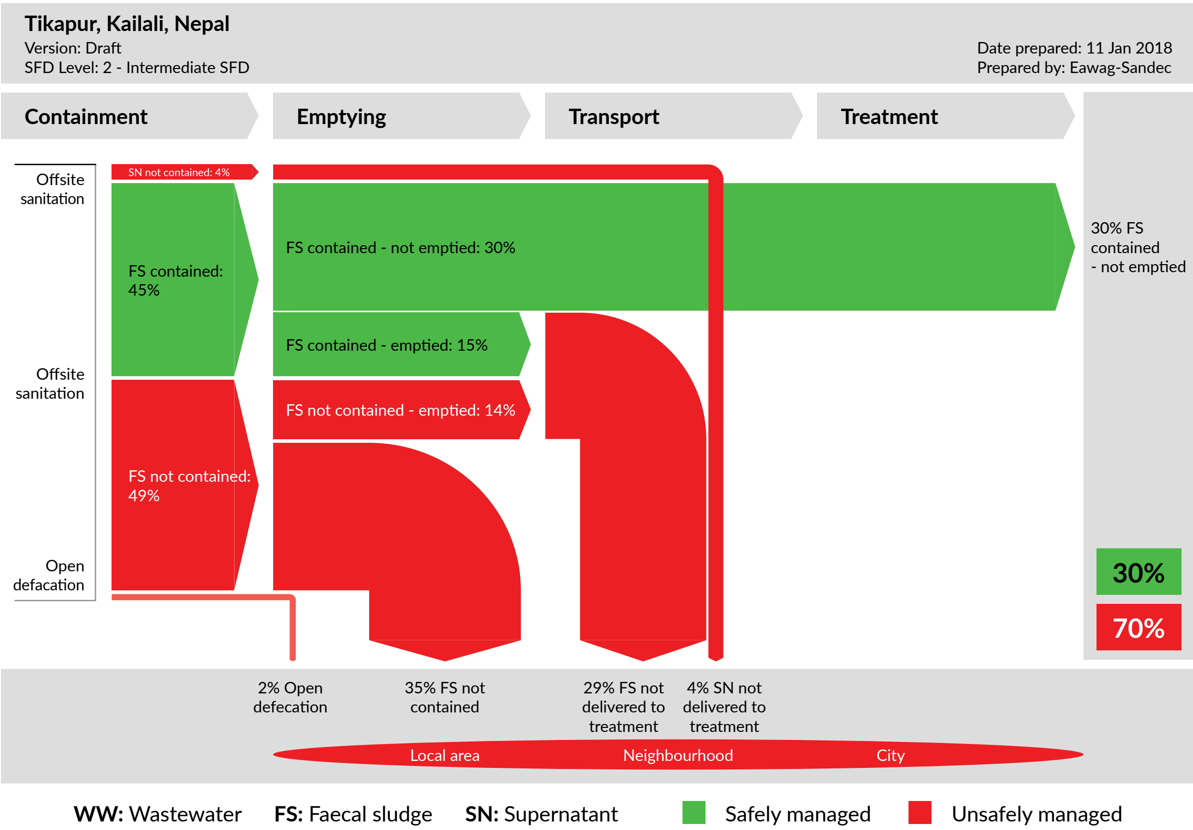
To meet the criteria for using a **safely managed sanitation service,** in all cases, people should use improved sanitation facilities that are not shared with other households. In addition, the excreta produced should be managed in one of three main ways:

- Treatment and disposal on site
- Storage followed by emptying and transportation to offsite treatment
- Transportation through a sewer with wastewater followed by offsite treatment

Shit Flow Diagrams (SFDs) were developed to map the excreta flows through each sanitation facility type (e.g. pit latrines, septic tanks, sewerage) and along the rest of the sanitation service chain, with assessments of the proportion of excreta that is safely managed, or unsafely managed at each stage. In this way, an SFD presents an overall estimate of the proportion of excreta that is safely managed (see Figure 3).

While SFDs are usually used to assess city-wide excreta flows, the same approach can be used to assess excreta flows in rural settings. Some assumptions usually have to be made to complete the SFD, as it is hard to find adequate data on the safe management of all excreta flows (e.g. through all technologies and along the entire service chain). Nonetheless, the value of the SFDs is in the highlighting of the unsafe excreta flows, which encourages increased attention to these areas (with more research to collect better data). Later in this report, we present SFDs compiled for a couple of the GSF-supported programmes (where adequate data were available).

Figure 3: Typical Shit Flow Diagram



Source: https://sfd.susana.org

One of the disadvantages of the SFD is that it presents excreta flows as either safe or unsafe. In practice, the type of pathogen[9] and the pathogen load[10] determine the level of hazard, and the pathogen load is in turn affected by what happens to the excreta in each part of the sanitation service chain. Pathogen loads in the excreta also change over time, with storage and treatment reducing the number of viable pathogens and affecting the hazard level in each excreta flow.

Recent research has examined the hazard and health risk from pathogen flows (in excreta) along the service chain, to identify the main hazards to address (and the potential benefits to be gained

9 Pathogen: anything that can produce disease. In this report, "pathogen" refers to an infectious microorganism such as a virus, bacterium, protozoan, or parasite (e.g. worms or insect larvae). Not all pathogens are equal—some pathogens can cause infection with only one organism, whereas others need several thousand organisms.

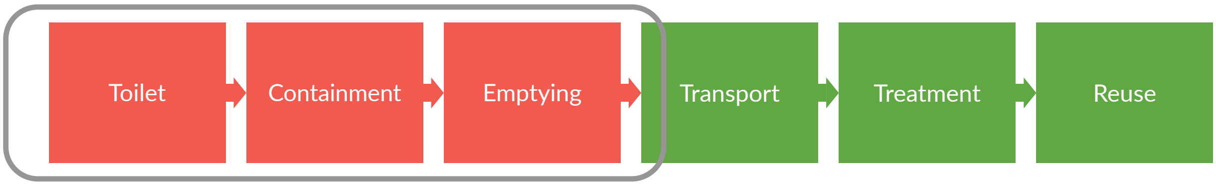
10 Pathogen load: the number of active pathogens in a given volume.

from doing so).[11] Although these approaches are complex and still under development, and thus will not be examined in detail here, the research has already yielded findings relevant to this study.

2.2.1 Unsafe return of excreta

A recent UNC study, "Models of Unsafe Return of Excreta in Four Countries" (Kolsky et al. 2019), summarised findings of models examining the proportion of excreta pathogen load that was returned to the local environment in four different settings (Ghana, Mozambique and Senegal in Africa; Indonesia in Asia). The models demonstrated that 50%–58% of the excreta hazard is unsafely released and that **80%–98% of this unsafe release occurred in the first parts of the sanitation chain** (user interface–containment–emptying).

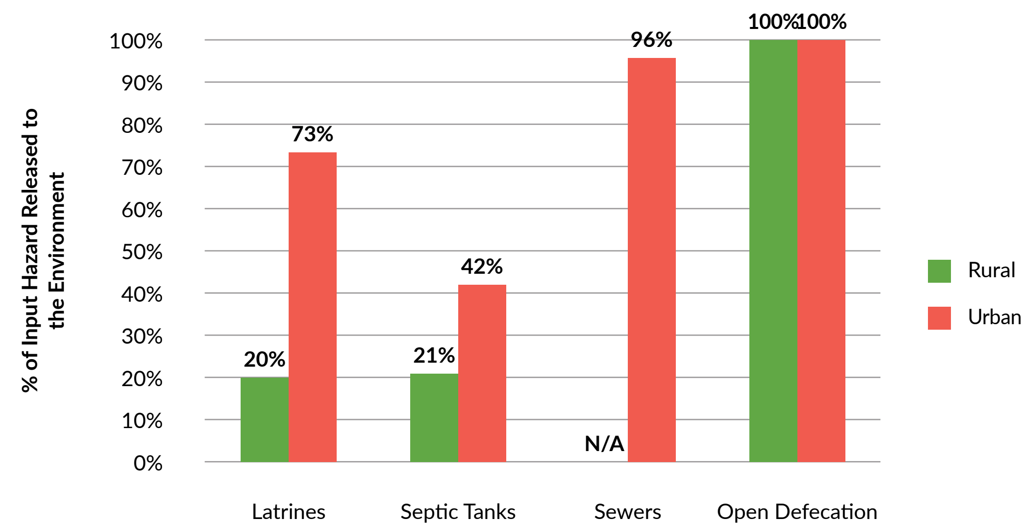
Figure 4: Sanitation service chain



80%–98% of unsafe return of excreta occurs in the early parts

Open defecation and unsafe containment at the household level are the predominant forms of unsafe return in the settings examined — around two thirds of which occur through these "leaks". Only a small percentage of the excreta hazard (in these settings) currently reaches treatment or reuse. This may change over time as economies develop and urbanise and transport and treatment systems expand and improve.

Figure 5: Hazard release to the environment of sanitation technologies in Senegal



Source: (Kolsky et al., 2019)

11 Kolsky et al. (2019); Mills et al. (2018); and Mitchell et al. (2016).

In Senegal, the UNC model found that the proportion of hazard released was higher in urban facilities and in purportedly more "advanced" technologies. Only 20% of the hazard was unsafely released by rural latrines, whereas 42%–73% of hazard was unsafely released by urban septic tanks and latrines, and 96% of hazard was unsafely released by sewer connections.

The model used in the study showed similar results in Indonesia: 11%–20% hazard release by latrines, compared to 52% by septic tanks. Around 90% of the unsafe return in Indonesia was from two sources: 44% related to open defecation, and another 46% due to unsafe return by septic tanks. Only 9% of the unsafe return was from latrines, and the remaining 1.6% was from sewers.

The UNC findings thus suggest a reversal of the usual hierarchy of sanitation technologies. According to the safe return data, latrines are safer than septic tanks and septic tanks are safer than sewerage.

The UNC study further report that the efficiency of latrines in reducing hazard is governed by two factors: (a) the duration of the sludge storage in the latrine before emptying, and (b) the safety and efficacy of the sludge–management chain at emptying and beyond. Septic–tank efficiency is more complex, as management of both liquid and solid fractions have to be considered. In low–income settings, septic tanks rarely have leach fields[12] or soakpits[13], with the result that the hazard associated with the liquid fraction is not effectively reduced before return to the environment.

2.2.2 Pathogen hazard in outflows from toilet containment systems

Wastewater outflows from toilet containment systems[14] are of significant concern, as these outflows contain high pathogen loads, are rarely monitored[15] (e.g. few surveys or monitoring systems currently check on outflows from pits or tanks), and rarely safely managed (based on the limited data available).

Infected individuals may excrete large quantities of pathogens daily. A recent analysis of the pathogen hazard from well–sealed and well–functioning septic tanks estimated that septic tank influent (from infected individuals) might contain one million to one hundred billion pathogens (see Figure 6). Figure 6 illustrates that the daily inflow (influent) to the septic tank may contain high levels of a range of pathogens (the "Before" box), and the sealed tank (with no leakage) may reduce the pathogen content by 68%–99% (0.5-2.0 log10 removal value[16]). While 99% removal of pathogens sounds significant, the pathogen hazard diagram illustrates that there are still likely to be a lot of pathogens left[17]: if the influent contains 1010 bacteria, after retention in the septic tank the treated effluent ("After" box) will still contain at least 108 bacteria (ten million bacteria).

12 "Leach fields", also called "septic drain fields" or "leach drains", are subsurface wastewater disposal facilities used to remove contaminants and impurities from the liquid that emerges after the retention of excreta in a septic tank. The leach field typically comprises an arrangement of trenches containing perforated pipes and porous material (e.g. gravel) covered with a layer of soil.

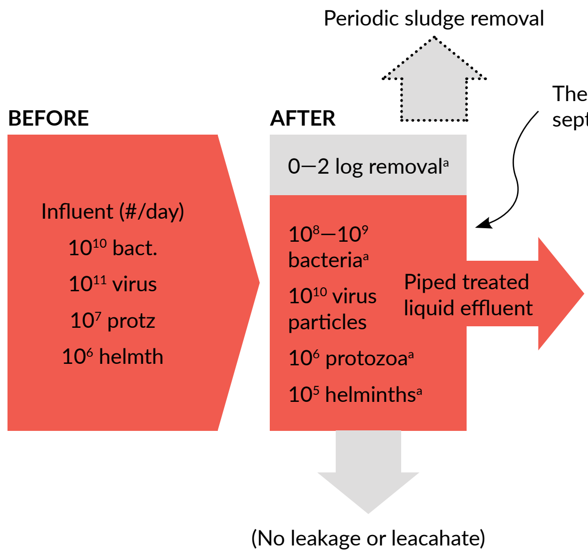
13 "Soakpits", also called "soakaways", are underground structures used to dispose of unwanted water or wastewater. Soakpits are typically covered, porous-walled chambers that are often filled with gravel or rubble to resist collapse.

14 "Toilet containment systems" are latrine pits or septic tanks designed to contain excreta.

15 For instance, the "sanitation service chain" schematic does not include any outflows from the containment system, and most faecal sludge management efforts focus on the management of sludge.

16 "Log removal value" is the logarithm of the ratio of pathogen concentration in the influent and effluent liquid of a treatment process. A log removal value of 1.0 is equivalent to 90% removal of pathogens; a log removal value of 2.0 is equivalent to 99% removal of pathogens.

Figure 6: Pathogen hazard diagram for septic tanks



	Minimum infective dose[c]	potential hazard (# doses)
bacteria	10^2–10^8	up to 10^7
viruses	10^0–10^1	up to 10^{10}
protozoa	10^0–10^2	up to 10^6
helminth eggs	10^0–10^1	up to 10^5

Source: Mitchell et al., (2016).

The "pathogen hazard diagram" above also considers the minimum infective dose[18] of different pathogens. The Guidelines for the safe use of wastewater, excreta and greywater (WHO, 2006) state that the minimum infective dose of helminths (worms), viruses and protozoa are very low (e.g. Ascaris roundworm 1–10 eggs, rotavirus 1–10 organisms, 1–100 cysts for protozoa like Giardia). While the minimum infective dose is higher for other bacteria (100–100,000,000 organisms), the limited pathogen removal achieved by even well-designed septic tanks, makes it clear that the potential hazard is very high. Therefore, **septic tank effluent may contain many thousands of "human infective doses" per day** (up to 100,000 infective doses of helminth eggs, millions of infective doses of protozoa, and many millions of infective doses of viruses and bacteria).

2.2.3 Potential groundwater contamination by onsite sanitation

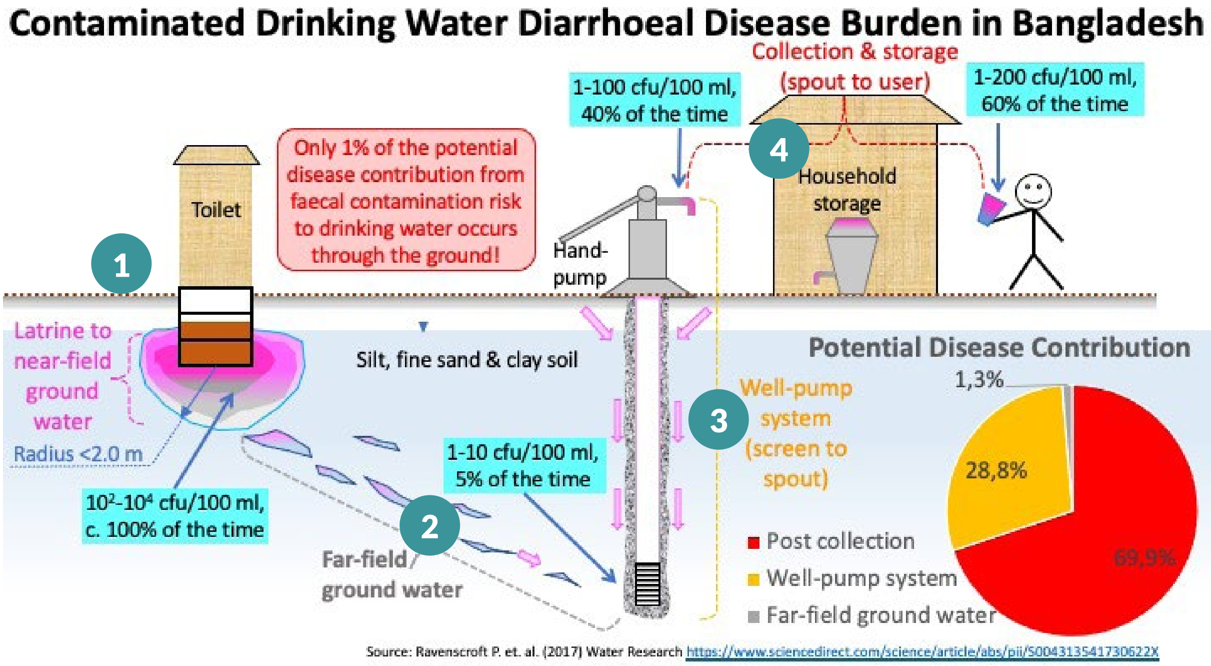
A related issue is the discharge of liquids from toilet containment systems to the soil, either through leaching from non-sealed latrine pits or septic tanks or from the disposal of effluent to leach fields and soakpits that are designed to allow liquids (and gases) to leach into the soil.

Ravenscroft et al. (2017) in a study on the public health significance of latrines discharging to groundwater used for drinking in Bangladesh found that 20%–50% of tubewell water samples were contaminated by low levels of faecal coliforms, even when the wells were tens to hundreds of metres deep (depths to which faecal bacteria could not survive if transported by normal groundwater flow). Other studies cited in this study noted the role of contamination through the pump, well and borehole systems, e.g. dirty priming water, leaking casing joints, cement

17 The pathogen reduction achieved by the septic tank depends on its design, volume, retention time, leakage etc. Feachem et al. (1983) estimated up to 99% (0-2 log10) removal in well-designed septic tanks with retention times from 1 to 3 days; whereas Stenström et al (2011) estimated only 90% (1 log10) removal for helminths (hookworm and Ascaris) and 68% (0.5 log10) removal for bacteria.

18 Human (or minimum) infective dose: minimum number of this pathogen organism required to cause an infection in a human.

Figure 7: Conceptual model of faecal contamination of groundwater-derived drinking water



Source: Adapted from Mark Ellery presentation (based on Ravenscroft et al., 2017)

grouting of borehole annulus, and biofilms on elastomeric handpump components.[19] Tests on the microbiological quality of groundwater (sampled through piezometers[20] rather than through boreholes) supported the conclusion that "the in-situ microbiological quality of groundwater is much superior to that of well water" (Ravenscroft et al., 2017, p. 198).

The study reported four sub-pathways for faecal contamination of drinking water: (1) leakage and biofiltration[21] of faecal waste at the latrine-aquifer interface in "near-field" groundwater (close to the latrine); (2) leachate migration[22] through the "far-field" groundwater (far from the latrine and close to the borehole); (3) from the face of the borehole to the pump spout; and (4) from point of collection to point of use (Figure 7).

Furthermore, the research found a large and rapid decline of faecal bacteria in the near-field groundwater followed by slow attenuation of low-level contamination in the far-field groundwater, and then **progressive increases in faecal bacteria due to recontamination from non-latrine sources.** To illustrate the public health significance of these different pathways, the study modelled the pathogen flows and estimated the relative disease burden. The model suggested that **only 1% of the disease risk at the point of use was likely to be attributable to contamination from the latrine itself** (through far-field groundwater); 29% arose between well entry and point of collection (in the well-pump system); and 70% occurred post collection (i.e. from the point of collection to the point of use).

19 These terms refer to different parts of the borehole and pump system, and to the water and other materials contained with these systems.
20 Piezometer: an instrument for measuring water pressure and monitoring groundwater depth.
21 Biofiltration: filtration by a bed of media (in this case, soil) on which microorganisms attach and grow to form a biological layer called a biofilm.
22 Leachate: liquid that drains (or "leaches") from a toilet containment system.

The findings reported in Ravenscroft et al. (2017) suggest that “the traditional attention given to horizontal spacing [between latrines and water points] is not only unwarranted but fails to understand the pathways of the widespread contamination of tubewells tens to a few hundreds of metres deep … only measures that reduce contamination along the P3 [well screen to pump outlet] and P4 [collection to consumption] sub-pathways will have a major impact on disease burden” (p. 200). These findings apply to all alluvial-deltaic terrains[23], but may not apply in areas with fractured or fissured aquifers and thin soil cover.

Unsaturated (dry) soils generally provide effective secondary treatment of leachate or effluent from toilet containment systems. The biological mat[24] around the base and walls of the container acts as a physical barrier to larger pathogens (helminths and protozoa) as seen in Mitchell et al. (2016). The soil then provides filtration, absorption and various other physical and biological pathogen removal and inactivation mechanisms (including desiccation, persistence and temperature).

Generally, the risk of faecal groundwater pollution is minimal when the depth of relatively fine (<1 mm) continuous unsaturated soil beneath the base of the latrine is greater than 2 m, provided the hydraulic loading[25] does not exceed 50 mm/day (Lewis et al., 1982). Exceptions are where soils are highly transmissive, such as coarse sands or fractured rock, or where hydraulic loading is very high (i.e. large quantities of wastewater leach into the soil), which may allow pathogenic wastewater to pass quickly through the soil before these natural processes have acted on the pathogens, or may exceed the capacity of these natural pathogen-reduction processes. **The risk of contamination is higher in saturated soils,** as pathogen reduction by natural processes in the soil is decreased due to lower adsorption, filtration and temperature effects.

Leachate or effluent from toilet containment systems (or soak pits or leach fields) may also cause chemical contamination, notably from the biodegradation of nitrogen (contained in both urine and faeces) in the waste, which can result in nitrification and nitrate formation. Nitrate is persistent and mobile in soils, difficult to remove, and poses health concerns if it enters drinking water (Templeton et al. 2015). Denitrification of faecal sludge (e.g. through carbon-rich additives such as wood shavings or sawdust to increase the Carbon-Nitrogen ratio) should be considered where water-quality testing suggests that nitrate contamination is prevalent.

2.3 Main SMSS issues to examine

The previous sections outlined key technical issues emerging from a literature review of key concepts and issues on safely managed sanitation services. This review informs the remainder of the study, which examines the extent and severity of these SMSS issues within the GSF-supported programme contexts, and proposes how GSF policy, programming and practice can best encourage and increase the use of safely managed sanitation services.

23 Alluvial-deltaic terrain: Land formed by deposition of unconsolidated sediments (silt, clay, sand, gravel or other matter) that have been eroded or reshaped by water in some form.

24 Biological mat: Multi-layered sheet of microorganisms that grows at interfaces between different types of materials, mostly on submerged or moist surfaces. In pit latrines, generally formed by the filtration and absorption of solids and organisms by the soil surrounding the toilet containment system.

25 Hydraulic loading: Volume of wastewater applied to the surface of the soil in a given period, here expressed in mm (height of wastewater per square mm) per day.

The SMSS review confirms that a broader and more informed approach to SMSS is required. Such an approach can then ensure that key public health issues are considered, with an examination of the pathogen loads in different excreta flows being critical to an assessment to determine if a sanitation system is safely managed. However, these new "pathogen-flow" approaches require detailed data, expertise and time. Few data collection instruments (even current large-scale household surveys) collect sufficient data on the relevant excreta flows, or on the pathogen loads within these excreta flows. Given the absence of detailed data in most contexts, this SMSS literature review was used to identify key SMSS issues to examine within the GSF-supported programme contexts that are discussed in the following section.

2.3.1 Dry pit latrines


A dry pit latrine in Madagascar. © *Andy Robinson*

Dry pit latrines normally contain excreta in leach pits (with permeable sides) that are designed to leach any liquids and gases into the surrounding soil. Safe containment requires that the excreta "are retained within the containment technology or discharged to the local environment in a manner that does not expose anyone to the hazard" (WHO, 2018).

In a dry pit latrine, the user defecates directly into the latrine pit through the drophole, without the need for any water to flush the excreta into the pit. There are few SMSS issues in dry pit latrines as the majority of the latrine pits are covered and replaced when full in most rural contexts. **The excreta in a dry pit latrine are generally considered safely managed when retained in the below-ground pit (without emptying).** In normal operation, few liquids are added to the pit (other than urine), thus the risk of groundwater contamination is also relatively low as water is the main medium of pathogen transport.

In some cases, the pit contents are dug out after several years, either to use as soil conditioner, or to re-use the pit (e.g. when the replacement pit is full, or to re-use a lined pit). In these cases, the storage time will significantly influence the pathogen load of the pit contents, with a two-year storage time generally sufficient to inactivate pathogens. The pathogen die-off rate is affected by a number of factors, with temperature particularly critical. Exposure to helminths may be a risk in certain situations. In particular, the Ascaris roundworm is one of the hardiest pathogens, with eggs that are highly persistent in soil and faecal sludge and not readily inactivated in latrine pits due to their thick protective eggshells.

The 2014 Eawag Compendium of Sanitation Systems and Technologies (Tilley et al. 2014) states that faeces dried and kept at between 2°C–20°C should be stored for 1.5 to 2 years before being used. At higher temperatures (i.e. > 20°C average) storage over 1 year is recommended to inactivate Ascaris eggs. A shorter storage time of 6 months is required if the faeces have a pH above 9 (i.e. if ash or lime has been added).

Another important issue is the groundwater level or the amount of liquid added to the pit, as pit contents that are regularly or permanently submerged will tend to have slower rates of pathogen inactivation within the pit. Groundwater flows can also transport pathogens out of the pit.

2.3.2 Pour-flush pit latrines


Pour flush pit latrine in Tanzania. © *Andy Peal*

Pour-flush pit latrines also contain excreta in leach pits, with excreta usually manually flushed into pits with water.[26] Sometimes water goes through a "gooseneck" trap into a pit directly below the pan, but more often it passes through a pipe into a pit offset from the latrine. In order to reduce the likelihood of collapse, pits used with pour-flush latrines are more likely to have a permeable pit-wall lining (e.g. honeycomb brickwork, open-jointed stonework, open-jointed concrete rings etc.) or at least a pit lining that extends for the first one to two metres below ground (in regions where soils are less stable).

Pour-flush pit latrines tend to have more SMSS issues than dry-pit latrines, because more water enters the pit (from flushing, and often also from anal cleansing) and emptying of pour-flush latrine pits is more common (as users generally want to re-use lined pits and the pit cover can often be removed without dismantling the latrine superstructure).

Adding flush and anal cleansing water to the pit means that the pit tends to fill up faster; outflows from the pit are greater (either through leaching into the soil, or through outlets from the pit); and the pit contents are necessarily wetter. As a result of these factors, there are greater risks of:

- emptying the pit before the contents have been stored for two years,
- unsafe emptying and disposal of wet pit contents, and
- unsafe outflows from full or "flooded-out" pits.

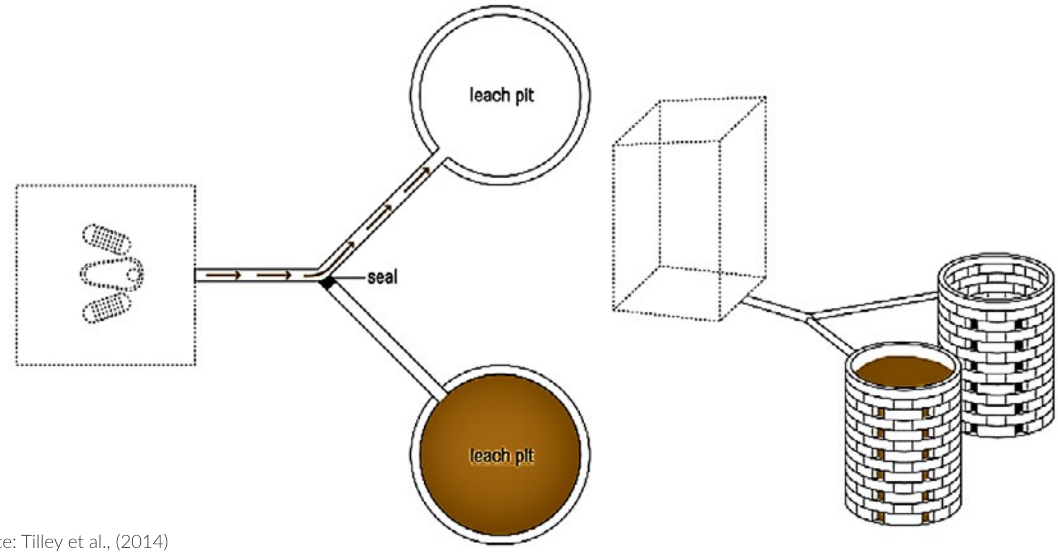
2.3.3 Latrines with alternating containment systems

There are a number of different latrine designs that use twin pits in an alternating fashion: one latrine pit is used until full, after which the latrine connection is switched to a second latrine pit. Before the second pit is full, the first pit is emptied, and the latrine connection is switched back to the first (now empty) pit; and so on.

26 Flush latrines (in which excreta are flushed into the pit using a raised cistern full of water and a flush mechanism) were reported to be rare in the GSF-supported programme areas, thus were not included as a separate category.

Sanitation technologies and latrine designs are explained in more detail in the Eawag Compendium of sanitation systems and technologies including: alternating twin pit latrines; double vault latrines (e.g. urine diverting dry toilets with twin dehydration vaults); double Ventilated Improved Pit (VIP) latrines; and Fossa Alterna (Tilley et al. 2014).

Figure 8: Alternating twin pit latrine design



Source: Tilley et al., (2014)

Alternating latrines have containment systems that are designed to be emptied periodically, with the filling time influenced by a large number of factors. There is a risk that not all pathogens will be inactivated (particularly helminth eggs) before emptying if:

- conditions and design encourage emptying of full pits after less than two years,
- pit contents are stored in wet ground (e.g. due to flooding or high groundwater), and/or
- temperatures are low.

2.3.4 Pour-flush latrines with septic tanks

The unsafe return of excreta study (Kolsky, 2019) highlights the high levels of unsafe release of excreta from septic tanks. Five key issues should be considered when determining the level of safety of septic tank systems:

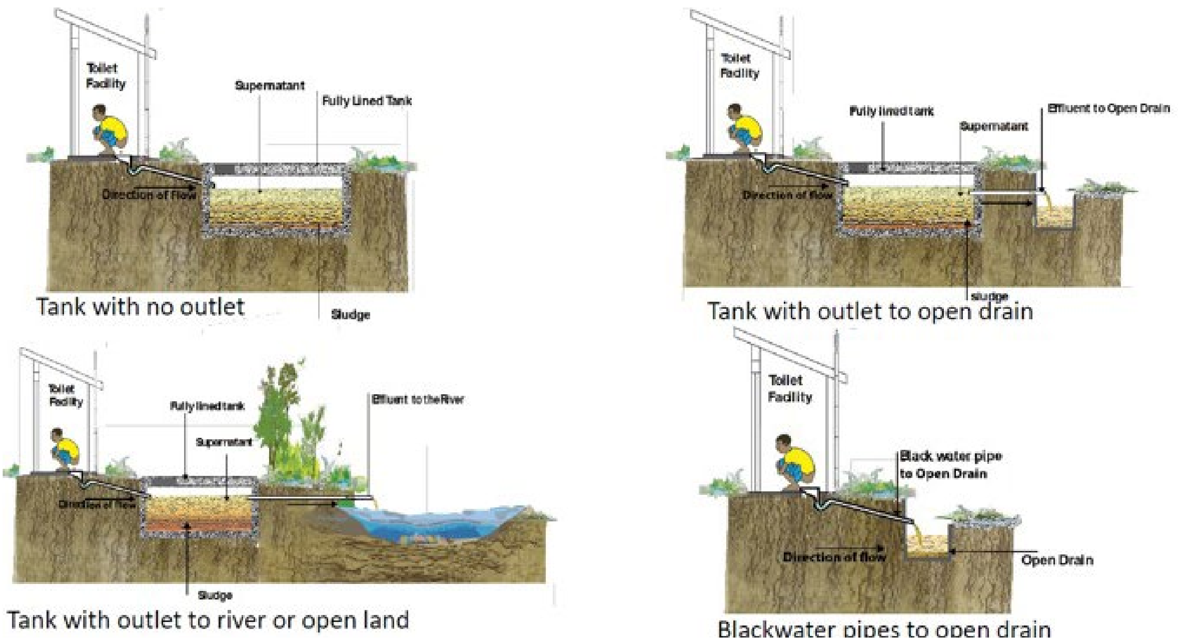
- unsafe effluent disposal to open spaces, water bodies or drains,[27]
- unsafe emptying and disposal of wet tank contents,
- leaks or overflows into the open or into open drains,
- poor design of tanks (inadequate baffles, retention time, inlet/outlet design), and
- no emptying (leading to "short-circuiting"[28] of tank).

27 Some septic tank owners reportedly like to see the effluent emerging to check that "it is working" (Sugden, S., 2015).
28 "Short circuiting": when the incoming excreta pass directly through the tank without any retention. Caused by poor design (outlet beside inlet; lack of baffles) and tanks full of sludge, through which a channel is cut directly to the outlet (i.e. no settlement and no retention time).

Sealed tanks with no effluent outlet are known as "holding tanks". These tanks fill up rapidly (as no liquid can flow out of the tank) and must be regularly emptied.

Septic tanks may also be badly designed. In a recent survey in urban areas of Tamil Nadu, India, Manga (2019) found that many septic tanks either had outlets to open drains; outlets to rivers or open land; or had no outlet (fully lined holding tank); and some households reported having a septic tank but on inspection no tank was observed (direct flush to open drain). Almost 60% of the septic tanks surveyed had no partition walls; none had baffles on inlets or outlets; and 98% of the septic tanks observed had adjacent inlet and outlet pipes (i.e. excreta entering the tank could flow directly out of the outlet with limited settlement, retention or removal of floating solids). Laboratory tests also confirmed that the liquid fraction of the faecal sludge had a higher E. coli concentration (assessed than the solid fraction (sludge).The examples in Figure 9 illustrate the wide variety of unsafe and non-standard septic tank designs found in low-income settings.

Figure 9: Examples of unsafe or non-standard septic tank arrangements



Source: Manga (2019).

Septic tanks in rural areas tend to be de-sludged only if they block and the faecal sludge backs up into the toilet, or they start to leak and emit bad smells. In many rural settings, septic tanks are badly designed and constructed, with inadequate retention of the faecal sludge, and significant leaks and unsafe outflows of pathogenic effluent. As a result, some septic tanks function for much longer than intended, and may contain excessive amounts of faecal sludge, with the risk that the inflows start to "short circuit" the tank, as mentioned above, carving a channel through the sludge and directly out of the effluent pipe with little or no treatment (as the intended retention time is greatly reduced).

Desludging of septic tanks can be a significant challenge in rural areas if vacuum tanker services (and safe disposal sites) are not available or affordable, due to the wet, pathogenic nature of the faecal sludge. In some countries (e.g. the Philippines), septic-tank owners in rural areas have reported that it is cheaper to build a simple septic tank than to pay to have the tank desludged (Robinson, 2009).

2.3.5 "Septic-pit" latrines

Pour-flush latrine systems sometimes discharge to containment systems with some of the characteristics of septic tanks and some of the characteristics of pit latrines. In this report, these containment systems are referred to as "septic pits".

For instance, lined latrine pits are sometimes sealed (e.g. joints between concrete rings are closed), which limits leaching from the pits; and septic tanks are sometimes not fully sealed, with leaching (or leakage) through unsealed floors, permeable walls, or badly sealed joints. Two-latrine pits are sometimes connected in series, so that the liquid fraction overflows into the second pit; and some septic tanks are not designed to retain solids (e.g. only one chamber, no baffles, and no features to increase the flow path and retention time).

When inspecting or monitoring a below-ground toilet containment system, it can be difficult to differentiate latrine pits, septic pits, septic tanks or holding tanks with no effluent outlet. Particular attention should be paid to latrines that have containment systems with the following characteristics:

- low storage volume
- unsafe outflows to open spaces, water bodies or drains
- unsafe emptying and disposal of wet pit contents
- a latrine type at high-risk for unsafe emptying (i.e. similar toilet containment systems are often emptied unsafely), even if it had not yet been emptied
- located in saturated soils or high groundwater areas

In general, septic pits that are not fully sealed and leach some liquids (and gases) into the soil will have lower unsafe return of excreta than sealed septic tanks (assuming the same effluent outlet arrangements), as some of the pathogen hazard should be removed and inactivated in the soil.

2.3.6 Unsafe emptying

Few safe emptying services exist in rural areas, even where households and facilities are accessible. Ability to pay for services is also often limited. As a result, when pits and tanks have to be emptied, households sometimes empty them themselves; or pay someone to empty the faecal sludge manually. Manual emptying, however, leads to a high risk of faecal exposure by those handling the faecal sludge (during emptying, transport and disposal); and subsequently by others living nearby, as the sludge is often dumped into nearby fields, open spaces, water bodies or drains (in order to limit transport and disposal costs).

2.3.7 Unsafe disposal and use

Faecal sludge may be used as fish or poultry feed or as soil conditioner in gardens or farms (with the potential to contaminate both food and non-food items). There are three main options for land disposal: land spreading; sub-surface incorporation (sludge ploughed into field immediately after discharge); and burial (trenching, pit burial or co-composting).

Uncontrolled use of untreated faecal waste poses potential public health risks, particularly where the waste is applied to land where fruit or vegetables are grown on the ground (potentially in direct contact with the pathogenic waste), where crops are harvested within three months (i.e. before pathogen die-off and inactivation can be assured), and where these fruits or vegetables may be consumed unwashed.

2.4 Use of basic sanitation services

Under the Joint Monitoring Programme (JMP) classification system (UNICEF & WHO, 2018), a sanitation facility cannot be classed as an SMSS unless it also meets the criteria for “access to basic sanitation”, which requires “use of improved sanitation facilities that are not shared with other households” (UNICEF & WHO, 2018, p. 7). Improved sanitation facilities are those designed to hygienically separate human excreta from human contact. For pit latrines, for example, the principle difference between improved and unimproved facilities is the presence or absence of a “slab”.

The WHO Guidelines on Sanitation and Health (2018) introduced some new minimum requirements “to ensure safety along each step of the sanitation service chain” (WHO, 2018, p. XV), including at the user interface or toilet:

- **Toilet design, construction, management and use should ensure users are safely separated from excreta.**
- Toilet slab and pan or pedestal should be **constructed using durable material** that can be easily cleaned.
- Toilets need to be **well maintained and regularly cleaned.**

One of the key differences from previous criteria is the requirement that slabs, and pans should be constructed from durable material. However, the WHO guidelines also state that investments should be prioritised according to the highest health risk, and locally specific risk assessment and management approaches should identify incremental improvements to allow progressive realisation of sanitation targets.

Rural households have two main options when building and using a sanitation facility: i) use durable and easy-to-clean slab materials that provide a higher chance of sustained outcomes, but may be more expensive; and ii) use less durable (but locally available and low-cost) slab materials that may require more frequent repair and replacement and may be less easy to clean. Neither of these options is a reliable predictor of long-term sanitation outcomes: households with slabs made of durable and easy to clean materials do not always maintain the toilet or keep the slab and pan clean and functional; and, conversely, some households with mud-covered latrine slabs maintain the toilet well, and keep the slab clean (no visible faeces) and functional.

The latest iteration of the JMP monitoring definitions for sanitation facilities (UNICEF & WHO, 2018, Table 3, p. 12) is based on the WHO Guidelines on Sanitation and Health (2018) and addressed concerns about the durability and hygiene of simple pit latrines with mud or earth-covered slabs. These monitoring definitions are important, as they define which toilets will be reported by the JMP as providing access to basic and safely managed sanitation services.

The updated JMP monitoring definitions suggest that pit latrines should have slabs that completely cover the pit, with a small drop hole, constructed from materials that are "durable and easy to clean (e.g. concrete, bricks, stone, fibreglass, ceramic, metal, wooden planks or durable plastic)" (UNICEF & WHO, 2018, p.12). The definitions further note that slabs made of durable materials covered with a smooth layer of mortar, clay or mud should also be counted as improved, but that "slabs constructed from materials that are not durable and easy to clean (e.g. sticks, logs or bamboo) should be classified as 'pit latrine without slab' and counted as 'unimproved', even if they are covered with a smooth layer of mortar, clay or mud."

The JMP estimates of sanitation access are informed by nationally representative household surveys (e.g. Demographic and Health Surveys or DHS; Multiple Indicator Cluster Surveys or MICS; and Living Standards Measurement Studies or LSMS) that do not, however, allow for the observation of sanitation facilities. The lack of observation data is a significant constraint, as JMP toilet classification has to rely on proxy indicators that can be reliably determined from household respondents, such as household recall of the type of material used to construct the latrine slab.

As noted above, the use of durable slab materials does not assure hygienic or sustained sanitation outcomes. Furthermore, the material type becomes even less relevant if monitoring includes observation of the sanitation facilities (e.g. sanitation-specific monitoring undertaken by a programme), since direct assessment of the functionality, cleanliness and sustained use of the toilet can then be undertaken.

The current JMP approach gives greater weight to the potential durability of the slab than to the safe containment of the excreta, as any toilet classified as an unimproved sanitation facility (e.g. because the slab is made of materials thought to be non-durable) cannot subsequently be classified as a safely managed sanitation service, even if the slab is observed to be clean, and excreta are safely contained in the pit (or other containment system).

These new JMP monitoring definitions are under review, as the shift from attention to the user interface towards the current focus on safe containment and safe management has highlighted some of the inconsistencies in the current framework. The JMP also recognises that further work is required to develop a harmonised set of monitoring indicators, tools and methods so that countries can fully assess safe management of on-site sanitation services (SMOSS), The Bill & Melinda Gates Foundation is currently supporting a three-year JMP initiative to strengthen SMOSS monitoring and reporting.

Three main user-interface risks (in pit latrines) were identified and will be considered in this study:

- faecal exposure due to unclean slabs, pans or pedestals,
- faecal exposure due to the slab exposing the pit contents (e.g. through slab or pit collapse), and
- reversion to open defecation (or use of unsafe sanitation services) due to unclean, collapsed or non-functional sanitation facilities.

2.5 Use of basic hygiene services

The SDG target 6.2 includes the requirement to achieve access to adequate and equitable hygiene for all by 2030. Progress towards this goal will be monitored using the SDG global monitoring indicator 6.2.1b that tracks the proportion of the population with a basic hygiene service, defined as availability of a handwashing facility on premises with soap and water.[29]

While the use of “basic hygiene services” is clearly an important part of the SDG 6.2 sanitation and hygiene target, it is not the main focus of this study on safely managed sanitation services. Handwashing data from the GSF-supported programmes are nonetheless reported in the following sections, with only limited analysis of these results.

While examining the GSF-supported programmes, three specific handwashing issues were considered:

- **handwashing monitoring:** if and how handwashing practice is monitored,
- **durability of low-cost handwashing stations,** especially those made from local materials,
- **practice of handwashing with soap at critical times:** particularly handwashing related to the care and feeding of children under 5 years of age (e.g. after cleaning excreta from a child or cleaning or disposing of a diaper; before preparing food for or feeding children).

Handwashing practices are hard to monitor. The JMP has adopted the presence of a handwashing facility (with soap and water available) as the main indicator of hygiene service, as this is a robust and easy-to-monitor indicator of handwashing practices. However, the presence of a handwashing facility does not, in fact, guarantee that its used consistently (or its use by all members of the household); or the use of soap while handwashing; or the practice of handwashing at critical times (e.g. after defecation or before eating). Structured observation of handwashing practice is generally considered the most reliable method of monitoring handwashing but is an expensive process and can cause reactivity (observer effect) in those being observed. As a result, reliable data on the practice of handwashing at critical times may not be available.

29 Limited hygiene service: Availability of handwashing facility on premises without soap and water.

Example of a tippy tap. Source: WOT (2007).

Community-based sanitation and hygiene approaches generally promote low-cost handwashing facilities built from local materials, notably the tippy tap (see Figure 10). Households often build these simple facilities after their promotion by projects, then find that the facilities are not durable (e.g. water containers degrade and crack in the sun; sticks collapse or are pushed over); the soap often disappears (e.g. eaten by animals or taken by others); and the small container requires frequent filling and repair. As a result, these simple tippy taps are often not durable.

Handwashing data often suggest that the practice of handwashing after defecation and before eating is relatively high, but that handwashing practice related to the care and feeding of children under the age of five is significantly lower. Given the importance of these child-related handwashing practices, the handwashing analysis will examine whether handwashing promotion has been effective in increasing practice at these critical times.

An alternative handwashing facility in Tanzania, with water storage mounted inside the latrine superstructure. © *Plan Tanzania*

3 Findings

This section of the report presents a summary of the findings based on:

- 11 GSF-supported programme desk reviews (undertaken in March-May 2019)
- Four country visits made to selected GSF-supported programmes (in June-September 2019)
- Reviews and analysis of key sector SMSS issues.

The study confirmed that people living in the programme areas already use SMSS. In particular, where people use largely dry pit latrines (e.g. most of the African programmes), the household facilities are likely to be safely managed. The risk of unsafe management is estimated to be far higher where pour-flush latrines with lined pits are used (e.g. Cambodia and Nepal). However, current GSF monitoring systems do not capture some of the unsafe practices, and in many programmes open defecation and unsafe child excreta management remain important sources of unsafe return of excreta to the open.

3.1 GSF-supported programme descriptions

The study examined 11 GSF-supported programmes, from the three longest-running programmes (Madagascar, Senegal and Nepal) to the three most recently launched programmes (Benin, Kenya and Togo). Table 1 provides a summary of the type of executing agency (UN agencies, national or international NGOs, government or a UN-government partnership).

Table 1: GSF-supported programmes–Overview

Country programme	Start date	Executing agency (and type)	Programme population[30]
Madagascar	2010	MCDI (International NGO)	10.4 million
Senegal	2010	AGETIP (National NGO)	0.7 million
Nepal	2010	UN-Habitat (UN agency)	6.0 million
Cambodia	2011	Plan International (International NGO)	2.6 million
Uganda	2011	Government	6.8 million
Ethiopia	2012	Government	5.2 million
Nigeria	2012	United Purpose (International NGO)	1.2 million
Tanzania	2012	Plan International (International NGO)	0.7 million
Togo	2013	UNICEF (UN agency) and Government	1.7 million
Kenya	2014	Amref Health Africa (International NGO)	0.8 million
Benin	2014	MCDI (International NGO)	1.9 million

30 Programme population includes population living in all of the programme areas covered since the start of the programme (including some communities that received no implementation).

Table 1 also includes the programme populations included in each GSF-supported programme:

- 5–10 million people are covered in each of the four largest programmes (Ethiopia, Madagascar, Nepal and Uganda).
- 1.2–2.6 million people covered in four medium-sized programmes (Benin, Cambodia, Nigeria and Togo).
- 0.7–0.8 million people covered in the three smallest programmes (Kenya, Senegal and Tanzania).

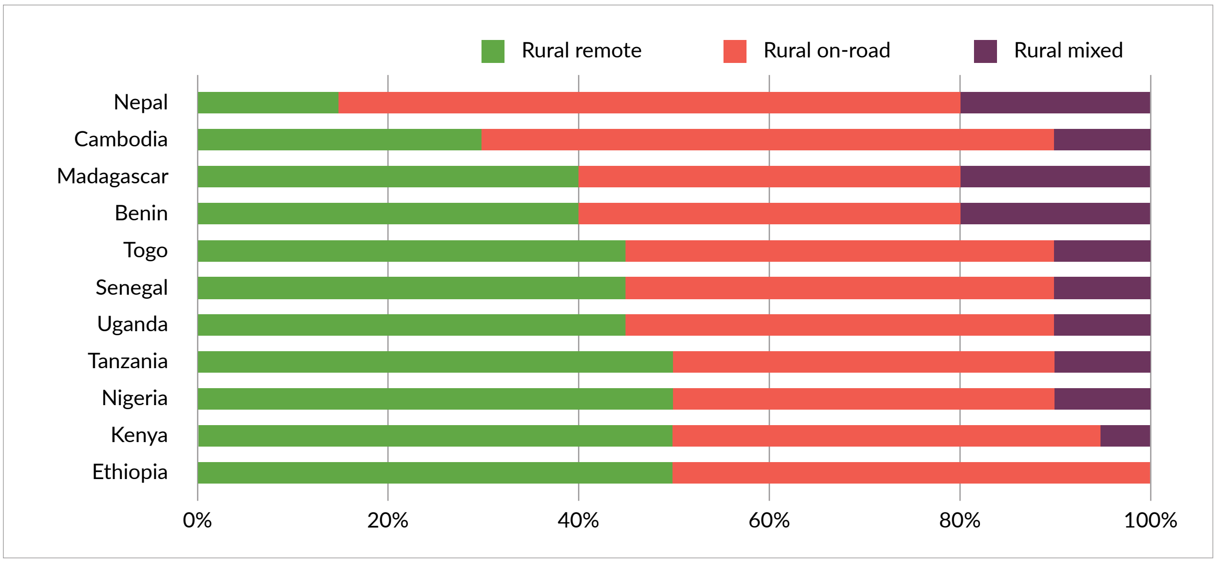
3.1.1 GSF-programme physical and economic contexts

The desk reviews classified the proportion of each country programme according to the physical and economic context typology provided by the WaterAid, Plan International, and UNICEF (2019, p. 39) "Guidance on Programming for Rural Sanitation":

- Rural remote (rural communities far from urban areas).
- Rural on-road (rural communities that are well connected with urban areas).
- Rural mixed (rural communities with urban characteristics, e.g. peri-urban areas).
- Difficult contexts (rural communities that are disaster-, climate- or conflict-affected, including drought-prone and flood-prone areas; have mobile populations; internally displaced people or refugees; or have coastal, lake- or river-side populations; or other areas with difficult physical conditions).

The telephone interview and online survey respondents confirmed that GSF-supported programme settings are predominantly rural (see Figure 11), with around 10% of the programme population (0% to 20% range) on average reported to live in more congested settings with urban characteristics (rural mixed)[31]. The data confirm that the two Asian GSF-supported programmes, in Nepal and Cambodia, cover fewer remote rural areas than the nine African GSF-supported programmes.

Figure 10: GSF-supported programme context type



31 Disaggregated data on the populations living in difficult contexts were not available at the time of the reviews, thus in Figure 11 these populations are included in the other categories.

3.1.2 Programme approaches

The main approaches used by the 11 GSF-supported programmes include:

- collective behaviour change approaches including Community-Led Total Sanitation (CLTS) with enhancements like Follow-Up MANDONA (FUM),
- sanitation marketing,
- hygiene behaviour change communications (BCC),
- WASH governance and systems strengthening (including institutional triggering), and
- sanitation finance (including toilet loans and savings groups).

The GSF-supported programmes are generally founded on a collective behaviour change approach, specifically CLTS, with limited or no hardware subsidies depending on national policies. In some countries, the GSF-supported programmes were among the pioneers of the CLTS approach. Governments have consequently been encouraged to shift towards a focus on sanitation behaviour change that persuades rural households to build their own facilities rather than relying on a more conventional and supply-driven "toilet-building" approach wherein the supplies and labour are furnished for toilet construction. The Follow–Up MANDONA (FUM) approach has been adopted by the majority of GSF-supported programmes in Africa. FUM is used to strengthen the success rate and sustainability of ODF initiatives and identify "small doable actions" such as improving household toilets that do not currently meet the ODF criteria or are not otherwise hygienic.

Most programmes include a sanitation-marketing component intended to encourage sustained sanitation outcomes and progress up the "sanitation ladder" through the local production and sale of improved sanitation goods and services. Limited information was available on the sanitation marketing initiatives and results, but the reviews suggest that few of the sanitation marketing initiatives have scaled up (see Section 3.2.6 for more detail), with some still being developed and piloted (e.g. in the Benin GSF-supported programme).

Hygiene behaviour change communication (hygiene BCC) is included in most GSF-supported programmes, with the main goal of increasing the practice of handwashing with soap. In most cases, the hygiene-BCC activities appear to be built into the CLTS process.

All of the GSF-supported programmes reviewed also included a WASH governance component designed to increase rural sanitation and hygiene support at national and sub-national levels, including institutional triggering (i.e. activities designed to trigger action and support by local leaders and influencers); development of relevant policies, strategies and plans; development of implementation and support capacity; strengthening of monitoring and evaluation; and support to learning and dissemination activities.

Some GSF-supported programmes reported sanitation finance components designed to encourage household purchase of toilets, generally through organising and supporting village savings and credit associations (in various forms) or through small-scale microfinance activities. Again, few of these toilet-finance initiatives were reported to have scaled up or play major roles in encouraging either access to universal basic sanitation or to safely managed sanitation services.

3.1.3 Enabling environments for GSF-supported programmes

All of the 11 countries reviewed had clear definitions of Open Defecation Free (ODF) status, and these definitions have usually been adopted by the GSF-supported programmes. The definitions all include criteria around no open defecation and 100% access to a latrine of at least an unimproved type. However, the criteria vary widely: some countries require evidence of use of toilet facilities; some allow a proportion of shared toilet use (e.g. 15% shared use is allowed in ODF communities in Cambodia); some require that all schools, health centres and public places also have toilets in use; others require that toilets have a superstructure that provides privacy; and some extend the ODF definition to include the presence of a handwashing facility.

A summary of ODF definitions from countries with GSF-supported programmes are outlined in Annex 5.

In 2017, GSF established the following minimum ODF criteria for GSF-supported programmes:

- No open defecation.
- Everyone has access to an improved toilet (limited or basic service level).
- Everyone has access to a handwashing facility with water and soap or ash.

As a result, some GSF-supported programmes (e.g. those where the national ODF criteria includes the use of unimproved toilets or does not require handwashing access) now report two levels of ODF achievement: achievement of the national ODF status, and achievement of the minimum GSF ODF status.

Most GSF-supported programmes promote the national ODF criteria as well as national minimum standards for toilet construction and require that latrines have a squat hole cover (Ethiopia and Togo), or a water seal (Nepal) or are “flyproof” (Benin, Kenya, Madagascar, Nigeria, Uganda). Little detail on what constitutes “flyproof” (beyond a cover or water-seal) is provided in the definitions, although in Madagascar specific flyproof toilet criteria are checked during ODF verification and routine monitoring:

- presence of a cover or water-seal,
- no scattered anal-cleansing materials,
- no holes or gaps (in the slab or floor) that allow flies to enter, and
- ash added to the pit after each use to eliminate odour and fly larvae.

In Ethiopia, Nepal, Tanzania and Togo, ODF status can be attained at two levels, with additional criteria required to attain the higher service level, such as 100% of households with access to improved latrines, and integration of other, wider aspects of sanitation and hygiene (e.g. safe water, safe food hygiene, access to handwashing facilities).

The concept of the use of safely managed sanitation services (SMSS) is new to most of the countries in which GSF-supported programmes are implemented. Few definitions exist although, as noted above, several countries have phased approaches to sanitation development with higher levels of sanitation status that include aspects of SMSS. In addition to its national ODF protocol, the Government of Nepal (2017) introduced separate “Total Sanitation Guidelines” (see Annex 4). These guidelines require “appropriate faecal sludge management” in the first stage of Total Sanitation (to achieve "Clean and Hygienic Areas") and full sewerage in the second stage (to achieve "Total Sanitation Oriented Areas").

Nonetheless, most countries have active rural sanitation platforms and working groups, and some of these fora are starting to address safely managed sanitation services. For instance, the Royal Government of Cambodia established a sub-group (within the WASH Technical Working Group) on rural faecal sludge management (FSM), known as the Rural FSM Technical Team, which recently developed national guidelines on rural FSM (Royal Government of Cambodia Ministry of Rural Development, 2020). Similarly, in Uganda the National Sanitation Working Group (NSWG), whose steering committee oversees and coordinates the Uganda Sanitation Fund (USF), is currently reviewing indicators for monitoring achievement of SMSS and developing guidelines for faecal sludge management.

Some countries have existing regulations that affect the achievement of SMSS. For instance, an old law in Senegal bans manual emptying of latrine pits, though it had become common, as many households have few other options. Now urban FSM work in Dakar has encouraged a move towards mechanical emptying by paid service providers, which has reinforced the ban on manual emptying.

3.2 GSF-supported programme results

3.2.1 ODF achievement and improved sanitation results

One of the central aims of the GSF-supported programmes has been to achieve Open Defecation Free (ODF) populations—that is, communities that have achieved the collective outcome of eliminating open defecation.

National ODF criteria vary from country to country, thus an ODF community in one country may not have the same sanitation outcomes as an ODF community in another. Most national ODF criteria require that human excreta are not visible in the community, with 100% access to a toilet of at least an unimproved type (although some countries allow some proportion of the community to use shared household toilets), and varying definitions of the minimum toilet standards. As noted earlier, standard ODF criteria (including the requirement for access to an improved sanitation facility), are now used in all of the GSF-supported programmes in order to improve comparability between programmes, and avoid counting populations using unimproved sanitation facilities.

The GSF routine monitoring data report significant ODF populations (Table 2), with at least 0.5 million people living in ODF environments in all GSF-supported programmes, and ODF populations of 2 million to 5 million reported by four programmes: Ethiopia, Madagascar, Nepal and Uganda. Overall, the GSF reported that around two-thirds (68%) of the population reached by the 11 GSF-supported programmes lives in an ODF community.

Table 2 also highlights the differences between the programme populations with access to improved sanitation facilities (including shared facilities) and the larger ODF populations reported. While there are some variations in the classification criteria used by the different GSF-supported programmes, these differences generally reflect that the ODF population also includes some people who had access to improved sanitation at baseline (which tends to increase this figure), whereas the population with access to improved sanitation generally reports the population gaining access since baseline.

Table 2: GSF-supported programmes–Progress on access to sanitation (late 2018)

Country programme	Programme target population	Population living in ODF environments	Population with access to improved sanitation
Uganda	6.8 million	5.1 million (75%)	1.7 million (25%)
Nepal	6.0 million	4.6 million (77%)	3.5 million (58%)
Madagascar	5.7 million	2.1 million (37%)	3.8 million (67%)
Ethiopia	5.1 million	4.5 million (88%)[32]	1.9 million (37%)
Benin	1.7 million	0.8 million (47%)	0.8 million (47%)
Togo	1.7 million	1.1 million (65%)	1.4 million (82%)
Cambodia	1.4 million	0.9 million (64%)	0.6 million (43%)
Nigeria	1.2 million	0.9 million (75%)	0.4 million (33%)
Kenya	0.8 million	0.5 million (63%)	0.4 million (50%)
Senegal	0.7 million	0.5 million (71%)	0.2 million (29%)
Tanzania	0.7 million	0.6 million (86%)[33]	0.3 million (43%)
Total	**31.8 million**	**21.6 million (68%)**	**15.0 million (47%)**

Notes: (1) In this table the percentages are the populations (ODF or with improved sanitation) as a percentage of the programme target population. (These populations exclude communities that did not receive implementation; thus some are lower than the programme populations presented in Table 1). (2) "People living in ODF environments (minimal GSF definition.) (3) SI01.3: In the GSF Results Framework, 'improved sanitation' facilities include safely managed, basic, and limited (shared) services aligned with the JMP categories

The ODF outcome is important to safely managed sanitation services, as open defecation results in 100% unsafe return of excreta to the local environment—that is, 100% of the faecal pathogens are excreted into the open, which is equivalent to 100% unsafe management close to the household, neighbourhood or community.

In Kolsky (2019) "Models of Unsafe Return of Excreta In Four Countries", open defecation contributed between 32% (Senegal) and 68% (Mozambique) of the estimated total pathogen hazard released, due to open defecation rates from 17% in Senegal to 40% in Mozambique.[34] The GSF-outcome-survey data presented in Table 3 below suggest that open defecation rates are generally lower (3%–16%) in GSF-supported programme areas. Nonetheless, these figures confirm that open defection rates remain a significant factor in the safe management of sanitation services because open defecation results in 100% unsafe return (compared to 11%–49% unsafe return by rural latrines).[35]

32 ODF level 1 and 2.
33 ODF level 1 and 2.
34 The open defecation rates include both rural and urban open defecation, although urban open defecation rates only ranged from 1% (Senegal) to 7% (Indonesia); whereas rural open defecation ranged from 15-16% (Ghana, Indonesia and Senegal) to 36% (Mozambique).
35 The proportion of unsafe return by a particular technology depends on the predominant toilet types, whether excreta are safely contained or not, and the typical emptying, treatment and disposal or use practices in that context.

There is extensive anecdotal evidence of ODF benefits, but little rigorous evidence of these benefits (particularly health benefits). As a result, some sector researchers (USAID, 2018) have questioned whether simple pit latrines, those that tend to be the result of CLTS interventions, “are sufficient to achieve and sustain health gains”. However, as noted earlier, simple pit latrines that safely confine excreta (and are covered and replaced when full) do prevent the unsafe return of excreta to the local environment, and thus are likely to contribute to improved public health.

While verified ODF status is an important step towards improved sanitation and improved public health, it is not a guarantee of benefits. Significant efforts are required to identify and block the primary pathways of faecal exposure in each setting, including through the promotion and monitoring of safe excreta containment, safe child excreta disposal, handwashing with soap at critical times and safe management of faecal sludge in emptying, transport, treatment, disposal or use.

Safe management of household excreta requires that the excreta of all members of the household are safely contained at all times. As a result, monitoring of intra-household sanitation practices, including practices of all household members at different times of day, is important as is monitoring of sanitation practices (defecation habits) when outside the home. In particular, it is critical to monitor the behaviours of adult males who are often away from home for long periods and who may have developed unhygienic sanitation practices and of young children who may be too young to use a toilet (see Section 3.2.3 below).

3.2.2 GSF outcome survey results

As noted earlier, GSF-supported programmes are currently conducting outcome surveys[36] that include household, school and ODF surveys as well as structured observation of household sanitation and hygiene practices. The household sanitation access results of the five completed GSF outcome surveys are summarised in Table 3 below.[37]

The GSF outcome surveys classed a toilet as safely managed if it provided access to a basic sanitation service (i.e. improved sanitation facility that is not shared with other households) and also met any of the following three criteria:

1. toilet connected to a sewer system,
2. toilet with on-site containment (pit or septic tank) that was emptied by a formal service provider or collection vehicle, or
3. toilet with on-site containment (pit or septic tank) that has never been emptied.

This protocol is largely aligned with the JMP approach to toilet classification. In addition, if toilet containment systems have been emptied, the JMP core questions ask both who emptied the contents (service provider or household) and where the contents were emptied. The GSF outcome surveys did not include a question on whether the faecal sludge emptied from toilets (under criteria 2 above) was safely treated or disposed (e.g. transported to a functional treatment works, or buried), which may have resulted in overestimates of the SMSS access reported (particularly in the Cambodia and Nepal surveys).

36 Designed by University of Buffalo and implemented by local consultants hired by the executing agency in each GSF programme.
37 Data extracted from the draft final GSF outcome survey reports for the Cambodia, Kenya, Nepal, Senegal and Tanzania GSF programmes.

The JMP core questions do not assess unsafe outflows from toilet containment systems. However, in the absence of national data on containment in on-site systems, the JMP assumes that faecal waste is effectively contained in 100% of latrine pits and in only 50% of septic tanks (UNICEF & WHO, 2019). Furthermore, an addition has been proposed to the JMP expanded questions which are recommended by the JMP for inclusion in future household surveys to check on outflows from toilet containment systems and safe disposal of these outflows (see Section 3.4.3 below).

The GSF outcome surveys did not examine outflows from toilet containment systems (e.g. effluent outflows from septic tanks, or regular outflows due to leaks or overflows) and whether these outflows were safely managed (e.g. discharged below ground into an appropriate leach field or soak pit). Unsafe outflows are usually above ground and visible to observers (e.g. into the open, drains or water bodies)[38] and, while these outflows are not always continuous, households are often aware when leaks or overflows have taken place (due to the smelly and unpleasant nature of these flows).

Table 3: GSF outcome survey results–Household sanitation

Country programme	Survey date	Households surveyed	No service/ OD	Access to limited + unimproved sanitation	Access to basic sanitation	Access to SMSS
Tanzania	2018	629	2.7%	26%	1.4%	**70%**
Kenya	2018	1,680	8.7%	28%	0.2%	**63%**
Nepal	2018	1,952	14%	14%	12%	**60%**
Cambodia	2018	1,189	9.9%	29%	6.2%	**55%**
Senegal	2018	827	16%	47%	2.5%	**34%**

Note: The GSF outcome survey samples included stratified random samples of households in ODF and non-ODF communities. The weighting of this sampling has generally been adjusted to reflect the prevalence of each type of community across the programme, which means the overall results presented here conceal the variations found across ODF and non-ODF communities. For example, the proportion of ODF villages in the outcome surveys ranged from 50% in the GSF Cambodia outcome survey to 85% in the GSF Senegal outcome survey.

The GSF outcome surveys estimated that access to SMSS ranged from 55% to 70% in four GSF-supported programmes (Cambodia, Kenya, Nepal and Tanzania), with lower SMSS access reported in the GSF Senegal programme (34%) due to the much higher proportion of households with access to unimproved or shared sanitation facilities. However, the GSF outcome surveys are likely to overestimate safe management, particularly in locations where septic tanks are common, such as the GSF Nepal programme (where 36% of toilets were reported to be connected to septic tanks), as the outcome surveys did not account for unsafe outflows from septic tanks, or for unsafe emptying of faecal sludge from these tanks.

Pit emptying rates in Cambodia and Nepal were reported as 18% and 13% respectively (see Table 10 in Section 3.3.3). Some of these toilets were assumed to be safely managed (e.g. when emptied by service providers). The pit-emptying rates reported in the GSF Cambodia and Nepal outcome surveys were relatively low, but this probably reflects the young age of most of the toilets. Rates are likely to increase as more pits and tanks fill up, with a high risk, however, of unsafe emptying and disposal.

38 Most outflows exit tanks immediately, or via a short pipe. However, in some cases, longer buried pipes to open disposal may be used, making it harder to spot the effluent outlet.

Other household surveys in Cambodia and Nepal suggest that unsafe management and emptying of septic pits and tanks is common: an SNV Nepal household survey (SNV, 2018) found that 77% of pour-flush toilets in the terai region are unsafely emptied; around 10% of toilets were reported to be safely emptied, but the faecal sludge from these toilets was not treated or safely disposed. As a result, only 13% of households were found to have safely managed sanitation services. Similarly, household surveys conducted in Cambodia by iDE (2018) found that up to 14% of rural households "flooded out" their pits[39], while those that did empty the pits reported that 90% of the faecal sludge was dumped in local fields, or disposed into open ponds, rivers or drains.

The outcome surveys reported that the majority of the improved dry pit latrines in the African GSF-supported programmes have not yet been emptied (e.g. only 0.2% latrine pits emptied in Kenya and 1.3% in Tanzania). The GSF-supported programme teams suggested that most of these facilities are covered and replaced when full. Consequently, 98% of the improved toilets in the GSF Kenya and Tanzania programmes were classed as safely managed. Given the context and the fact that many of the toilets are less than 5 years old, this seems reasonable. However, there is a risk that this approach (assuming that all not-yet-emptied improved pit latrines are safely managed) may encourage people to under-report unsafe emptying and over-estimate safe management.

Ideally, the classification of not-yet-emptied toilets should be based on typical management practices in the same area. For example, in places where surveys suggest that 60% of toilets of this type tend to be emptied unsafely, then any assessment of SMSS should assume that 60% of not-yet-emptied toilets of the same type will be unsafely emptied in the future. Similar to the JMP 50% rule for septic tanks for which complete data are not available, this approach ensures that the default assumption is not always safe management. This will encourage stakeholders to address unsafely managed sanitation services and improve monitoring to demonstrate increases in safe management.

The GSF Senegal outcome survey reports only 34% access to safely managed sanitation services, which is much lower than in the Kenya and Tanzania programmes. This finding is partially due to the higher use of pour-flush latrines (22%) with offset pits, which are emptied more often and some of which are disposed unsafely (rather than the toilet being covered and replaced). But this finding is mostly due to the higher levels of OD plus unimproved and shared toilet use (63% in Senegal compared to 29% and 37% in Tanzania and Kenya respectively) which, under the JMP SMSS protocol, cannot be classified as safely managed.

3.2.3 Safe management of infant and child excreta

The safe management of infant and child excreta is an important aspect of safely managed sanitation services. Infant and child excreta contain high pathogen loads for a number of reasons, including frequent contact with contaminated soil and animal excreta while crawling and playing and peak infection rates in under twos due to developing immune systems and weaning onto solid foods. These excreta are rarely well managed however, and child sanitation practices are rarely well monitored.

39 Flooding out is a practice of opening holes, inserting spigot pipes or removing the pit cover so that wastewater and faecal sludge flows out of the pit (particularly during periods of high groundwater, flooding or heavy rain). The intention is usually to reduce the need for pit emptying, although the practice is also reported when the toilet will not flush due to seepage into the pit in the rainy season.

Infant excreta are sometimes collected in a diaper or cloth; however, when children become older and more mobile, they may start to use potties, or practice open defecation (often in and around the house) until they are able to use a toilet either with or without assistance. Safe management of infant and child excreta requires the safe containment or disposal of these excreta, any diapers, cloths, potties or tools used to collect the excreta, and safe cleaning of any soiled surfaces, and handwashing with soap and water after handling child excreta or any of the soiled materials.

Table 4: GSF outcome survey results–Child excreta disposal

Country programme	Toilet use by children under five	Safe disposal of excreta of children under five	Unsafe disposal of excreta of children under five
Cambodia	30%	23%	47%
Kenya	25%	57%	19%
Nepal	19%	28%	52%
Tanzania	16%	51%	33%
Senegal	5%	63%	32%

The GSF outcome surveys confirmed that the majority of children under 5 years old defecate in the open, with toilet use ranging from only 5% to 30%. From 23%–63% of excreta is collected by child carers and safely disposed into the toilet, but 19%–52% of excreta are either collected and unsafely disposed (into drains, bushes, open space or rubbish dumps) or left untouched.

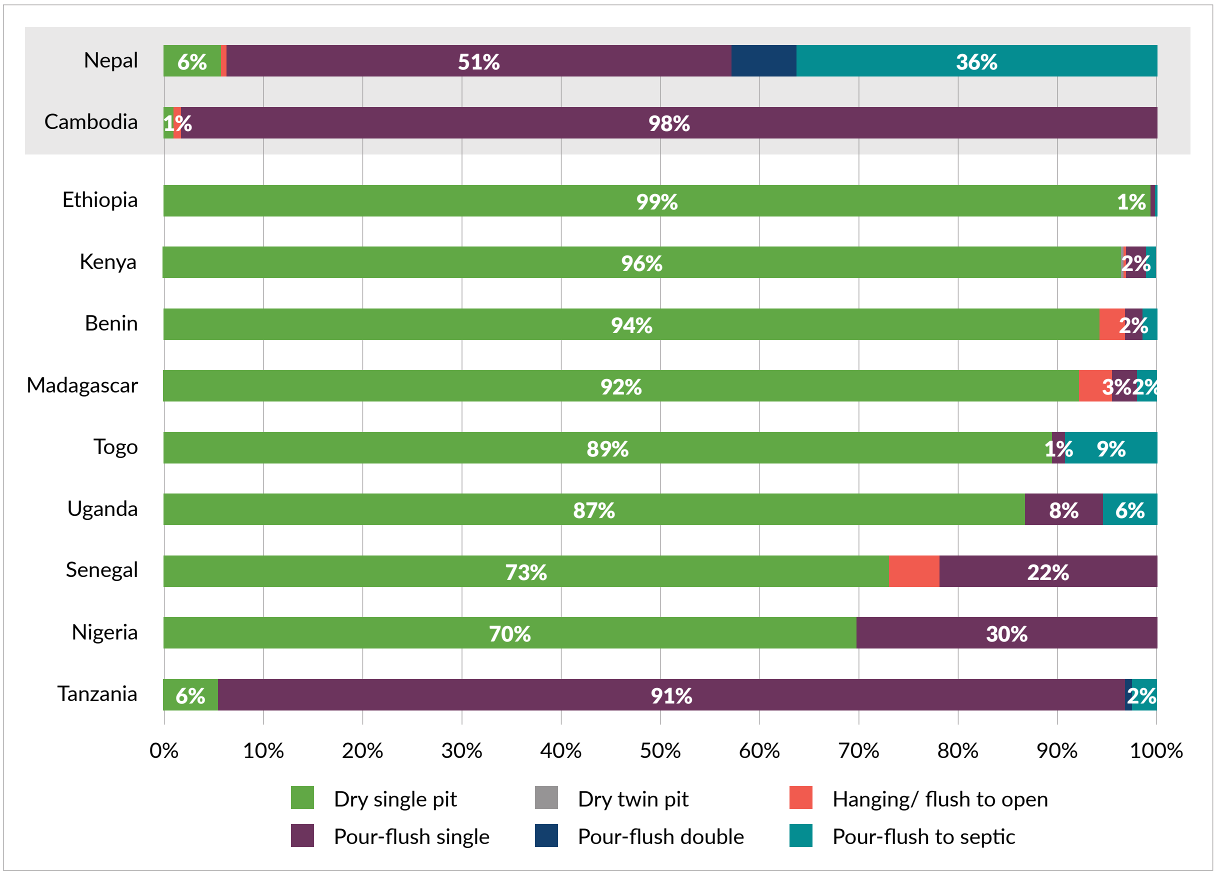
Other studies confirm that the rate of open defecation by children generally exceeds the adult rate, and that child excreta disposal is a serious issue for SMSS. For instance, Ensink et al. (2015) on the potential impact of sanitary child stool disposal reported that safe child excreta disposal rates (based on MICS survey data) were as low as 18%–22% in Bangladesh, Burkina Faso and Nepal. The same research also conducted a multi-country review estimating that almost half (45%) of caregivers in sub-Saharan Africa practice unsafe child excreta disposal. The GSF outcome surveys (from both self-reported data and structured observations) confirmed these findings, with between 30% and 65% of infant and child excreta reported to be unsafely managed.

3.2.4 Types of sanitation facility and service

The sanitation-facility type used by a household is affected by a large number of factors including social norms, availability and affordability of market goods and services, socio-economic status, ground conditions, sanitation and public health regulations, technologies promoted locally etc. While it is often hard to determine why a household uses a particular toilet type and containment system, the technologies selected have a significant effect on the safe management of household sanitation services. In particular, two key distinctions are important: between dry latrines (in which no water is required to flush excreta) and wet latrines (in which excreta is flushed or pour-flushed into the containment system); and between latrine excreta storage in pits or in septic tanks (or septic pits).

Figure 12 presents data on the main toilet types found in the 11 GSF-supported programmes reviewed by the study. While detailed programme data on toilet type were not available in all country programmes' GSF outcome surveys, Figure 12 highlights the main differences across the GSF-supported programmes based on other data sources.[40]

Figure 11: Main toilet types in GSF programmes



3.2.5 Toilet types in the nine African GSF-supported programmes

The main difference in toilet types across GSF-supported programmes is to be found between pour-flush toilets in Asia and dry pit latrines in Africa. The majority of the African GSF-supported programmes, with the exception of the GSF-supported Tanzania programme, report 70%–95% dry pit latrines (largely single pit latrines). In contrast, the two Asian GSF-supported programmes (Cambodia and Nepal) have 94%–98% pour-flush latrines[41], with only 1%–6% other latrines (including dry pit latrines).

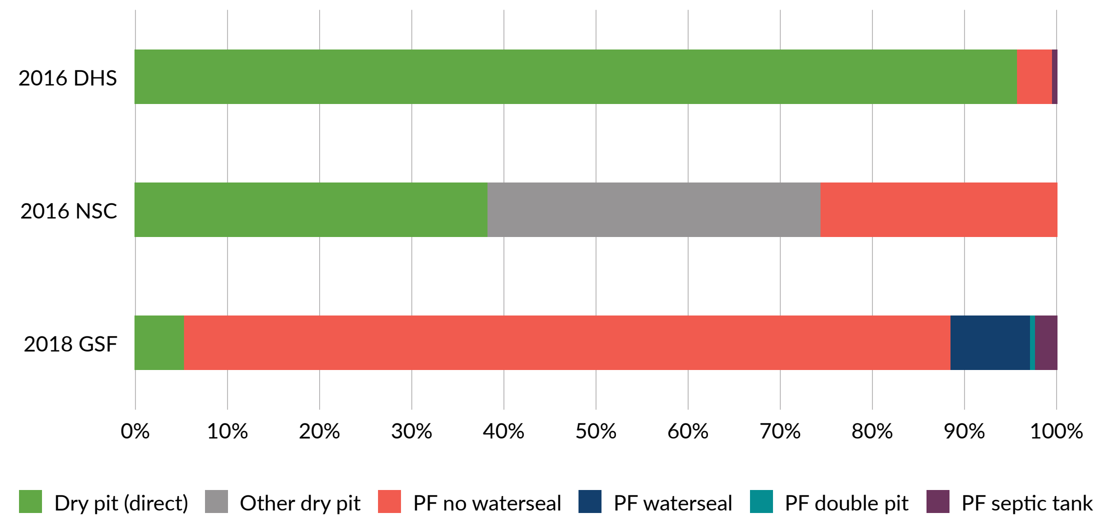
40 Detailed data on household toilets were available in five GSF programmes (Nepal, Cambodia, Senegal, Tanzania and Kenya) from the 2019 GSF outcome surveys. GSF Nigeria provided programme-monitoring data that allowed estimates to be made. In the other five GSF programmes (Benin, Ethiopia, Madagascar, Togo and Uganda), detailed data on toilet types were not available, thus more generic JMP data (nationally representative for rural areas) were used, including the following household surveys: Benin DHS18; Ethiopia DHS16; Madagascar MIS16; Togo DHS14; Uganda PMA15.

41 The JMP definition of a pour-flush toilet has a water seal (U-shaped pipe below the seat or squatting pan, which is flushed by pouring water into the pan) to prevent the passage of flies and odours. However, some pour-flush toilets have no water seal, with only an open pipe (usually connected to the pan by a 90� bend) through which excreta are flushed into the toilet containment system.

Tank for pour flush toilet under construction in Tanzania. © *Andy Peal*

Furthermore, the data on toilet types from the GSF Tanzania programme are quite different to the toilet types reported by the other GSF-supported programmes in East Africa (see Annex 6). The 2018 GSF Tanzania outcome survey reported that 83% of the toilets surveyed in programme areas (Dodoma region) were simple pour-flush pit latrines without water seals (i.e. excreta are manually flushed through an open pipe into an offset pit). Previous household surveys sampling all regions, including the 2016 Tanzania Demographic and Health Survey (2016 DHS) and a 2016 household survey for the National Sanitation Campaign (Mwakitalima et al., 2018), found that most households (74%–96%) in rural Tanzania used dry-pit latrines, with only 4%–26% of households reported to use pour-flush latrines.

Figure 12: Household survey data on toilet types in rural Tanzania



Note: PF = Pour flush.

The GSF Tanzania country visit confirmed that many new or replacement facilities built by households in programme areas are now offset pit latrines, which require manual flushing but do not have a water seal. Rural households apparently prefer this design because the slab and superstructure are less affected by pit collapse, and less water is required for manual flushing than in a conventional pour-flush latrine with a water seal. However, there is no water seal to limit smell or fly nuisance, thus a drop hole cover is required to make these facilities flyproof.

The GSF Nigeria and the GSF Senegal programmes reported a lower proportion of pit latrines than most of the other African programmes, with 25% to 30% of households reported to be using pour-flush toilets.[42] These facilities commonly discharge to an offset pit (rather than a direct pit under the toilet slab) and—as in Tanzania—are not always fitted with a water seal. In Senegal, 98% of the surveyed programme population were Muslims, who generally use water for anal cleansing, thus are more likely to use pour-flush latrines.

In the African GSF-supported programmes, the desk reviews suggested that pit latrines are usually made largely from local materials. Most latrine pits are unlined, except where the soils (e.g. sandy soil) are collapsible in which case some form of simple pit lining is used (e.g. truck tyres, plastic or metal drums, clay lining). Latrine slabs (which usually cover the pit) are generally made of wood, or wood covered with mud. However, the GSF-outcome-survey data suggest that significant populations are now using latrines with concrete slabs or cement covered slabs: 32% of toilets in Senegal; 37% in Tanzania; and 51% in Kenya.

Upgrading of mud-covered slabs by addition of a cement-mortar screed has been promoted across the African GSF-supported programmes. The cost is considered affordable (approximately US$ 2–5 in Madagascar[43]) and the outcome is a washable toilet floor that should be easier to keep clean. However, none of the GSF-supported programmes reported routine monitoring of toilets with concrete or cement-covered slabs, although some monitor whether the toilet floor is washable. Field observations during the country visits to Madagascar, Tanzania and Uganda confirmed that many new toilets have a cement-mortar screed floor and that some older toilets have been improved by addition of a cement-mortar screed.

3.2.6 Toilet types in the Asian GSF-supported programmes

The situation is quite different in the two Asian GSF-supported programmes reviewed. In Cambodia and Nepal, the majority of toilets are pour-flush latrines with lined pits: 98% pour-flush pit latrines (with concrete slabs and concrete ring lined pits) in Cambodia and 94% pour-flush pit latrines in Nepal. The remaining 5% or so of households use dry pit or VIP latrines with single or double pits, generally with water used for anal cleansing.

An example of a retrofitted twin-pit system in Nepal. © *Patrick England*

Pour-flush latrine to two ring lined pits in Cambodia. © *Andy Robinson*

42 In the GSF Senegal outcome survey, only 5.3% of toilets were reported to be flush or pour-flush toilets, but another 19.5% of the pit latrines were reported to have water seals (hence have been counted as pour-flush latrines in this study).

43 In Madagascar, part of one sack of cement was used to construct the cement slab covering, with the remainder of the cement often used for other home improvements.

Growing numbers of twin pit latrines are reported in Cambodia and Nepal (largely in the terai districts),[44] with respectively 10% and 6% twin-pit pour-flush latrines reported. However, in many cases, the twin pits are connected in series (thus both pits contain fresh excreta and wet sludge) rather than as alternating twin pit latrines (as currently being promoted in both countries).

The GSF Nepal outcome survey reports that 36% of the toilets surveyed were pour-flush toilets that discharge to septic tanks. This is an unusually high proportion among rural households and may reflect the wide range of facilities classed as septic tanks (which is likely to include "septic pits" as well as cess pits or holding tanks).[45] For comparison, data on rural households in terai districts from SNV Nepal (SNV, 2018) suggest that 11% of toilets discharge to septic tanks, and 24% discharge to cess pits (holding tanks) that are regularly emptied.

Superstructures in the Asian GSF-supported programmes also tend to be more solid, made from bricks, concrete blocks, metal sheets and other market-bought materials. Better-off households finish concrete slabs with ceramic tiles and construct open water tanks next to the latrine pan (for flushing, cleaning and handwashing).

3.2.7 Toilet cleanliness

Pit latrines with slabs made from non-durable and non-washable materials are often assumed to be less likely to remain in sustained use or to be kept clean.

In the three African GSF outcome surveys (available at the time of the study), 50%–80% of the toilets were reported to have non-concrete slabs. However, the outcome survey data suggest that the proportion of toilets reported to have visible faecal smears in or around the slab is low, even where non-concrete slabs are used. Only 4%–7% slabs were reported as unclean in Senegal and Tanzania, which is similar to the 3%–5% unclean slabs reported in the GSF Cambodia and Nepal programmes, where almost all toilets have concrete slabs. Furthermore, data from a 2017 survey of dry pit latrines in the GSF Madagascar programme found that only 5% of toilets were unclean.

The proportion of unclean toilets was higher in Kenya, with 17% of toilets reported to have faecal smears visible inside the toilet. Further work is required to understand why toilet cleanliness was lower in the GSF Kenya programme than in the other programmes.

A pit latrine in Madagascar with fly-proof cover.
© Andy Robinson

44 Terai: Lowland region in southern Nepal that covers around 23% of Nepal's land area adjoining the border with northern India.
45 Cess pits are usually sealed underground holding tanks from which faecal sludge is regularly emptied, but the term may sometimes be used to refer to non-sealed holding tanks.

3.2.8 Flyproof toilets

Several of the GSF-supported programmes promote flyproof toilets, with the aim of preventing fly access to pit contents to limit fly nuisance and potential transfer of faecal pathogens. Pour-flush latrines with water seals are generally flyproof. Vent pipes installed on the pit or tank, however, can allow flies and other insects to enter the pit if the pipe is not screened.[46] Thus the majority of the promotional efforts are in the GSF-supported programmes where people use dry pit latrines, including Kenya, Madagascar, Nigeria, Tanzania and Uganda.

Table 5 presents data from selected GSF-supported programmes on the presence of drop hole covers or water seals in toilets (which are assumed to limit fly access into the pit or tank). The proportion of toilets in which flies were observed during the household survey inspection is also included. The 2017 GSF Madagascar Country Programme Monitor (CPM) report, based on a survey of 1,502 toilets in 270 programme villages, found that 90% of pit latrines had no holes or gaps in the slabs, and 93% had drop-hole covers. Despite this, flies were still observed in 32% of the toilets surveyed by the Country Programme Monitor (CPM) in Madagascar. In Nigeria, the 2018 CPM survey reported that 95% of the surveyed toilets were made flyproof through the use of drop-hole covers (although no data were provided on fly observation).

Table 5: GSF-supported programmes–Flyproof toilet prevalence

Country programme	Drop hole cover or water seal	Flies observed in toilet (% toilets)
Cambodia	96% water seals	10%
Madagascar	93% covers	32%
Nepal	92% water seals	3%
Senegal	44% covers + water seals	10%
Kenya	39% covers	29%
Tanzania	35% covers	37%

Sources: All data from GSF outcomes surveys except for Madagascar for which data is from the CPM survey.

The GSF-outcome-survey data suggest lower use of drop hole covers in Kenya, Senegal and Tanzania, with only 35% to 45% of the toilets surveyed found to have covers (or water seals) in place, and another 5%–15% of toilets reported to have covers present but not in place. Unsurprisingly, fly observations were lower in toilets with water seals (e.g. majority of Cambodia and Nepal toilets). Approximately half of the flyproof toilets in Senegal were reported to have water seals, which may have contributed to the lower fly observations reported by the GSF Senegal outcome survey.

46 Pour-flush latrines that flush to leach pits should not require a vent pipe, as gases should be absorbed by the soil, except where soils are highly impermeable (where build-up of gas can make flushing difficult). Multi-chamber septic tanks may require vent pipes when both inlet and outlet pipes to a particular chamber are below the liquid level or fitted with a water seal.

3.2.9 Interventions to improve toilet quality and durability

Most of the GSF-supported programmes reported implementation of some form of sanitation marketing activities (except for the GSF Benin programme, which conducted a study on sanitation marketing and planned to introduce a component in mid-2019), as well as non-market technical support (often linked to the Follow-Up MANDONA approach). These activities are generally designed to encourage households to upgrade and improve their sanitation facilities so that toilets are more hygienic and durable and more likely to be used.

Non-market technical support refers to support provided to encourage households to find affordable and appropriate ways to address sustainability and hygiene issues faced by their current toilet designs and sanitation practices. These interventions generally involve the use of local materials and local building techniques, rather than market-bought materials or external services, and often promote the use of local rather than external technologies.

Market-based sanitation solutions were also promoted, particularly in the latter half of the GSF-supported programmes, with most programmes adopting a conventional sanitation marketing model of formative research followed by the development and marketing of appropriate low-cost toilet models. However, there is little evidence that the market-based products or services have achieved significant sales or had an impact on sanitation access or sustainability at scale.

Several GSF-supported programmes reported that the disappointing results from the sanitation-marketing initiatives, which most stakeholders attributed to affordability constraints, led to the adoption of more low-cost and local approaches (e.g. non-market technical support).[47]

A partially finished wooden slab for a pit latrine under construction in Madagascar. © Andy Robinson

In Madagascar, GRET (2016) reported that its sanitation marketing initiatives had sold 6,000 pit latrines in urban areas, but noted that the cost of these toilet models ranged from US$ 28 to US$ 98 (with a 20% subsidy available on the most expensive model) even though the cost for which people in rural areas were willing to pay for toilets was estimated at only US$ 12.50. As a result, the GSF-supported Madagascar programme reported that market-based toilet sales in rural areas have been low, with most toilets built instead using local materials. Local innovations in Madagascar included the use of termite-resistant wood to construct slabs, durable coverings for wooden slabs, traditional construction of adobe walls for toilet superstructures, production of tight-fitting drop hole lids, and the addition of cement screeds on top of existing wood and mud slabs.

47 Technical support to communities (e.g. on latrine design and improvement) is not generally part of a CLTS process in order to encourage innovation and local problem solving (rather than top-down solutions). However, non-market technical support is increasingly used post-triggering, with the emphasis on sharing local innovations and practical solutions to common problems, while allowing households to decide what is appropriate and desirable (rather than imposing external requirements).

In Tanzania, the sanitation marketing approach was modified to provide households and local artisans with "on-the-job coaching" on how to construct toilets from locally available materials (e.g. how to fix roofs, cement floor slabs, and build offset toilets) and advice to village leaders to purchase cement in bulk, so that they could then sell it to individuals in smaller quantities.

Similarly, in Nigeria, the approach focused on empowering village WASH committees (WASHComs) to "find community solutions for community problems". In each ward, a "sanitation clinic" attended by WASHCom members from the local villages, was used to identify the most appropriate types of toilet, how they could be constructed, their costs and any local innovations. This did not exclude promotion of toilets built from market-based materials, but it helped identify affordable alternatives built from local materials.

A pit latrine in Uganda with a self-sealing "Sato Pan". © Andy Peal

Water for People reported implementing an 18-month sub-component of the Uganda GSF-supported programme, which included delivery of a behaviour-change communication strategy to 5,000 households, training of masons and development of a business model for supply of SaTo pans.[48] As a result of these interventions, 521 households constructed new or improved latrines (generally using SaTo pans). The high cost of transporting materials in remote rural areas and the lack of affordable latrine options (latrine models ranged from US$ 7 to US$ 200) were cited as some of the reasons for the low uptake of the improved designs. The World Bank (Gibson et al., 2018) reports that 20,000 SaTo pans (costing US$ 4 each) have since been sold through 350 hardware outlets, which suggests increasing uptake. However, this total represents sales across Uganda (not just in GSF-supported programme areas) and includes both urban and rural sales.

The GSF-outcome-survey data on toilet types (see Figure 12 above) confirm the much higher use of market-bought materials by rural households in the GSF Cambodia and Nepal programmes, with 94%–98% of toilets reported to have concrete slabs and water seals. GSF-supported programme teams have reported that the majority of these toilets have lined the latrine pits with concrete rings. Much lower proportions of toilets with concrete slabs are reported in the African GSF-supported programmes (32% toilets with concrete slabs in Senegal, 37% in Tanzania and 51% in Kenya), despite similar levels of poverty in most of the Asian and African GSF countries.[49] For a number of reasons, sanitation markets appear to have worked better in Cambodia and Nepal.

48 SaTo pan (name derived from "Safe Toilet" and also known as a "flapper" pan) is a simple pour-flush plastic pan with a counter-weighted flap at the base, which closes automatically after use.

49 2018 GDP per capita (current USD): Madagascar US$ 461; Cambodia US$ 1,025; Tanzania US$ 1,050; Cambodia US$ 1,152; Senegal US$ 1,522; Kenya US$ 1,710; Nigeria US$ 2,028. Retrieved from: https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.PCAP.CD&country=

Sanitation marketing in Cambodia has also been particularly successful. Three large sanitation-marketing programmes (iDE Cambodia Sanitation Marketing Scale Up; WaterSHED Cambodia Hands Off Sanitation Marketing; and East Meets West Foundation Community Hygiene Output-based Aid) helped to trigger sanitation demand, develop low-cost products and services, and strengthen the enabling environment for rural sanitation. More than 200,000 toilets have been sold by each of the two largest programmes. Starting conditions were supportive: low cement and transport costs; middle-income households were willing to invest US$ 30 to US$ 50 in an attractive new toilet; toilet subsidies were available to some poor households (e.g. through the CHOBA project); and development partners financed relatively expensive sanitation marketing projects (e.g. typical project costs in Cambodia were around US$ 40 per toilet sold, which was more or less the same as the price paid by the household for the toilet).

Similarly, in Nepal, little sanitation marketing has been required, as affordable sanitation products were already available in most markets, and the 2011 National Sanitation and Hygiene Masterplan (Government of Nepal, 2011) required a permanent toilet sub-structure (with concrete slab and water-seal pan). As sanitation demand increased with the government drive for an ODF Nepal, and social norms began to develop for the use of pour-flush latrines with ceramic pans and washable concrete slabs, the main challenge has been to generate demand among poor households and link this demand to local service providers (rather than develop markets and latrine options from scratch).

The 2018 WASHPaLS desk review on market-based rural sanitation development programmes (USAID, 2018) confirmed that:

- Few "true" market-based-sanitation interventions have scaled.
- The typical unit programme cost of large-scale interventions was US$ 20-50 per toilet.
- Interventions can scale if funders stay invested.

The WASHPaLS review found that most of the successful examples of market-based sanitation reached scale after 4–6 years, and that 70%–90% of toilets were sold after the initial 4.5-year development and expansion period. While an interesting analysis, which mirrors analysis of CLTS development in the East Asia and Pacific region, all of the large-scale examples cited are from Asia: with large-scale projects found in Bangladesh, Cambodia, India, Indonesia, Nepal, and Vietnam.

The only two significant market-based sanitation examples that the WASHPaLS review (USAID, 2018) reported in Africa were the WSP Tanzania Total Sanitation and Sanitation Marketing project (16,100 SanPlats sold) and the SNV Ghana Results-Based Finance for Sanitation and Hygiene project (2,400 toilets built). The programme unit cost in these two programmes was estimated at US$ 150 per toilet (excluding the user investment in the toilet), which is approximately five times the median cost of the large-scale Asian programmes.

The main focus of most of the sanitation-marketing initiatives examined by this study was to encourage households to build latrines with concrete slabs, or other durable alternatives, with little attention to the safe management of the sanitation services. Most latrines marketed were single pit latrines, and many of these latrines were lined with concrete rings (or brick linings), with the risk that the pits will be unsafely emptied when full.

3.2.10 Equity and non-discrimination

GSF-supported programmes generally address equity and non-discrimination (EQND) through improved CLTS approaches and, in some programmes, sanitation finance for disadvantaged households such as toilet subsidies provided to some poor households by local governments in Cambodia and Nepal. While CLTS is intended to be an inclusive and community-led process, following the 2017 GSF EQND study (House et al., 2017), further efforts have been made to ensure that "potentially disadvantaged" people are considered and included during triggering and follow-up activities (including FUM), and that internal support mechanisms, such as provision of labour and materials to disadvantaged households (e.g. by family members, or by community), have been encouraged.

While some form of support is often provided to help disadvantaged households to build toilets, particularly during the drive to achieve an ODF community, limited evidence was found of support being provided to disadvantaged households for safe management of sanitation services. Several potential issues to be addressed were identified:

- construction of low-quality toilets with high risk of unsafe containment,
- inability to dig replacement pits and rebuild superstructures,
- inability to empty pit safely, and
- inability to dispose of pit contents safely.

The toilets used by disadvantaged households may have a higher risk of unsafe containment, as they are sometimes built quickly with community or external assistance (perhaps with limited attention to the quality of the materials or the design of the facility) and the users sometimes have limited ability to maintain or repair the facilities.

When latrine pits or tanks become full, or leak and overflow, disadvantaged households may not be able to respond appropriately—to dig replacement pits and rebuild toilets or empty the pit and dispose of the contents—particularly if they were reliant on support to build the toilet in the first place. Once the main ODF drive and CLTS process are finished, it can be hard to rekindle enthusiasm for support to disadvantaged households, especially when they are marginalised within the community and their loss of service is not well recognised.

The GSF-outcome-survey data on toilet use by people with disabilities (including elderly people and persons with mobility and/or vision disabilities), and on alternative sanitation practices of people with disabilities are presented in Table 6. These data suggest that the elderly people surveyed have similar latrine use to the rest of the population, which is marginally lower in the two African GSF-supported programmes, and 7%–11% higher in the two Asian programmes. However, people with disabilities reported that their latrine use was substantially lower in the Kenya and Nepal GSF-supported programmes—by 11% in Nepal, and 25% in Kenya. Where people with disabilities were not able to use toilets, the majority reported that they used a bucket latrine (which someone else in the household emptied) with 15%–18% of people with disabilities using bucket latrines in Kenya and Nepal. A small percentage of people with disabilities reported practicing open defecation, but this practice was lower than in the rest of the population (presumably due to limited mobility).

Table 6: GSF outcome survey results–Equity of sanitation access

Country programme	Total latrine use	Over 65 latrine use[50]	Latrine use by people with disabilities[51]	Bucket use by people with disabilities	OD by people with disabilities
Tanzania	92%	90%	84%	7%	2%
Kenya	92%	87%	67%	15%	5%
Nepal	86%	97%	75%	18%	9%
Cambodia	89%	96%	92%	6%	2%

Note: Excluding the GSF Senegal outcome survey results since the equity data presented in the GSF-outcome-survey report (Section 3R and Tables R1 & R2) did not match the other survey data reviewed.

The Royal Government of Cambodia (2016) introduced "National Guiding Principles on Hardware Subsidies for Rural Household Sanitation", which allow toilet subsidies to be provided to ID-Poor 1 and ID-Poor 2 households[52] without an improved latrine, but only in communes where 60 percent or more of households in the commune[53] are using an improved latrine (in the understanding that this level of access indicates that social norms are changing, and sanitation supply chains are developing). Toilet subsidies can only be applied towards the costs of the latrine sub-structure (except for people with disabilities who may require additional accessibility features beyond their ability to pay) and must not "exceed US$ 50 per latrine" or "reduce the ID-Poor household monetary contribution to below US$ 30" (Royal Government of Cambodia, 2016, p.2). ID-Poor households within the GSF Cambodia programme area have benefitted from toilet subsidies provided by the provincial rural development departments and by other sector agencies (e.g. East Meets West and World Vision).

In Nepal, the 2011 Sanitation and Hygiene Master Plan (Government of Nepal, 2011) encourages a zero-subsidy CLTS approach but allows support for the "poorest of the poor" which is often interpreted as support by local authorities to the last 5% of households that have not construct sanitation facilities. The 2017 GSF Equity and Non-discrimination (EQND) study (House et al., 2017), noted that delaying financial support for toilets until this late stage, following months of community pressure on the disadvantaged to build facilities, puts unnecessary stress on disadvantaged households that may have little or no capacity or ability to build a toilet.

No data were available on differential sustained use of toilets by households (or individuals) who received toilet subsidies. Badly administered toilet subsidies can result in lower sustained use (due to a low sense of ownership and limited ability or willingness to pay for repairs and replacement), but there is little evidence of this issue in the reviews or visits.

50 Self-reported use from surveys of people over 65 years (GSF outcome surveys)
51 Self-reported use from surveys of people with disabilities (GSF outcome surveys)
52 Households identified by the national poverty system (Identification of Poor Households Programme or ID Poor) as being food poor (ID-Poor 1) or below poverty line (ID-Poor 2).
53 Commune is the third level administrative division in Cambodia (after province and district). On average, each commune contains about nine villages.

3.2.11 Handwashing with soap

Handwashing with soap is one of the key barriers to faecal contamination, particularly at critical times after faecal exposure. The presence of a handwashing facility with soap and water is included in the SDG 6.2.1 sanitation target, but it is monitored separately using SDG indicator 6.2.1b (“population with a basic handwashing facility with soap and water available on premises”). All 11 GSF-supported programmes promote handwashing through the CLTS process. Handwashing with soap, and other improved hygiene behaviours, are usually introduced during triggering and again during follow-up activities (e.g. by health-extension workers in Ethiopia or using FUM in other programmes).

Household handwashing facilities generally consist of a tippy tap or a similarly simple arrangement. These are usually made from recycled plastic bottles, branches and other freely available or low-cost local materials. However, whilst the tippy tap is affordable, the durability of the handwashing facility is a major challenge. Theft, vandalism, damage, misuse, degradation (e.g. plastic bottles cracking) and minimal maintenance (e.g. water containers not refilled, or soap not replaced) were all reported as challenges to the sustainability of these simple handwashing facilities.

Handwashing progress is reported in the GSF annual reports. All but one GSF-supported programme reported an increase in number of people with access to a handwashing facility with soap, which is the JMP basic hygiene service level (Table 7). Overall, the GSF progress data suggest that around half (46%) of the total target population of the 11 GSF-supported programmes now wash their hands with soap and water.

Three programmes also monitor the use of soap alternatives such as ash, soil, sand or other materials, with higher levels of access reported when these alternative options are included in addition to soap (see Table 7). Importantly, the JMP considers the use of these alternative handwashing agents to be less effective than soap (both because ash is less effective than soap at removing pathogens, and because they can be contaminated). Facilities observed with these handwashing agents are therefore counted as “access to limited handwashing facilities” (UNICEF & WHO, 2018) and are reported separately.

A ‘limited’ handwashing facility in Nigeria with ash. © *Jason Florio*

Table 7: GSF-supported programmes–Progress on hygiene access (to end 2018)

Country programme	Programme target population	Population with access to a handwashing facility with water and soap (JMP: basic service level)	Population with access to a handwashing facility with water and soap, or with ash, sand or mud (JMP: at least limited service level)
Uganda	6.8 million	4.2 million (62%)	-
Nepal	6.0 million	3.4 million (57%)	-
Ethiopia	5.1 million	1.9 million (37%)	5.0 million (98%)
Madagascar	5.7 million	1.3 million (23%)	3.8 million (67%)
Nigeria	1.2 million	0.9 million (75%)	-
Cambodia	1.4 million	0.7 million (50%)	-
Senegal	0.7 million	0.7 million (100%)	-
Kenya	0.8 million	0.5 million (63%)	-
Tanzania	0.7 million	0.5 million (71%)	-
Togo	1.7 million	0.4 million (24%)	-
Benin	1.7 million	0.0 million (0%)	0.8 million (47%)
Total	31.8 million	14.5 million (46%)	-

Note: In this table the percentages shown are the population with access to a handwashing facility (either basic or limited service level) as a percentage of the programme target population.

The GSF-outcome-survey data on the presence of a handwashing facility (see Table 8) suggest that handwashing access is much higher in the Asian GSF-supported programmes (73%–99%) than in the African GSF-supported programmes (25%–48%).

Table 8: GSF outcome survey results–Household access to handwashing facilities

Country programme	Baseline survey			2018 Outcome surveys			Change
	No service	Limited	Basic	No service	Limited	Basic	Basic +/-
Senegal	-	-	-	55%	21%	25%	-
Kenya	-	-	-	15%	38%	48%	-
Tanzania	99%	1.2%	0%	54%	17%	29%	+29%
Nepal	63%–74%	26%–37%	0%	5%	22%	73%	+73%
Cambodia	92%	7%	0.9%	0.5%	0.7%	99%	+98%

Note: JMP hygiene service levels: "No service" = no access to a handwashing facility; "Limited" = access to handwashing facility with either soap or water, other agents (e.g. ash) or neither; "Basic" = access to handwashing facility with both water and soap present.

The GSF outcome surveys also included structured observation of a sub-set of households (approximately one in four of the surveyed households). The observations of handwashing practice recorded whether hands were washed with soap and water at critical times (after defecation, after contact with faecal matter, before breast feeding, before feeding an infant, before eating, before preparing food). Table 9 presents the range of handwashing practice reported at different critical times (from the least to the most prevalent practice).

Table 9: GSF outcome survey results–Structured observation of handwashing practice

Country programme	Handwashing with soap and water at critical times
Senegal	27%–40%
Kenya	3.5%–31%
Tanzania	0%–11%
Nepal	4%–60%
Cambodia	0.4%–15%

Note: From structured observation (handwashing with water and soap at critical times).

Structured observations present a different picture to the self-reported household survey results in the GSF outcome surveys: while the GSF Nepal programme reports the highest access to handwashing with soap and water at critical times related to defecation and faecal contact (60% and 50% respectively), handwashing behaviour before contact with food (food preparation, eating, feeding children) is much less common (4%–13%). Similarly, the GSF Cambodia programme, with almost universal (98%) self-reported access to basic handwashing services, was found through structured observation to have much lower practice of handwashing with soap and water: 11%–13% after faecal contact and defecation, and only 2%–6% at critical times linked to food.

In contrast, the GSF Senegal programme reported higher handwashing practice at critical times than access to basic handwashing facilities—while only 25% of households were reported to have access to a handwashing facility with soap and water, the structured observations suggested that 36%–40% washed their hands with soap and water after defecation or contact with faecal material, and 27%–34% washed with soap and water at critical times linked to food.

The observed handwashing rates in the GSF Senegal programme are higher than those observed in the two Asian GSF-supported programmes, despite apparently higher access to basic handwashing services in those programmes. Further research is required to explain this finding, but it is possible that the Senegal households were using soap, water and water carriers that were not observed during the household survey (perhaps because there was no separate handwashing facility at the toilet). A 2016 Plan International evaluation (Robinson, 2016) found that households in West Africa (Ghana, Niger and Sierra Leone) prefer to keep handwashing materials in the kitchen, rather than outside the toilet, which resulted in few observations of handwashing facilities with soap and water outside toilets in the household survey and low reported handwashing access. However, anecdotal reports of good handwashing habits led to further research, which confirmed that the surveys failed to count handwashing facilities that were used within the house or kitchen.

The structured observation data from the GSF outcome surveys suggest that the routine monitoring indicator (presence of a handwashing facility, with soap and water) is insufficient to detect whether the programme population is washing their hands with soap at the critical times linked to faecal exposure. The GSF Cambodia handwashing data confirm that practice at critical times is low (below 15% for all critical times) despite 98% of households having access to handwashing facilities with soap and water. More detailed and more frequent monitoring of handwashing facilities and practice is required to identify unsafe practices (or infrequent practice) and improve the effectiveness of the handwashing interventions.

3.3 Safely managed sanitation services in GSF-supported programmes

Monitoring the functionality and safe containment provided by rural sanitation services is often limited, in part because the MDG sanitation target aimed to reduce by half the proportion of people without access to improved facilities , while, SDG 6.2.1 moves beyond this goal to consider the safe management along the entire sanitation service chain. In addition, while previous monitoring was based largely on recall surveys at the household level, assessment of safe management requires regular observation of the on-site sanitation services to detect any change over time in the toilet condition or the safe containment of the excreta.

The SDG sanitation target for the use of safely managed sanitation services requires more detailed monitoring of the facilities and the whole chain of service, specifically:

- type of sanitation facility (e.g. direct dry pit latrine, pour-flush with water seal, pour-flush without water seal, slab materials, superstructure materials);
- type of containment (e.g. single or twin pit; direct or offset pit; leaching or sealed containment system; effluent outlets, leach fields or soak pits);
- faecal sludge that exits the containment system (either through emptying, or through leakage, overflows, effluent outlets etc); and
- off-site services (transport, treatment, end use or disposal).

Most of the GSF-supported programmes were designed and launched in the MDG era (between 2010 and 2015 precisely), thus detailed monitoring of facilities, containment and services was not included and had not yet taken place. Today however, the GSF outcome surveys performed in the SDG era did collect data on: type of sanitation facility (presented earlier in Figure 12); type of containment; and toilets that had been emptied (including who had emptied them and, if emptied by the household, where they had disposed of the faecal sludge).

The country visits were used to collect additional information on SMSS where available. Solid information on SMSS was available from research conducted by other rural sanitation stakeholders in Cambodia, but little additional information was available in Madagascar, Tanzania or Uganda.

3.3.1 Safe user interface

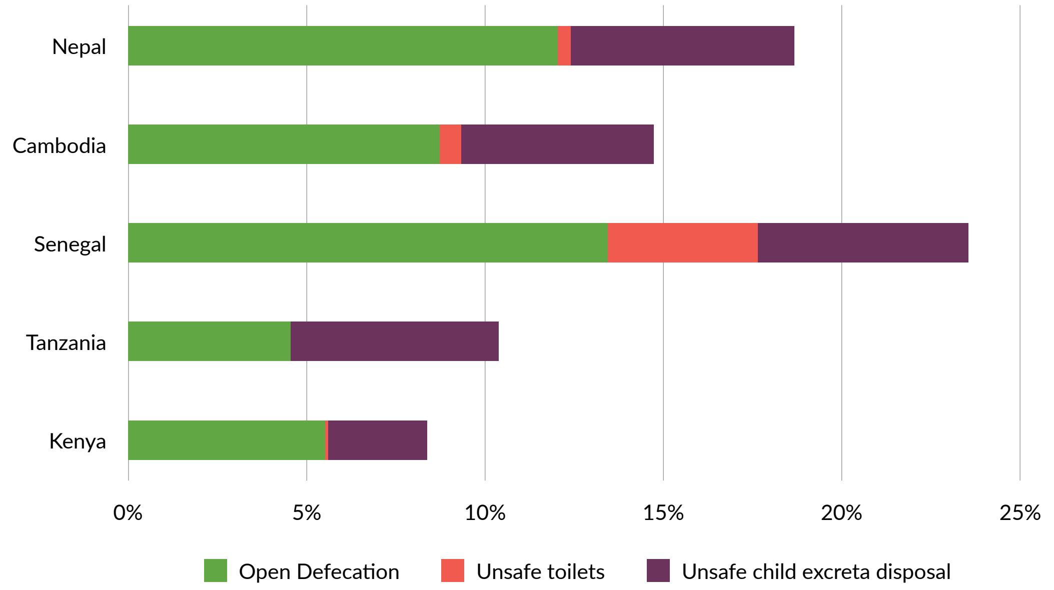
Where toilets exist, the pathogen hazard is usually related to unsafe containment, and unsafe emptying and disposal (where practiced). However, hazards at the user interface, before excreta enters containment, can also be significant. Unsafe excreta returns before containment are caused by:

- an absence of toilets (e.g. practice of open defecation);
- unsafe management of defecation by children (e.g. unsafe disposal of infant and child excreta); and
- unsafe toilets (e.g. toilets without storage or containment, such as hanging toilets, or toilets that flush to the open).

In all of these cases, 100% of the excreta hazard is released unsafely to the local environment.

Figure 14 below presents data from the GSF outcome surveys on unsafe excreta return at the user interface, including: 100% unsafe excreta release from open defecation; from unsafe toilets; and from child excreta that were not safely disposed (e.g. put into toilet or buried).[54]

Figure 13: GSF outcome surveys: Unsafe excreta return before containment



Note: The unsafe child excreta disposal figures were estimated using DHS data on the percentage of children under five in rural populations, plus GSF-outcome-survey data

The estimates of unsafe excreta return before containment highlight the importance of safe child excreta disposal. The GSF-outcome-survey data suggest that unsafe child excreta disposal may represent between 25% and 56% of the total unsafe excreta return before containment. In Tanzania, the outcome survey data suggest that unsafe child excreta flows may exceed those from open defecation by older children and adults.[55]

Child defecation and excreta disposal practices are very different behaviours from those related to adult toilet use or to safe management of sanitation facilities and services. Child excreta management may involve the use of nappies or potties, and often requires the intervention of an adult or other carer to pick up, transport and dispose of the excreta, and to clean the child and any other soiled items. As a result, different interventions and monitoring approaches are required to adequately address safe management of infant and child excreta.

54 The GSF-outcome-survey data on open defecation and unsafe toilet use were adjusted to remove the under-five child populations, as the excreta flows from these children are reported separately in the child excreta data.

55 Although this assumes that the daily pathogen load in the excreta of under-five children is similar to that from adults and older children. Further work is required to assess the relative pathogen loads in these groups given different infection rates, excreta volumes, defecation practices etc.

Little evidence was available on other aspects of safe management of the user interface. The latest JMP criteria for an improved "pit latrine with slab" require that the slab is durable and easily cleanable. The "easily cleanable" criterion is intended to minimise the risk of faecal smears on the slab, pan or around the interior of the latrine, which could potentially transmit pathogens to latrine users.

The pathogen flow approach suggests that the safe containment of the excreta in a latrine pit is the main factor in the safe separation of the excreta from human contact (required in an improved sanitation facility). The JMP sanitation task force previously examined two potential disease transmission risks in the "pit latrine with slab" category: potential transmission of enteric disease or trachoma from fly entry into the pit; and potential transmission of hookworm from latrine floors (UNICEF, 2010).

The GSF-supported programmes generally include flyproof criteria to reduce fly nuisance in toilets and limit any potential pathogen transport.[56] The risk of hookworm transmission in latrines with earth-covered slabs was previously discussed by the JMP task force, with several key points noted:

- Hookworm infection from soil outside the toilet is also a risk, particularly in communities where open defecation has not been eliminated.
- The risk of hookworm transmission in the toilet can be prevented through wearing footwear in the toilet.
- The main benefit of a pit latrine with slab is in the safe containment of the faecal pathogens in the pit, and any incremental benefit from a cleaner slab should not jeopardise the construction of pit latrines that provide safe containment (i.e. the risk that people may not build a pit latrine if a concrete slab is required, due to the cost of the concrete slab, was found to outweigh the risk that an earth-covered slab might transmit hookworm).

More recent research by the WASH Benefits trial in Kenya (Steinbaum et al., 2019) found that the interventions to limit helminth infection in rural households (provision of plastic latrine slabs, plastic potties, metal scoops for removing animal and child faeces, and behavioural messaging to reduce helminth infections) had little impact on the prevalence of helminth eggs in soil collected from outside the main entrance to the house.[57] The research paper concluded that increased access to improved latrines and child-faeces-management tools may not be enough to impact environmental occurrence of soil-transmitted helminths (STHs) where latrine access is already high. The paper also noted that these findings are consistent with previous research: a cross-sectional study in Tanzania found no difference in STH egg levels in soil samples from urban and rural households with different JMP sanitation service levels (Exley et al., 2015); and another study in Brazil found no correlation between Ascaris egg concentration and the level of sanitation service (ibid).

56 Evidence on disease transmission by flies from excreta in pit latrines is limited (in part because not much research has been undertaken). The Musca sorbens flies that transmit trachoma breed in openly deposited faeces, but do not breed in pit latrines (hence pit latrines can contribute to the reduction of M sorbens, if open defecation is adequately reduced).

57 19% prevalence of soil transmitted helminth eggs in control households, compared to 17% in treatment households. Note: no hookworm eggs were detected in this trial – the majority were Ascaris or Trichuris eggs (Steinbaum et al., 2019).

However, the Kenya WASH Benefits trial (Steinbaum et al., 2019) did find evidence that Ascaris infection rates were lower among children that received the WASH intervention, which included water treatment and handwashing with soap interventions. The authors suggested that these additional components could interrupt other environmental transmission pathways for STHs, such as ingestion through drinking water, or food contaminated by unclean hands.

Handwashing with soap is, therefore, another aspect that needs to be considered for a safely managed user interface. The focus of the pathogen flow approach to SMSS is on minimising the hazard released into the local environment, but any programme should also consider other potential barriers to pathogen transmission.

3.3.2 Safe containment

Key safe containment issues that were examined in the GSF-supported programmes included:

- length of excreta storage in the containment system,
- unsafe outflows from the containment system, including leaks or overflows,
- collapsible soils (integrity of the containment system may be compromised due to rainfall, flooding or surface water flows), and
- leachate or effluent entering groundwater (potential contamination of water sources).

Toilet pits and septic tanks usually receive fresh excreta every day, which means that at least the top portion of in-use latrine pits and septic tanks contains pathogenic sludge. However, pathogens die off over time, with variable die-off rates depending on the type of pathogen and the storage conditions. Most pathogens in most conditions are inactivated after two years. As a result, the length of storage has an effect on the total pathogen load in a latrine pit or septic tank—if the pit is 10 years old, then it can be assumed that 80% of the pathogen load (i.e. pathogens in the excreta that entered the pit during the first eight years) has been inactivated, although there will still be a significant pathogen load from the excreta that entered the pit within the last two years.

The main factor affecting storage time is what happens when the pit (or tank) becomes full. If emptied immediately, then the contents need to be safely managed as the pathogen hazard will be significant. If emptied after a period of storage, then the length of time since any fresh excreta were added will determine whether the pathogens have been inactivated. This is possible for example in an alternating twin pit latrine, or in a single latrine pit that is dug out for later use (e.g. where soil conditioner is valuable, or where soil conditions make it difficult to dig new pits). In general, two years is considered a safe storage period before emptying and reuse. Finally, some latrine pits are never emptied—they are covered and replaced with a new pit—hence the storage time always exceeds two years, and the pathogens should be fully inactivated.

No detailed data were available on the lifespan of latrine pits (or tanks) in the GSF-supported programmes. The GSF outcome surveys asked whether pits (or tanks) had ever been emptied (and when last emptied) but did not check whether the household had previously closed and replaced any full latrine pits.[58]

58 Data on the number of years of toilet access were collected, but these data may not differentiate between toilets or pits changing at different times.

Pour-flush latrine in Cambodia with the concrete ring pits connected in a series. © Andy Robinson

Estimates of typical pit filling times in each GSF-supported programme were made, based on data and estimates provided by the GSF programme managers (see Annex 5). The estimated pit-filling times, which range from only 1.5 years in Nepal up to 20+ years in Nigeria and Senegal, confirm significant differences in the pathogen loads and potential FSM requirements associated with the sanitation technologies found in the GSF-supported programmes.

The GSF outcome surveys differentiate between single- and double-pit latrines but did not include a category for "flush latrine with twin pits".[59] As a result, few twin pit latrines were reported in Cambodia, despite evidence from other stakeholder surveys[60] that between 12% and 82% of rural households use pour-flush latrines connected to twin pits (often connected in series).[61] However, the GSF Nepal outcome survey reported 7% use of latrines with twin pits, and 1% twin pit latrines were reported by the GSF Tanzania survey.

These data suggest that, outside of the GSF Cambodia and Nepal programmes, more than 99% of GSF households use toilets with single pits. In addition, the emptying rates reported in the GSF outcome surveys are low. Only 0.2% of toilets were emptied in the GSF Kenya programme, 7% toilets emptied in Senegal and 18% emptied in the GSF Cambodia programme (see Section 3.3.3 Safe Emptying for more details).

The emptying data reflect the fact that most dry pit latrines are covered and replaced when full. In other words, a new pit is dug nearby, and the latrine slab and superstructure are either replaced or rebuilt over the new pit. While reliable data on this practice were not available, anecdotal evidence from the GSF country visits and from discussions with GSF-supported programme managers and other key sanitation stakeholders confirmed that very few dry pit latrines were emptied when full. There were some reports that full pits that had been covered and left for more than two years were dug out later (e.g. in Madagascar: both to use the humus as soil conditioner, and sometimes to reuse the pit). This practice did not appear to be widespread, however. SNV implements its SSH4A programme across Africa and Asia and reports less than 0.1% emptying of dry pit latrines in its African SSH4A programmes.

59 The JMP report this toilet category as "twin pit with slab", defined as either dry (double VIP, fossa alterna) or wet (offset pits connected to a pour-flush toilet) latrines with a second pit used when the first fills up.

60 iDE FSM survey (iDE, 2018) reported 12% pour flush twin pit latrines; SNV FSM survey (SNV, 2018b) in Banteay Meas district in Cambodia reported 82% rural households with pour flush latrines connected to twin pits in series.

61 Sanitation stakeholders in both Cambodia and Nepal are promoting pour flush latrines with alternating twin pits, but few service providers or households currently recognise the advantages of safe management through an alternating twin pit system.

When the first latrine pit fills, households sometimes make improvements and upgrades to the next generation of toilet (see images below). Where more investment is made in a toilet, with expenditures on market goods and services to make the toilet more durable, solid and attractive, it becomes less attractive to abandon the old pit and rebuild the toilet over a new pit. The "second toilet" example from Benin is one example, as are those in most households in the Cambodia and Nepal GSF-supported programmes.

Benin household's first toilet

Improved second toilet

A second trend observed in the GSF-supported programmes was the installation of low-cost pour-flush pit latrines without water seals. In Tanzania, where most households would have used dry pit latrines previously, the 2018 GSF outcome survey reported 83% pour-flush latrines with no water seal, and another 9% pour-flush latrines with water seals. The rate of toilet emptying reported is still low, at 1.3%, but this rate is six times higher than that reported in the GSF Kenya programme. The move towards offset pour-flush latrines needs to be carefully monitored, as it may increase the risk of leaks, pit collapses, and unsafe emptying.

Unsafe outflows from toilet containment systems

The emptying data confirm that emptying rates are considerably higher when pour-flush latrines are used, in part due to the volume of flushing and anal-cleansing water that enters the pit. Pour-flush pit latrines often include a solid lining to the latrine pit (e.g. concrete rings, brick or stone masonry) to support the soils containing the wetter pit contents and, having invested in this pit lining, users often prefer to reuse the lined pit rather than build a new pit.

Four main options are possible when a lined pit is full:

- immediately emptying the fresh faecal sludge from the pit, and then continuing use of the pit;
- "flooding out" some of the faecal sludge to avoid emptying the pit (and extend the filling time)[62];
- constructing a second lined pit in series, with a pipe connecting the two pits (so that the pits operate like chambers in a septic tank, with settled sludge flowing from the first pit to the second pit); or
- constructing a second lined pit to create an alternating twin pit latrine[63] that can be used immediately (while the full latrine pit is isolated and covered so that the faecal sludge can be left to decompose while the second pit fills).

In both the GSF Cambodia and Nepal programmes, most households use small pits lined with concrete rings that are 0.9 m in diameter. These small latrine pits typically take just 2–3 years to fill with wet faecal sludge,[64] and recent reports suggest that some pits fill with liquids even more quickly (SNV, 2018), due to the limited leaching capacity of the pits. This may be because the concrete rings are not permeable, and the joints between the rings are sometimes sealed.[65] This in turn prevents or limits liquid absorption into the soil surrounding the pit. As a result, many households opt to empty the pit, add another pit, or flood out the sludge. iDE Cambodia reported that 14% of households pierce their pits to "flood out" faecal sludge (particularly during the rainy season) and avoid pit emptying.

The GSF outcome surveys did not provide data on outflows from toilet containment systems. Toilets connected to septic tanks[66] were only reported in Nepal (36%) and Tanzania (2.5%), but no details were available on whether these tanks were fully sealed, whether there was an effluent outlet, or whether this outlet was connected to a leach field or soak pit.

Leaks or overflows from toilet containment systems may occur when the system is compromised (e.g. partial collapse of pit; or holes created by animals, or deliberately by people); when high groundwater levels or heavy rainfall limit leaching from the pit; when flooding causes pit contents to mix with floodwater; or when pits are full and in need of emptying. Most people continue to use the pit in spite of these issues. As noted earlier, outflows from the toilet containment system are most likely in wet pits that do not leach well, as these pits often have a constant liquid fraction.

62 "Flooding out" refers to the practice of allowing faecal sludge to flow out or overflow from the pit through either a pipe, a hole pierced in the pit, or by removing the pit cover. This practice often occurs in the rainy season, when high groundwater, flooding or heavy rain can affect latrine operation (including increasing sludge levels when surface or groundwater flows into the pit).

63 In practice, many households in Cambodia and Nepal have installed a second pit in series (connected by a pipe to the first pit) which further complicates faecal sludge management, as both pits then contain fresh, wet faecal sludge that is highly pathogenic and unpleasant to empty.

64 Some households invest in more concrete rings to deepen the pit and increase the pit filling time.

65 Often because masons (and households) assume that the unsealed base of the pit will absorb liquids. In practice the pores in the soil at the base of the pit quickly become clogged and blocked by faecal solids, hence leaching usually only occurs through the sides of the pit.

66 Most toilets surveyed in the GSF Cambodia programme were classed by the GSF outcome survey as pour-flush latrines connected to septic tanks, but further investigation confirmed that these toilets were connected to lined leach pits (rather than sealed tanks with an effluent outflow), thus these facilities were re-classified as pour-flush latrines to leach pits in this report.

SNV uses a "timely emptying" concept in its SMSS protocol (SNV, 2019) to identify households whose pits (or tanks) should have filled, but which have not yet been emptied. This "timely emptying" approach is also automatically applied to household survey data in the SSH4A online survey database. The approach is not relevant for dry pit latrines (with direct pits), however, as these can no longer be used when they are full. The aim of this approach is to identify toilets that may be leaking, overflowing, or have other outflows that prevent the containment system from filling in the normal time, so that these toilets can be further investigated to check whether the toilet is unsafely managed.

The SNV "timely emptying" protocol uses the typical pit volume in the programme area, the household size, the type of faecal sludge containment (which determines the sludge accumulation rate) and solid waste practices (which alter the sludge accumulation rate) to estimate the time in years for the pit to fill. SNV then compares this "timely emptying threshold" with the age of the pit (since last emptying or construction) and determines whether the pit should have been emptied or not. Latrine pits that are older than this timely emptying threshold are flagged as potentially unsafe as SNV considers these toilets a higher risk of contamination than toilets whose pits are emptied more regularly.

Groundwater contamination by on-site sanitation

SNV Nepal (SNV, 2018) notes that "major faecal exposure risks are likely to occur due to the failure to safely empty and treat faecal sludge, especially in areas with high groundwater". Monitoring of outflows from pour-flush pit latrines in areas with high groundwater tables suggests that regular leaks or overflows occur in a significant proportion of these latrines, and that the limited leaching potential in pits lined with solid concrete rings (whose joints are often cemented) may be a factor.

Most GSF-supported programmes report that households are advised to build toilets a minimum distance away from any water points, and usually a minimum distance above the groundwater table. The minimum distances vary, from 10 m to 30 m horizontally, and from 1.0 to 5.0 m vertically, but these rules of thumb are rarely based on soil conditions or groundwater vulnerability factors and are rarely monitored or enforced. An urban FSM study in Senegal confirmed that the minimum safe distance of toilets from water supply wells was not respected (USAID, 2014).

Further work is required to assess the risk posed by on-site sanitation facilities to groundwater or other water supplies in GSF-supported programme areas. Where appropriate data are available, programmes should **identify areas with high "groundwater vulnerability" to contamination from on-site sanitation.**

Groundwater vulnerability can be mapped across the programme area through mapping the following risk factors:

- **soil transmissivity** (e.g. coarse sands and fractured rock are highly transmissive);
- **groundwater depth below ground** (e.g. if over 10 m then risk is considered low, but if less than 5m then risk maybe considered significant);
- **percentage of sanitation facilities located near to groundwater** sources (e.g. within 10 m of wells);
- **percentage of drinking water that is obtained from groundwater sources; and**
- **density of sanitation facilities that could release faecal pathogens into soil.**

Data on these factors should be obtained at macro level, through household surveys, and through discussion with local stakeholders on dominant soil types, groundwater conditions, facility numbers, types and density, and using any other research and data sources available. The aim is to identify areas where a number of risk factors overlap, and where further (more detailed) formative research may be required to evaluate the extent of the contamination risk and assess the best options for SMSS in these areas.

The Shit Flow Diagram (SFD) website[67] includes a groundwater pollution risk estimation tool that enables an initial estimate of the groundwater contamination risk. This tool was designed to assess the groundwater contamination risk in cities, thus is not tailored to the mapping of groundwater vulnerability across a large programme area. Nevertheless, based as it is on “Guidelines: Assessing the Risk to Groundwater from On-Site Sanitation” (ARGOSS guidelines: Lawrence et al., 2001), this tool provides a useful starting point for any assessment.

Where high groundwater vulnerability is identified, the best solutions may be to:

- ensure that groundwater is not used for drinking water supply (as shallow groundwater is easily polluted by other factors);
- consider whether different sanitation technologies might reduce the contamination risk; or
- undertake water-quality tests and other formative research to determine whether the faecal exposure risk is genuine, and develop appropriate guidance based on these assessments (for areas with high groundwater vulnerability. This guidance may involve investment in regular drinking-water quality tests to check for faecal contamination over time[68] and specific technology choices to reduce contamination risks).

3.3.3 Safe emptying

Emptying refers to the deliberate removal of wastewater or faecal sludge from a toilet or containment technology for transport, off-site treatment, use or disposal. In rural areas, where few sewers or septic tanks exist, emptying may not be required (e.g. where full latrine pits are covered and replaced). However, in some cases, containment systems are emptied manually[69] or mechanically[70] followed by transport, treatment or disposal of the faecal sludge.

Toilets that flush to offset (alternating or in-series) twin pits, or to a septic tank, should be designed for periodic emptying[71]—as the faecal sludge in these containment systems builds up and needs to be removed. The faecal sludge in these “wet” pits and tanks tends to be more liquid due to the water used for flushing and/or anal cleansing. Hence, they can be more unpleasant to handle or—in alternating systems –can be left for longer to dry the pit contents and inactivate pathogens before emptying.

67 Sustainable Sanitation Alliance (SuSanA). (n.d.) Groundwater pollution risk estimation. https://sfd.susana.org/risk-groundwater

68 These tests and assessments should nonetheless note that faecal contamination of groundwater (and other water supplies) may also result from open defecation and other faecal contamination entering unprotected wells and water sources (e.g. faecal pathogens in the local environment from pour-flush latrines that flush directly to drains, water bodies or open spaces; unsafe disposal of septic tank effluent, and unsafe disposal of faecal sludge).

69 Often using buckets, spades and other readily available tools (although sometimes using hand-operated pumps e.g. gulper).

70 Vacuum tankers, farm pumps into mobile tanks (towed by tractors or other vehicles), waste pumps direct to disposal, or other powered or manual mechanical emptying technologies (e.g. gulper or diaphragm manual pumps).

71 Although often the design does not allow for emptying (e.g. no access cover is provided; cover slabs are cemented on; septic tanks are inaccessible under floor slabs).

Pit emptying in Uganda. © Andy Peal

Emptying of toilet containment systems can be problematic in rural areas, as few safely managed services currently exist, and ability to pay for services is often limited. Vacuum tankers offer one of the safest pit- or tank-emptying options since contact by operators with the faecal sludge is limited. But these services are generally only available in densely populated areas, and may be too expensive for rural residents even if available.

Vacuum tankers are also not usually suitable for emptying unlined pits. During emptying, the suction can cause the side walls to collapse and, where lower volumes of water enter the pit or tank (e.g. in dry pit latrines) or where most liquids leach from the pit or tank, the consolidated sludge and solids at the bottom of the pit may be difficult to remove by suction. As a result, most pit or tank emptying in rural areas is done manually or using simple mechanical pumps. The toilet users either empty the pit or tank themselves or employ someone to empty it.

The reviews identified some more densely populated areas where both informal and formal emptying services were available (e.g. in Cambodia). No reports, however, showed that any of these services deliver faecal sludge to a treatment facility or an approved disposal site. In most cases, the faecal sludge was emptied manually, and disposed locally (either in the compound or land of the toilet owner, or in fields, drains or water bodies nearby).

Some FSM services are available in the GSF countries but are concentrated on the larger towns and cities. Even these services do not fully cover the large proportion of the population using on-site sanitation. For example, currently there are no working treatment plants in Benin although three urban treatment plants are planned. Data from 16 cities in the African countries where the SFD process has been used suggest that only half of the cities have any sort of treatment facility, many of which are not performing as per design. In addition, affordable, reliable, regulated emptying and transport services are scarce. Consequently,

Transporting faecal waste in Uganda. © Andy Peal in these 16 cities, when pits fill up, a large proportion of emptied sludge is dumped unsafely in open drains, on open ground or to water bodies. And, because of the lack of affordable services, a similarly large proportion of faecal sludge from full pits is not emptied but is either buried on site—either safely or unsafely—or unsafely "flushed out" to another pit or to the open.

Rural households may want to re-use a full containment system, often because of sunk investments, or lack of space for a replacement, or because it was designed to be re-used (e.g. a septic tank or twin pit latrine). In such cases, they often empty the containment system themselves (or pay someone else to empty the containment system manually), with a high risk of faecal exposure by those handling the faecal sludge (during the emptying, transport and disposal processes) and by others living nearby (as the faecal sludge is often dumped into nearby fields, drains, water bodies or open spaces in order to limit transport and disposal costs). For instance, research in Cambodia found that 73% of households dumped the faecal sludge from latrine pits within 500 m of the sanitation facility (SNV, 2018a).

Few reliable data are available on emptying practices in low-income rural areas, as most formal services are found in more urban contexts, and faecal sludge management (FSM) has rarely been a focus of previous rural sanitation programmes. The few data available confirm that:

- Manual emptiers are rarely trained in safe emptying practice (and rarely use appropriate personal protective equipment).
- Few safe treatment or disposal services are available locally, thus both manual and mechanical emptiers tend to dispose of faecal sludge unsafely.
- Formal service providers often struggle to access rural sanitation facilities with emptying vehicles (due to poor road access and difficult placement of the facility). Thus, most emptying in rural areas is by informal providers.
- Little monitoring of emptying practices takes place, thus there are few incentives or mechanisms to promote, regulate or enforce safe emptying, disposal or use.

The GSF outcome surveys reported: 18% pit emptying in Cambodia; 13% in Nepal; 7% in Senegal (Table 10); 1.3% in Tanzania; and only 0.3% in Kenya. As noted earlier, the proportion of toilets emptied appears to be correlated with the proportion of pour-flush latrines—with more emptying reported in the programmes with higher proportions of pour-flush latrines.

With the exception of the GSF Senegal outcome survey (which was translated into French, with some added questions), the outcome surveys did not include questions to households (or service providers) to determine how and where the faecal sludge was disposed (or used). The surveys also did not confirm whether it was treated in any way before disposal. As a result, it is difficult to assess reliably the population with access to safely managed sanitation services based on the outcome survey data. The data confirm who emptied the pits, but not where the faecal sludge went, or whether it was safely handled, transported, treated, used or disposed.

Full assessment of emptying and disposal services requires that service-provider surveys be conducted in addition to the household surveys (which usually only capture on-site practices), to capture and report off-site transport, treatment and disposal practices. The GSF-outcome-survey data suggest that formal service providers are currently used in only 10%–20% of emptying events. However, this proportion is likely to grow as more toilet containment systems become full, service providers begin to respond to this demand, and local authorities begin to monitor and regulate safe emptying and disposal practices.

Table 10: GSF outcome survey results—Toilet emptying

Country programme	% toilets emptied	Emptied by households	Emptied by paid labour	Emptied by paid service	Safely disposed
Cambodia	18.2%	61%	38%	-	25%[72]
Nepal	13.2%	34%	57%	9%	-
Senegal	6.7%	61%	17%	17%	77%

In Cambodia, the GSF outcome survey reported 195 emptied toilets (out of 1,070 toilets surveyed). All but one were pour-flush latrines (189 flush to "septic pit"; 5 "flush to pit"; and 1 composting toilet). More than three quarters (83%) of these toilets had been emptied within the last 2 years, with 61% of households emptying the containment systems themselves; and 38% hiring labour to empty. No data were available on disposal practices after emptying.

The 2015-2017 iDE Cambodia FSM survey found that **10%–14% of rural households report piercing their latrine pits to "flood out" some of the pit contents and allow continued use of the latrine** (iDE, 2018). Slightly more households (18%) reported emptying their latrine pit at some point, with 94% of these latrines emptied by the household or a family member (using a bucket and rope), and only 5% emptied by paid manual labour. The survey reported that 90% of faecal sludge was either dumped in local fields, used as fertiliser (on own fields) or disposed into a pond or river (2%). Just 10% of the emptied faecal sludge was safely disposed (buried). The recent iDE and SNV FSM surveys in Cambodia suggest that 75% to 90% of faecal sludge emptied from rural latrine pits or tanks is unsafely disposed.

The emptying data in the SNV Nepal SSH4A programme were similar: 7%–14% of latrine pits in different regions (mountain, hills and terai) had been emptied (SNV, 2018a). Different emptying practices were reported in the different regions. Households in the mountain and hill districts emptied the pits themselves, and households in the terai paid "sweepers" to empty their pits and dispose of the faecal sludge. The **SNV Nepal SSH4A surveys report that 80% of the faecal sludge was unsafely disposed** (SNV, 2018a). Furthermore, demand for pit emptying services in the terai region is reported to be growing fast, particularly among better-off households who are willing to pay private service providers for emptying services.

Households in Nepal and Cambodia report that a bad smell or a blocked toilet usually signals that the pit needs emptying. iDE Cambodia has developed a simple floating "pit gauge" that is installed when the toilet is built and designed to provide a permanent indication of the depth of liquid in the pit. There is the possibility of a rough estimate of the depth of sludge by pushing the pit gauge down until the thicker sludge is detected. The initial pit gauge design was easily broken by animals or children, thus a new more durable pit gauge 2.0 was introduced in 2018 and is now installed with all iDE latrine packages.

72 Safe disposal data from iDE and SNV FSM surveys (iDE, 2018; SNV, 2018b).

In Senegal, the GSF outcome survey reported only 39 emptied toilets (6.7% of 832 toilets), of which only 7.7% were reported to be pour-flush latrines (whereas 22% of the toilets surveyed were pour-flush latrines). Despite manual pit emptying being banned in Senegal (apparently by an old law[73]), more than 60% of the emptied toilets were reported to be emptied by households themselves, with another 17% emptied manually by paid labour; and the remaining 17% emptied mechanically by paid service providers. Surprisingly, **the majority of these households (77%) reported safe disposal of the faecal sludge** (buried in the compound), with the remainder (23%) reporting either that they didn't know where the sludge was disposed (because it was disposed by a paid service provider) or that it was unsafely disposed.

The mid-term review of the GSF-supported Senegal programme included a household survey that reported urban FSM practices in Senegal: 10% of households empty their latrine pits: 38% of these pits are emptied by the households; 15% are emptied by paid manual labour; and 38% pay for mechanical desludging (presumably by better-off households). Only 4% of the faecal sludge was disposed into approved sites, **with the majority of the faecal sludge unsafely disposed** (into the bush, or the compound). The higher safe faecal sludge disposal rate reported by the rural households in the GSF-supported programme (compared to the urban households in the other FSM survey) may reflect awareness raising on safe FSM conducted by the programme team (or over-reporting of safe practice by households).

In the GSF Kenya and Tanzania outcome surveys, only 0.3% and 1.3% of the households with toilets reported having emptied their pits. These programmes are only 5 years old and the average estimated pit filling time is around 7 to 11 years, thus many pits will not yet be full. In addition, the preferred method of managing a full pit is usually to cover and replace.

An urban study in Tanzania (Jenkins et al., 2015) found that 43% of households practiced "flooding out" of latrine pits through specially installed drainage or overflow pipes during the rainy season, so that some sludge was washed out of the pit and latrine use could continue (effectively extending the life of the latrine pit through this unsafe practice). These data confirm the risk that faecal sludge in pour-flush latrines may be unsafely managed.

The cost of pit emptying in Madagascar is reported to be very high. As a result, most rural households in Madagascar prefer to cover and replace full pits. The GSF Madagascar program manager suggested that some households return to closed pits after several years, dig out the decomposed sludge, and use it as soil conditioner. A pilot project by one of the GSF implementing partners identified latrine pits that had been closed for more than four years, with the aim of using the decomposed pit contents to produce organic fertiliser. The pit contents were dug out, mixed with rice bran ash, and then solar dried for 6-8 hours before being packaged.[74] Use of the organic fertiliser (known as Biotay) has been piloted in several communities, with commercial production and sale planned (subject to approval by the Government of Madagascar, which is conditional on laboratory testing of the Biotay product to prove that all pathogens have been inactivated and it is safe for agricultural use).

73 According to the GSF Senegal team this law exists, although a copy of the law was not obtained despite the best efforts of the review team to track it down.

74 Solar surface drying is not recommended when the pit contents may contain viable pathogens, as there is a risk of helminth eggs (and other pathogens) being transported during the handling and drying process or blown or washed out while on the ground. In this case, the pit contents have been stored for at least four years, thus all pathogens should already be inactivated.

Alternating twin pit latrines

GSF-supported programmes (and other development partners) in both Cambodia and Nepal have been promoting the alternating twin pit latrine model as a solution to the regular pit emptying problem in these contexts (where pit volumes are relatively small, and low leaching rates result in short pit filling times).

iDE Cambodia reports about 5,000 sales of alternating dual pit upgrade packages (for around US$ 60-80) in the last few years, with a second lined pit connected to the latrine at the side of the existing full pit (where space and layout allow).[75] Both the Nepal and Cambodia governments view the alternating twin pit latrine model as a safe and viable model for rural FSM and are encouraging its promotion and uptake. However, the relatively high cost and dislike of the future obligation to empty and handle the decomposed pit contents have limited uptake to date. The main sanitation actors in Cambodia are hopeful that people will see the ease of emptying and value of using the humus from the rested alternate pit as this latrine model becomes more common, and that it will then start to scale up. iDE Cambodia has also starting promoting lime dosing to treat the contents of the full pit, in part to tackle household concerns that the pit contents will not be safe for re-use (see Section 3.3.4).

In Tanzania, in areas where there is a shift towards the use of offset latrine pits, there is also potential for a second pit to be added. Households could then switch from "cover and replace" to the use of alternating twin pits. However, no evidence was found of households adopting this practice, with respondents observing that the Usafi wa Mazingira Tanzania (UMATA) programme (and National Sanitation Campaign) focus has been on achieving ODF rather than on management of full pits. Difficulty in emptying unlined pits, as well as cultural taboos around handling faecal sludge (which are also reportedly common with little end use of dried or treated faecal sludge) are also cited as reasons why households prefer to "bury and forget".

3.3.4 Safe treatment

WaterAid (2019), in a review of wastewater treatment plants in low- and middle-income countries, confirmed significant non-functionality rates in treatment systems. The review found 95% failure rates for wastewater treatment plants in Mexico; 80% failure rates in Ghana; 54% poor or very poor functionality in India; and 33% substantially overloaded plants in Vietnam. The causes of these problems were reported as inappropriate technology choice; poor plant design; inadequate operation and maintenance; and institutional weaknesses (e.g. lack of budget and capacity to sustain services).

There are often few incentives for a tanker operator to take the sludge to an appropriate treatment facility: which are, at any rate, extremely rare in rural areas.[76] Even when available, they are rarely located close to the emptying point. Where long travel distances are required to reach households, service providers charge higher fees (and may be reluctant to drive to approved treatment or disposal sites), which is a major disincentive to scattered populations living in remote areas. Furthermore, where these services exist in rural areas, there is rarely any regulation or monitoring to encourage safe treatment, disposal or use of the faecal sludge.

75 Personal communication with Andy Robinson (while in Cambodia in November 2019).

76 Some of the countries reviewed do not have operational faecal sludge treatment plants in the capital cities, hence there is almost no capacity and finance to develop and sustain these facilities in rural areas.

Waste treatment plant in Lira, Uganda. © Andy Peal

Briquettes produced from faecal waste. © Andy Peal

Tanker operators in Tanzania reportedly travel from Dodoma or Morogoro to provide emptying services within the programme area, charging around US$ 30 per trip with more than one trip often required to fully empty a tank. The operators only service lined pits and tanks, mostly belonging to guest houses, hotels, schools, businesses and institutions within the programme area. Rather than make the long journey back to treatment plants in Dodoma (or Morogoro), they reportedly dump the faecal sludge in fields (if farmers are willing to use untreated sludge) or in drains, water bodies or other open spaces.

In Uganda, a pilot project by Water for People established a faecal sludge emptying, transport and treatment service to households and schools in the small towns of Kole and Lira. Sludge emptied by a service provider is delivered to a small, centrally located treatment plant where it is dried and carbonized with charcoal dust, before being ground and mixed with a molasses or cassava flour binder. Finally, the treated sludge is extruded into solid fuel sticks, or pressed into a honeycomb shaped briquette, and sold locally. The scale of the activity is small, with operations limited to customers that use lined pits (or tanks) and can afford the service (US$ 40 to US$ 70, depending on the distance to the faecal sludge treatment plant). The operator reports emptying around 10 to 15 pits or tanks a month, owned by households, local schools, hotels, businesses and institutions.

Lime dosing to treat faecal sludge

iDE Cambodia has conducted extensive tests on the use of hydrated lime (and other forms of lime) to treat faecal sludge at household level (Chakraborty et al, 2014). Hydrated lime powder is readily available and inexpensive in Cambodia and is widely used in more industrial processes (and in some humanitarian settings) to disinfect and treat contaminated waste. iDE confirmed in the laboratory that lime dosing was effective in eliminating pathogens from faecal sludge solutions (i.e. faecal sludge mixed thoroughly with water) and examined options for packaging and dosing lime powder and lime solutions for household use.

Lime dosing was seen as a potential option to treat faecal sludge before emptying the pit (so that the faecal sludge was less smelly and hazardous to handle, and safer to dispose), and for dosing into full pits before closing them (to accelerate the pathogen elimination process). However, given the hazardous chemical nature of hydrated lime and the technical challenges of safely handling and correctly dosing the hydrated lime, iDE concluded that lime dosing was not suitable for household application, and was best carried out by trained service providers (e.g. latrine producers and installers who are becoming involved in the installation of second pits, and may be asked to recommend emptying services).

iDE Cambodia is now using lime dosing as part of its Alternating Dual Pit upgrade package: the service provider installs the second pit (with pit gauge); reroutes the latrine pipework into the new pit; then doses lime into the old pit (using a mechanical stirrer to ensure that the lime and sludge are well mixed) before covering and closing the full pit. The service provider also offers instructions to the household on how best to manage the twin pit system and what to do when the new pit fills. iDE reports that households like the idea that the pathogens in the full pit have been inactivated by the lime and are then encouraged that the faecal sludge will be safe to use as soil conditioner after drying for 1-2 years while the new pit fills up.

Lime dosing has also been used at larger scale for low-cost faecal sludge treatment in the Philippines (USAID, 2015), but generally only where mechanical desludging enables collection and transport of the faecal sludge to a central treatment facility.

3.3.5 Safe disposal and use

Land disposal of untreated faecal sludge adds nutrients and carbon to the soil but poses risks to the health of agricultural users and consumers of farm produce (Tayler, 2018). Land disposal of faecal sludge was once the norm in the USA and Europe, but increased recognition of the risks has led most countries to either ban or severely restrict the use of untreated or partially treated faecal matter on land.

Use of faecal sludge should be monitored (and regulated), particularly in settings where faecal products (either direct from the pit or tank, or after some form of treatment or processing) are used as fish or poultry feed, or used as soil conditioner in gardens or farms (i.e. with potential to contaminate both food and non-food items).

There are three main options for land disposal:

- **land spreading:** land spreading refers to spreading (or spraying) faecal sludge on farmland. Surface deposits can lead to problems with pathogen exposure, flies and other vectors.
- **sub-surface incorporation:** sludge ploughed into the land immediately after discharge
- **burial:** trenching, burial in pits, co-composting in pits

The "Guidelines for the Safe Use of Wastewater, Excreta and Wastewater" summarise the health risks associated with the use of wastewater for irrigation (WHO, 2006). The WHO guidelines report that the greatest health risks (in places where wastewater is used without adequate treatment) are usually associated with intestinal helminths.

There are several kinds of risks:

- **consumer risks:** significant risk of Ascaris infection; cholera, typhoid and shigellosis outbreaks; evidence of parasitic protozoa found on wastewater-irrigated vegetable surfaces;
- **farm-worker risk:** significant risk of Ascaris infection; increased risk of diarrhoeal disease and Salmonella infection in children; increased risk of amoebiasis;
- **risks for nearby communities:** significant risk of Ascaris infection where flood or furrow irrigation is used; sprinkler irrigation with high aerosol exposure associated with increased rates of bacterial infection.

Shallow and deep trenching has been used for faecal sludge disposal in several countries. The Malaysian government introduced compulsory de-sludging of septic tanks every two years. This required that all local authorities set up faecal sludge management services and regularly monitor emptying and disposal practices. In less than 10 years (1993-2001), Malaysia increased the proportion of septic tanks that had been desludged from 2% to 58%. In rural areas without treatment facilities, faecal sludge was disposed (after collection and transport by vacuum tankers) into shallow trenches dug in nearby forestry plantations, which increased the rate of tree growth and generated economic benefits.

In South Africa, research by Partners in Development and the University of KwaZuluNatal (Still et al 2012 quoted in Tayler (2018))[77] into deep trench burial of faecal sludge from pit latrines for forestry and land reclamation purposes found that trees grown on entrenched sludge had about 60 per cent more biomass than control trees. Nitrate, phosphorus and pH fluctuations in nearby boreholes remained within acceptable ranges—despite excess loading of faecal sludge. After three years of burial, less than 0.1% of the helminth eggs in the buried sludge remained viable.

Wetlands Work conducted research in 2018 for GSF Cambodia that examined the disposal of fresh faecal sludge (emptied from wet pit latrines) into shallow soil-covered trenches in rural settings. Lab testing of soil samples from the trenches confirmed that E. coli levels were reduced to zero (in dry season) or close to zero (in wet season) after only two months. Other work in Cambodia (Chakraborty, 2015) found that limed sludge application produced a 20% increase in the yield of corn crops (although this trial also found that the cost of the lime exceeded the cost of fertiliser despite some economic benefits from increased crop production).

SNV Nepal has introduced shallow-trenching disposal of faecal sludge in the terai districts of its SSH4A project[78]. The first two trenching sites became operational in late 2019, and another two sites will be completed in early 2020. These pilot sites are managed by rural municipalities (gaunpalika) and used to dispose of faecal sludge emptied from latrine pits and holding tanks by tractor-pulled vacuum tankers (3.5 m3 capacity). SNV Nepal trained the sanitation workers in safe emptying, transport and disposal practices, and provided them with personal protective equipment. These pilot activities are not sufficient to serve the entire district, however, and are instead intended to demonstrate how local governments can finance and manage simple services for safe disposal of faecal sludge in rural areas.

77 Still et al (2012) quoted in Tayler (2018).

78 Personal communication with Andy Robinson (during field visit to Nepal SSH4A project in February 2020).

Few large-scale applications of faecal sludge disposal through trenching in rural areas have been reported—except for the Malaysian example, which relied on well-resourced government emptying and transport services using vacuum tankers. Both deep and shallow trenching appear effective in inactivating pathogens, can provide nutrients for improved tree and crop growth, and offer effective solutions for faecal sludge disposal in rural areas.

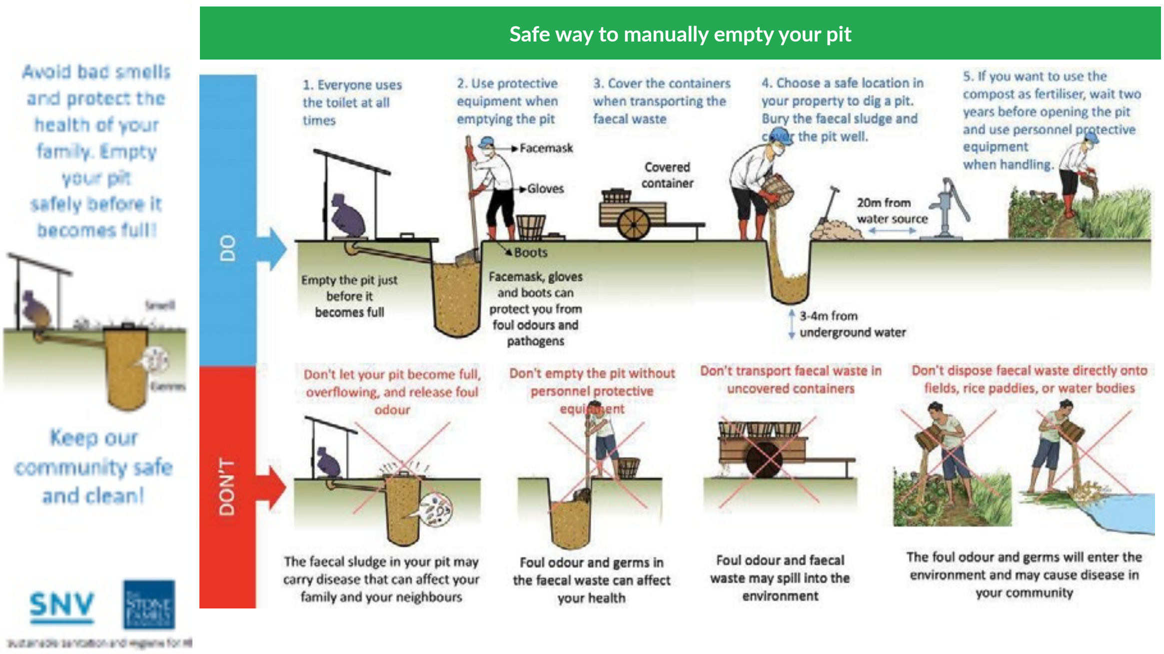
Community-based emptying and disposal process

There is little evidence that mechanised emptying and off-site treatment and disposal services are likely to be affordable or practical in "rural remote" and "rural on-road" contexts. Road access to household pits and tanks is often limited in these areas, populations are scattered, willingness to pay is low, and the capacity and resources for the monitoring and regulation of emptying and disposal practices are negligible.

Therefore, where toilet containment systems have to be emptied, household or community-based services may offer the best medium-term option for safe emptying, transport, and disposal of faecal sludge (particularly outside the small proportion of "rural mixed" and peri-urban populations found in GSF-supported programme areas). The involvement of local governments in the monitoring, regulation and support of safely managed sanitation services will also be critical to scaling up and sustainability. As with CLTS, it will be important to work with key local leaders and influencers to raise awareness of the hazards associated with unsafe FSM and develop capacity for improved monitoring and support to local FSM services.

Some stakeholders have developed training for the promotion of safe management practices by households and other local stakeholders (see Figure 16). However, pit emptying and disposal practices by households and informal service providers are ad hoc, infrequent (i.e. households may only empty pits every 2-5 years) and extremely difficult to control, not least because it is difficult to reach the entire rural population with safe management messages.

Figure 14: Household guidance on safe manual pit emptying (SNV Cambodia, 2019)



In the absence of well-trained and regulated service providers, simple processes and guidance are recommended. In rural areas, where space is generally available, faecal sludge emptied from toilet containment systems should be buried (or put in trenches) and left underground for at least two years before any contact or use (or left permanently underground).

The risk that households may not follow simple instructions (like those in the SNV guidance in Figure 16), or may not be willing to dig pits or trenches (when the alternative option is to dump the faecal sludge in a nearby drain or field) suggests that a community-based and local-government-led process may be necessary. The aim would be both to encourage safely managed emptying, transport and disposal processes, and to monitor and regulate the sanitation management practices.

The local government could:

- propose a scheduled annual process (in the dry season),
- identify pits or tanks that need emptying (i.e. full in next 12 months),
- dig communal trenches or pits for safe disposal (in appropriate locations),[79]
- inform local service providers of potential demand for emptying services,
- provide training and support on safe emptying, transport and disposal practices,
- provide protective personal equipment and mechanical pumps,[80] or
- monitor, regulate and supervise safe emptying, transport and disposal practices.

The community-based emptying and disposal process described above has not yet been tested. The concept has emerged from an analysis of the safe management challenges faced by rural communities in the GSF-supported programmes and appears to address several of the key barriers to safely managed sanitation services in low-resource and low-capacity settings.

3.3.6 Rural Shit Flow Diagrams

The Shit Flow Diagram (SFD) process is used for rapid assessments of excreta flows in towns and cities using a graphical representation. The SFD analysis uses the sanitation chain to track excreta flows from the point of production (user interface and containment), through emptying, transport and treatment, up to the point of end use or disposal. SFD analysis is based on the classification of excreta flows as either “safe” or “unsafe”. Safety is assessed by whether the hazards (pathogens in the excreta) are likely to enter the environment at each point along the sanitation chain and if human exposure to that hazard at that point is also likely to result in a significant public health risk. While similar to the JMP methodology, the SFD process includes additional data points on potentially hazardous events. For example, an assessment of the risk of pollution of groundwater used for drinking, and an assessment of the performance of offsite treatment facilities is included. Such additional data points provide for a more nuanced assessment of safely managed services.

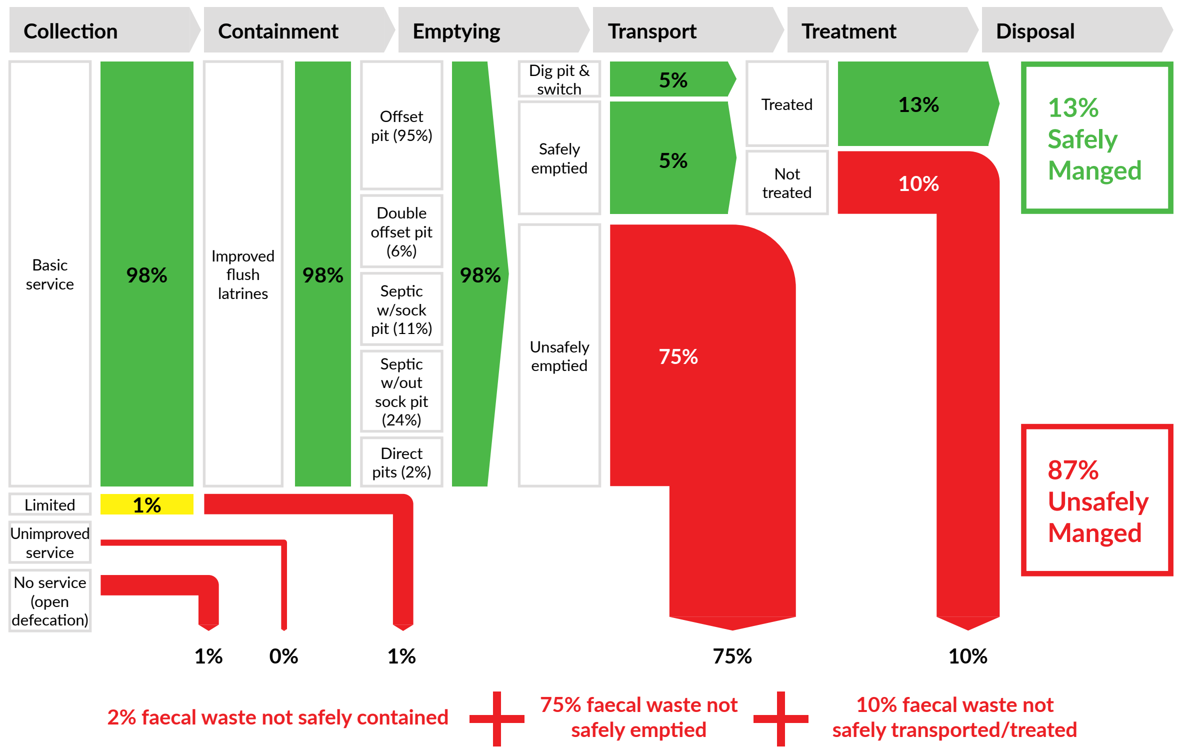
79 Disposal sites should be a safe distance away from water sources; and at least 2m above maximum groundwater level. Disposal sites close to forestry or agricultural plots may increase the nutrients in the soil and improve productivity.

80 For example, manual diaphragm pumps that limit direct contact between the emptier and the faecal sludge.

SNV used household survey data to produce rural Shit Flow Diagrams (SFDs) for its Nepal and Bhutan SSH4A programmes. SNV made estimates based on current sanitation management practices (using data from the SSH4A household surveys), but only a small proportion of latrine pits have filled or been emptied to date, hence these estimates will need regular updating as more data become available.

The SNV Nepal SFDs examined three different settings: rural hill districts, rural mountain districts and rural terai districts. The SFD in Figure 17 shows the sanitation management practices evident in the terai settings. Only 13% of sanitation services in the rural terai districts are estimated to be safely managed.

Figure 15: SNV Nepal SFD rural terai districts



Source: SNV (2019).

The rural SFDs produced by SNV involved significant assumptions and estimates and did not follow the full SFD process. Nevertheless, these SFDs provide a useful summary of excreta flows and safely managed sanitation services in these settings. The Nepal SFDs are particularly good at highlighting the difference in emptying practices, with Figure 17 showing that, for instance, 75% of improved pour-flush latrines used in the terai are unsafely emptied.

The GSF-outcome-survey data were used to produce SFDs for the GSF Cambodia and Tanzania programmes. The methodology used was slightly different to the SNV approach, with unsafe excreta flows classed according to the JMP sanitation service levels (open defecation, unimproved service, limited service), and the separation of child excreta flows from other excreta flows in order to highlight the different practices that influence these flows. Where data were not available from the GSF outcome survey, the 2017 iDE Cambodia FSM survey data were used to fill any gaps. (This was possible as some of the iDE implementation provinces overlap with the GSF implementation areas.)

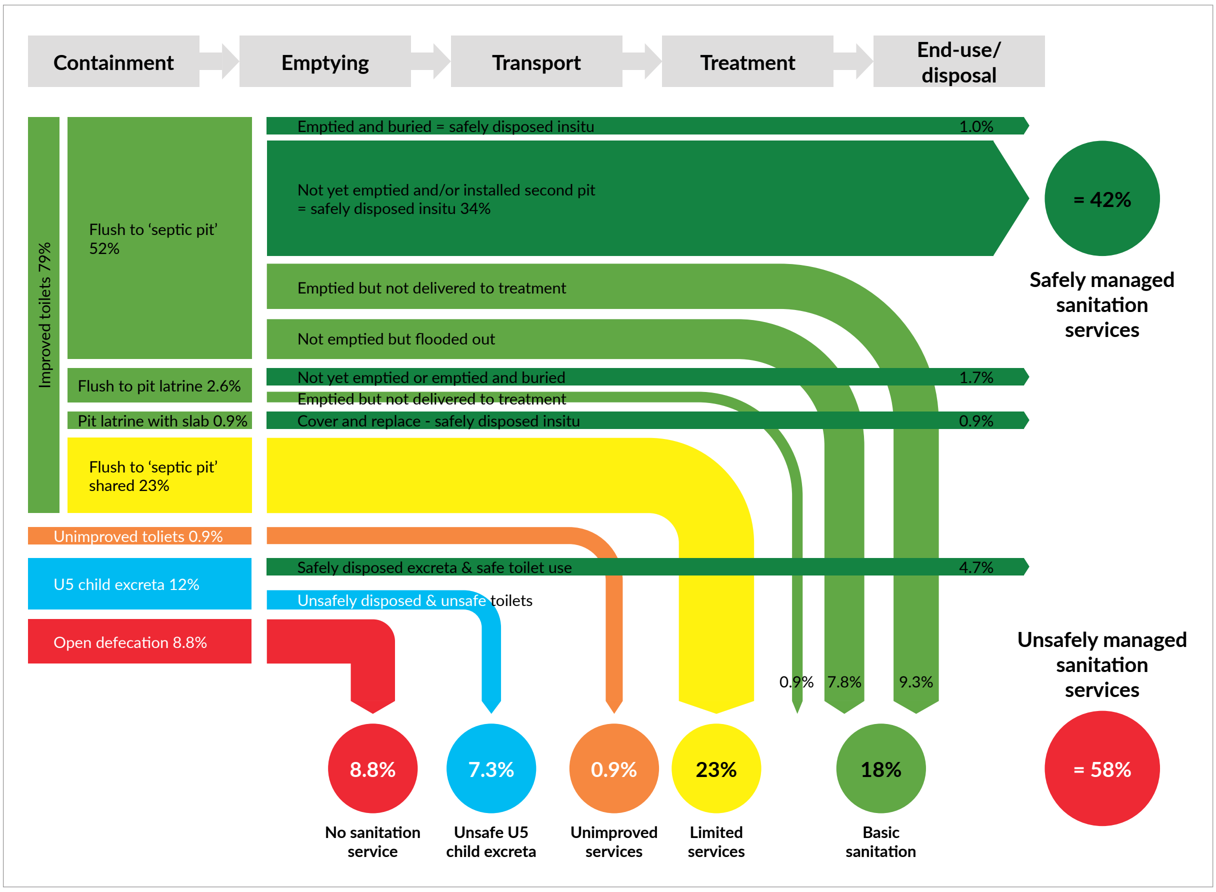
The child excreta flows were added to highlight the different people, behaviours and services involved in the safe management of child excreta.[81] The analysis of the GSF-outcome-survey data in this study has confirmed that unsafe child excreta flows are significant, yet rarely well addressed in the design, monitoring or evaluation of rural sanitation programmes.

The GSF Cambodia SFD (Figure 18) estimates that only 42% of sanitation services are safely managed. The short-term nature of the current situation is also visible, as a large proportion (35% out of 42%) of the safely managed excreta flows are either from households with toilets connected to "septic pits" that have neither filled up yet nor been emptied, or from households that have installed a second pit to delay the need for emptying. The SFD also shows significant unsafe excreta flows due to unsafe emptying of latrine pits, use of shared and unimproved sanitation facilities, unsafe child excreta disposal, and open defecation. There are few affordable options for safe emptying or management. Thus, as more containment systems become full, it is likely that more households will manage their pits and tanks unsafely. The SFD clearly indicates the need for the introduction of safe management solutions for full pits and tanks that will alter this trajectory and ensure safely managed services in the long-term.

Constructing a latrine's septic pit in Cambodia. © WSSCC

81 Child excreta flows were estimated based on the proportion of rural population estimated to be under-five children in the 2014 Cambodia DHS report, and the child sanitation and excreta disposal practices reported in the GSF outcome survey (both head of household survey and structured observation survey). All other excreta flows include only excreta from adults and older children.

Figure 16: Rural shit flow diagram for GSF Cambodia programme

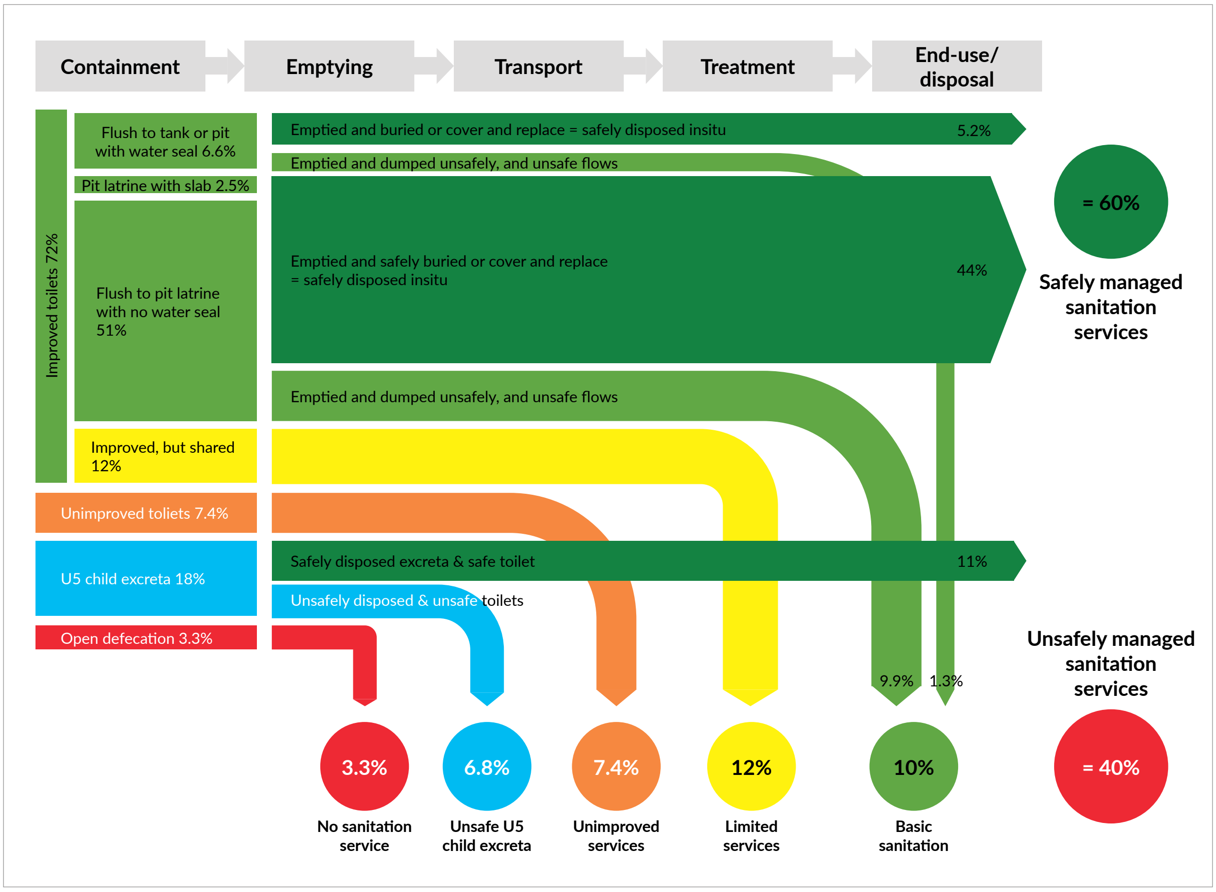


The GSF Cambodia SFD is a first attempt, based on the limited data available on safely managed sanitation in the GSF Cambodia outcome survey. Additional monitoring indicators—for instance on unsafe outflows from latrine pits and tanks—would allow more reliable SMSS estimates. Other improvements could also be made. For instance, reliable data on the safe management of shared sanitation facilities would allow shared excreta flows to be divided into safely and unsafely managed services. (The main argument for classing shared sanitation facilities as a limited service is that facilities shared by larger groups have a higher likelihood of unsafe management than private facilities used by close family members.)

The GSF Tanzania SFD (Figure 19) estimates that 60% of sanitation services are safely managed, due largely to the high proportion of latrine pits assumed to be covered and replaced when full, and the low open defecation rate (by adults and older children) reported in the GSF Tanzania outcome survey. Despite a high under-five child population (18% of total rural population in Tanzania[82], compared to 12% in Cambodia), the proportion of unsafe child excreta disposal (both from child use of unsafely managed toilets and from unsafe disposal of infant and child excreta) is similar to that estimated for the GSF Cambodia programme, due to the better child excreta disposal practices observed in the GSF Tanzania programme (through the structured observation survey).

82 Child excreta flows were estimated as for the GSF Cambodia SFD, except for the proportion of rural population estimated to be under-five children, which was from the 2016 Tanzania DHS report.

Figure 17: Rural shit flow diagram for GSF Tanzania programme



The GSF Tanzania SFD assumes that all toilets with a slab of some kind (i.e. wooden slabs, wood covered with compacted mud, cement-covered or concrete slabs etc) are classified as improved sanitation facilities. However, if the GSF Tanzania outcome survey data are stratified further for presence of a "washable floor" (e.g. concrete slab), in a construction that also has a roof, walls and a door (which are all required as per the national guidelines for an improved toilet), then the outcome will change significantly, with far fewer people reported to use an improved toilet, and far lower use of SMSS.

The intention of the rural SFDs presented for the GSF Cambodia and Tanzania programmes is to highlight the main areas of unsafely managed sanitation services and draw attention to excreta and pathogen flows such as those from unsafe management of child excreta that have not previously received much priority or investment. The SFD analysis inevitably requires that some assumptions and estimates be made (see Annex 9 for summaries of the SFD excreta flow estimates). The process of producing an SFD also draws attention to critical areas with weak or missing data and should encourage further study and data collection in these areas.

3.3.7 Elimination of open defecation

All of the GSF-supported programmes reported some slippage of households in ODF communities back to the practice of open defecation. This ODF-sustainability issue poses a similar public health risk to the use of toilets that do not provide a safely managed sanitation service—as 100% of the fresh excreta are unsafely returned to the local environment (where it can be washed or transported into water supplies, homes, child play areas etc).

Reasons suggested for ODF slippage included:

- **structural collapse of pits due to loose soils, or heavy rain and flooding:** Often this is linked to low quality of construction, low durability of materials or the lack of a roof;
- behaviour change not being fully **embedded (e.g. by nomadic people who do not** sustain use, or marginalised groups who were not fully involved in the ODF process);
- **inadequate ODF verification** (i.e. communities declared ODF following an inadequate ODF verification process, or due to political pressure for ODF achievement, despite some households and individuals not using hygienic toilets);
- **overly stringent ODF criteria** (including some criteria that are harder to sustain than others, hence ODF status is not sustained even where open defecation has stopped).

In addition, all of the GSF-supported programme teams reported ODF slippage as a result of socio-economic issues. For example, temporary housing of internally displaced people or of international refugees due to conflict or other perturbations. Construction by and for disadvantaged households (sometimes with support from the community or external groups) of inadequate and poor-quality latrines means that they will rapidly degrade and become unusable once the main ODF process is completed.

Programmes also report that ODF slippage is highest in very rural remote locations that are hard to reach, where resources are scarce and household ability to pay is low, and where implementers find it difficult to provide follow-up support or monitor outcomes regularly due to poor access and concerns over local security. Hard-to-reach locations often also face difficult physical contexts (e.g. hard ground or loose soils, heavy rain and flooding).

In Madagascar, the CPM noted that 38% of households without toilets reported that their toilets had been destroyed by natural events or disasters (e.g. storms, flooding). In Tanzania, heavy rains and localised flooding in 2018 also led to sustainability issues: 2% latrine coverage slippage nationwide, and a 6% slippage across the three UMATA programme districts. Intensive follow-up activities have reportedly redressed this slippage. They have recommended installing roofs on superstructures in order to prevent rainwater damaging the slab and its support, or entering and flooding the pit and using offset pits, so that if a pit is flooded or damaged irreparably it can be replaced without having to replace the toilet slab and superstructure. The rising frequency of severe climate events suggests the resilience of sanitation facilities in high risk areas and the potential effects of these events on sustainability should be considered in GSF policy and programming.

Guidelines on the different types of household toilets that can be constructed have been developed for the Ethiopian GSF-supported programmes by the Ethiopian Ministry of Health and for Uganda by the international NGO, Water for People. The focus of both technology manuals is on affordable improved latrine options that can be made with locally available materials. Various options are presented from simple, low-cost designs to more expensive and resource-intensive models. Both illustrated manuals also recommend adaptations that can be made in order to improve sustainability of toilets in areas with loose soils, hard ground and in areas where the groundwater table is high. However, the study found limited monitoring of where and to what extent these techniques have been used, and little information on the uptake and success of these technologies and adaptations.

3.3.8 Equity of safely managed sanitation services

People who may be disadvantaged face greater challenges in using safely managed sanitation services. In the African GSF-supported programmes, where most latrine pits are closed and replaced when full, potentially disadvantaged people who were reliant on “internal” community support to build their current latrine may find that the groups mobilised by collective behaviour change activities are no longer active (or motivated) when their pit fills. People who are potentially disadvantaged may require labour and materials to close the old pit and construct a replacement pit latrine and may not know how (or be able to) contact the right people or organise the work. Where there is no regular or reliable monitoring of sanitation behaviour, no enforcement of ODF or SMSS criteria, and no long-term support mechanisms, there is a significant risk that disadvantaged people will lose access to basic sanitation when the latrine pit fills.

The challenge is probably greater in the Asian GSF-supported programmes, where pits are smaller and tend to fill more quickly, and many of the safely managed options require specialist skills or payments for services. In the GSF Cambodia and Nepal programmes, the reviews found that sector agencies have discussed the provision of hardware subsidies for the construction of a second pit to create an alternating twin pit latrine, and the use of subsidies to encourage people who may be disadvantaged to build alternating twin pit latrines as their first latrine (to avoid future problems). However, there was little evidence of the provision and use of these subsidies.

Recent work by a World Bank-led coalition including the ILO, WaterAid and the World Health Organization (World Bank, 2019) examined the health, safety and dignity of sanitation workers. The findings confirmed four main challenges associated with sanitation workers:

- **occupational and environmental health and safety:** Sanitation workers are exposed to multiple hazards.
- **weak legal protection:** informal work; lack of occupational and health standards, and weak agency to demand rights
- **financial insecurity:** Informal and temporary sanitation workers are poorly paid, and income can be unpredictable.
- **social stigma and discrimination:** in some cases, experienced as total and inter-generational exclusion.

Sanitation workers who are not protected by adequate health and safety measures risk injury, infection, disease, mental health issues, and death. Specifically, the reported physical and medical conditions directly associated with sanitation work include: headaches, dizziness, fever, fatigue, asthma, gastro-enteritis, cholera, typhoid, hepatitis, polio, cryptosporidiosis, schistosomiasis, eye and skin burn and other skin irritation, musculoskeletal disorders (including back pain), puncture wounds and cuts, blunt force trauma and fatality (World Bank, et al. 2019). Common accidents include losing consciousness and death by asphyxiation resulting from noxious gases in septic tanks and sewers; pit collapse or falling masonry, and wounds from sharp detritus. Sanitation workers of all kinds often work without any form of personal protective equipment, and with little to no formal training on the occupational risks of their work.

This Work Bank assessment (World Bank, et al. 2019) notes that development partners should integrate the safeguarding of sanitation workers' rights into sanitation programme design, monitoring and evaluation frameworks.

3.4 Monitoring safely managed sanitation services

Improved monitoring is essential to the achievement of safely managed sanitation services. At the moment, most monitoring and evaluation frameworks focus on ODF villages and access to basic sanitation only. Most routine and national sanitation monitoring tend to be part of wider WASH- or health-monitoring systems, and thus include only core sanitation and hygiene indicators (e.g. whether or not households use a toilet; whether or not the toilet is considered improved or not) in order to minimise the cost and capacity required for data collection, analysis and reporting.

Periodic household surveys are increasingly used, particularly by large-scale sanitation programmes, to provide more detailed information on household sanitation and hygiene outcomes. These programme surveys allow the use of different survey methodologies and more efficient data collection tools. They have succeeded in demonstrating that these alternative approaches to sanitation monitoring can collect reliable information on safely managed sanitation services without large investments in new systems or significant capacity development.

The following sections on monitoring summarise the study findings on sanitation monitoring within the GSF-supported programmes, and then present the findings from a review of the most promising advances in SMSS monitoring in rural areas.

3.4.1 Monitoring access to basic sanitation

Routine monitoring of sanitation and hygiene outcomes in rural areas remains a significant challenge for governments and large-scale programmes. Most routine monitoring is carried out at community level by volunteers, including WASH or sanitation committee members, community health volunteers, and other natural leaders from the CLTS process.

In GSF-supported programmes, the community monitoring data are collated by an implementing partner (e.g. local NGO, local government official or health extension worker) and then passed up the monitoring chain to programme level, or to ward, district, regional and national levels. In paper-based monitoring systems, considerable work is required to collate, aggregate and clean up regular monitoring data provided by hundreds or thousands of monitors in order to generate useful summaries of access to basic sanitation (and other relevant indicators). Data quality and reliability are serious challenges in these systems, with few quality assurance or verification checks undertaken in most systems.

Online monitoring systems—particularly those that use smartphones to collect and transmit data—have the potential to greatly improve the efficiency and cost-effectiveness of sanitation and hygiene monitoring and evaluation. Well-designed online systems upload data from online devices directly into databases that allow instantaneous review, reporting and use of the data. Online systems also provide multiple mechanisms for checking data quality and reliability (including GPS coordinates, time-stamped photographs e.g. of toilet facilities, interview duration etc).

Some online systems, such as the ones being developed and used by the Government of Tanzania and the Government of Kenya, are only partially online. Data is still collected and aggregated using paper-based monitoring systems, which a government official then has to process and upload into the online system. These partial systems allow ready reporting of regional and national sanitation statistics, but do not offer the local improvements available from a true online system.

Both online and paper-based monitoring systems have to face the challenge of motivating large numbers of community level monitors to collect and report sanitation data on a regular basis, and of checking the reliability of these data. As a result, most large-scale rural sanitation monitoring systems struggle to provide reliable, comprehensive or up-to-date summaries of access to basic sanitation. Investment in some form of internal verification, such as random checks on a fixed percentage of monitoring data and reports could include telephone checks on a larger sample or field checks on a smaller sample. This can enable rapid identification of areas of low data quality and reliability and increase the incentives for monitors to do a good job.

Most programme monitoring systems count the number of toilets, with increasing efforts to differentiate the type of toilet, the toilet condition and hygiene, and whether or not a handwashing facility is available. Where the national ODF criteria include specific toilet criteria, such as the requirement for flyproof latrines in Madagascar or for improved latrines in Tanzania (ODF level 1), additional toilet criteria such as presence of a lid, presence of ash, presence of an easily cleaned slab or latrine floor, are also monitored.

Data on toilet type, quality and other sanitation and hygiene outcomes over time will be important to evaluate the durability, hygiene and sustainability of different technology types and sanitation behaviours. Without these data, it is hard to assess whether simple technologies, such as pit latrines with mud-covered wooden slabs, continue to provide safe containment over time (where users are convinced of their benefits, and are able to maintain, improve and replace facilities) or whether more durable and easily cleaned slab materials are required as suggested by WHO Guidelines (WHO, 2018) and the JMP definitions (UNICEF & WHO, 2018).

More detailed monitoring indicators (and reported data) would also encourage attention to related policy and practice issues. The JMP does not monitor the presence or use of drop hole lids because the benefits are assumed to be derived from a tight-fitting lid being in place at all times (thus preventing fly entry). This is difficult to determine without observation of the sanitation facility, however, which is not undertaken in most nationally representative household surveys. Closer and more reliable programme monitoring of this feature could be used to encourage (and evidence) the routine use of tight-fitting lids, and to evaluate any benefits that arise from this practice as well as other similar improvements and practices— such as waterproof roofs on pit latrines to protect and extend the life of mud-covered slabs.

Most GSF-supported programmes monitor some aspects of the toilet type and quality, particularly where these features are included in the criteria for verification of ODF status. However, the study confirmed that none of the programmes currently collect enough data for detailed assessment of access to basic sanitation or use of safely managed sanitation services.[83]

83 For example, toilets are usually classified as improved or unimproved facilities, but the criteria used for this classification are not usually reported, thus data cannot be verified, nor can toilets be re-classified.

3.4.2 Monitoring the use of safely managed sanitation services

None of the GSF-supported programmes currently have sufficiently detailed monitoring systems (with relevant SMSS indicators) to allow them to assess whether households have access to safely managed sanitation services (SMSS).

A few GSF-supported programmes monitor the use of flyproof toilets but there is no systematic monitoring of whether toilets provide safe containment of excreta. The individual criteria used to assess whether the toilets are flyproof are also not reported separately, which makes it difficult to check these assessments. Furthermore, no data were available on outflows from toilet containment systems (or the disposal of these outflows). In addition, no data were available on proximity to groundwater tables or water points, hydraulic gradient, soil type, or sanitation facility density, thus no assessment of groundwater vulnerability was possible.

Other than on the five GSF outcome surveys, no reliable monitoring data were available on the number and position of latrine pits (e.g. whether single offset, single direct, or twin pits); on the size, volume or depth of latrine pits (or tanks); or on the type of containment (e.g. leach pit, sealed tank with effluent outlet, sealed tank with no outlet). While the GSF outcome surveys may become part of a regular monitoring and evaluation process, the study confirmed that most programmes had few toilet data available.

Importantly, no routine monitoring data were available on the number of latrine pits that have filled up, or on what happens when these pits fill (although some data on pit emptying were available from the five GSF outcome surveys). Furthermore, no GSF monitoring data were available on the practices of service providers that empty pits, such as whether they wear and use personal protective equipment or enter pits or tanks during emptying; or on faecal sludge disposal practices (e.g. onsite, or transportation offsite for treatment, disposal or use).

3.4.3 Improved monitoring of SMSS

The 2018 update of the JMP "Core Questions on Water, Sanitation and Hygiene for Household Surveys" (UNICEF & WHO, 2018) includes revised and additional core questions on sanitation (to be included in all national household surveys to facilitate monitoring of progress towards the SDG targets on household sanitation), as well as "expanded questions" ("XS") which can be used in conjunction with the core questions to collect additional information on specific aspects of household sanitation services.

The JMP collects data from nationally representative household surveys conducted by third parties (e.g. national statistical bodies responsible for censuses, and other national surveys processes such as MICS, DHS, and LSMS). All of these surveys are multi-sector household surveys in which the sanitation and hygiene module comprises only one small part of a large survey instrument. This means that questions on sanitation and hygiene have to be kept to a minimum. The national surveys collect data largely through household interviews, thus almost all data is self-reported. Efforts to include observation of household sanitation outcomes in these national surveys have been unsuccessful thus far. Therefore, under the current system safely managed on-site sanitation services have to be assessed based on enumerator interpretation of household responses to survey questions.

As a result, the JMP questions currently focus on issues on which the household can reliably respond and include only a few core questions. In addition, given the propensity for household respondents to over-report good behaviour, and the limited knowledge or awareness of most households (and enumerators) on safely managed sanitation issues, there is a risk that any SMSS assessment based only on household responses is unreliable.

It is difficult to assess household sanitation outcomes (e.g. condition of user interface and containment) without observation of the facility, containment system and surrounding area. Effective household surveys, such as those implemented by the SNV SSH4A programme, include detailed household interview questions on safe containment, as well as observation of the household sanitation outcomes. Observed outcomes take precedence over the reported outcomes where there is any significant difference.

Routine sanitation monitoring systems face a similar dilemma to the JMP challenge in monitoring global SMSS progress. As noted earlier, most national monitoring systems limit the number of sanitation and hygiene indicators included, and there is often a reluctance for government systems to adopt new technologies (such as smartphone monitoring) that are unfamiliar and often operated by international private or non-government organisations.

SMSS monitoring in Cambodia

The Royal Government of Cambodia has been developing a WASH Management Information System (MIS) for several years. Following an unsuccessful effort to introduce smartphone monitoring several years ago, the government preferred to develop a simple Excel-based MIS that can be expanded and improved over time.

After considerable discussion, 32 core MIS indicators have been agreed, with 13 detailed indicators for access to sanitation. The core indicators are largely process indicators related to governance (staffing levels, budgets, meetings held, reporting, guidelines developed, devolved functions, data collection), with five detailed indicators on sanitation outcomes:

3.1: Percentage of poor households with access to basic sanitation services.
3.2: Percentage of households in challenging environments with access to basic sanitation services.
3.3: Number of ODF villages.
3.6: Number of ODF villages that sustain status for at least three years.
3.9: Percentage of households using safely managed sanitation services.

The last indicator is obviously pertinent to SMSS but monitoring of more detailed and specific indicators across the sanitation service chain (eg. surveys of service providers) will be required in order to assess SMSS. Fortunately, the WASH sector is well coordinated in Cambodia, and a Rural FSM Technical Team has been established within the Rural Sanitation and Hygiene Working Group to develop guidelines on rural FSM and develop more detailed monitoring instruments.

In 2018, the Rural FSM Technical Team reviewed a number of FSM surveys undertaken by sanitation stakeholders in Cambodia over the last few years and used this review to develop a comprehensive rural FSM survey questionnaire that could be used by all stakeholders to assess SMSS. The original intention was that all of the large-scale rural sanitation programmes would run the new FSM survey in their programme areas, and the combined dataset would enable sub-national estimates of SMSS progress and identification of key issues to address and regulate.

Unfortunately, only iDE Cambodia implemented the new FSM survey (completed using smartphone survey software in iDE programme areas in late 2019). Neither the government nor the other external support agencies (including Plan International Cambodia, the executing agency for the GSF Cambodia programme) were able to find the budget or capacity to implement the survey.

Consequently, little progress has been made in any national assessment of SMSS despite the availability of a well-designed rural FSM survey, awareness of the high level of unsafely managed sanitation services in rural Cambodia, good sector coordination and sector agreement to monitor households using safely managed sanitation services.

National monitoring systems are slow to adopt new approaches and new indicators. Progressive programmes (and sub-national governments) first have to test and develop the monitoring systems; demonstrate that they can be implemented (cost effectively) across large programme areas; and work with local partners to institutionalise the new systems and indicators. National authorities are more receptive to new approaches and new indicators once they have seen them in action and understand the value that they can add to large-scale sanitation development. Therefore, programming should include the explicit objective to develop SMSS monitoring systems suitable for long-term adoption by the national government and its local partners.

JMP indicators of SMSS

The JMP now requires the following core questions on emptying in all surveys (UNICEF & WHO, 2018):

- Has your (pit latrine or septic tank) ever been emptied? (S4)
- The last time it was emptied, where were the contents emptied to?
- [Possible responses: 1. Removed by a service provider: to a treatment plant; 2. Service provider: buried in a covered pit; 3. Service provider: to don’t know where; 4. Emptied by household: buried in a covered pit; 5. Household: to uncovered pit, open ground, water body or elsewhere; 6. Other (specify); 8. Don’t know.] (S5)

In addition, the following “expanded questions” on intra-household toilet use, containment and emptying are recommended:

- Do all household members usually use the sanitation facility? (XS2, follows S1)
- Is everyone in the household able to access and use the toilet at all times of the day and night? (XS3, follows S1)
- The last time [name of child] passed stools, what was done to dispose of the stools? (XS3, follows S1)
- Does your sanitation facility leak or overflow wastewater at any time of the year? (XS9, follows S1)

- Where does your septic tank discharge to?
- [Possible responses: 1. To a leach field or soak pit; 2. To a sewer; 3. To an open drain; 4. To open ground or watercourse; 5. Other (specify); 8. Don't know.] (XS10, follows S1)
- How many years ago was your pit latrine/septic tank last emptied? (XS12, follows S4)
- The last time your pit latrine/septic tank was emptied, who emptied it? (XS13, follows S5)
- How do you dispose of household water used for cooking, laundry and bathing? (XS15, follows S5)

The JMP classifies all improved sanitation facilities that have not yet been emptied as having "safe onsite disposal" (and therefore a safely managed sanitation service), regardless of the age, size, number of users or potential emptying practices. Only 50% of not-yet-emptied septic tanks are counted as safely managed (in recognition that a large proportion of these tanks have unsafe outflows or will not be safely emptied) (UNICEF & WHO, 2018). It is recommended that where evidence is available on typical sanitation management practices for the main categories of excreta flow (or sanitation technology), such evidence should be used to generate more credible SMSS estimates. For example, if data from household surveys in other areas of the GSF-supported programmes (or from other similar programmes) suggests that 30% of pour-flush latrines with single offset pits are unsafely emptied, then the SMSS assessment should recognise the risk that 30% of "not yet emptied" pour-flush latrines with single offset pits will be unsafely emptied in the future (and only adjust this figure when better data are available).

Toilet users rarely have reliable information about what happens to faecal sludge once it has been emptied. Thus, where formal sanitation services are utilised, separate surveys of service providers are required to assess what happens to faecal sludge emptied, handled, transported, treated or disposed by paid service providers (either manually or mechanically). This monitoring should inform estimates of the potential volume of faecal sludge to be managed by different services, which can then be used to plan the finance, development and support of any FSM services required in each setting. The WHO has developed draft questions for piloting in service-provider surveys (see Annex 7).

SNV indicators of SMSS

SNV recently published its SSH4A Performance Monitoring Framework (SNV, 2019), which details a number of household survey questions used to assess SMSS practices and outcomes in the SNV Sustainable Sanitation and Hygiene for All (SSH4A) programme[84] (See Annex 8).

These extensive SNV household surveys provide detailed information on every household surveyed (in a representative sample of the programme population). SNV then uses a protocol to assess "safe management of toilet contents" and classes each toilet according to a Level 0-4 indicator scale (from "no on-site containment" to "safe and timely emptying and disposal"). These household survey data allow SNV to assess the proportion of safely managed toilets in each programme area and identify areas and issues that need to be addressed by the programme. Where problems are found (e.g. significant proportions of toilets that are not safely managed), formative research is then used to understand the causes of the problem and identify potential solutions for SMSS.

84 The SNV SSH4A household surveys are sample surveys undertaken using Akvo smartphone software, usually at intervals of one year or less.

The SNV monitoring framework classifies sanitation facilities based on functionality, not on toilet technology type (as used by the JMP); and also examines use and maintenance; environmental safety (whether the toilet contaminates groundwater or the environment); menstrual hygiene management; and safely managed sanitation (replacement, emptying, transport, treatment, disposal and use). SNV has introduced additional monitoring indicators in the understanding that strengthening government-led monitoring takes time, and that more progressive indicators and systems need to be tested and used at scale in order to move towards safely managed sanitation services.

The use of smartphone monitoring (mostly based on the Akvo FLOW platform) has enabled SNV to bring down the resources and capacity required for regular household surveys, and enabled the SSH4A country programmes to conduct biannual household surveys in the initial programme phases (when feedback to the policy and programming was most critical) dropping to annual household surveys in the later phases of the programmes. The smartphone survey application automatically checks that survey responses are in the right format (before proceeding to the next question); applies skip codes; and requires critical information (e.g. photographs of the toilet) before the survey record can be completed. The smartphone survey data is then immediately uploaded (as soon as the enumerator has access to a mobile data network) to the online Akvo database that can be accessed from anywhere with an Internet connection. Data processing and cleaning requirements are greatly reduced. The survey data are available for immediate review and analysis, which enables rapid and low-cost use of these data (rather than previous paper-based surveys, which often took six months to process, clean, aggregate, analyse and report on).

The adoption of this new survey technology is neither difficult nor expensive, even in low-income countries, as most stakeholders are familiar and comfortable with mobile phone technology. SNV has successfully implemented smartphone household surveys in remote rural areas of its SSH4A programmes (e.g. South Sudan, the Amhara region of Ethiopia, and in remote mountain areas of Nepal), despite limited mobile data networks and other constraints associated with these remote areas. In the nine SNV SSH4A country programmes that were part of the 2014-2020 DFID WASH Payment by Results programme, these household surveys enabled SNV to identify specific areas with safe containment and faecal sludge management problems (e.g. terai areas of the SNV Nepal SSH4A project, where high groundwater tables and heavy rains led to frequent leaks and overflows from flooded pits, and where nearby water points were at risk of faecal contamination). Thereafter, formative research was conducted to identify practical solutions to these safe containment and safe management issues.

The GSF Togo programme, whose executing agency is UNICEF Togo, planned to introduce Akvo smartphone monitoring in 2019 (with support from the UNICEF Burkina Faso programme, which is already using Akvo smartphone monitoring).

Water quality monitoring

Water quality monitoring may be required where groundwater vulnerability to contamination from onsite sanitation is detected. Water quality monitoring can be undertaken through existing national systems, or through a household survey approach, such as the JMP-MICS methodology for water quality testing.

Denitrification of faecal sludge (e.g. through carbon-rich additives such as wood shavings or sawdust to increase the Carbon-Nitrogen ratio) should be considered where water quality testing suggests that nitrate contamination is prevalent.

4 Recommendations

The following recommendations are based on an analysis of the SMSS study findings:

4.1 Improve monitoring the use of safely managed sanitation services.

Improvements in the use of SMSS require information on current SMSS status and key issues in each programme context. Improved monitoring should be the first priority for all GSF-supported programmes.

The study has demonstrated that reliable monitoring of SMSS requires:

- Surveys that include observation of safe containment.
- Regular monitoring (as safe management can change over time).
- Data collection from households, service providers and local authorities (full-service chain).
- Internal checks and verification of monitoring data (to improve data quality and reliability).

Most national surveys are currently unable to assess SMSS reliably because no observation is included, and there are few questions on outflows from pits and tanks. Government systems for routine monitoring tend to be limited to only core indicators, with limited appetite or capacity to increase the indicators monitored.

Therefore, **investments should be made in developing, testing, improving and scaling up reliable SMSS monitoring systems.** The intention should be to develop and advocate for reliable systems that can later be adopted by government; and to use these improved data to identify unsafe sanitation services and trigger programme (and government) responses to improve these services. Other monitoring activities will also be required: surveys of service providers; and efforts to combine monitoring data along the service chain (e.g. data from households, service providers and local authorities) to make comprehensive SMSS assessments.

4.2 Collaborate with sector for national SMSS assessments.

Advocate for and support efforts to produce reliable national assessments of SMSS through:

- Coordination (alignment and harmonisation of SMSS monitoring systems),
- Finance (few agencies or programmes currently budget for SMSS monitoring),
- Capacity and system building, and
- Work to develop government systems for SMSS monitoring (over the long term).

Some agencies (e.g. SNV and iDE) have already developed good SMSS surveys. These good practices should be spread, incorporating them into policies, programming and practice; and encourage better SMSS monitoring. Importantly, the awareness of government (and other support agency) of the public health relevance of investment in SMSS monitoring, development of response mechanisms (to strengthen and support SMSS) and encourage local monitoring and regulation of SMSS.

4.3 Analyse SMSS challenges at national (or programme) level.

Use SMSS data to prepare Shit Flow Diagrams (including child excreta flows) for different contexts and settings, with identification of data gaps that can be used to strengthen monitoring systems in these areas. The SFDs should be used to identify critical unsafe excreta flows and inform both national and programme policy, programming and practice.

Where possible, pathogen flow estimates should be added to the excreta flows already included in the SFDs, so that the relative risk of the different excreta flows can be assessed, and high-risk services, practices, areas and populations can be identified and addressed.

4.4 Address unsafe excreta return before containment.

Prioritise interventions to address unsafe excreta return (including unsafe child excreta disposal) before excreta enters containment. Based on the GSF outcomes surveys, open defecation, unsafe toilet use (without containment), and unsafe child excreta disposal comprise up to a quarter of all excreta flows (and a higher proportion of pathogen flows, as 100% of pathogens are unsafely released into the environment):

- Open defecation accounts for up to 15% of unsafe excreta flows.
- Use of unsafe toilets without containment (e.g. hanging latrines, latrines that flush to the open) accounts for up to 8% of unsafe excreta flows.
- Unsafe child excreta disposal (and use of unsafely managed toilets by under-five children) accounts for up to 18% of unsafe excreta flows.

It is important to recognize that **up to one fifth of unsafe excreta flows (and a higher proportion of pathogen flows) relate to unsafe child excreta disposal** and should ensure that investments and sanitation programmes address this critical public health issue. Open defecation is now a less common practice in GSF-supported programme areas, thus more targeted efforts should be made to identify OD households and individuals, understand why they have not managed to achieve or sustain the use of improved sanitation facilities, and support them to build and use safely managed sanitation services.

4.5 Use non-market technical support to upgrade unimproved toilets

The study suggests that, in most of the GSF-supported programme contexts, safe containment and safe emptying practices are the critical differences between unimproved sanitation services and safely managed sanitation services. The study confirmed that even simple pit latrines with mud-covered slabs can provide safe user interfaces and safe containment if they are well maintained and pits are covered and replaced when full.

Where sanitation goods and services are available and affordable in local markets, these should be encouraged and further developed through approaches like Sanitation Marketing. However, where markets are not ensuring everyone can use safe sanitation services (for example, in remote areas where market goods and services are not yet prevalent or where goods and services in the market are out of reach for the poorest) non-market technical support provides a practical and immediate way to progress towards SMSS.

In the context of collective behaviour change interventions, non-market technical support includes community-based support systems using local materials and technical expertise to ensure new and upgraded toilets with safe containment, provision for safe management when containment systems are full, and—where necessary—more durable and easily cleaned toilet slabs. Additional support, including smart sanitation finance and institutional support mechanisms (e.g. monitoring and support to high-risk groups, appropriate changes in policy and programming), should be considered where some populations require more resilient or more accessible facilities.

4.6 Undertake groundwater vulnerability mapping.

Conduct macro-assessments to map groundwater (and water supply) vulnerability to contamination from on-site sanitation, using available data to:

- Identify areas with highly transmissive soils or fractured rock.
- Map areas with high groundwater tables (permanent or seasonal).
- Map areas with high density of sanitation facilities (with hazard leaks).
- Intensify monitoring of water quality, safe containment and safe management of sanitation services in these critical areas.

Where contamination problems are identified, consider whether alternative sources of water supply are available, and determine the most cost-effective and practical solution. Household surveys can also be used to identify unsafe containment (or other unsafe practices) that may contaminate groundwater, using standard protocols that can be run on survey databases.

4.7 Conduct formative research in critical areas.

Where solutions to unsafely managed sanitation services are not apparent, and problems are hard to solve, **consider targeted formative research** to identify context and historical factors that influence sanitation behaviours and practices; understand the drivers of unsafe management; and examine appropriate solutions in different contexts. The formative research should then be used to design interventions to improve SMSS.

4.8 Keep excreta in the ground.

Wherever possible, i.e. where space and groundwater conditions allow, **excreta should be stored and left in the ground to encourage pathogen die-off** and limit the risk of faecal exposure.

High risks are involved in the emptying, transport, treatment and disposal of faecal sludge, particularly in rural areas with limited formal services. In order to avoid these risks, excreta should be stored in the ground for as long as possible; and any liquid outflows should be disposed to leach fields or soakpits. (Where possible, communal leach fields should be considered where individual facilities are not feasible).

4.9 Bury fresh faecal sludge.

Where faecal sludge containing fresh excreta (or any excreta stored for less than two years) must be emptied, and suitable land is available, **encourage burying of faecal sludge in pits or trenches.**

Faecal sludge cannot usually be buried in congested urban areas, thus often has to be treated using expensive and complex technologies. In rural areas, where sufficient space for safe burial is often available, long-term storage in soil is generally the safest option:

- Dig pits or trenches close to the emptying site (in dry season, in an appropriate place away from water points and households; cover with soil and leave for at least four months before planting crops in this area).
- Use mechanical pumps (e.g. diaphragm pumps) and covered storage containers to minimise the risk of faecal exposure by sanitation workers.
- Ensure that households and/or sanitation workers use protective clothing and equipment.
- Ensure that households, sanitation workers and local authorities are aware of the health risks associated with handling fresh faecal sludge, and are trained in safe emptying, transport and disposal practices.
- Consider communal trenches (or pits) if they facilitate safe disposal.
- Promote alternating twin pit latrines where suitable space is available (particularly where this solution is likely to be cheaper and safer than emptying the pit).

4.10 Test communal emptying and disposal processes.

Test and promote collective emptying and disposal processes:

- Scheduled annual process in the dry season.
- Identify pits or tanks that need emptying.
- Dig communal trenches or pits for safe disposal in appropriate locations.
- Inform local service providers of potential demand for emptying services (and develop private services when required e.g. because none exist).
- Provide protective personal equipment and mechanical pumps.
- Monitor, regulate and supervise safe emptying, transport and disposal practices.

4.11 Raise household awareness of SMSS costs and requirements.

Make households aware of SMSS costs and requirements before investment in new or upgraded sanitation facilities:

- **Size requirements**: Large families may require bigger pits or tanks.
- **Emptying costs:** Alternating twin pit latrines may reduce emptying costs (and a second pit may be cheaper than the pit emptying cost).
- **Ease of emptying and replacement:** Toilet slabs, superstructures and containment systems should be designed for easy emptying or replacement.

National and local laws, regulations, monitoring and sanctions should be revised to strengthen household (and service provider) incentives to create and maintain safely managed sanitation services. Where households are aware that unsafe management is illegal, and will be detected and sanctioned, they are more likely to invest in safely managed sanitation services.

4.12 Determine strategies for challenging environments?

Safe management of sanitation services may be more difficult in challenging environments, such as flood-prone and high groundwater areas, floating and mobile communities, difficult physical conditions (e.g. collapsible or rocky soils). In these cases:

- Conduct targeted formative research on appropriate, low-cost local solutions for these specific environments.
- Introduce new technologies where required (raised facilities, sealed pits, floating treatment pods, container-based sanitation, pit linings from local materials).
- Consider sanitation finance (e.g. toilet subsidies) where disadvantaged populations face high sanitation costs (and high disease burden).
- Invest in close monitoring of safe management in potentially high-risk environments.

Develop specific strategies and approaches for SMSS in challenging environments and ensure that SMSS progress in these areas is carefully monitored (including progress among key disadvantaged groups in these areas).

4.13 Raise awareness of the risks of agricultural use of faecal sludge.

Raise awareness of the risks of direct application of faecal sludge to fields. After surface application of faecal sludge, attention should be paid to:

- Fruit or vegetables that grow on the ground are likely to be unsafe.
- Crops that are consumed unwashed are likely to be unsafe.
- Workers that apply sludge or work with crops are at risk of faecal exposure.
- Nearby populations are at risk due to surface runoff containing faecal pathogens.

Agricultural use of faecal sludge should trigger increased monitoring and regulation, including regular surveys of the practices of service providers, agricultural workers, and crop consumers; and testing of products associated with the use or disposal of faecal sludge (e.g. fertiliser from latrine pit humus, crops grown on land where faecal sludge has been applied) and of sanitation workers and crop consumers(who are at higher risk of infection).

4.14 Don't forget handwashing with soap.

Handwashing with soap at critical times blocks faecal exposure routes that will remain important for public health even when everyone is using safely managed sanitation services. The GSF outcome surveys confirmed that the practice of handwashing with soap at critical times was not common even when access to basic handwashing facilities is available, with particularly low practice associated with handwashing related to the care and feeding of young children.

Improved monitoring of handwashing, such as the composite handwashing measures used in the DFID WASH PbR programme (mention of handwashing at critical times + presence of facility with soap and water + ability to demonstrate handwashing with soap and water), and the use of structured observations (as in the GSF outcome surveys) provide stronger measures of handwashing practice at critical times that allow better evaluation of the effectiveness and sustainability of hygiene promotion. A mix of more frequent handwashing monitoring (e.g. through improved routine monitoring and regular household surveys) and more rigorous handwashing monitoring (through periodic structured observations) will be important to provide the regular feedback to policy and programming that is required to accelerate and sustain progress in the practice of handwashing with soap at critical times.

Improved latrine with a handwashing facility in Naivasha, Kenya. © Jason Florio

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Annex 2: Key informant interviews

WSSCC Secretariat

Name	Position
Elizabeth Wamera	Technical Expert on Water, Sanitation and Hygiene, Technical Support Unit
Patrick England	Knowledge Management & Innovation Support Officer, Technical Support Unit
Matteus van der Velden	Manager, Asia Regional Unit
Clara Rudholm	Manager, East and Southern Africa Unit
Simon Msukwa	Programme Officer, East and Southern Africa Unit
Hakim Hadjel	Manager, West and Central Africa Unit

Global sector informants

Name	Position	Organization
Jesse Shapiro	Environmental Health Team Lead, Senior WASH Advisor, and Sanitation Focal Point	Global Health Bureau, USAID
Pippa Scott	Partner and Principal Consultant in WASH	i-San
Prit Salian	Principal Consultant	i-San

GSF-supported programmes

Name	Position	Organization
Benin		
Yadjidé Adissoda Gbedo	Programme Manager	Medical Care Development International
Cambodia		
Rafael Catalla	Programme Manager	Plan International
H.E Chreay Pom	Director General Rural Affairs	Ministry of Rural Development
Dr. Chea Samnang	National Coordinator	Council for Agricultural and Rural Development
Ethiopia		
Mesfin Gebreyes	Programme Manager	UNOPS
Abireham Misganaw Ayalew	Team Leader, Basic Sanitation Services	FMOH
Amanuel Tafese Atomsa	Sanitation Expert	KPMG

Name	Position	Organization
Kenya		
Daniel Kurao	Programme Manager	Amref Health Africa
Okumu Nakitari	CPM Representative	Deloitte
Madagascar		
Rija Fanomeza	Programme Manager	Medical Care Development International (MCDI)
Nepal		
Sudha Shrestha	Programme Manager	UN-Habitat
Nigeria		
Nanpet Chuktu	Programme Manager	United Purpose
Kabiru Abass	WASH Technical Focal Point	PricewaterhouseCoopers
Priscilla Achakpa	National Coordinator	Women Environmental Programme
Senegal		
Adama Sy	Programme Manager	AGETIP
Tanzania		
Nelson Mmari	Programme Manager	Plan International
Lydia Mcharo	Acting Programme Manager	Plan International
Emmy Patroba	CPM WASH Consultant	Deloitte
Togo		
Fataou Salami	Programme Manager	UNICEF Togo
Uganda		
David Mukama	Programme Manager	Ministry of Health
Priscilla Nkwenge	Sanitation & Hygiene Specialist	Deloitte
Jane Nabunnya	National Coordinator	IRC WASH

Annex 3: SMSS online survey results

Introduction

The survey was available in English and French. The data has been analysed by language and reveals interesting similarities and differences.

Limitations of the online survey

The sample size was relatively small with 70 responses from the English survey (seven countries) and 15 responses from the French survey (four countries) for a total of 85 responses.

Country and agency representation (Q. 1 and 2)

The responses in English were from: Uganda 21; Nepal 19; Nigeria 13; Kenya 10; Cambodia 3; Ethiopia 2; and Tanzania 2.

The responses in French were from: Benin 10 and Madagascar 5.

The majority of the English survey replies were either from representatives of implementing partners (37) or from representatives of executing agencies (31). Only two were replies from representatives of programme coordinating mechanism organisations and none were from country programme monitors. Nearly half (48%) of the English survey replies were from NGOs (including local NGOs, International NGOs, CBOs and faith-based organisation), 39% were from national and local government departments and the balance (13%) were from representatives of UN-Habitat in Nepal.

The French survey responses were from the international executing agencies (7), implementing partners (6 in Benin), a consultant in Madagascar, and a local government partner (commune) in Benin.

Understanding of SMSS (Q. 5,6,7,8)

When asked “How clear is the concept of 'safely managed sanitation services'” 44% of the English survey respondents said that they were “very clear”, but a similar proportion (37%) said that they were only “somewhat clear”, suggesting that there is some doubt around the definition across the programmes. The French responses were similar with 47% responding “not clear” or “somewhat clear”, compared to 53% responding “very clear” or “completely clear”.

The survey asked respondents to “explain the difference between 'basic' and 'safely managed' sanitation services” This produced a wide range of responses, with many respondents identifying a ‘basic’ latrine as one of ‘low’ quality and a ‘safely managed’ latrine as one of a ‘higher’ quality. Many gave examples to illustrate this point, for instance for ‘basic’: “minimum services”, “one that may not guarantee separation of humans from excreta”, “simple toilet used in the household”, “availability of toilet and water supply”, “sanitation but with minimal health benefits”, “rudimentary aspects of sanitation”, “minimum accepted level”, “not ideal and convenient and are not durable”.

Typical ‘safely managed’ examples were: “increased privacy”, “more user-friendly”, “more advanced technologies/service”, “improved/civilized/developed/conformed sanitation services”, “fulfil all requirements of sanitation and hygiene”, “better health benefits in terms of disease control”, “satisfy all the required standards of a healthy environment”, “durable cleanable and sealable and convenient to use”, “clean latrine, free of flies and with hand-washing facility”, “no open defecation”, “quality standards looking at the community in its entirety”. But some confusion was also apparent, with some respondents suggesting that safely managed sanitation required equitable access for all, and others that this was for local committees to decide as there should be no “imposition of options”. Others noted that safely managed sanitation related to treatment of faecal waste, which has been common feedback throughout the study (with many respondents to both the online survey, and the telephone interviews, suggesting that safely managed sanitation requires faecal sludge management with vacuum tankers and treatment facilities).

When asked: “What would ‘safely managed sanitation services' look like in your own programme context?”, many again used examples: “washable floor slab”, “fly-proof”, “with handwashing facility”, and “double pit with composting”. Overall, only around 25% of the replies provided a response that was in line with or roughly in line with the SDG 6.2.1 definition for SMSS.

However, a higher proportion of English respondents were either very confident (36%) or somewhat confident (40%) that “the programme is adequately addressing safely managed sanitation services” (SMSS), with the balance (24%) being “not so confident” or not confident at all”. Only 27% of French respondents felt extremely or very confident that their programme was adequately addressing SMSS, with the remaining 73% reporting that they were “somewhat confident”, or “not confident at all”.

Government understanding of SMSS (Q. 25, 26, 27)

While the survey respondents expressed a reasonable degree of confidence in their knowledge of SMSS, less than a third “felt that the local government and other partners .... have a good understanding on what 'safely managed sanitation services' means” or that “local government and other partners are prioritizing the promotion of safely managed sanitation services”. When asked if they were “aware of any government criteria for assessing how many people/communities are using safely managed sanitation services”, only 10% of French and 40% of English respondents knew of any activity, and many of these cited examples in relation to monitoring ODF compliance or a general reference to the use of sanitation surveys (i.e. not specific to SMSS).

Monitoring and reporting on SMSS (Q. 9, 10, 11)

Nearly three quarters of the English survey replies stated that on their programme they "actively monitor and report on safely managed sanitation results indicators and activities". However, in line with the earlier responses on definitions, many gave examples relating to monitoring progress towards achieving ODF and improved latrine targets, rather than monitoring related to SMSS. In contrast, only five responses specifically mentioned that they monitored households or communities practicing 'emptying, transport, treatment and end-use/disposal', or 'safe disposal on-site'.

Just over 50% of the survey respondents confirmed that in their opinion "nearly everyone" or "most people" on their programmes "are using improved latrines/toilets (i.e. basic sanitation services)", compared to a smaller percentage 19%–33% who thought that "nearly everyone" or "most people" on their programmes "are using safely managed sanitation services".

Context (Q. 4, 12)

Respondents confirmed that the most common contexts in which the GSF programmes operate are settings where there are "high levels of poverty" (81%–100%); "rocky soils" (73% in French responses); "communities that are difficult to travel to" (66%); "flood-prone areas" (53%–64%); and "collapsible or clay soils" (53%).

In contrast, the least common contexts are settings where there is "low land availability/unclear property rights" (20%–23%); "refugees/internally displaced persons" (0%–26%); and "high population densities (i.e. urban environments)" (13%–30%).

The English survey respondents confirmed that on the two Asian GSF programmes "water seal" household toilets are the most commonly used types. Whereas dry "pit latrines" are the most common in the seven African GSF programmes (for which responses were received), with more respondents of the opinion that pit latrines with a "squat-hole cover and a slab with no holes" are more common than pit latrines without these features (i.e. no squat-cover and holes in floor).

What happens when full (Q. 16, 17, 18)

In the two Asian programmes, over half of the respondents reported that the most common method of managing a full pit is to empty it re-use the same facility. However, the replies indicated that this activity is rarely done safely, as over three quarters of respondents reported that "emptied waste" is most commonly emptied to "an uncovered pit, open ground/field, water body, or elsewhere", with two-thirds of respondents agreeing that "someone had to enter the pit during emptying" but only a third of respondents were of the opinion that "people wear protective equipment or clothing".

In the seven African GSF programmes, the majority of respondents reported that the most common method of managing a full pit is to close and cover it over, dig a new pit and construct a new toilet over it.

Barriers households face in achieving UBS and SMSS (Q. 22)

Two thirds of the respondents identified “affordability” as the “biggest barrier for people who may be the most disadvantaged to upgrade/relocate their latrines, or access emptying services”. Availability of services was reportedly the next biggest barrier for anglophone respondents; whereas the francophone respondents reported that mental and physical disabilities were the second biggest barrier for households.

Biggest gaps an organisation faces in promoting SMSS (Q. 28)

In the seven anglophone GSF programmes, “low prioritization by the programme” and a “lack of understanding on the concept” were most commonly cited by respondents as the biggest gaps that organisations face in promoting SMSS. “Inadequate monitoring systems” and “awareness of programming approaches” were chosen by respondents as the least common problems. The priorities were slightly different in the francophone responses: with the main barriers being a “lack of clearly established definitions and criteria” and a “lack of appropriate capacity and skills by partners and staff”.

Support most requested from GSF (Q. 29)

Across the nine countries that responded, the most common type of support requested by the respondents were learning exchanges, training workshops, field manuals, and monitoring criteria and guidelines from WSSCC/GSF (and government). The least favoured options were case studies from other programmes, a visual compendium, and webinars.

Annex 4:
Enabling Environments for GSF programmes

Box 1: Total Sanitation status in Nepal

A two-stage sanitation development process has been adopted in Nepal, with verified ODF communities then striving to become Total Sanitation communities. However, the 2017 Nepal Total Sanitation Guidelines state that achievement of Total Sanitation status will be broken down into two phases:

1. Clean and Hygienic Area (selected criteria)

- Proper use of toilet (toilets built in all households, institutions and public places; toilets safe and clean with soap and water available; faeces not visible in open spaces; children's faeces safely disposed; user-friendly institutional and public toilets)
- Personal hygiene (handwashing stations with soap and water in all households, schools, institutions and public toilets; awareness of personal hygiene, including menstrual hygiene management)
- Access to and use of safe water
- Safe food hygiene
- Household and institutional sanitation (clean inside and out; safe disposal of sanitary napkins; solid waste management; animal excreta management)
- Environmental sanitation (appropriate sanitation technologies for solid and liquid waste management; appropriate faecal sludge management (FSM); sanitary landfills; and wastewater treatment systems)

2. Total Sanitation Oriented Area (selected criteria)

- User-friendly toilets have been built.
- Faecal sludge will be discharged through sewerage systems and disposed in a designated safe disposal site, with emphasis on the reuse of products.
- Water quality of rivers, ponds and reservoirs has been maintained.

Basic sanitation service: definitions[85]

The study found that each GSF programme had adopted their respective national definitions for an improved sanitation facility and that these generally align with the sanitation classifications used by the JMP. Importantly, the 2018 update of the JMP core questions on WASH household surveys (WHO, 2019) includes some revised monitoring definitions for sanitation facilities, notably “pit latrines with slabs ... constructed from materials that are durable and easy to clean (e.g. concrete, bricks, stone, fiberglass, metal, wooden planks or durable plastic) should be counted as improved” and “slabs made of durable materials that are covered with a smooth layer of mortar, clay or mud should also be counted as improved”. However, “pit latrines with slabs … constructed from materials that are not durable and easy to clean (e.g. sticks, logs or bamboo) should be classified as ‘pit latrine without slab’ and counted as ‘unimproved’, even if they are covered with a smooth layer of mortar, clay or mud.”

The JMP does not require that pit latrines be flyproof in order to be classified as an improved sanitation facility. For instance, the revised JMP monitoring definitions note that “some latrines have tight-fitting lids to cover the drop hole when not in use, but such lids are not part of the definition of improved sanitation facilities”.

As a result of these new JMP-monitoring definitions, a significant number of toilets with mud-covered slabs (and even some with cement mortar-covered slabs) that were previously classified as ‘improved sanitation facilities’ may now have to be re-classified as ‘unimproved sanitation facilities’ (which are not counted as providing access to basic sanitation services). Conversely, the GSF focus on the promotion and monitoring of flyproof latrines suggests that many of the sanitation facilities found in GSF programme areas may provide a higher level of service than JMP access to basic sanitation.

Safely managed sanitation service definitions

The desk reviews found only one country with a written definition for SMSS, and none of the GSF programme documents contained a definition of SMSS. Nevertheless, all GSF programme respondents were aware of the SDG 6.2.1 SMSS target, and most were able to provide a reasonable definition of safely managed sanitation services, indicating general understanding of the concept.

However, there were some questions about the relevance and application of this concept in rural areas. For instance, many respondents to the online survey and telephone interviewees suggested that these services relate to faecal sludge management, with service providers required to empty and transport faecal sludge to treatment plants or disposal sites. A few respondents noted that SMSS also includes safe containment of excreta, and that a household using a private pit latrine with slab that is closed and replaced when the pit is full should be counted as a household using safely managed sanitation service.

85 In interviews, respondents often used the term “basic” to describe a poor-quality or unimproved toilet, as opposed to describing an improved toilet that meets the JMP definition of providing access to a “basic” sanitation service. This is not surprising considering how recently the sanitation monitoring ladders have been adjusted in line with SDG 6.2.1, in line with national documents that predate the revised SDG sanitation ladders. For instance, the first level of the Tanzania ODF verification criteria (ODF Level 2) requires that all households have access to “basic” sanitation, while the second level (ODF Level 1) requires that all households have access to “improved” latrines.

In Kenya, the definition of basic sanitation given in the glossary of the National ODF Kenya 2020 Campaign Framework (MoH, 2016) has been extended to include the requirement that "… excreta is only considered to be safely managed where it is safely transported to a designated disposal/ treatment site, or treated on-site before being re-used or returned to the environment." What form this can take, or any other details, are not provided or explained.

The review also looked at other definitions and approaches used in the sector to estimate SMSS. For example, the Shit Flow Diagram (SFD) process (SuSanA, 2018) is used for rapid assessments of excreta flows in towns and cities using a graphical representation. The SFD analysis uses the sanitation chain to track excreta flows from the point of production (containment), through emptying, transport and treatment, up to the point of end use or disposal. It is based on the idea that excreta flows are either 'safe' or 'unsafe', with safety assessed by whether the hazard (pathogens in the excreta) are likely to enter the environment at each point along the sanitation chain and if human exposure to that hazard at that point is also likely to result in a significant public health risk. It is therefore similar to the JMP methodology but includes additional data points on potentially hazardous events (e.g. it includes an assessment of the risk of pollution of groundwater used for drinking, and an assessment of the performance of offsite treatment facilities) and therefore provides a more nuanced assessment of safely managed services.

Sanitation targets

National targets for ODF:

- Madagascar and Nepal: ODF by 2019
- Ethiopia: 82% of kebeles ODF by 2020
- Kenya: 2020[86] (current status: 20% villages certified ODF)
- Nigeria: 2025 (current status: 1% villages certified ODF)
- Other seven GSF countries: ODF in 2030 (based on SDGs)

There is less clarity on targets for access to basic sanitation services—although respondents were aware that the SDG goal is for universal access to basic sanitation (UBS) by 2030.

- Ethiopia: 82% of households with access to improved sanitation and handwashing facilities by 2020
- Tanzania: increase access to improved sanitation to 95% by 2025.
- Uganda: Uganda Vision 2040 confirms target of UBS by 2030

86 Kenya ODF date originally set for 2013.

Annex 5: National ODF Definitions

Country	ODF Criteria
Benin National Strategy Document for the Promotion of Basic Hygiene and Sanitation	• All OD areas are cleaned • Each household has access to a fly-proof hygienic latrine • All hygienic latrines are used and well maintained • Each latrine is equipped with a handwashing facility with soap/ash with proof of use While not specified in the strategy document, a 'clean environment' is taken into consideration by the Ministry as part of the ODF criteria: the compound and areas around water points are clean (no rubbish, swept, weeds removed).
Cambodia National Guidelines on ODF Verification, 2013	• No defecation in the open, including children's faeces. Dig and bury is considered an OD practice. • 100% of people do not defecate in the open and at least 85% of people have access to a functional improved latrine (pour flush). The remaining 15% can either share or use unimproved (dry-pit) latrines. • Community has formulated and enforces informal or formal actions against open defecation
Ethiopia (Community-led Total Sanitation and Hygiene Implementation and Verification Guide)	ODF Level 1 • 100% of latrines are in use • Latrines have a squat hole cover • Latrines have a superstructure • All institutions have gender friendly latrine • Latrines have been constructed for use of travellers and in public gathering areas and are in use • No trace of open defecation ODF Level 2 • All the above • Each latrine has a hand-washing facilities are on working order and have water and soap or a soap substitute • Household safe water handling • Existing water sources are well protected from potential contamination by livestock and others, with good drainage

Country	ODF Criteria
Kenya National ODF Certification Guidelines; ODF 2020 Campaign Roadmap	• No defecation in the open (including in latrines) • Everyone must have access to a latrine (owned or shared) • All latrines must be fly-proof (tight fitting hole covers if not VIP) • Latrine floors must be free of faeces and urine • Superstructures provides privacy • All households have a handwashing facility near latrine with soap/ ash and water • Evidence of use of latrines by household members (footpath leading to the toilet) Other environmental hygiene components such as compost pits, clothing lines, dish racks, and safe water storage are also considered. While not part of the core ODF criteria, the verification team will take these components into consideration with the community so that they are addressed in a timely manner.
Madagascar (National guidance document pending)	• All open defecation areas are cleaned and/or transformed • All latrines are "flyproof" • Every latrine is equipped with a hand-washing device with soap/ash
Nepal Sanitation and Hygiene Master Plan, 2011	• There is no OD in the designated area at any given time; • All households have access to improved sanitation facilities (toilets) with full use, operation and maintenance; and • All the schools, institutions or offices within the designated areas must have toilet facilities • In addition, the following aspects should be encouraged along with ODF declaration process: • Availability of soap and soap case for hand washing in all households; and • General environmental cleanliness including management of animal, solid and liquid wastes is prevalent in the designated area.
Nigeria Protocol for certification and verification of ODF and total sanitation communities	• No defecation in the open • All households have a latrine, which are maintained and have evidence of use (path to latrine, ash is used in the pit) • All latrines are fly-proof • All anal cleansing materials are disposed in the pit • Hand-washing materials are available in or near the latrines with soap/ash • Latrines not close to groundwater drinking sources (30 meters) • Schools, market places, and health centres have latrines and handwashing facilities (separate facilities for boys and girls in schools)
Senegal (no official government CLTS strategy at the present time?)	• No defecation in the open • Each household has a latrine which is consistently used by the household (no sharing) • Each latrine has a handwashing station (with soap?) • The community environment, including water points, are clean

Country	ODF Criteria
Tanzania National Guidelines for Verification and certification of ODF Communities, 2016	ODF Level 2 • All households have access to basic sanitation • All institutions e.g. schools churches, mosques, health facilities, market places have improved and properly managed sanitation and hygiene facilities • No signs of OD around farmlands, bushes, water points, valleys, play fields, rivers, around water sources etc ODF Level 1 • All the above plus • All households have access to improved latrines • All households have functional hand washing points next to the latrine with soap • Existence of clear strategy to ensure ODF status is sustained e.g. enforcement of by-laws, close and regular follow up support • Clear commitments by community for maintaining ODF status
Togo Politique nationale d'hygiéne et d'assanissement 2016 et le PANSEA 2016)	• 100% of the concessions has and uses the latrine (sharing is not accepted outside of the compound) • Each latrine is equipped with a handwashing facilities and water plus soap/ash • All latrines have ash to remove odor and keep flies away • Each latrine slab has a cover • 100% of old OD sites are destroyed (No open defecation site in the community) • Schools, health centres, market places, and places of worship have latrines that are in use • No trace of OD around the concessions or in the village Total sanitation post ODF situation: Integration of other aspects of hygiene and sanitation: • Waste water management • Waste household management
Uganda Not aware of any national guidance document	• No defecation in the open • Latrines are fly-proof • Handwashing stations are located next to latrines with soap/ash

Annex 6: Lifespan of latrine pits

The GSF-supported programme managers provided estimates of typical latrine pit sizes (in different contexts), which were used to estimate how long it would take a typical latrine pit to fill. The faecal sludge accumulation rate was assumed to be 40-60 litres per person per year (see below). No allowance was made for the addition of degradable (or non-degradable) solid waste[87], as no data were available on solid waste addition (or on sludge accumulation rates). The pit-filling times in the table below illustrate the effect that different pit volumes and household sizes can have on pit-filling times (rather than to provide reliable estimates for each country programme).

Pit-filling times (based on GSF estimates of typical latrine pit sizes)

Country programme	Household size (# individuals)	Typical pit volume[88] (m3)	Typical pit-filling time (years)
Madagascar	5-8	3.0	6-15
Senegal	10	9.8	16-24
Nepal	5-8	0.7-1.4	1.5-7.0
Cambodia	5	0.76	2.5-3.8
Uganda	6	2.6-4.3	7-18
Ethiopia	5	1.6-2.4	5-8
Nigeria	5	2.3–4.0	7.5-20
Tanzania	5	2.2	7-11
Togo	5-6	1.7	5-8
Kenya	5	2.2	7-11
Benin	6	1.3	3.6-5.4

The estimates of pit filling times, which range from 1.5 years in Nepal up to 20+ years in Nigeria and Senegal, confirm significant differences in the potential FSM requirements associated with the sanitation technologies found in each country programme. In some cases, the pit is closed and replaced when full; in others the pit is emptied (either immediately so that it can be re-used, or after several years while a second 'alternate' pit fills).

87 The addition to the pit of non-degradable solid waste can double the sludge accumulation rate. Different types (and volumes) of anal cleansing material that are added to the pit may also affect the sludge accumulation rate.

88 These estimates are very approximate, and do not allow for 30cm space at the top of the pit (depth should usually be reduced by 30cm to allow for level of pipe entry, and soil to cover and close pit when full).

In Senegal, households build large pits (2.5m diameter and 2.0m deep) which, despite an above-average rural household size of 10 people, may take 20 years to fill. Large pits were also reported in Nigeria, where some households invest in pour-flush latrines with permanent superstructures and build as large a pit as they can afford to reduce the need to replace or empty the facility. And in Uganda, national guidelines stipulate that pits will be a minimum of 5 m deep and can therefore also take up to 20 years to fill.

In contrast, the small concrete ring-lined pits in Nepal and Cambodia, which are often only 0.9 m in diameter, were estimated to take just 1.5-2.5 years to fill. A household survey conducted by iDE Cambodia (iDE, 2018) between 2015 and 2017 (3,720 households surveyed in 7 provinces) found that 88% of households had only one latrine pit, and 16%–18% of households had emptied their pit at some point.

Pit-filling time is influenced by:

- **number of people using the latrine:** large households and shared use latrines will require larger volume pits to avoid filling up quickly,
- **pit lining:** whether sealed or open, whether liquids can leach into soil,
- **groundwater level:** high groundwater level can create anaerobic conditions, and limit leaching of liquids into soil,
- **permeability of soil surrounding the pit:** low permeability soils like clay will limit leaching of liquids into soil,
- **volume of water flushed into pit:** due to anal cleansing, toilet cleaning and disposal of other wastewater into the pit,
- **volume of solids added to the pit:** ash and sawdust added to reduce smell and fly nuisance; solid anal cleansing materials; solid waste disposed to pit,
- **climate:** hot temperatures usually increase degradation rate and lengthen filling time, and
- **diet:** amount of fibre in diet can influence pit filling time.

Pit-filling rates are highly variable by context and population, due to the large number of variables listed above. Most studies of rural pit latrines suggest that sludge accumulation rates average 40-60 litres per person per year, with wet pits generally found to have lower accumulation rates (due to the faster degradation under anaerobic conditions) and dry pits to have higher accumulation rates. Where solids are regularly added to the pit, filling times may reduce by 33% (for biodegradable solids) to 50% (for non-biodegradable solids).

Some studies have reported much higher latrine-pit-filling rates (up to 300 litres per person per year) but these data are from urban latrines, with large household populations (more than 20 people) using facilities with limited leaching potential, and high water inflows into the pit, all of which reduce the chances of any degradation of the pit contents and significantly reduce the pit-filling time. Dry pit latrines containing consolidated faecal sludge are difficult to empty completely, and these latrine pits appear to fill more quickly over time because each emptying leaves a progressively larger volume of consolidated and hard-to-remove sludge in the bottom of the pit.

The GSF Madagascar programme encourages the regular addition of wood ash to the latrine pit after use. The programme manager suggested that the addition of ash assists the decomposition process (through provision of carbon to increase the carbon-nitrogen ratio and assist the degradation process) and extends the pit-filling time (pits where ash was not added to faecal sludge were thought to fill more quickly than pits with regular addition of ash).

While the science of the decomposition of faecal sludge is complex, with many different variables that affect rate of decomposition, most research suggests that wood ash (in sufficient quantities) is a desiccant that raises the pH of the pit contents and, as a result, slows the natural composting process.[89] While the higher pH is beneficial for pathogen elimination, as a pH above 10.0 is sufficient to kill most pathogens (with the exception of Ascaris eggs which require a pH of 12.0 or above), it seems likely that substantial ash addition to pit latrines is likely to slow degradation rates and reduce pit-filling times. However, the addition of wood ash is beneficial because it increases the carbon content (although the addition of wood shavings is even more effective); helps to dry the pit contents (increasing aerobic potential); and diminishes fly and smell nuisance that are often significant factors in long-term latrine use and user satisfaction.

89 Desiccation (through wood-ash addition) reduces a moisture content below 40%, which is too low to allow biological growth and conservation of heat to reach thermophilic temperatures that encourage aerobic compost microorganisms to feed on organic matter and cause decomposition. Oxygen levels (e.g. through aeration of the compost pile) and carbon-nitrogen ratios are also critical to this process.

Annex 7:
Toilet type definitions used in Tanzania

In Tanzania, the National Guidelines for Verification and Certification of ODF Communities (MoHCDGEC, 2016) include five latrine types:

- Type A : Traditional pit latrine (TPL)
- Type B: Improved traditional pit latrine (ITPL)
- Type C: Ventilated improved pit latrine (VIP)
- Type D: Pour-flush/flush (with water seal)
- Type E: Ecological sanitation

Photographs of examples of these latrine types are included in the table below along with the Swahili name in parentheses.

Latrine type (Aina ya choo)	Example of toilet type (Picha za Vyoo)
Type A: Traditional pit latrine (Choo cha asili)	  
Type B: Improved Traditional pit latrine (Choo cha asili kilichoboreshwa)	  
Type C VIP- ventilated improved pit latrine (Choo chenye bomba la hewa)	 

Latrine type (Aina ya choo)	Example of toilet type (Picha za Vyoo)
Type D Pour-flush latrine (Choo cha maji)	
Type E Ecological sanitation (Choo cha Ikolojia)	

Type A toilets (traditional pit latrines) are defined as unimproved latrines. The latter are typically characterised by one or more of the following attributes: no floor slab, or a non-washable floor slab, no door, or a door and walls that do not afford the user privacy, and no roof. The definition of terms provided in the MoHCDGEC, 2016 guideline indicates that Types B to E are considered "improved latrines", in that they will have "a washable floor, walls and door for privacy, a roof and the potential to safely contain faecal matter from contact with human being." Importantly, any Type D toilet (pour-flush/flush) that does not have a water seal is considered to be a Type B toilet. The Usafi wa Mazingira Tanzania (UMATA) programme follows the national guidelines and therefore uses the same Type A to Type E classification system, and the same definition for an improved toilet. The photographic examples of each toilet type (see above) are used by the UMATA programme to help classify toilets. In line with the national guidelines, UMATA also collects data on a number of other features that help to determine the quality of the facility (e.g. whether shared or not, if floor is washable, and presence of walls, roof, door and handwashing facility). However, the pit type (single or twin) and presence of any lining is not monitored and, despite the fact that many of the toilets are known to be offset-pit toilets, the pit location (direct or offset) is not monitored. Monitoring these features would help improve understanding of household sanitation preferences and enable strategies to be developed for supporting households. For instance, monitoring the number of pits that are lined would help when estimating the current demand for emptying as only these pit types are routinely emptied. And, while the current situation suggests that demand is low (e.g. routine monitoring data shows only 1% with pour-flush latrines), as urbanisation increases it is not unreasonable to expect that the demand for emptying will also increase.

Annex 8:
WHO draft service provider surveys

Below is a list of WHO draft questions for piloting emptying and transport (E&T) service provider surveys:

- ET1. What is your employment status (self-employed, company owner, employee)?
- ET6. How many other E&T service providers working in the same areas?
- ET7. What sort of toilet facilities do you empty?
- ET8. What type of equipment do you use for emptying?
- ET9. What type of equipment do you use for transport?
- ET10. When emptying and/or transporting the faecal sludge, do you [or your colleagues or employees] wear any special clothes or equipment?
- ET11. What special clothes or equipment is worn? [Selection options: 1. Gloves; 2. Boots; 3. Masks; 4. Overalls; 5. Others (specify); 8. Don’t know.]
- ET12. On average, how many septic tanks, pit latrines and other systems do you empty per day/week/month?
- ET13. Do you discharge each [truck/vacutug/cart] load to the same location?
- ET14. How many different sites or locations do you visit and discharge loads?
- ET15. Do you visit one site or location more than others?
- ET17. Do you keep a record of all household emptying and transport activities?

Annex 9:
SNV SSH4A survey questions

Sanitation (SAN) Survey Module

- SAN3 (Ask and observe): What type of toilet is it? Can you show it to me?
- SAN3A (Ask and observe): Where do the faeces go? Options: to street, field, open; pond; latrine pit, tank, sewer.
- SAN4 (Ask and observe): Can rats reach the faeces in any way?
- SAN5 (Ask and observe): Does the toilet pan or slab allow flies to go in and out of the pit?
- SAN5A (Ask and observe): Is the toilet slab washable and/or cleanable?
- SAN6 (ask and observe): Is the tank/pit above ground?
- SAN7: How deep is the toilet pit below the surface?
- SAN8: Does the pit or toilet leak, overflow or flood at any time of the year?
- SAN8A: How often does the pit or toilet leak, overflow or flood? Options: it happened once; rarely; regularly; continuously.
- SAN9: Can (ground)water get in or out of the pit?
- SAN10: When the pit was dug, was any groundwater seeping in?
- SAN11 (Ask and observe): What is the distance to the nearest water source?
- SAN12 (Ask and observe): is that water source uphill or downhill from the toilet?
- SAN13: Is there any solid waste that you dispose in the toilet?
- SAN14: Which type of solid waste do you dispose in the toilet?

(If “No” to SAN16) SAN17: Why has the pit never been emptied?
SAN17A: How long have you been using the current pit?

- SAN20: To empty the pit, did someone need to enter the pit?
- SAN21: Did emptiers use any of the following: boots, gloves, face mask, or none of the above?
- SAN22: What was it emptied into? Options: directly into drain/water body (<500m away); directly into field (<500m away); into open pit on compound; into temporary covered pit on compound; into permanent covered pit on compound; stored for composting in compound; into open drum/container and taken away; into closed container/tanker and taken away.
- SAN23: Were the pit contents dry when removed?
- SAN24: Did you use any of the pit contents?
- SAN25: How long do you store the pit contents before it is used?
- SAN26: Do you do any further processing apart from storage before it is used?

Use of Sanitation (USAN) survey module

- USAN2 (Ask and observe): Is the toilet functioning as intended?
- USAN3 (Ask and observe): Are the walls and door of the toilet in place?
- USAN4 (Ask and observe): Is the toilet free from faecal smears on pan, wall and floor?
- USAN5 (Ask and observe): Is the toilet pan free from used cleaning materials?
- USAN6: What do you use for anal cleansing?
- USAN7: Do you use water in your toilet? Options: No; yes, for anal cleansing; yes, for flushing; yes, both anal cleansing and flushing.
- USAN8: Is water available in the toilet?
- USAN9 (Ask and observe): Does the toilet provide privacy?
- USAN10: How do you dispose of stools of children under the age of three years?
- USAN11: Is everyone in the household presently able to use the toilet easily and conveniently, unassisted?
- USAN12: If no to USAN11, why?
- USAN13: How many small children in your household are unable to use the toilet easily and conveniently, unassisted?
- USAN13A:How are small children supported to use the toilet?
- USAN17: Did you make any changes to make sure that everybody can use the toilet easily and conveniently, unassisted?
- USAN21: Do you have any problems cleaning and maintaining your toilet?

Annex 10: Shit Flow Diagrams based on GSF outcome surveys

Below are two Shit Flow Diagrams (SFDs) based largely on data from the 2018 GSF Cambodia and Tanzania outcome surveys. For the GSF Cambodia SFD, additional data on emptying and unsafe management practices were obtained from a summary of iDE FSM surveys undertaken between 2015 and 2017. Excreta flows from under-five year old children ('U5s' in the table) were separated from the other excreta flows (adults and older children), based on the percentage of under-five children in the rural population in the 2014 Cambodia DHS report (11.5%). The other excreta flows were reduced by this percentage to recognise that infant and child excreta flows are managed differently to those of adults and older children. Where detailed data were provided on the types of toilets used by under-five children, the proportion of children estimated to use safely managed sanitation services was based on these toilet types.

Summary of GSF Cambodia SFD estimates

Cambodia SFD including under 5s															
	adjust for U5s	0.88													
			Containment		Emptying/what happens when full					Child excreta		End use/disposal			
	JMP data	%age of population	Safe	Unsafe	Emptied	Unsafely emptied*	Install second pit	Not yet full	Cover and replace	Safe	Unsafe	Safe burial	Dumped in fields	Percentage safe	
Flush to septic tanks	59	51.9	51.9		20							10	90		
					10.4							1.0	9.3	1.0	
						15									
						7.8									
							50	15							
							26.0	7.8						33.7	
Flush to pit latrine	3	2.6	2.6		65							100			
					1.7							1.7		1.7	
						35									
						0.9									
Pit latrine with slab	1	0.9	0.9						100						
									0.9					0.9	
Flush to septic tanks, shared	26	22.9		23											
Unimproved toilets	1	0.9		0.9											
U5 child excreta	12	12.0								39.29					
U5 Child share of safe excreta flows										4.71				4.7	
											60.71				
U5 child unsafe toilets and unsafe disposal											7.29				
Open defecation	10	8.8		8.8											
														42.1	= safe
Percentage unsafe				32.6		8.7					7.3		9.3	57.9	= unsafe
														100.0	
* flooded out															

A similar process was followed for the GSF Tanzania SFD, except that fewer complementary data sources were available on emptying and unsafe management practices. The 2016 Tanzania DHS report estimated that under-five children make up 17.7% of the rural population.

Summary of GSF Tanzania SFD estimates

Tanzania SFD including under 5s															
	adjust for U5s	0.82													
			Containment		Emptying/what happens when full					Child excreta		End use/disposal			
	JMP data	%age of population	Safe	Unsafe	Emptied	Unsafe flows	Install second pit	Not yet full	Cover and replace	Safe	Unsafe	Safe burial	Dumped in fields	Percentage safe	
Flush to tank or pit with water seal	8	6.6	6.6		5							10	90		
					0.3							0.03	0.3	0.0	
						15									
						1.0									
							0	0	80						
							0.0	0.0	5.2					5.2	
Flush to pit latrine with no water seal	62	50.8	50.8		5							10	90		
					2.5							0.3	2.3	0.3	
						15									
						7.6									
								0	80						
								0.0	40.7					40.7	
Pit latrine with slab	3	2.5	2.5					0	100						
								0.0	2.5					2.5	
Improved but shared	14	11.5		11.5											
Unimproved toilets	9	7.4		7.4											
U5 child excreta	18	18								62.21					
U5 Child share of safe excreta flows										11.20				11.2	
											37.79				
U5 child unsafe toilets and unsafe disposal											6.80				
Open defecation	4	3.3		3.3											
														59.9	= safe
Percentage unsafe				22.1		8.6					6.8		2.6	40.1	= unsafe
														100.00	

Annex 11: Summaries of GSF-supported programme visits

Cambodia country visit summary

Reason programme selected for visit

Although the GSF-supported Cambodia programme has not yet introduced activities to promote safely managed sanitation services (SMSS), other rural sanitation stakeholders in Cambodia have been working on faecal sludge management (FSM) and SMSS options for several years. In addition, the Royal Government of Cambodia has constituted a national working group on rural FSM and instructed this group to develop guidelines on safe rural FSM. As a result, significant learning on SMSS was available from the Cambodia visit.

Background

The consultant visited the GSF Cambodia programme (CRSHIP-2) for one week in late June 2019. The visit was designed to allow time for discussion with the GSF Cambodia team and other sanitation stakeholders (largely in Phnom Penh) on their research and SMSS activities, with only 1.5 days allocated for field visits to the GSF programme area. Field visits were made to three ODF communities in Takeo province. These communities were randomly selected from the older CRSHIP-1 communities, as the aim was to learn how communities were managing their toilets (and faecal sludge) over time.

Typical toilets

More than 95% of toilets in the programme areas are flush or pour-flush latrines with water seal pans, with less than 1% of toilets reported to be dry pit latrines (with or without slab), hanging latrines or composting toilets. Around 75% of the pour-flush latrines are estimated to flush to a single offset pit (usually lined with 3 concrete rings and covered with a round concrete slab); with another 10% of pour-flush latrines installed directly over a 3-ring lined pit; and the remaining 10% flushing to twin offset latrine pits (usually installed in series, with a connecting pipe).

The concrete rings used to line the latrine pits were originally designed to allow leaching (of liquids and gases) into the soil surrounding the pit, either through open joints, holes left in the rings, or other porous additions to the concrete. However, masons have started using solid concrete rings (intended for lining wells or drains rather than latrine pits) in latrine pits, and high groundwater tables often encouraged people to cement the joints (to reduce water ingress into the pit). Masons often suggest to households that leaching can still place through the open base of the pit, this is extremely unlikely as the soil at the base quickly becomes covered in faecal sludge, which blocks the pores in the soil and limits infiltration. As a result, the leaching capacity of some latrine pits in Cambodia is limited, and the pits often fill up with liquid more quickly than expected.

Typical pit volume = 0.9m dia. x 2/4 x 1.2m deep = 0.76 m3
Average filling rate = 40-60 litres per capita per year
Average household size = 5
Typical pit filling time = 2.5-3.8 years

Limited leaching capacity (leading to shorter pit filling times) encourages toilet users to add a second pit in series (which receives the liquid sludge that overflows from the first pit, thus acting as a 'septic pit'), or to pierce (make a hole in) the highest concrete ring to allow liquid faecal sludge to flow out (contaminating the local environment) to extend the period until the pit needs emptying (i.e. when it fills with solid faecal sludge or becomes blocked).

No GSF data were available on leaks, overflows or flooding out from the toilet pits or tanks. However, iDE Cambodia has collected data from more than 3,700 households in seven provinces during 2015-2017 which suggested that 10%-14% respondents had 'pierced' their latrine pit to let out liquid faecal sludge (particularly during the rainy season when groundwater tables rise, more water enters the pit, and some people have difficulties flushing their toilets). These data suggest that, even if households eventually empty their pits safely (e.g. using a service provider with appropriate protective clothing and equipment that disposes of the faecal sludge into a buried pit or to a safe treatment or disposal site), a proportion of toilets are not safely managed during their lifetime, with the risk that some households will let out liquid faecal sludge to prolong the life of the pit and avoid emptying.

Observed SMSS issues

Around 30% of the toilets observed in the three ODF villages visited had containment problems, notably signs of leakage and overflow from the pits (e.g. heavy vegetation around the pit, when other surrounding areas were lightly vegetated). One toilet with a single pit had an open "casting hole" above ground, with liquid effluent continuously flowing out of this hole and pooling around the pit. A significant proportion of toilets had grey water discharges (from washing in the toilet) around the pit, with the risk that this wastewater might enter the pit.

Around 50% of the households interviewed reported that they had emptied full pits (NB many of these toilets were 5-7 years old). Most had used some form of mechanical emptying:

- Self-emptied using some form of agricultural or drainage pump.
- Paid an informal operator to pump the sludge into a tank on a farm vehicle.
- Paid a vacuum tanker to collect the sludge.

The reported emptying costs varied from USD 10 (farm pump) up to USD 40-70 (vacuum tanker) depending on the volume of the pit. These costs are high for poor households, which encourages unsafe management (e.g. leaks, overflows, or deliberate outlets from the pit – known as flooding out, or piercing the pit – that are likely to reduce emptying requirements).

The frequency of emptying reported was also highly variable: only twice in 20 years, annually, and every 3 months. The frequency was clearly affected by the volume of the pit (some households had invested in 7 concrete rings, whereas others used only 3 rings; some had two pits connected in series, some had only one pit), the leaching capacity of the pit, and the success in emptying (as sometimes settled sludge becomes compacted at the base of the pit, and may not be removed by suction pumps, thus gradually accumulates and reduces the available storage volume).

The sludge emptied from the pits was generally disposed to nearby rice fields, although some households did not know where paid service providers (especially vacuum tankers) took the sludge. Only a couple of wastewater treatment plants were reported to be operational in the country (in Siem Reap and Phnom Penh) so there are currently few alternative options for safe disposal.

The potential to bury faecal sludge in pits or trenches was discussed with several sanitation stakeholders in Cambodia. Trenching has been used to dispose of faecal sludge at scale in Malaysia, and has been tested as a potential rural disposal solution in South Africa and Cambodia. Where space is available, trenching (or burial) provides a simple solution that limits the need to transport faecal sludge (as suitable burial or trenching sites can usually be found within or nearby most rural communities) and avoids the need for sludge treatment facilities, which are often beyond the capacity and resources of even large towns and cities in low income countries.

Productive use of faecal sludge

Another challenge is that rural communities in Cambodia are aware of the productive value of faecal sludge. The reason that most faecal sludge is dumped to rice fields is that people are aware that the nutrients will benefit the crop, and the value of the sludge as fertiliser often outweighs any potential concerns about the safety of the practice.

Uncontrolled use of untreated faecal waste poses potential public health risks, particularly where the waste is applied to land where fruit or vegetables are grown on the ground (potentially in contact with the pathogenic waste), where crops are harvested within three months (i.e. before pathogen die-off and inactivation can be assured), and where these fruit or vegetables may be consumed unwashed.

SMSS monitoring

Little monitoring of SMSS takes place. The CRSHIP programme recently introduced the following faecal sludge management (FSM) indicators into its programme database, in response to the new SMSS indicator in the GSF monitoring framework, but no data have yet been collected for these indicators:

- Households with filled latrine pit (number)
- Households who have emptied latrine pit (number)
- Households who have rebuild latrine (number)
- Households who have twin pit latrines (number)
- Households using biogas latrines (number)

The national WASH MIS includes only basic indicators on toilet use with no SMSS indicators. In addition, all national monitoring is currently paper-based, which creates problems of aggregation, verification and use of the data (although some stakeholders, such as iDE and SNV, use smartphone monitoring systems in their programmes).

Key challenges to achieving SMSS

A large number of toilets with lined single pits have been built in rural Cambodia over the last 10 years, with many pits now becoming full, overflowing and requiring replacement or emptying. Few households with ring-lined pits are willing to abandon or replace the investment made in these latrine pits; and while households are reluctant to pay someone else to empty the pit, they are also often reluctant to empty the faecal sludge themselves.

In rural areas, the data from previous studies suggest that:

- the majority of toilet owners have emptied their latrine pit at least once.
- more than 80% empty the wet faecal sludge manually (using a bucket on a rope)
- more than 70% dispose of the faecal sludge unsafely (to nearby fields, drains or water bodies).

SNV research on faecal sludge management perceptions also confirmed that:

- 94% stated that it was important to empty pits to avoid bad smells
- 89% believe that faecal sludge is dangerous
- 61% are not comfortable with manual emptying their pit themselves
- 50% have some acceptance of overflowing latrine pits in rural areas
- 50% have some acceptance of disposal of faecal sludge to fields and water bodies

Some households delay pit emptying by installing an overflow from the top of the pit - either by piercing the topmost ring so that liquid faecal sludge floods out (particularly in the rainy season); or by installing a pipe connected to a second pit so that the liquid faecal sludge overflows into the second pit. Therefore, most toilets are either emptied unsafely, with the pit contents disposed unsafely; or allowed to discharge directly into the local environment (which is possibly more unsafe, as the discharges are likely to contain high pathogen loads that will contaminate an area close to the house).

Rural sanitation stakeholders in Cambodia recognise these challenges, and are promoting the alternating dual/twin pit (ADP) latrine as the most sustainable solution. However, an ADP upgrade currently costs USD 50-75, with demand for ADP upgrades relatively low (in part because households understand that they will still have to empty the full pit at some point in the future, which will either involve a payment or an unpleasant job for the household members). There is currently insufficient experience with ADPs to convince rural toilet owners that the ADP is a simple and effective solution to their pit emptying problems, where the faecal sludge decomposes and allows them to empty relatively safe and harmless material when the second pit becomes full.

As a result, unsafe pit emptying is still prevalent and needs to be addressed (at the same time as promoting alternative solutions). Awareness needs to be raised on the public health hazards associated with the handling and disposal of untreated faecal sludge, and guidance needs to be provided (to all stakeholders, including local governments) on safe practices for emptying, transporting, treating and disposal of faecal sludge. Where FSM service providers are used (or are likely to become prevalent), local governments should monitor and regulate these services, and apply sanctions to households or service providers that do cause public health hazards through unsafe containment, emptying, use or disposal of faecal sludge.

As ADP toilets become more common and acceptable, financial support may be required to enable poor and disadvantaged households to upgrade their toilets from single pit facilities. East Meets West (EMW) piloted targeted subsidies for ADP systems in Svay Teab district to complete the district ODF process, but these subsidies only reached 40-60 households thus provide few lessons for larger-scale implementation.

Lessons learned

The successful promotion of pour-flush pit latrines with concrete slabs and concrete ring-lined pits has resulted in almost all toilets in rural Cambodia providing access to basic sanitation. The toilets are generally good quality, with only 5% found to be unclean. However, these toilets do not always provide safe containment – many of the toilets do not leach well, which means that they fill up quickly with wastewater, and some households solve this problem by allowing them to overflow, or by piercing a pit ring so that liquid faecal sludge can flow out. Furthermore, when the pits become full or unusable, a significant proportion of households empty their pits and unsafely dispose of the faecal sludge nearby.

Not everyone has a toilet – the GSF outcome survey suggested that around 10% of the GSF programme population has no facility and practices open defecation (despite 50% of the households surveyed living in certified ODF communities), and almost 30% share their toilets with 1-2 other households. Further work is required to reach these groups, as this excluded population (without access to basic sanitation) is likely to include the majority of poor and disadvantaged people, and the majority of the disease burden.

Madagascar country visit summary

Reason programme selected for visit

The GSF Madagascar programme was the first national programme funded by the GSF in 2010, thus has been a testing ground for developing programme approaches and systems. The Follow-Up Mandona (FUM) approach was developed in Madagascar, and several of the GSF Madagascar programme team have been involved in the transfer of capacity and knowledge from Madagascar to other GSF programmes (largely in Africa).

Background

The consultant visited the GSF Madagascar programme (FAA) for one week in early September 2019. The original intention of the visit was to learn about the programme from the FAA team in Antananarivo; and visit communities and local partners in one coastal region and one highland region. Unfortunately, due to the closure of one airline, and the busy summer holiday season, flights were not available to reach a coastal region thus the field visit schedule was revised to include two of the regions in the central highlands: Itasy and Vakinankaratra. These two regions are among the five major programme regions, and report high numbers of ODF communities, with around half of these ODF villages achieved during the 2011-2105 period (i.e. by now toilets will be filling and in need of replacing or emptying). In total, 9 ODF villages were visited (3 in Itasy and 6 in Vakinankaratra).

Toilet conditions

The toilets observed during the field visits were in generally good condition:

- Most were flyproof (covers in place and smooth easily cleanable slabs)
- Ash was present in most toilets
- Handwashing facilities were present in most toilets (usually tippy taps)
- Some upgraded toilets with cement slabs (although no market products)

Figure 1 Good latrines observed during the GSF Madagascar field visits

Figure 1 Good latrines observed during the GSF Madagascar field visits

The FAA team confirmed that toilets in the central highland regions are generally more durable and hygienic that those found in the coastal and southern areas. Two main factors were suggested: the presence of good building materials in the central highlands (where most houses are built solidly from fired bricks and timber, are often several storeys high, and have thick walls to protect against the cold); and good agricultural livelihoods (linked to the more predictable and temperate climate). The FAA team noted that toilets in the coastal areas tend to have a more flimsy construction (using branches and thatch), and are less durable and resilient in the face of tropical storms and collapsible soils.

Safely managed sanitation services

Figure 2 Non-flyproof latrines observed during the GSF Madagascar field visits

Figure 2 Non-flyproof latrines observed during the GSF Madagascar field visits

Figure 3 New latrines: observations of new pits, new construction and upgraded latrines with cement screeds

Figure 3 New latrines: observations of new pits, new construction and upgraded latrines with cement screeds

No open defecation was observed during transect walks, despite one community reporting that some households had reverted to open defecation. Sanitation access was good in most villages, but there was a high proportion of sharing: 43%-88% of households owned their latrines, with 12% to 57% sharing other people's latrines. All of the latrines observed appeared to be in use, with full pits reported and evidence of use in most cases.

Households reported that pits take 4-10 years to fill (similar to the estimated pit filling time, which was based on pits being about 2.0m deep), and that most dig new pits and build new latrines when the pit is full. No pit emptying was reported, and there was no evidence of leaks, overflows or other safe containment issues.

In these central highland regions, households reported that they were digging replacement pits from 6.0m to 8.0m deep in order to prolong the life of the new latrine. These claims were confirmed by the deep pits (under construction – see Figure 3) observed during the visit. These deeper pits are likely to have at least double the filling time of previous pits, taking perhaps 10-20 years to fill.

In the non-ODF village, some households had full latrine pits, or almost full pits, and had started to dig new pits, but had not completed the replacement latrines. In several cases, the households had abandoned old latrines, and claimed to be sharing their neighbour's (or family member's) latrine, but there was evidence (and confirmation from some villagers) that some households had reverted to open defecation. Despite these problems, the households with full pits confirmed that they were planning to build new toilets, and almost every household had already dug a new pit, which suggested that there was demand for sanitation (and some pressure to avoid open defecation) even in the worst performing village visited.

Biotay fertiliser

The IP in Vakinankaratra has developed a process for using old pit contents to create organic fertiliser, known as Biotay. An old pit was excavated while the consultant was in one of the villages, thus the process was observed in detail. A team of four workers walked from a nearby village and excavated a four-year old latrine pit (owned by a household that had already filled in and replaced at least three latrine pits). The excavation process took an hour, with the team digging down just over a metre until the excavated soil changed from red soil to dark brown soil. The team indicated that this dark soil was the start of the pit contents (which also contained solid waste: notably scraps of discarded clothing) and explained that, as the pit contents degrade over time, more soil is added to fill the hole, which explained the metre of red soil above the degraded pit contents. The team filled plastic sacks with the nutrient-rich humus from the old pit, and carried these sacks back to the Biotay centre.

The rest of the process was not observed, but the team explained that they would then mix the humus with rice husk ash before solar drying the mixture for at least six hours. The fertiliser product is then packaged and sold to households. The Biotay team had used the product to fertilise several fruit trees nearby, and reported good growth and high productivity in these fruit trees (e.g. a young papaya tree was reported to have borne fruit a year earlier than normal, and was heavily laden with fruit at the time of the visit).

While an interesting trial, which suggests that the nutrients in the old pits may be beneficial for agricultural use, the Biotay production process is complex, including: identification of full pits; excavation of pits; transport, mixing and solar drying of Biotay; packaging and distribution of fertiliser. At small scale, under good management, the Biotay production has worked. However, as the scale increases, the process will become harder to manage, and the costs (many of which are currently not evident, due to community contributions of labour, working space and NGO support) may limit the long-term viability of the process.

Key challenges to achieving SMSS

Many single pit toilets are now 3-5 years old, thus smaller pits are starting to fill and there is growing demand for replacement toilets and, in some cases (where people have built more permanent structures), for emptying and disposal services.

The field visits highlighted multiple examples of full latrine pits that had not been properly covered or closed. As a result, the pit contents remained visible and accessible (e.g. to flies and insects, rodents, birds and other animals); there is potential for the pit contents to be washed out (e.g. during heavy rainfall or flooding events); and, in some case, there is a potential hazard due to the risk that a young child could fall into the hole (either injuring themselves, or risking contamination from the faecal sludge).

Figure 4 Full latrine pits that have not been safely covered or closed

Figure 4 Full latrine pits that have not been safely covered or closed

The emptying process could be more safely managed, with three key areas to address:

- Burial of any sludge that has been stored for less than 2 years.
- Closure of any openings into toilet containers containing fresh sludge.
- Use of personal protective equipment by manual emptiers.

Research in other countries confirms that even properly trained sanitation workers rarely wear protective clothing or use suitable equipment, even where it has been specially provided for their use (in part because it is often hot, and sanitation workers are often used to the conditions, thus do not understand the need for protective clothing or equipment). Therefore, emptying of full pits should be avoided unless absolutely necessary.

Addition of non-degradable waste to latrine pits

The excavation of latrine pits to create Biotay fertiliser has revealed the substantial amounts of solid waste that are disposed into rural latrine pits in Madagascar. The single pit excavation observed during the field visits contained clothes, glass and other solid waste.

The addition of non-degradable solid waste can reduce the pit filling time by almost 50%, which means that a pit designed to last 9 years may only last 6 years. This practice has a substantial effect on the investment made by rural households in building and maintaining their latrines, but households appear unaware of the negative impact of adding solid waste to their latrine pits.

Improved M&E required to spot unsafe toilets

Around 10%-20% of the toilets observed (during the field visits in the central highlands) were not flyproof, or not clean, and needed some improvement. Improved monitoring would identify these facilities, and trigger follow up to encourage upgrading and improvement to more durable and hygienic facilities. The FAA team suggests that the proportion of unsafe toilets (user interface) is likely to be higher in coastal and southern regions, hence that improved monitoring will be even more important in these areas.

The field visits also highlighted the importance of making random checks on ODF and household sanitation and hygiene outcomes. The FAA monitoring suggests high sanitation access and use in almost 22,000 villages, whereas the random field visits found 1/9 ODF villages were no longer ODF, and that no follow up had been conducted in this village during the last three years.

Recommendations

Most toilets observed in the GSF Madagascar programme are likely to be safely managed, as very few latrine pits are currently emptied when full (or emptied after less than two years of storage), no outflows were reported from latrine pits, and groundwater levels (at least in the Central Highlands) are relatively deep. Nonetheless, 10% to 20% of toilets are either not durable, not well managed, or the pits are not safely closed and covered when full. Further work is required to identify these toilets (through better monitoring), and address these problems.

The GSF Madagascar programme reports a very high level of shared use of toilets, and the field visits confirmed that some shared toilets are not well managed. Shared use of toilets, particularly by large numbers of people, also has an impact on the lifespan of the pit, hence on the frequency and amount of replacement costs. Improved monitoring of the safe management of these toilets over time would enable the FAA to identify the categories of shared use that are problematic, and recognise the shared use of toilets that are safely managed.

While the field visits did not cover the coastal or southern programme areas, the FAA team highlighted the different sanitation challenges faced in these areas, notably the greater sustainability challenge for households affected by flooding, tropical storms and high groundwater. More work is required to develop resilient toilet designs that are better able to resist these climate events (or easier to repair and rebuild after these events), including the consideration of sanitation finance and additional support to disadvantaged households that are unable to build more durable and resilient toilets.

Finally, the review and field visits confirmed that while the concept of SMSS is well understood by the FAA team (not least because of their medical backgrounds), the WASH sector in Madagascar has not yet incorporated SMSS into its systems or practices. The GSF programme should use these study findings to boost national attention to SMSS; collect data and case studies on SMSS that can inform and stimulate a national process to work towards the use of safely managed sanitation services; and trigger government and key institutions to improve SMSS policy and activities.

Tanzania country visit summary

Reason selected for country visit

Toilet quality is an historical issue in Tanzania, in part due to the legacy of high rural sanitation coverage from the 1970s villagisation process, with rural communities often accepting the use of unhygienic toilets as normal. The GSF Tanzania outcome survey data indicated a fairly high level (70%) of access to at least a basic sanitation service, especially when compared to the latest JMP report (29% of rural population with access to at least basic sanitation, WHO/UNICEF, 2019). A country visit was therefore proposed to understand how the programme has changed social norms and 'moved people' from open defecation and use of unimproved toilets, to use of improved and safely managed sanitation services.

Background

The GSF Tanzania programme (UMATA) was visited for one week in late July 2019. Meetings were held with regional and district officials from the Ministry of Health, Community Development, Gender, Elderly and Children, with the National Sanitation Coordinator and with representatives of other key organisations and institutions involved in delivery of sanitation, wastewater and water supply services in Tanzania.

Eight ODF villages were visited during a three-day field visit to the three programme districts of Bahi, Chamwino and Kongwa. In each location, as well as observing household toilet access and use, village representatives were interviewed to understand how toilets are managed and learn about key issues affecting safe management. Where possible, interviews were held with both private emptying service providers and local government officials responsible for delivery of services.
Overall, 2018 UMATA monitoring data indicates that 86% of the programme target population (0.6 million of 0.7 million) live in ODF environments, while 0.3 million have access to improved toilets. This suggests that a large proportion of household toilets in the UMATA programme remain unimproved. However, since access to an improved latrine is part of the UMATA ODF criteria, this difference is because the ODF population also includes some people who had access to improved sanitation at baseline (which tends to increase this figure), whereas the population with access to improved sanitation generally reports the population gaining access since baseline.

Toilet types

Remote rural areas: The most common type of toilet on the UMATA programme includes some form of pit latrine, which is typically either a direct, dry pit latrine or an offset pit toilet. The latter comprises a pan, slab and superstructure which, as the name suggests, is not constructed over the pit but is located several metres away, with an open pipe (laid at a gradient) connecting the pan (usually with no water seal) to the pit.

Construction materials and methods are the same for both direct and offset pit types. Typically, the pit is left unlined and covered with a slab made from timber and compacted mud. A screed of cement mortar is added when available (or affordable), which can make the slab easier to wash clean. Toilet superstructures are predominantly made from locally available materials. For example, unburnt bricks or mud and wattle walls, a thatched or recycled corrugated iron sheet roof, and a door fabricated from recycled corrugated iron sheets or rough timber.

Heavy rains in recent years reportedly resulted in a large number of direct pit latrines collapsing. The offset pit arrangement is therefore increasingly preferred by households because if the pit collapses (from flooding or due to loose soil etc) the superstructure and slab do not fall into the pit. The majority of the toilets observed during the field visit were connected to offset pits and the National Sanitation Campaign (NSC) Coordinator reported that their use is also increasing in other areas of the country. In addition, at least six offset type toilets were observed under construction (or recently completed) reportedly to replace old direct pit toilets, which suggests that sanitation behaviour change is being sustained.

However, as no data are collected on the pit configuration by UMATA or NSC, it is not known how many offset pit toilets have been constructed under the programme or under the NSC. Estimates from respondents ranged up to 50% of household toilets, while the outcome survey data indicates that as many as 94% of toilets surveyed in programme areas may be connected to an offset pit. Importantly, the majority of these (83% of toilets surveyed under the outcome survey) are likely to be 'simple' pour-flush pit latrines without water seals and are therefore classified by UMATA as improved traditional pit (Type B) toilets. The majority of the offset pit toilets observed during the field visit were of this type, while the UMATA monitoring data indicate that across the programme only 1% of toilets are 'proper' pour-flush with water seal toilets (Type D).

Rural on road and peri urban areas: Direct pit latrine and offset pit toilets are also favoured by residents in less remote areas. However, in these locations, where both household incomes and access to materials are higher, it is more common for households to have installed a toilet pan with a water seal connected to a lined pit (and added a more substantial, burnt brick type superstructure with a corrugated iron sheet roof). For example, UMATA monitoring data indicate use of (Type D) pour-flush toilets by 7% of Chamwino Ikulu township households and by 18% of Kongwa township households.

Safely managed sanitation services

Containment

The few unimproved (Type A) toilets observed during the field visit typically had slabs that were not washable (and/or not clean), no roof and/or incomplete walls or doors. The majority of these were direct pit latrines.

Overall, the latrine slabs observed were generally complete, with no cracks or holes through which rodents could enter the pit; other key SMSS observations were:

- No toilets/pits overflowing/discharging to open ground, drain or elsewhere
- No toilets/pits close to (within 15 metres) of groundwater source
- No toilets/pits located up-gradient of a groundwater source
- No full pits left uncovered/abandoned

These observations confirm that the majority of the toilets observed could currently be considered as safely managed. However, a key feature of the commonly used simple pour-flush offset pit latrines is that they do not have a water seal, which means less water is required for manual flushing than in a conventional pour-flush latrine, but there is no water seal to limit smell or fly nuisance. And the addition of even relatively small amounts of flush water to a pit could adversely affect safety, as the pit is likely to fill more quickly – increasing emptying frequency or toilet replacement frequency - and the pit content drying time will increase – slowing the pathogen die off rate. Compared to the drier direct pit contents (used without flushing water) these offset pit contents could therefore be more hazardous to handle and dispose, especially if the contents of a closed pit are not properly covered (or emptiers do not wear personal protective equipment or dispose of the contents safely e.g. by safe burial). The management of these offset pits will therefore require careful monitoring, especially as they become full and households choose how to empty or replace them.

Management of full containers

Remote rural areas: Respondents shared the view that when pits fill up in the remote rural areas (which characterise the vast majority of the UMATA programme area) there was sufficient space for households to cover the full pit, arrange for another pit to be dug and the superstructure moved or replaced. And since the majority are low-cost (Type A and Type B toilets, which are generally made from locally available, often recycled materials) replacement is considered affordable.

The outcome survey reports only eight households (1.3% of 629) having emptied their pit, which is not surprising as it is estimated that pits take on average 7 to 11 years to fill and the programme is only 5 years old. The field visit confirmed that very few households had emptied a full pit so that they could carry on using the toilet. In addition, it was generally agreed that an unlined pit is very difficult to empty mechanically, as over time the contents dry and harden so that they require hand digging.

Rural on road and peri urban areas: There are no mechanical pit emptiers based in Chamwino Ikulu, Kongwa or Kibaigwa townships. Currently, private emptying service providers travel from Dodoma or Morogoro to provide services as and when required, with the emptied faecal sludge taken to the treatment plant in Dodoma or discharged locally either to a farmers' fields or "to a remote location". The service is expensive at around USD 30 per trip with more than one trip often required to fully empty a tank. The emptiers only service lined pits and tanks, mostly belonging to guest houses, hotels, schools, businesses and institutions; it is not known how many private households have sealed tanks or lined pits that are emptiable, with respondents of the opinion that the number was increasing but was still relatively small.

Manual emptiers also operate in towns offering a less costly service at USD 15 to 20 per pit emptied. They also only empty lined pits and bury the faecal sludge in a hole dug nearby, which is then filled in and covered. The service provided is very rudimentary with the pits being emptied by hand using only shovels and buckets. The operatives rarely wear gloves, boots and overalls, or take any precautions to prevent themselves, the household or local residents from coming into contact with the emptied faecal sludge.

The unregulated disposal of faecal sludge by mechanical and manual private emptiers is acknowledged as a concern by the local town officials. However, with no local treatment works or designated safe disposal location, they have found it hard to restrict the practice and there is no management plan in any of the townships. They also acknowledge that, as these small-town populations increase, the situation is likely to worsen. Chamwino Water and Sanitation Authority (CHUWASA) have commissioned the design of a sewerage system and there are plans to strengthen the water supply system in Chamwino Ikulu – the site for the new presidential palace. However, CHUWASA is not responsible for onsite sanitation or for management of faecal sludge emptied from pits and tanks.

Handwashing with soap

UMATA routine monitoring data for 2018 report that 71% of the target population (0.5 million of 0.7 million) had access to a handwashing facility with water and soap (HWWS), which is the JMP 'basic' handwashing service level and the target service level for the GSF programmes.

Handwashing is introduced to households during Follow Up Mandona interventions and when triggered to act, the outcome in nearly all locations is the construction of some form of tippy tap. These are made of locally available materials and are generally low quality and not durable. Respondents reported that tippy taps often last only two months, as they degrade in the sun, while theft and vandalism is also a problem. The country visit confirmed this finding with many households observed with no handwashing facility, or with a facility but no water or soap available. Respondents agreed that although awareness has been raised, handwashing practice is not sustained. This view is also supported by the 2018 GSF household outcome survey, which found only 29% of the population with access to HWWS and (from structured observation surveys) only 0%-11% handwashing at critical times (i.e. after defecation, after contact with faecal matter, before breast feeding, before feeding an infant, before eating, before preparing food).

Bathroom cubicles adjacent to the toilet cubicle, or space within the toilet cubicle for bathing, were observed at many of the household toilets visited. This feature is not routinely monitored and not included in the outcome survey, but it may indicate a change in hygiene behaviour that, compared to handwashing practice, is more sustained by households.

Uganda country visit summary

Reason selected for country visit

The USF was selected to learn how and to what extent one of GSF's largest and longest-running government-led programmes has enabled households to access improved and safely managed sanitation services. A country visit was therefore proposed to investigate key issues, including:

- how full pits are managed by households (with some household pit-type toilets approaching ten years old)
- the outcome of the programme's sanitation finance and marketing initiatives, such as the Water for People loan scheme
- the potential benefit of clustering of FSM services (that has been piloted for delivery of services to small towns in Uganda) in rural programmes.

Background

The country visit in the last week of July 2019 included field visits to Soroti and Lira districts implemented under Uganda Sanitation Fund (USF) phase 1 (from 2011) and phase 2 (from 2014) respectively; as well as meetings in Kampala with Ministry of Health (MoH) officials and members of the National Sanitation Working Group.

The fieldwork included visits to four ODF villages, and meetings with district-level implementing officers, representatives from an implementing partner (Water for People (WfP)), a service provider (Saniwaste Solutions) and a masons' group (Kole Masons).

The villages visited were all certified ODF and coverage was reportedly good in both districts: Soroti = 67% and Lira = 85%. Overall, 2018 USF monitoring data indicated that 75% of the programme target population (5.1 million of 6.8 million) lived in ODF environments, while 1.7 million had access to improved toilets. These data suggest that a large proportion of household toilets in the USF programme remain unimproved. However, since access to an improved latrine is part of the USF ODF criteria, this difference is generally because the ODF population includes some people who had access to improved sanitation at baseline (which tends to increase this figure), whereas the population with access to improved sanitation reports the population gaining access since baseline.

Toilet types

The majority of the toilets observed were direct pits and all were fitted with a slab (only one pour flush toilet was observed). Slab types observed included compacted murram (on a timber base), compacted murram with cement screed, precast concrete slab or sanplat. Flyproofing methods observed included the use of squat hole covers and the fitting of SaTo pans, with some toilet pits were fitted with vent pipes (however, few of these were fitted with a suitable mesh fly screen, which means that the toilets are not fly-proof).

All toilets were enclosed by four walls, covered by a roof and fitted with a door, and therefore all provided a good degree of privacy. The superstructure materials used varied too; the majority were made from locally available materials (unburnt mud bricks, mud and wattle and grass thatching), while those implemented through the Water for People loan scheme featured market-bought materials, e.g. burnt bricks, concrete blocks and iron sheets.

Anal cleansing materials were present in most of the toilets while the majority were observed to be clean, with a clear path indicating sustained use. Compounds observed during transect walks were generally clean with no visible OD and drying racks commonly in use.

Safely managed sanitation services

Containment
Latrine slabs observed were complete, with no cracks or holes through which rodents could enter the pit. Other key SMSS observations were:

- No toilets/pits overflowing or discharging to open ground, drain or elsewhere
- No toilets/pits close to (within 15 metres) of groundwater source
- No toilets/pits located immediately uphill from a groundwater source
- No full pits left uncovered/abandoned

Overall, the toilets visited were safely managed.

Management of full containers
Respondents all shared the view that full pits in rural areas are covered, closed and then replaced with a new toilet and pit. There were no reports of full pits being emptied in the villages visited and only one report of a full pit having been replaced. No issues were observed, or raised by households, with respect to the safe covering of excreta in full pits. Faecal sludge emptiers (trained by WfP) were interviewed in Soroti and reported that to date they had not emptied any rural pits, and they felt that there were limited business opportunities. Reasons cited included a) the use of deep pits (minimum depth of 5 metres) and therefore the long pit filling time (over 10 years) e.g. two pits were observed that were built in 2006 and not yet full; b) the majority of pits are unlined; and c) the widespread use of cover and replace to manage full pits.

Formal emptying, transport and treatment services

There are a limited number of formal FSM service providers in Uganda and these operate only in towns and cities. Similarly, faecal sludge (and wastewater) treatment facilities are found only in towns and cities and although the number is increasing, there are still very few and the functionality of these is reportedly poor.

Clustering of FSM services, where a treatment plant is located between two or more small neighbouring towns, has been trialled in some parts of Uganda. Typical of these is a pilot faecal sludge treatment plant operated by a small-scale service provider (Saniwaste Solutions) that serves the towns of Kole and Lira. Faecal sludge delivered to the plant is first dried before being processed ('carbonized') into solid fuel briquettes that are sold in the market. Saniwaste Solutions also provide an emptying service (using a gulper), which is less costly than that provided by local cesspool emptiers (who use large vacuum trucks). However, even the gulper service only serves households with lined pits (or tanks), and the charge of USD 40 to 70 per household toilet means that the service is often too expensive for rural households to use. Observations during the field visit confirmed that maintenance of the treatment plant is minimal, the trash screen had not been cleaned recently and the anaerobic filters are no longer functioning, which, along with the high cost and limited market for emptying, highlights the challenge of running a formal FSM service in rural Uganda.

Sanitation marketing

As part of their sanitation marketing sub-project, Water for People enabled households in Soroti to access loans (through Post Bank) to construct improved toilet facilities (that also included features such as satopans or pans with water seals) with permanent superstructures. Around 300 loans were successfully issued in Soroti district, and the field visit confirmed that a number of households have benefitted from the arrangement and have upgraded to - or constructed new - 2-stance toilets made from market bought materials. These typically include SaTo pans or pour-flush pans connected to lined pits. However, the data suggest that the total number of these toilets in Soroti and Lira is less than 1,000, which is less than 1% of the 105,000 households with toilets in the two districts. The majority have constructed less costly toilets made from non-market, locally available materials.

Considerable project effort has also been expended in training masons, not only in construction techniques but also in marketing and business skills. The chairperson of the Kole mason group explained during the field visit that since their formation in 2013 they had supported only 20 households to build toilets, and upgraded a further seven by applying a cement screed which, considering the membership of 28 masons, is less than one toilet per member, and therefore a poor return on the resources used in their training. The group is still functioning and their skills have presumably been useful in the other construction work in which they have been more active, which is clearly beneficial to other sectors in Uganda, if not directly to sanitation and hygiene.

When the level of support and resources expended in supporting the mason group and facilitating loans is viewed in terms of the small scale results, it is clear that in remote rural areas of Uganda (where the GSF programme operates) the less costly non-market technical support approach, which has had a much larger reach, appears more appropriate.

Handwashing with soap

USF routine monitoring data for 2018 report that 62% of the target population (4.2 million of 6.8 million) has access to a handwashing facility with water and soap (HWWS), which is the JMP basic handwashing service level and the target service level for the GSF programmes.

Handwashing is introduced through the CLTS approach during triggering and then during follow up visits (e.g. using Follow Up Mandona). When triggered to act, the outcome in nearly all locations is construction of some form of tippy tap. These are made of locally available, often recycled materials and are generally of low quality and not durable. Respondents agreed that although awareness has been raised and many have access to a facility, handwashing practice is not usually sustained.

Many of the tippy-tap handwashing facilities appeared to have been recently repaired, which may indicate sustained behaviour change but it may also be because the facilities were no longer working and therefore households were encouraged to fix or replace them ahead of the field visit by MoH officials (and an external consultant).

The USF is not alone in facing this challenge, as changing hygiene behaviours so that handwashing becomes the norm is an issue common to many rural sanitation and hygiene programmes across Africa. And, although it is a hardware not a software solution, an innovative, affordable, durable handwashing facility could be the catalyst needed to change handwashing behaviours.

A practical solution observed during the field visit was use of a small live tree to support the tippy tap, rather than timber posts or branches driven into the ground, which over time, tend to become loose and fall over. By using the live tree, the handwashing station becomes permanent and cannot be knocked over or broken accidently.

A second innovation, which is still under development, is the Egesa handwashing facility. This has been developed by a MoH Environmental Health Assistant working in Lira and, much like the tippy tap, it comprises a water container supported by a frame and is not operated by use of a hand (that may not be clean). Instead, the wrist is used to start and stop the flow and the container is supported by a stand so that it is at a convenient height. A range of container sizes (from 10 to 250 litres) have been tried and tested and prototypes have been installed in schools in Lira. The feedback has been positive but as the frame is fabricated from metal, the cost remains relatively high when compared to the very low cost tippy tap. The price of a 10 litre Egesa is approximately USD 8, whereas a simple tippy tap can be constructed for less than USD 1. (The larger Egesa models cost USD 13 = 20 litre; USD 27 = 50 litre and USD 100 = 250 litre).

SHF
The Sanitation & Hygiene Fund

THE SANITATION & HYGIENE FUND

15, Chemin Louis-Dunant
1202 Geneva
Switzerland

T +41(0) 22 560 81 81

wsscc.org
www.shfund.org