Guidance for monitoring safely managed on-site sanitation (SMOSS)

Lessons from M-SMOSS pilot project

Source: UNICEF Bangladesh Monitoring SMOSS Pilot

Authors: This document was prepared in 2025 by Freya Mills (consultant), Rick Johnston (WHO), Tom Slaymaker (UNICEF), Dave Trouba (WHO) and Jorge Bica (UNICEF). The WHO-UNICEF JMP team can be contacted at: info@washdata.org

Reference: This document along with the five annexes are available at https://washdata.org/monitoring/sanitation/safely-managed-on-site-sanitation

World Health Organization
WHO UNICEF JMP
unicef

Summary

Introduction

This document summarizes emerging best practice monitoring methods to inform the monitoring of safely managed on-site sanitation (SMOSS). Although globally more people use on-site sanitation services than have sewer connections, there are major gaps in monitoring SMOSS [1]. Estimates for excreta that were emptied and treated off-site are only available for 2% of the global population using on-site sanitation. The lack of data on SMOSS presents a major constraint for national and global monitoring of SDG indicator 6.2.1a: the use of safely managed sanitation services, as well as for monitoring of SDG indicator 6.3.1 on wastewater treatment.

This document describes the global indicators for SMOSS, proposes core questions and tested methods to collect data and proposes steps to strengthen national monitoring systems. While there is not one standard approach to monitoring SMOSS, this document consolidates methods and findings from the JMP monitoring SMOSS pilots as well as experience from global and national monitoring. This guidance aims to support national governments, WASH sector stakeholders, and others looking to improve national monitoring of SMOSS, to build from existing knowledge and address the many outstanding monitoring gaps. This document is accompanied by WHO Academy summary and technical online self-paced training courses and tools available on https://washdata.org website.

Global indicators

The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP), requires consistent assessment across countries, with globally comparable indicators that can be drawn from national data. These are the **global indicators** (Table 1), which all countries should be able to report on during the SDG period. There are potentially many **local indicators**, that capture additional details of safely managed sanitation that countries may decide to monitor depending on their national sanitation policies, context, and resources. Examples of possible local indicators are provided in Table 3, however these are not used in global monitoring.

Table 1. Global indicators for monitoring SMOSS

Containment	Containment is not overflowing or discharging waste to the surface environment
Disposal in-situ	Contained, not emptied; OR Contained, emptied, buried in-situ
Emptying	If containment was ever emptied
Transport	Excreta delivered to treatment facility
Treatment	Designed to provide treatment for both solid and liquid phase

Methods

Monitoring SMOSS requires a mixed methods approach since assessing safely managed services requires data at both individual and communal scale so cannot rely on household questionnaires alone. Table 2 summarizes the different data collection methods applied in the pilots and indicates which methods are best suited to inform each part of the service chain.

Table 2. Sources of data across the service chain

Data collection method	Facility type	Containment	Emptying	Transport	Treatment
Household questionnaire				*	
Household sanitation inspection					
Data from service authorities (e.g. administrative data)					
Data from service providers (including via regulators)					
Spot checks / inspections of service chain					

* In-situ only

Levels of reliability and use of source

Low High

This guidance provides **recommended core questions** that correspond to the global indicators for all data collection methods. These questions can be used in household questionnaires, sanitation inspections, service provider and authority surveys and were tested in the JMP M-SMOSS pilots in 10 countries and other monitoring efforts. The analysis section provides steps to systematically analyse and integrate data for estimates of safely managed sanitation. Steps to

strengthen national monitoring systems are presented drawing on global guidance for strengthening regulatory systems and key lessons from the monitoring pilots.

Contents

Introduction to SDG 6.2 monitoring

Goal 6: Ensure availability and sustainable management of water and sanitation for all.

- **Target 6.2** 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
  - **Indicator 6.2.1a** Proportion of population using safely managed sanitation services

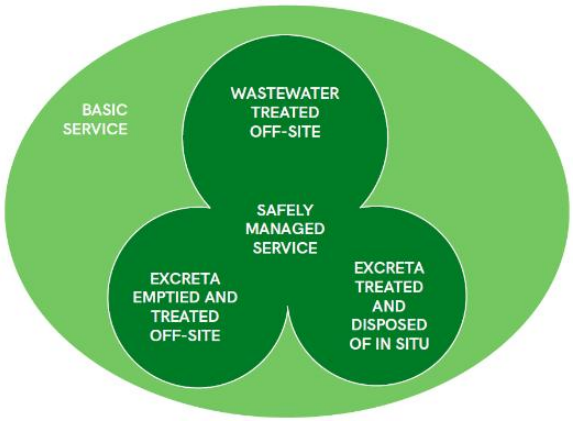
The SDG global target 6.2 calls for use of safely managed sanitation services by all, as well as access to basic handwashing facilities with soap and water and the elimination of open defecation. This guidance focuses on safely managed sanitation, which requires that all excreta (wastewater, faecal sludge) are safely managed along the entire service chain: containment, emptying, transport and treatment. While previous global monitoring focused on household access to improved toilets, safely managed sanitation requires assessing both household level facilities and containment, as well as the performance of service providers in emptying, transport and treatment at community or larger scales. This responds to persistent challenges in the management of faecal sludge and that large volumes of wastewater conveyed through sewers remain untreated or receive insufficient treatment to protect public health [2].

Monitoring safely managed sanitation is complex as there are a variety of service options and criteria for assessing safe management at each step of the chain. Data are needed for the management of both on-site sanitation (i.e. excreta from septic tanks or pit latrines) and off-site sanitation (i.e. sewer systems).

The World Health Organization (WHO) and United Nations Children's Fund (UNICEF), through the Joint Monitoring Programme (JMP) for Water Supply, Sanitation and Hygiene, track progress toward SDG targets 6.1 and 6.2. The sanitation service ladder (Figure 1) is applied to all countries to assess households use of different levels and types of sanitation services. To be considered safely managed sanitation under SDG 6.2, households must use improved sanitation facilities that are not shared with other households (equivalent to the basic service level), and the excreta produced must be managed through one of the safely managed pathways defined by the JMP (right of Figure 1).

Figure 1. JMP ladder for sanitation services (left) and three pathways to safely managed services (right) [3]

SERVICE LEVEL	DEFINITION
SAFELY MANAGED	Use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or removed and treated off-site
BASIC	Use of improved facilities that are not shared with other households
LIMITED	Use of improved facilities that are shared with other households
UNIMPROVED	Use of pit latrines without a slab or platform, hanging latrines or bucket latrines
OPEN DEFECATION	Disposal of human faeces in fields, forests, bushes, open bodies of water, beaches or other open places, or with solid waste



***Note**: Note: Improved facilities include: flush/pour flush toilets connected to piped sewer systems, septic tanks or pit latrines; pit latrines with slabs (including ventilated pit latrines); and composting toilets.*

Status of monitoring and need to focus on SMOSS

Every two years, the JMP updates the WASH estimates for all countries, by identifying newly available data from household surveys, censuses, administrative records, and other national data sources, and integrating them into country files for producing draft estimates. WHO and UNICEF conduct a two-month consultation with national stakeholders to review and validate data, ensuring that JMP estimates are based on reliable national sources and strengthening collaboration between global and national monitoring systems. This process promotes national ownership, supports alignment of indicators, and leads to finalized JMP estimates for households published every two years.

The progress report for the 2024 update shows that the proportion of the global population using safely managed sanitation services increased from 48% in 2015to 58% in 2024, meaning 3.4 billion people still lack safely managed services [1]. More people use improved on-site sanitation facilities (3.8 billion) than sewer connections (3.5 billion). However, people with sewer connections were more likely to have safely managed services (33%) than people with on-site sanitation (26%). The majority of safely managed on-site sanitation is from safe disposal in-situ (24%) from households reporting their facilities are contained and never emptied, with emptying and removal off-site relatively rare among countries with data.

Data coverage for safely managed sanitation services was available for 86% of the global population, however large gaps in national data remain, especially for the management of excreta from on-site sanitation systems. For households connected to sewers, excreta are considered safely managed if they are transported in sewers and then treated off-site. In 2024, data on wastewater treatment was available for 60% of the global population with sewer connections [1]. For on-site sanitation, excreta are safely managed if they are i) stored, treated and disposed of in situ, or ii) stored temporarily and then emptied, transported and treated off-site. However, while data on disposal in-situ were available for 87% of the global population using on-site sanitation, data on excreta emptied and treated off-site were only available for 2% of the population. Given that more people rely on on-site sanitation than sewers, and the use of on-site facilities is increasing faster than sewer connections, strengthening monitoring of SMOSS is essential to improve SDG 6.2 estimates and support evidence based planning.

Objective of this guidance

This guidance supports efforts to SMOSS more effectively and to strengthen estimates of progress toward SDG 6.2. It explains how the JMP monitors safely managed sanitation, outlines steps to identify gaps and opportunities to improve national monitoring systems, and provides advice to design or adapt methods to collect and analyse SMOSS data. The guidance draws heavily on experience from SMOSS monitoring pilots, as well as global examples and other material developed by WHO and UNICEF. Pilots to test approaches and methods to improve monitoring of SMOSS were conducted in Bangladesh, Ecuador, Indonesia, Kenya, Serbia and Zambia in Phase 1 from 2020-2023 and Malawi, Moldova, Nepal and Oman between 2023 and 2025, supported by the JMP with funding from the Gates Foundation. Lessons from the pilots were consolidated in the Phase 1 Synthesis Report[1] and informed this guidance as well as the new self-paced online courses in WHO Academy. These include an overview course for national and local government and WASH stakeholders, and a more detailed technical course for practitioners engaged in sanitation services, monitoring and systems strengthening (link).

There is no single approach to monitoring SMOSS due to the diversity of sanitation systems, service arrangements and data sources. Rather than prescribing one approach, this guidance consolidates existing methods, offers examples of global and local indicators, and outlines practical steps to improve monitoring using existing national systems.

This guidance summarises the global indicators used by the JMP for SDG 6.2.1 reporting, proposes local indicators that can support national planning, and describes common methods for data collection and

[1] Monitoring safely managed on-site sanitation (SMOSS): Synthesis of lessons from phase 1 pilots and recommendations for phase 2 pilots. https://washdata.org/sites/default/files/2022-05/jmp-2021-smoss-synthesis-report.pdf

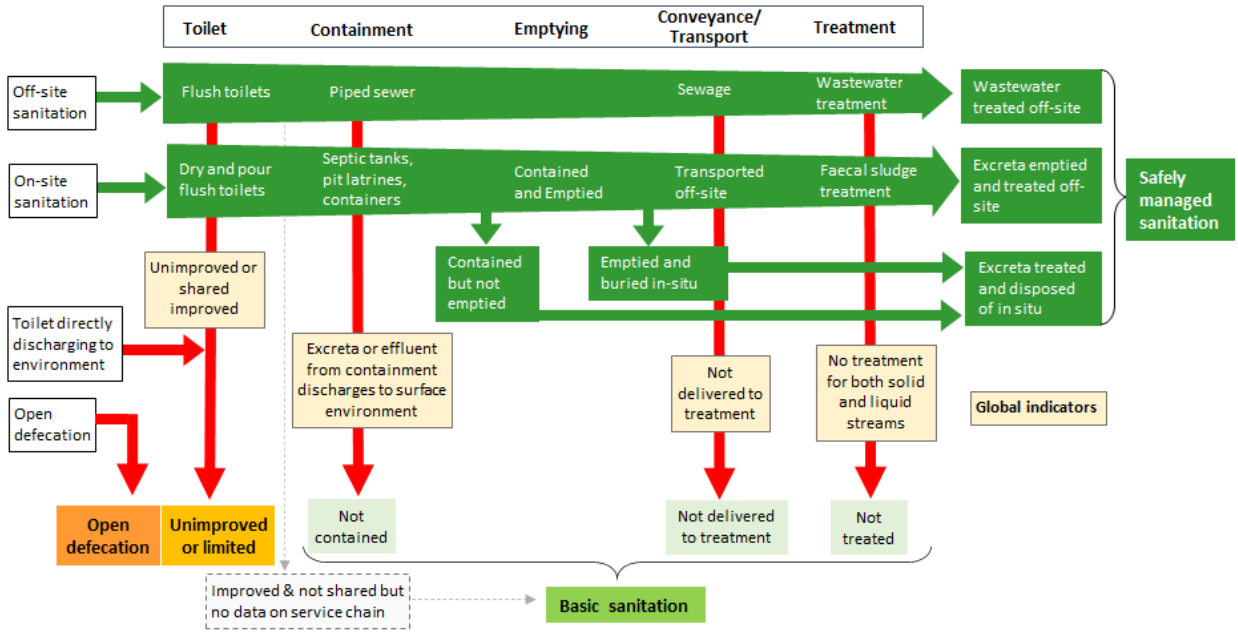
analysis to estimate safely managed sanitation services. It also highlights lessons from the pilot countries to help strengthen national monitoring systems. The Annexes include recommended core questions for national surveys, examples from existing monitoring efforts, and detailed guidance on survey design and the analysis of indicators for estimates of SDG 6.2.1a. The annexes are available on the WASH data SMOSS monitoring webpage and can be accessed by the following links:

- A. Global indicators for monitoring SMOSS
- B. Data collection – Household questionnaire
- C. Data collection – household sanitation inspections
- D. Data collection - Service authority and service provider surveys
- E. Analysis to inform national estimates for SDG 6.2.1

Indicators for monitoring SMOSS

Safely managed sanitation is the highest rung of the JMP sanitation service ladder (Figure 1) and therefore requires that the basic sanitation service criteria of the lower rungs are met: use of improved facilities that are not shared with other households. Beyond this, safely managed sanitation requires that excreta are managed across all steps of the service chain - from toilet to treatment or final disposal. Bot on-site and off-site systems can meet this standard by safely managed pathways differ. For sewered (off-site) systems, excreta must be conveyed in sewers and treated off-site to at least secondary level. For on-site sanitation, excreta must either i) remain safely contained in-situ but not emptied, ii) be emptied and safely disposed in situ, or iii) be emptied and treated off-site. Assessing these requires systematic evaluation of each step of the service chain (see Figure 2).

Figure 2. Excreta flow diagram showing global indicators used for global monitoring of safely managed sanitation (adapted from [4], [5])



Global and local indicators for assessing SMOSS

The JMP has defined a small set of **global indicators** for SDG 6.1 and 6.2 that can be consistently applied across countries and assessed using existing national data systems. These indicators form the basis of SDG 6.2.1a reporting. It is recognized that the global indicators do not capture all aspects of safety identified in the WHO guidelines on Sanitation and Health [4]. Countries may therefore track additional **local**

indicators tailored to their policies, service models and resources. Table 3 presents the global indicators alongside examples of local indicators that some countries are considered to strengthen national and sub-national monitoring. This list is illustrative rather than comprehensive and there are many more local sanitation indicators useful for regulation and service provision.

As part of their national commitment to the SDGs, all countries should be able to report on the core global indicators. This requires that national monitoring systems align in principle with the JMP definitions so that national data can be used for consistent and comparable SDG reporting. At the same time, governments are encouraged to localize the global indicators and set their own national targets for progressing safely managed services and reducing inequalities, based on national policies, priorities, capacities and levels of development [6].

In practice, some countries apply national indicators that differ from global ones. This may reflect continued use of MDG era indicators, or national definitions designed to address specific national objectives. A UNICEF review of SDG 6 monitoring across Eastern and Southern Africa found that in many cases minor changes to national surveys, such as revising or adding survey questions, could improve alignment with JMP global indicators [7]. Where countries use different national definitions or targets, monitoring systems should collect data needed for both national and global indicators. This avoids compromising global comparability while allowing countries to track their own priorities. Figure 3 illustrates how local indicators across the service chain can lead to national estimates that differ from global SDG 6.2.1 values; clear communication is necessary when presenting both sets of results. Examples of national targets or definitions that differ from the global (JMP) definitions include:

- Indonesia: National targets require that on-site systems are emptied after 5 years to be considered safely managed, whereas global indicators do not specify an emptying frequency.
- Bangladesh: The 2005 national sanitation strategy considers latrines shared between up to two households as improved [8] and therefore potentially safely managed, while the global framework classifies all shared facilities as a limited service.
- Bolivia: In urban areas only sewerage is classified as improved sanitation, meaning on-site sanitation are not considered improved [9], contrary to global definitions which include on-site systems as improved.

Figure 3. Example excreta flow diagram showing local indicators that may be considered for national and sub-national monitoring of safely managed sanitation

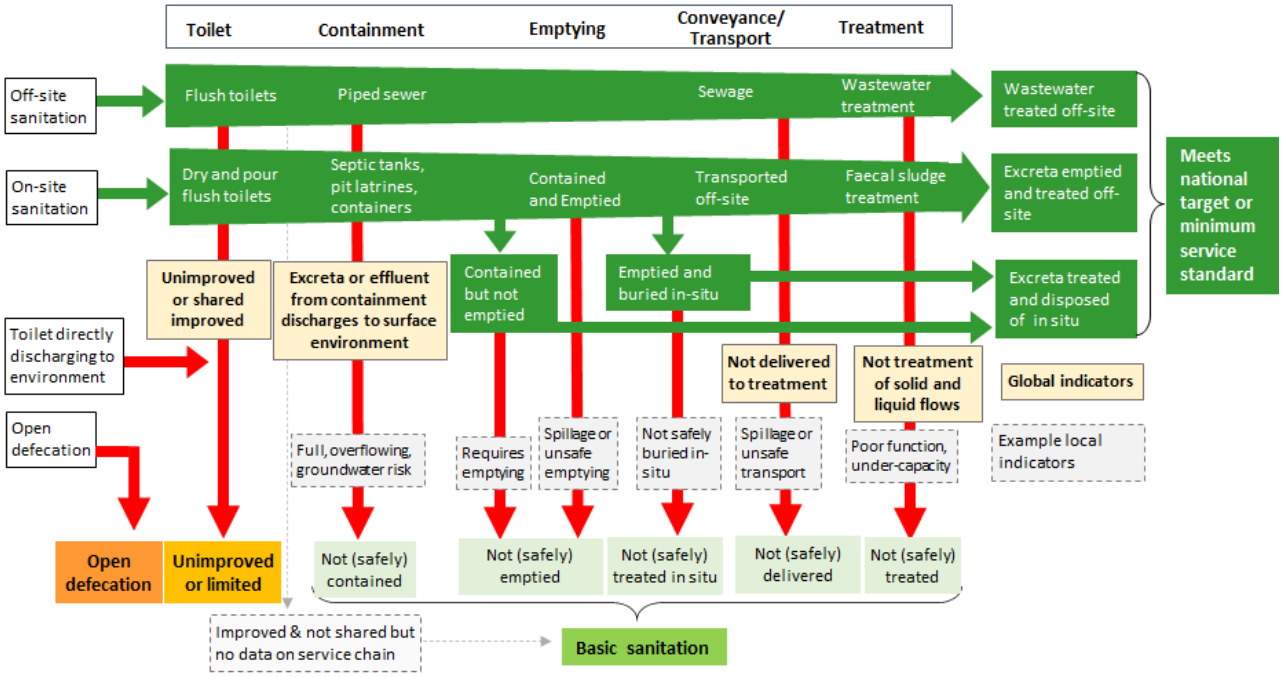


Table 3. Summary global indicators and example local indicators

	Global indicators	Example optional local indicators for national monitoring
Basic sanitation serivce	Use of improved toilet facilities	- **Use:** all members using facility, child stool disposal, cleanliness - **Access:** Location, accessibility all times and to all, privacy, safety,
	Toilet is not shared with other households	- **Use:** all members using facility, number households sharing, restrictions, payment - **Safety:** Cleanliness, privacy, lockable doors, proximity, lighting, gender separated, - **Quality:** water access, tiling, handwashing
Containment	Excreta isolated in on-site system and not discharged or overflow to the surface environment	- **Design standards:** sealed cover, wall and base material or permeability, chambers, dimensions, outlet type - **Functionality:** damage, blockage, leaks, sludge depth - **Groundwater risk**: proximity to wells, depth of groundwater, soil characteristics density (volume/area requirements for infiltration)
Disposed in-situ	Contained, not emptied	- **Function:** Years operation, size, sludge depth, - **Risks:** Groundwater risk, flood risk
	Contained, emptied, buried in-situ	- **Location:** on/off premises, distance from house - **Safety:** covered, how buried, buried in rainy season, groundwater risk, proximity to waterways / residents - **Reuse:** contents used after less than 2 years storage
Emptying	If on-site system ever emptied	- **Emptying frequency:** years, regular or scheduled - **Method**: manual, mechanical (type of equipment) - **Safety to workers:** PPE/protection, not entering pit - **Safety to user/public:** no spillage, flushed to drain - **Accessibility:** location of containment, presence of lid/manhole, street access
Transport	Excreta delivered to off-site treatment facility	- **Method of transport:** manual (cart), motorized, - **Safety to workers:** PPE/protection during transport - **Safety to user/public:** no spillage, covered transport, vehicles not used for water supply
Treatment	Designed to provide treatment for both solid and liquid phase	- **Design standards:** meets national standards for faecal sludge treatment facilities; treatment adequately level for the risk of exposure to the effluent - **Function:** Systems function, not overloaded/ reasonable capacity, not damaged, leaking, overflowing or bypassed.
Reuse	Not included in global indicators for SDG 6.2	- **Safety:** duration stored, compliance with quality standards, adequate treatment for intended reuse - **Use:** type of use, method of application,

The Table below provides detailed definitions of the indicators across the on-site sanitation service chain which is expanded from Table 3 in the published JMP 2018 Core questions document to include further details relating to monitoring of on-site sanitation services.

Table 4. Monitoring definitions for on-site sanitation

Definitions of improved sanitation facilities	Notes on classification
• **Flush/pour-flush toilet:** a flush toilet has a cistern or holding tank to store water for flushing and has a water seal (which is a U-shaped pipe below the seat or squatting pan) to prevent the passage of flies and odours. A pour-flush toilet also has a water seal but has no cistern and water is poured by hand for flushing. • **Flush to piped sewer system:** is a toilet that flushes excreta to a system of sewer pipes, also called sewerage, which is designed to collect human excreta (faeces and urine) and wastewater and remove them from the household environment. • **Flush to septic tank:** is a toilet that flushes excreta to a water-tight container, normally buried underground away from the dwelling, designed to separate liquids from solids which are then allowed to settle and decompose. • **Flush to pit (cesspool):** is a toilet that flushes excreta to a covered pit which retains solids. The base and sides of latrine pits may be permeable to allow liquids to percolate into the soil. This may also be referred to as cesspool or wet pit latrine. • **Flush/pour flush to don't know where:** indicates that the household uses an improved sanitation facility but does not know whether it flushes to a sewer, septic tank or pit latrine. • **Single pit latrine with slab:** is a dry sanitation system that collects excreta in a pit in the ground. The pit is covered by a squatting 'slab' or platform that is constructed from materials that are durable and easy to clean. The 'slab' has a small drop hole, or is fitted with a seat, allowing excreta to be deposited directly into the pit. • **Twin pit latrine with slab:** refers to a system where households use a second pit when the first one fills up and is designed to ensure that excreta are treated in situ for a sufficient amount of time before the wastes are evacuated safely. Twin pit latrines can be dry (double VIP, fossa alterna) or wet (offset pits connected to pour flush toilets). • **Ventilated improved pit (VIP) latrines with slab** (dry pits with ventilation pipes) are used in some parts of the world but neither ventilation nor superstructure design are part of the definition of an improved sanitation facility. 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. • **Composting toilet:** is a dry toilet into which carbon-rich material (vegetable wastes, straw, grass, sawdust, ash) is added to the excreta and special conditions maintained to produce inoffensive compost. A composting latrine may or may not have a urine separation device. • **Container based sanitation:** refers to a system where toilets collect excreta directly in sealable, removable containers (also called cartridges) which are regularly collected by commercial service providers and delivered to treatment. If there is no active and functioning program for collection and treatment, the container should be classified as a bucket.	1. **Improved sanitation facilities** are those designed to hygienically separate human excreta from human contact. These include wet sanitation technologies such as flush and pour flush toilets connected to sewers, septic tanks or pit latrines, and dry sanitation technologies such as dry pit latrines with slabs and composting toilets. 2. **Sewer systems** consist of facilities for collection, pumping, treating and disposing of human excreta and wastewater. The sewer category should only be used for systems designed to convey wastewater to treatment plants. Covered drains which are not designed to convey wastewater to treatment may be mistakenly referred to as sewers and clarification of local interpretation of "sewer" may be needed in some contexts. 3. **Septic tanks** are designed to contain and treat excreta in situ and should have at least two chambers separated by a baffle and a T-shaped outlet pipe to reduce the scum and solids that are discharged. The effluent should infiltrate into the subsurface through a soak pit or leach field, or discharge to a sewer system or further treatment. However many household respondents are not able to provide technical information on the design of and construction of storage tanks. 4. The principal difference between improved and unimproved pit latrines is the presence of a 'slab'. **Pit latrines with slabs** that completely cover the pit, with a small drop hole, and are constructed from materials that are durable and easy to clean (e.g. concrete, bricks, stone, fiberglass, ceramic, metal, wooden planks or durable plastic) should be counted as improved. Slabs made of durable materials that are covered with a smooth layer of mortar, clay or mud should also be counted as improved.
Definitions of unimproved sanitation facilities	**Notes on classification**
• **Flush/pour flush to covered drain or open drain:** refers to households using toilets that discharge into covered or uncovered drains do not effectively contain excreta thereby exposing the community to faecal pathogens. These differ from	5. '**Flush/pour flush to elsewhere**' suggests that excreta are not being discharged into a sewer, septic tank or pit latrine) but into the local environment and should therefore be classed as unimproved.

sewer as they are not designed to convey wastewater and not connected to treatment plants. Some countries may include covered drain as an optional unimproved option. • **Pit latrine without slab/open pit:** is a dry sanitation system that uses a pit in the ground for excreta collection and does not have a squatting slab, platform or seat. An open pit is a rudimentary hole in the ground where excreta is collected. • **Bucket:** refers to the use of a bucket or other container for the retention of faeces (and sometimes urine and anal cleaning material), which are periodically removed for treatment, disposal, or use as fertilizer. • **Hanging toilet/hanging latrine:** is a toilet built over the sea, a river, or other body of water, into which excreta drops directly. • **No facility/bush/field:** includes defecation in the bush or field or ditch; excreta deposited on the ground and covered with a layer of earth (cat method); excreta wrapped and thrown into garbage; and defecation into surface water (drainage channel, beach, river, stream or sea).	6. **Pit latrines (or other facilities) with slabs that only partially cover the pit**, or with slabs constructed from materials that are not durable and easy to cleanJ (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. 7. The use of open '**buckets**', 'pans', 'trays' or other unsealed containers which are collected and emptied each day by informal service providers (including 'manual scavengers') presents significant health risks and is classed as an 'unimproved sanitation facility'.
Definition of contained	**Notes on classification**
"Contained on-site sanitation facilities" have containments that do not overflow or discharge excreta directly to the surface environment • **Containments:** on-site systems (permeable or impermeable containers for storing excreta) that are located close to the toilet or latrine. Examples of containments include wet or dry pit latrines, septic tanks, and holding tanks. • **Do not overflow excreta to surface environment:** containment has no outlet or has an outlet discharging to a subsurface infiltration system (e.g. leach pit or infiltration field) or is connected to a piped sewer or closed drain for further treatment. Outlets or overflow pipes that discharge effluent directly to the surface environment (e.g. surface, open drains, waterways) are considered not contained. • **No overflow or other discharge to the surface environment**. This applies to all on-site systems (flush and dry) and could be due to overflow or flushing out of excreta during flooding, leakage or overflow due to containments being full, other leakage of excreta due to damage to the containment or other events. • **Directly to surface environment:** refers to direct discharges to surface environments (ground, floor, open drains, waterways) which may expose the household to harmful pathogens . Does not include sub-surface infiltration. **Not contained:** • Containments that have either an outlet/overflow pipe that discharges excreta directly to the surface environment, or are broken/leaking/overflowing excreta to the surface environment may expose humans to harmful pathogens and are classified as not contained.	8. Containment only applies to on-site sanitation facilities, permeable or impermeable container for storing excreta close to the toilet or latrine (i.e. pit latrines, cesspools, septic tanks, and holding tanks) and not toilets connected to sewer, drains or the environment. 9. Containment applies to both solid contents (settled sludge consisting of excreta along with hygiene or other waste products) and the liquid contents (supernatant consisting of excreta, flushing and ablution water, and occasionally also greywater from kitchen, washing, bathing, etc.). 10. **Dry pit latrines** (and container based sanitation) receive relatively little liquid inputs and are less likely to have outlet pipes for liquid effluent but may release excreta due to overflow, flooding or damages/collapse. 11. Many containments discharge liquid to the soil/ground through infiltration from the impermeable walls or base of the containment. For the purposes of SDG monitoring these are considered as 'contained', as long as the effluent does not contaminate the surface environment. In some contexts, expanded indicators may be used to assess potential risk to groundwater.
Definition of emptied	**Notes on classification**
• **Emptied:** improved on-site sanitation facilities that have **ever** been emptied. • **Not emptied but covered and left undisturbed when full:** As all pit latrines and septic tanks could be emptied, the emptying question is typically asked to all respondents with improved containments. However dry pit latrines, particularly in rural areas where there is adequate space, may not necessarily be emptied when full and are instead covered and a new pit built. While this is equivalent to never emptied, this response category was added due to previous	12. It is recognized that some containments are designed for regular emptying (e.g. septic tanks) however emptying frequency is not considered in the global indicator. Expanded indicators can be used to assess duration of operation (age) or time between emptying (emptying frequency) and compare these to the local design standards. 13. All service providers (e.g. public, private or informal) and methods of emptying (e.g. manual, shovel, mechanical) are assessed as emptied.

confusion for respondents that do not expect to ever empty their dry pit.	14. Some survey respondents, particularly tenants, may not know if their containment was emptied. "Do not know" response is assumed to be 'not emptied'.
Definition of in-situ treatment and disposal	**Notes on classification**
Treatment and disposal in situ is classified as: • **Contained, not emptied:** All improved on-site systems that are contained but have never been emptied (see emptying definition above) can be considered safely managed through treatment and disposed in-situ. • **Contained, emptied, buried in-situ:** All improved on-site systems that are contained, emptied and disposed of in-situ can be considered safely managed if not shared. This includes buried in a covered pit at or near the household.	15. **In-situ** is not limited to the household premises and can also include covered burial nearby to the household. There is no definition or limit on the proximity. 16. **Covered pit/trench elsewhere:** While similar to buried in-situ this is classified as delivered off-site. 17. **Arborloos:** the practice of planting a tree on-top of a covered pit fits into this category. 18. Potential risk to groundwater from in-situ disposal is not considered**.**
Definition of transported to treatment	
• **Transported to treatment**: Excreta and other materials (faecal sludge) removed from containments and delivered to an off-site treatment plant or designated disposal site. • **Buried in a covered pit/trench elsewhere** (not at or near household) is considered transported to treatment.	19. **Transport** does not consider the level or type of treatment, therefore faecal sludge discharged at the follow sites can be considered transported: treatment plants (all types), piped sewer networks connected to treatment, or designated sites for faecal sludge treatment and disposal (i.e. landfill, drying beds, constructed wetlands, trenches) 20. All methods of transport (manual cart, truck or tanker) are included. **21. Transported and discharged to open drains, water body or open ground (including agriculture fields) are considered not transported to treatment**. While on-site sanitation facilities provide some minimal treatment, faecal sludge is unlikely to be adequately treated for direct use **in agriculture or disposal in the environment.**
Definition of treated	**Notes on classification**
• Faecal sludge is considered treated if delivered to a treatment plant that is designed to treat both solid and liquid phases and is treated. • Types of treatment accepted for faecal sludge are summarised Figure A3. Solid-liquid fraction separation alone is not considered treated. Faecal sludge can be treated at a faecal sludge treatment plant, a wastewater treatment plant, or co-treated with solid waste/composting (provided both solids and liquids are treated).	22. **For SDG 6.2** (safely managed sanitation) only the specified type and level of treatment is considered. Performance of the treatment plant and exposure risk of disposal and reuse are not considered for SDG 6.2. 23. **For SDG 6.3** (safely treated wastewater) performance of treatment plants against national standards is considered. Exposure risk of disposal and reuse are not considered for SDG 6.3. 24. Transport response category "Buried and covered in a pit/trench elsewhere" can be considered off-site treatment as per safe burial and storage (e.g deep row entrenchment).

Data collection methods and sources

Monitoring safely managed sanitation requires information on both household-level sanitation systems and shared services that support safe containment, emptying, transport and treatment. While household questionnaires have commonly been used to assess use of improved sanitation facilities, they are inadequate for assessing the entire chain and a mix of data collection methods are required. Table 5 summarizes different methods to collect data on safely managed sanitation services and which are most reliable to inform each part of the service chain. Gaps in data on emptying, transport and treatment of excreta from on-site sanitation facilities persist. As of 2024, JMP data on excreta emptied and treated off-site are only available for 2% of the relevant global population [1]. This demonstrates the importance of strengthening national monitoring systems to monitor the entire service chain. This section summarizes the steps to assessing data gaps in national monitoring systems and summarises the different data collection methods outlined in Table 5.

Table 5. Potential sources of data for different steps of the service chain

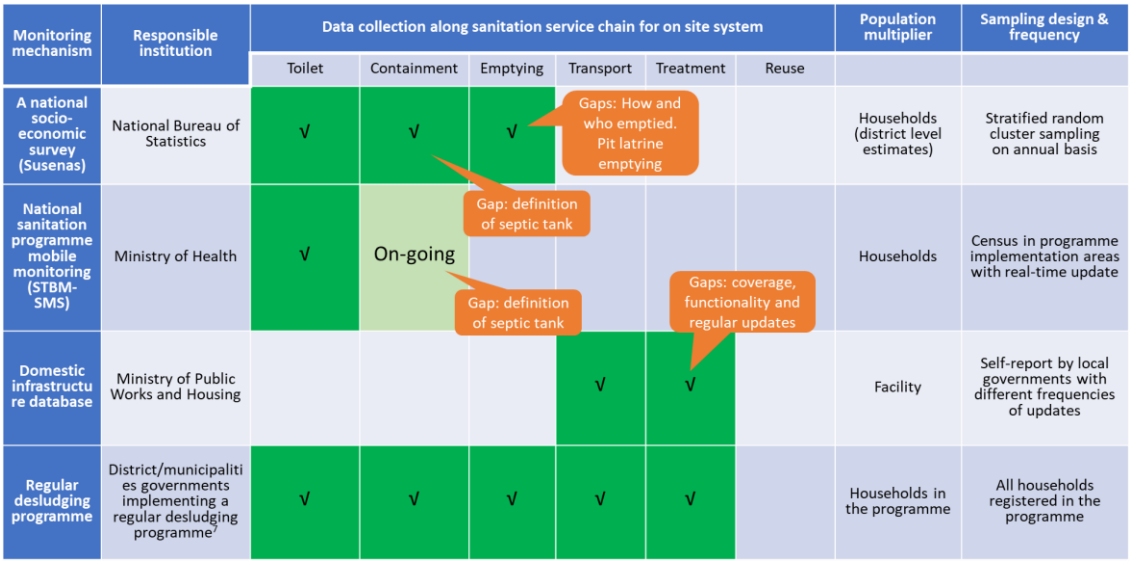
Service chain / Data collection method	Facility type	Containment	Emptying	Transport	Treatment
Household questionnaire				In-situ only	
Household sanitation inspection					
Data from service authorities (e.g. Administrative data)					
Data from service providers (e.g. via regulators)					
Spot checks / inspections of service chain					

Levels of reliability and use of source — Low — High

Coverage and alignment of existing national monitoring framework

Improving national estimates of SMOSS begins with **assessing the coverage, alignment and completeness of existing monitoring frameworks.** M-SMOSS pilot countries found that compiling a comprehensive inventory of data sources was a critical first step, typically involving a desk review followed by stakeholder interviews or workshops. Given that responsibilities for on- and off-site sanitation often span multiple ministries, utilities, municipalities and environmental agencies, broad stakeholder engagement is essential to uncover lesser-known data sources, clarify regulatory responsibilities for monitoring or reporting, and identify opportunities to share data or integrate new indicators. Mapping stakeholders and regulations (see regulatory mapping in Figure 6) across the service chain helps determine who collects what data, where gaps exist and how monitoring systems can be strengthened. The initial gaps assessment conducted for the Indonesia M-SMOSS pilot (Figure 4) provides an example of how gaps may arise in service data but also across geographic or population groups. From other pilot countries, data on emptying, transport and treatment may only be available for urban areas, or regular household monitoring may exclude certain minority populations, such as informal settlements. Understanding the sampling design, geographic coverage and frequency of data collection helps determine how different datasets can be combined to inform national and global estimates. The JMP's criteria for data acceptance also provide guidance on the types of sources that can contribute to global estimates [10].

Figure 4. Assessment of SMOSS in existing data and potential data sources, Indonesia



Harmonizing indicators and identifying data gaps

Strengthening monitoring systems also requires harmonizing definitions and indicators. Harmonization refers to the consistent application of standard definitions and classifications when assessing sanitation facilities and service levels. Ensuring indicators are harmonized within countries is important, as different ministries or levels of government may use separate systems, tools and definitions, leading to inconsistent data and missed planning opportunities. Harmonization with global indicators allows national data to be reliably aggregated for SDG reporting and compared globally and over time. This is why WHO and UNICEF work with countries through the JMP to clarify definitions and align indicators. Harmonization does not mean eliminating local indicators but ensuring that monitoring systems can report consistently on both local priorities and global SDG requirements. Harmonized monitoring frameworks reduce duplication, improve efficiency and strengthen data quality.

A practical starting point is to review how national indicators align with global SMOSS indicators and identify where revisions are needed. This may involve adjusting survey questions, refining response categories, or adding new variables to capture missing information. Common gaps include inconsistent labelling of sanitation facilities, collecting data on septic tank emptying but not on pit latrines, or recording only whether OSS are full rather than whether have been emptied, or compiling administrative data on sludge treatment design capacity but not the type of treatment. Existing tools can be compared with the core questions provided in Annex B to identify what simple changes would improve alignment. Clarification with stakeholders can inform whether misalignment reflects alternative national standards or targets, different local interpretations of key terms, or use of outdated indicators. Consultation with sub-national agencies and service providers helps ensure alignment or reconcile differences across sectors and agree on harmonized indicators to improve efficiency in data collection and clarity on how progress is reported. When global and national indicators are aligned, or at least clearly mapped, it creates a shared understanding for ministries, service providers, donors and development partners.

Integration of global indicators into national monitoring systems

Once gaps are identified, the next step is to identify how additional core questions or new methods can be integrated into existing national monitoring systems. Engagement with national statistics bureaus helps to clarify the timelines and procedures for testing or validating new questions before they can be integrated into large national surveys. In some countries, this involves incorporating pre-testing questions

into existing planned surveys, such as a national Water Quality survey in Indonesia or a household employment survey in Ecuador. Elsewhere, stand-alone surveys may be required to pre-test questions prior to integrating into national surveys, as was done in many M-SMOSS pilot countries or within government or development partner project monitoring programs. Service authority or service provider surveys can be distributed through existing communication channels, such as NGO facilitated distribution to local government and service providers in Serbia. Dedicated surveys should be designed to refine questions and methods, ultimately strengthening routine national monitoring and reporting on safely managed sanitation.

Data collection methods

The following section describes the proposed five data collection methods for informing SMOSS. For each method there is a summary of the type of sanitation services they are best suited to monitor, examples of how they have been implemented and considerations for survey design. Countries should determine what methods best suit their institutional context and existing monitoring systems, informed by the previously mentioned monitoring gaps assessment. To date there are many more examples of the application of household questionnaires to monitoring SMOSS that the other methods, however household questionnaires alone will not fill the important data gaps on emptying and treatment from on-site sanitation.

The annexes B-D provide the proposed core questions for each data collection method, example expanded questions and a summary of sampling considerations.[2] The SMOSS monitoring pilot phase 1 synthesis report provides details of the methods used by each pilot country, their approach to implementation and sampling.[3]

[2] Annexes available at https://washdata.org/monitoring/sanitation/safely-managed-on-site-sanitation

[3] Monitoring safely managed on-site sanitation (SMOSS) : Synthesis of lessons from phase 1 pilots and recommendations for phase 2 pilots. https://washdata.org/sites/default/files/2022-05/jmp-2021-smoss-synthesis-report.pdf

Household questionnaire

Censuses and nationally representative household surveys make up around 50% of the national data sources contained the JMP global databases for monitoring water and sanitation [4]. Household questionnaires are often based on those of international survey programs (e.g. MICS, DHS or a combination of modules) and ask questions about the household's sanitation facilities, their use and function. Censuses, led by national statistical offices, reach entire populations but often include only a few key sanitation questions. Inclusion of social-economic information in household questionnaires and censuses enable sanitation data to be disaggregated to assess inequalities between population sub-groups (e.g. urban/rural, sub-national region, wealth quintiles, ethnicity, education).

What parts of SMOSS are monitored: Household questionnaires typically rely on self-reporting, which is effective for easily understood questions, however, can be less reliable when questions become more technical or relate to services occurring outside their household. For this reason, household surveys should focus on questions related to access and sharing of sanitation facilities, their type and function, as well as some information on containment, emptying and in-situ disposal practices (see Table 5 above). Proposed core questions for household surveys and how they inform SMOSS indicators are provided in Annex B Table B1. Examples of expanded questions that could be used to monitor local indicators or inform service delivery are provided in Table B2. The additional time for data capture and analysis should be considered when selecting expanded questions and inclusion of core questions should be prioritized as these are necessary to inform estimates for SDG 6.2.1.

Implementing household surveys in SMOSS Pilots: In the M-SMOSS pilots household questionnaires were either integrated into existing national monitoring or conducted as dedicated surveys for the pilot. As noted above, there are a range of options for integrating household survey questions into national monitoring systems and for the pilots, the timing of existing surveys and ability to add new questions were important considerations. Dedicated household surveys were either implemented by the pilot partners (e.g. by UNICEF volunteers in Bangladesh and NSO enumerators in Malawi), by local environmental health staff (Moldova, Serbia, and Zambia) or contracted to an independent organization managing survey design and implementation (Ecuador and Kenya). The enumerators' experience, knowledge about sanitation, and extent of training on the survey, were necessary to ensure quality data collection, particularly for the assessment of technical aspects of sanitation (e.g. type of facility, discharge of effluent or sludge). Supplementary explanations or visual guidance tools were occasionally provided to enumerators to address common assessment challenges or provide a systematic approach to clarifying uncertainties.

Survey design: To improve the quality of questionnaires and ensure they can provide data needed for SDG estimates, some important survey design steps include:

1. Confirm list of indicators and analysis plan prior to data collection to ensure questions can inform global indicators, and also local indicators if needed. This may require updating or adding new questions to existing national surveys (see suggested core questions in Annex B Table B1).
2. Clear question and response wording and pre-testing questions to confirm correct interpretations. Pre-testing can also identify additional response categories to reduce use of "other" responses, which were time consuming at the interview and analysis stages. A table of definitions is provided in Annex A Table A3 provides the intention and conditions of each indicator that can support accurate translation and interpretation. A summary of ambiguous survey questions is provided in Annex B section B.3 provides examples of commonly challenging terminology .
3. Adequate training of enumerators and pre-testing to confirm enumerators understand survey intention and terminology, particularly related to facility types and discharge from containment.

Sampling: The scale and sample size were chosen based on the objective of the survey and budget. Some pilots conducted nationally representative to inform national estimates (e.g. Bangladesh, Serbia and Zambia), while others were targeted surveys designed to test methods in greater detail and include priority demographical contexts (e.g. Kenya). Information on sample design and identification are provided in Annex B section B.4.

Household sanitation inspections

Household sanitation inspections are an observational technical and risk assessment of toilet facilities and containment systems. They can capture more detailed technical information than household questionnaires and help validate self-reported responses. Similar inspections approaches can be applied to treatment plants, see below.

What parts of SMOSS are monitored: The accuracy of household questionnaires to assess sanitation facilities depends on how well enumerators can explain technical features, which may not align with common interpretations (e.g. varied containment types are labelled "septic tanks"). Inspections provide a more reliable assessment of technical characteristics that are difficult to capture through self-reporting. They also help verify information that households may be reluctant to disclose for regulatory or social reasons (e.g. illegal effluent discharge, damaged or overflowing containments). Inspections can therefore be used to assess facility type, containment and effluent discharge, system functionality or health risks. Beyond monitoring, inspections may also include discussions on follow up actions to improve containments or reduce risks. Inspections have also been used to monitor accessibility, cleanliness, privacy, and handwashing facilities, although this report focuses more on facility type and containment.

Implementing sanitation inspections: Inspections can be implemented as part of a larger household questionnaire or conducted as dedicated sanitation inspection. Depending on the scope and objective of the household questionnaire, integrating inspections may mean fewer observations can be included and that the enumerators are not necessarily technically trained, however will likely enable large sample sizes and minimum additional cost to the standard questionnaire. In Annex C Table C1 we have proposed the minimum **core questions** for household sanitation inspections that could be integrated into a household questionnaire to assess the global indicator for containment. Dedicated inspections could be conducted by a technically skilled enumerator and go into more detail, such as conducting more detailed risk assessments, with example **expanded questions** provided in Annex C Table C2. In countries with strong regulatory systems, trained inspectors carry out periodic checks to track OSS performance against national laws or standards. There are examples of dedicated sanitation inspections conducted in France, Ireland and Japan which are summarised in Annex C section C.3. The WHO and UNICEF Sanitation inspections: user guide includes these different approaches, as well as how to integrate inspections into national monitoring, regulation, or risk management [11].

Enumerators and training: Inspections may be conducted by environmental health inspectors, community health extension workers (e.g. Indonesia) or household survey enumerators. Environmental inspectors generally have greater technical expertise but can visit fewer households annually, while community health workers can collect more routine information but may require more intensive training. All enumerators need clear guidance to ensure assessments align with core indicators and definitions rather than personal judgement about "good sanitation systems". Visual aids, such as photos of response options or diagrams of inspection points, can support consistency. For example, the WHO sanitation inspection checklists provide diagrams of typical assessment sites for different facility types [11].

Survey design: Inspections may incorporate additional methods such as taking photos, measuring containment dimensions or setback distances, or inspections of sludge depth. However, the added value of these methods to inform SMOSS global indicators must be weighed against the increased time and complexity involved. Some methods may be useful during initial formative research but unnecessary for routine monitoring. The M-SMOSS pilots showed challenges with expanded indicators, including low acceptance or access for internal tank inspections. In Indonesia, only 25% of households permitted inspections, and less than one third of those containments were accessible.

Sampling: In surveys that integrate inspections, a subset of households may be selected for inspection. For example, the Bangladesh pilot inspected one third of surveyed households. This sampling approach may need to be refined once more inspections have been conducted and analysis on the variability of response geographically and over time. Sampling also depends on how the data will be analysed and used. For instance, whether inspection findings are combined with household survey data or used to generate national assumptions (i.e. the portion of uncontained septic tanks). Annex C.4 provides examples of sampling methods and stragies from the M-SMOSS pilots and from monitoring in Ireland and France.

Service authority data: Administrative data, local government surveys

Administrative data refers to the routine information collected by governments and service providers through their day-to-day business (registration, record keeping, service delivery) [12, 13]. Although administrative data are primarily collected for operational or regulatory needs, these data can be processed to respond to many national statistical needs [14]. Administrative data sources are important for JMP monitoring with 40% of national sources used for the 2025 JMP progress report for sanitation coming from administrative data sources [1]. For SMOSS, administrative data are particularly valuable for services beyond the household scale (e.g. emptying, transport, treatment).

However, there are still very few examples of the use of administrative data from service authorities or service providers to inform SMOSS indicators; most existing data relates to wastewater. The core questions and methods proposed in this guidance were tested in the Phase 2 pilots but are not yet widely integrated into routine monitoring systems, reflected by the 2% of population using on-site systems with data on emptying and treatment off-site. Because administrative systems vary widely, proposed questions and approaches should be adapted to the national sanitation and monitoring context.

Target audience: As local authorities (local government, municipality, etc.) are ultimately responsible for overseeing the sanitation services provision, this section outlines how data for global SMOSS estimates can be collected from local **service authorities**. Although authorities can also act as the service provider, this section focuses on their role as the authority and data relevant to sanitation services within the administrative jurisdiction (e.g. district, city, province). The subsequent section details data collection from **service providers** about their individual service provision. Further explanation of the division of these roles are provided in Annex D.

Sources of administrative data: Ideally, local governments routinely collect and storing data on all steps of the sanitation service chain as part of their oversight and management of services. Central ministries may also require periodic reporting on key indicators through sector information systems. National ministries of local government, infrastructure, health and environment may distribute periodic questionnaires to compile topic specific information. When consistently collected, these data can be valuable for SDG reporting. For JMP global monitoring, administrative data often come from regional programs (EUROSTAT, IB-NET, other) or from reports by national authorities, statistical offices, ministries, and regulators. Other potential sources include building registers, environmental compliance records from septic tank inspections (see Box 1), emptying service records, business registers or national databases of treatment facilities. We assume that the service authority can provide updated data every 1-2 years on the main types of services provided and the populations served within their administrative jurisdiction, even if doing so requires adapting existing data collection systems.

Box 1 Administrative data on containment inspections

The 2021 JMP report and the WHO Sanitation inspections: user guide summarize data sources for assessing containment, with administrative data available for various European countries, including data from Statistics Norway on direct discharges from individual treatment plants (on-site containments) (WHO/UNICEF 2021). Elsewhere, France's Office for Biodiversity manages an online data portal on public water and sanitation services where municipalities submit data regularly on the status of collective and non-collective (i.e. on-site) sanitation. In Ireland the national environmental authority requires local authorities to self-report against an annual quota of inspections. In Japan the Johkasou decentralized treatment plants are legally obligated to be inspected annually to confirm adequate maintenance and desludging. This inspection is conducted by a specified inspection agency which is a public service corporation of the prefecture (WHO 2024).

A review of national administrative sources can identify existing sanitation data and other systems in which SMOSS questions could be integrated. Potential sources may emerge from stakeholder mapping and include data from specific departments (e.g. Departments of Infrastructure, Water, Health or Environment), regulators, departments or associations supporting local authorities, amongst others. Given administrative data are not designed for statistical analysis, assessments should examine alignment with global definitions, reference periods, coverage, alignment of indicators and units; response completeness and accuracy [12].

Adding SMOSS questions to existing administrative data systems: Relevant administrative data for SMOSS are often limited, so additional core questions on emptying, transport and faecal sludge treatment will need to be added (Annex D Table D1). In the Phase 1 pilots, Ecuador added 19 questions related to on-site sanitation to an existing municipality survey, with data collection by the association of municipalities of Ecuador (AME) (further details in Annex D.6). The survey was sent out to the 221 municipalities and was implemented in coordination with the national institute for statistics and censuses (INEC) and the Water Regulation and Control Agency (ACRA).

Conducting dedicated surveys of service authorities in the absence of administrative data: When administrative data are lacking, surveys of local government can capture one-off data and provide an example for future administrative data collection. The recent GLAAS report found that less than 15% of countries had regulatory authorities that fully publish publicly accessible reports on the service quality of septic tank and pit latrine emptying services in either urban or rural areas [15]. Proposed core indicators for service provider surveys for emptying and transport, and for treatment are provided in Annex D Sections D.3 and D.4 respectively. In Serbia, the Phase 1 pilot implemented a dedicated survey on local government units and service providers using an online form distributed by the Standing Conference of Towns and Municipalities, an NGO that is closely connected with and supporting local government units.

Survey design: Survey design depends on the distribution method and who is expected to complete it. Surveys should prioritize core questions for global indicators, although expanded questions maybe support local monitoring. Often service authority surveys also capture details on finance, policy, and regulation; however, these do not specifically inform service delivery outcomes for SMOSS [15]. Findings from Ecuador and Serbia highlight key quality considerations in designing and implementing local government surveys:

- Provide clear indicator definitions, especially when asking new data. Limited ability to support respondents in both pilots may have contributed to low response rates or missing data.
- Low response rate, particularly to questions relating to safe disposal and treatment. Poor understanding and uncertainty about relevance may lead to unanswered questions. Improved survey design and clearer objectives can reduce accidental or intentional skilling.
- Validate self-reported through inspections, spot check or comparison with service authority and provider response.

Scale: Ideally, administrative data are nationally representative, however given the responsibilities for sanitation are often fragmented, some datasets may cover only certain service functions (i.e. only treatment), or parts of the population (i.e. only urban populations, or populations connected to piped water). Existing national or regional practices can inform the sampling approach. For example, Eurostat data collection on water and wastewater focuses on larger towns as these populations will have more impact on the national estimate [16]. In Serbia, responses from 50% of local governments represented 80% of the population and were considered nationally representative. Examples of sampling for service authority surveys are presented in Annex D Section D.6.

Service provider data

Service providers are entities responsible for delivering sanitation services. They can be large or small, public or private, an operate formally or informally. In some countries, service provision is regulated through licenses and permits, although unlicensed providers may still operate, while in other countries service provision may be weakly regulated or without formal licencing. Data from service providers covers a similar scope of the sanitation chain as service authority data, however the sampling strategies and data types often differ. Service providers may be involved in any stage of the chain, including toilet pan manufacturing, construction of septic tank and pit latrine, emptying and transport services, and treatment plant operation. This guidance focuses on core and expanded questions for emptying and treatment providers. While service authority data typically covers the entire population of an area, service provider data reflects the customers they serve and their service coverage. Although it can yield more detailed information, sampling and analysis are more complex because data may only represent part of the population.

Administrative data on service providers: Administrative data on service providers may come from regulators or local governments. Licensed service providers are often required to routinely report service information to the authority that issued their license. Regulators may also conduct spot checks to assess compliance with service standards. However, this data may be limited to formally recognised providers . Additional administrative data on private or informal providers may be available from business registers, associations, or organizations supporting non-government actors. The quality and suitability of these sources for JMP estimates may require approval from national statistical authorities. Core questions assume that service providers can routinely report annual data on service quantity and quality (e.g. populations served, containments emptied, sludge treated), and describe the type, function and performance of their services.

Implementing service provider surveys: In many countries, routine administrative data for emptying, transport and treatment service may not exist due to weak regulation of on-site sanitation. In these cases, dedicated data collection can generate baseline information and demonstrate how provider data could be integrated into regular monitoring. These surveys are more challenging than those of service authorities because additional steps are needed to identify the all potential service providers and determine feasible modes for distributing surveys. While local governments or regulators may have data on formal providers, alternative approaches may be required for informal or independent operators. Household surveys can help identify which providers households have engaged with, and stakeholder mapping and interviews may be needed to develop an appropriate strategy for identifying and reaching all providers.

Sampling: Sampling service providers is complex because the population they serve are not fixed, may overlap with other providers, or may cross administrative boundaries. Unlike off-site sanitation, where treatment plant catchments are clearly defined by infrastructure, populations served by individual providers or a treatment plant must be identified. Selecting a sampling strategy may require preliminary understanding of variability between providers, which could be informed by previous studies or secondary data. Regulations can also influence sampling. For example, in Serbia private emptying providers are not permitted to deliver sludge to treatment plants, therefore only government providers were sampled, as private providers will always be considered unsafe. For local planning, it may be useful to collect data from these providers to understand disposal practices, even if illegal. Sampling must be representative at both district and national levels and will depend on the number and scale of existing service providers. For example, countries with 10 sludge treatment plants require a different strategy from countries with 150 plants. The sampling approach should also align with the intended analysis, as discussed in the following chapter. Annex D.7 provides examples of sampling strategies, including UN-Habitat guidance on nationally representative sampling from cities, which could be relevant to service provider surveys [17].

Service chain inspections / spot checks

What parts of SMOSS are monitored: As with household sanitation inspections, visual inspections and technical assessments, or "spot checks", can be used to assess the emptying, transport, treatment and reuse services. These inspections are typically combined with operator questionnaires and reviews of relevant data records, generating both qualitative and quantitative information. Because large scale implementation of spot checks is often impractical, they are primarily recommended for validating other data sources, particularly where there are concerns about data quality, limited provider understanding of risks, or low confidence in self-reported information.

Implementing spot check/ inspections: Regulators or service authorities may conduct inspections to verify compliance with service standards. Common examples include environmental regulators monitoring treatment effluent and sludge by-product quality, or inspections of package treatment plants by the fabricator. However, regular inspections of emptying and transport services are rare and few countries conduct assessments aligned with global indicators. Effective inspection requires technical knowledge to assess treatment type, performance and risks. National-scale implementation could involve training local government engineers to conduct inspections or establishing a centrally train inspector cadre. Where on-site expertise is limited, inspections may be supported through detailed guidance and photo or video documentation collected by local staff and reviewed remotely by a technical specialist. Inspections of emptying and transport services require coordination with providers to ensure visits occur during active emptying operations.

Survey design: Although the pilots did not include service chain inspections, draft core and expanded questions (Annex D.5) are proposed to assess treatment against global indicators. These build on earlier WHO and UNICEF draft tools, which have yet to be widely tested. Inspections not only generate monitoring data but also help identify opportunities to improve services. They typically include sections to document risks, outline corrective actions and agree on follow-up activities with the operator. Coordination with the responsible agency on how inspection findings will be used to address service issues should be determined during survey design.

Sampling: As with service provider surveys, sampling should reflect the full range of service types and ensure representative of harder-to-reach operators, such as manual emptiers or private service providers. The required sample size depends on the purpose: representative sampling is needed when inspections serve as a primary data source, whereas smaller samples may suffice for validation. Frequency should also consider the quality of self-reported data and the potential hazards arising from non-compliance [16].

Analysis

Systematic assessment across the service chain

Analysis of SMOSS data requires systematic assessment of excreta flows against the global indicators at each step of the sanitation service chain and the three pathways to safely managed sanitation: (i) excreta not emptied but stored/treated and disposed in-situ, (ii) excreta emptied and disposed in-situ, or (iii) excreta emptied and treated off-site. Estimates of the population using each type of safely managed service (SDG 6.2) are derived from the global indicators presented in

Table 7, calculated from the core questions. As outlined in the previous section on global and local indicators, any additional local indicators collected to meet national definitions or monitoring needs are not included in national estimates for global reporting. These should instead be presented separately as a local assessment (see Figure 3). This section explains how core questions and global indicators are calculated and used to inform national estimates. Drawing on the core questions (Annex B-D), we specify the relevant questions and response categories that inform each indicator (

Table 7) and how they are analysed across the service chain following the decision tree (This decision tree enables a systematic analysis of the service chain, indicating which response options from the core questions relate to the sanitation ladder, from open defecation to safely managed services.

Figure 5). This analysis can be done either by calculating directly from survey data using data analysis software, or by calculating ratios at each step of the service chain (Table 6). Given that multiple data sources may inform certain indicators (e.g. containment S8 or emptying S9), and some indicators require merging data from different sources, an analysis plan should be developed during the design of data collection methods. This ensures that consistent indicators are used across datasets and that all necessary data are captured. Suggested approaches for integrating multiple data sources are provided at the end of this section.

Table 6. Ratios for analysis of core indicators

Ratio	Definition	Calculation of ratio from core questions
RS1	% improved sanitation facilities that are shared	S01 (improved) AND S02 (shared) / S01(improved) = SUMIF [S01(11,12,13,18,21,22,23,31,32) AND S02(1)] / S01(11,12,13,18,21,22,23,31,32) Ratio includes both on- and off-site improved. Assumes S02 is asked to both improved and unimproved.
RS2	% improved on-site sanitation facilities that are contained	= 1 – {SUMIF [S0b(3,4,5,6,8) OR (any of S04a/b/c/d=1)]} / S7 Alternatively use inspection questions IH3 and IH4
RS3	% improved on-site sanitation facilities that are emptied	= S05(1 emptied) / S7 Assumes S05 was just asked to respondents with improved on-site sanitation.
RS4	% improved on-site sanitation facilities that are emptied and disposed of in-situ	= S07a(3,4) / S05(1 emptied) Assumes S05 just asked to those who emptied.
RS5	% improved on-site sanitation facilities from which excreta are emptied and delivered to designated off-site treatment or disposal location	= S07a(1) / S05 (1 emptied) Alternatively, if S07a not included/reliable: = S07a(3 off-site)/ S05 (1) * (proportion disposed to treatment from service authority or service provider data)
RS6	% excreta received from on-site sanitation facilities (faecal sludge) that is treated	Service authority survey: = SA 40 (a,b) (FSTP) + SA41 (a,b) (WWTP and sewer) Other disposal sites: individual assessment needed to confirm proportion receiving adequate treatment at other disposal sites.
RS7	% wastewater that is delivered to treatment plants	From local government and service provider data (e.g. sewer leakage and overflow rates). Not detailed in this guidance.

RS8	% wastewater delivered to treatment plants that receives treatment	From local government and service provider data (e.g. proportion of wastewater that receives at least secondary treatment). Not detailed in this guidance.

Table 7. Global indicators for monitoring SMOSS in SDG6.2 and link to core questions

Indicator	Definition: the proportion of the population using…	Core questions[1]
S1	No sanitation facility (open defecation)	S01 (95)
S2	Unimproved sanitation facilities	S01(14,15,24,41,51,96)
S3	Improved sanitation facilities	=All HH-S1-S2
*	*Note S4-S13 do not include unimproved facilities but do include shared improved facilities*	
S4	Improved sanitation facilities connected to septic tanks	S01 (12)
S5	Improved pit latrines or other improved sanitation facilities	S01 (13,21,22,23,31, 32)
S6	Toilets connected to sewers	S01 (11,18)
S7	Improved on-site sanitation facilities	=(S4+S5)/All HH
S8	Improved on-site sanitation facilities that are **contained**	=RS2 x S7
S9	Improved on-site sanitation facilities that are contained and **emptied**	=RS3 x S8
S10	Improved on-site sanitation facilities that are contained, not emptied and stored on-site **(treated and disposed of in-situ**)	=(1-RS3) x S8
S11	Improved on-site sanitation facilities that are contained and from which excreta are **emptied and buried in situ**	=RS4 x S9
S12	Improved on-site sanitation facilities from which excreta are **emptied and delivered to treatment** or designated disposal site)	=R5 x S9
S13	Improved on-site sanitation that are contained and from which faecal sludge delivered to treatment are treated **(excreta emptied and treated off-site)**	=RS6 x S12
S14	Improved sanitation facilities which are shared (**Limited sanitation services)**	=RS1 x S3
S15	Improved sanitation facilities which are not shared but are not safely managed **(Basic on-site sanitation services[2])**	=(1-RS1) x S7-S19
S16	Improved on-site sanitation facilities which are not shared, and from which excreta are treated and disposed in-situ (**Safely managed on-site sanitation)**	=(1-RS1) x S10
S17	Improved on-site sanitation which are not shared, and from which excreta are emptied and disposed in-situ (**Safely managed on-site sanitation)**	=(1-RS1) x S11
S18	Improved on-site sanitation which are not shared, and from which excreta are emptied and treated off-site (**Safely managed on-site sanitation)**	=(1-RS1) x S13
S19	**Safely managed on-site sanitation**	=S16+S17+S18
S20	Toilets connected via sewers to treatment plants	=R7 x S6
S21	Toilets connected via sewers to treatment plants where wastes are treated	=R8 x S30
S22	Sewer connections that are not shared but are not safely managed (**Basic off-site sanitation services**)	=(1-RS1) x S6 -S23
S23	Sewer connections that are not shared and wastewater are treated off-site **(Safely managed off-site sanitation)**	=(1-RS1) x S21
S24	**Basic[2] sanitation services** (total on and off-site)	=S15+S22
S25	**Safely managed sanitation services** (total on and off-site)	=S19+S23

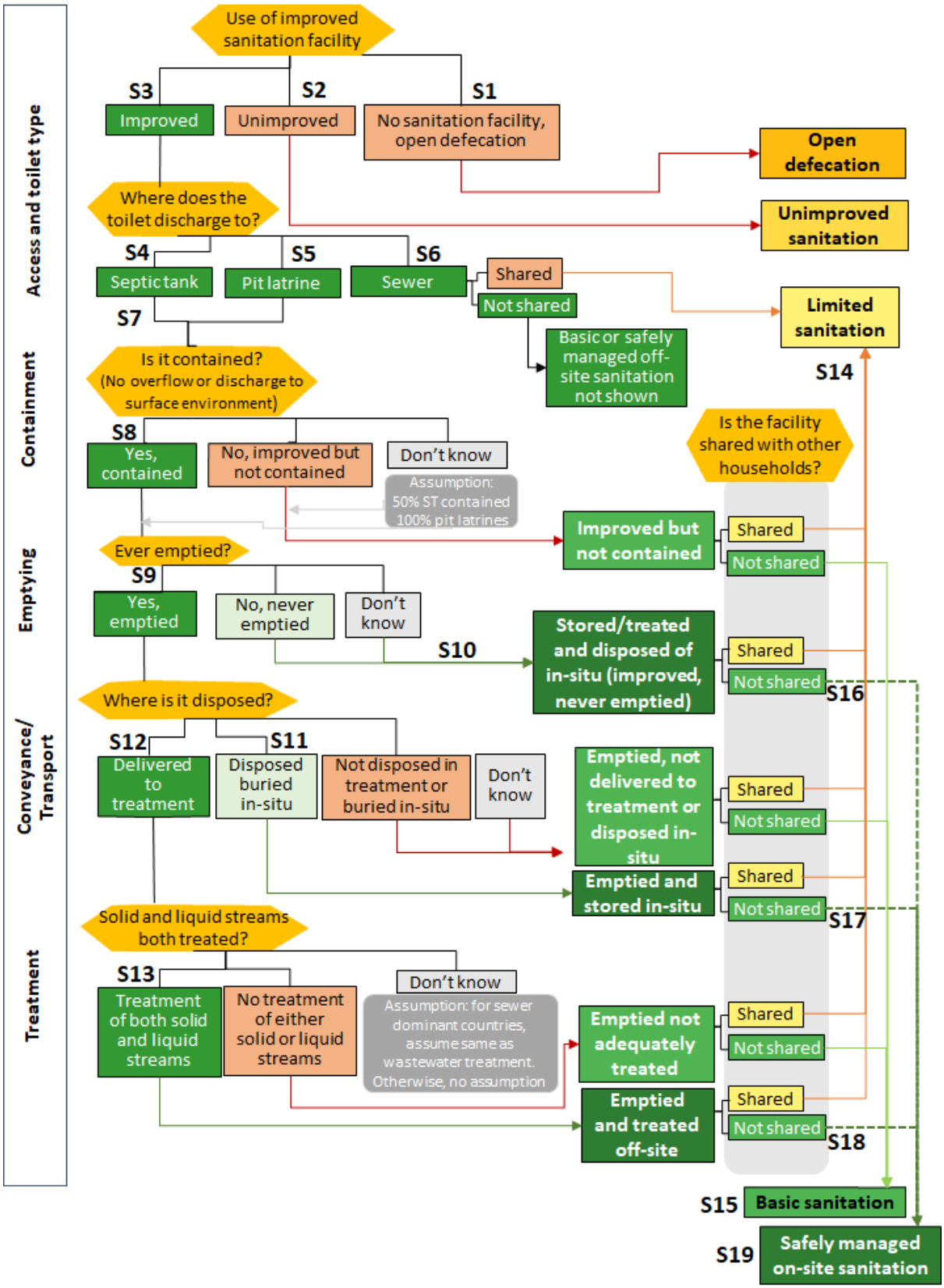
Notes:

1. In the first phase SMOSS pilots, most countries did not use a data analysis software to analyse survey data for individual households and instead used a spreadsheet to calculate aggregate proportions for each category. This approach is adequate for national and global monitoring but has some limitations, particularly in the assumption that shared systems are evenly distributed across safe and unsafely managed practices. A data analysis software would enable assessment of multiple criteria for each respondent and therefore provide a more detailed assessment which may be useful for programming.

2. Since households with safely managed services also meet the criteria for basic services, the two levels can be grouped together as '**at least basic'** which is the indicator used for monitoring SDG target 1.4 (universal access to basic services) . In the above Table At least basic = S24 and S25 (basic + safely managed).

This decision tree enables a systematic analysis of the service chain, indicating which response options from the core questions relate to the sanitation ladder, from open defecation to safely managed services.

Figure 5. Decision tree for analysis of core questions to inform SMOSS global indicators


Access and toilet type
Containment
Emptying
Conveyance/ Transport
Treatment
Use of improved sanitation facility
S3
Improved
S2
Unimproved
S1
No sanitation facility, open defecation
Open defecation
Unimproved sanitation
Where does the toilet discharge to?
S4
Septic tank
S5
Pit latrine
S6
Sewer
Shared
Not shared
Limited sanitation
Basic or safely managed off-site sanitation not shown
S7
Is it contained? (No overflow or discharge to surface environment)
S14
Is the facility shared with other households?
S8
Yes, contained
No, improved but not contained
Don't know
Assumption: 50% ST contained 100% pit latrines
Improved but not contained
Shared
Not shared
Ever emptied?
S9
Yes, emptied
No, never emptied
Don't know
S10
Stored/treated and disposed of in-situ (improved, never emptied)
Shared
Not shared
S16
Where is it disposed?
S12
Delivered to treatment
S11
Disposed buried in-situ
Not disposed in treatment or buried in-situ
Don't know
Emptied, not delivered to treatment or disposed in-situ
Shared
Not shared
Emptied and stored in-situ
Shared
Not shared
S17
Solid and liquid streams both treated?
S13
Treatment of both solid and liquid streams
No treatment of either solid or liquid streams
Don't know
Assumption: for sewer dominant countries, assume same as wastewater treatment. Otherwise, no assumption
Emptied not adequately treated
Shared
Not shared
Emptied and treated off-site
Shared
Not shared
S18
S15
Basic sanitation
S19
Safely managed on-site sanitation

Assumptions

In many cases there are gaps in suitable data to inform some steps of the service chain. For JMP global estimates, general assumptions are used in the absence of suitable national data (Table 8). These are general global assumptions and where quality data are available locally, they can replace or improve the assumptions. For example, in Bangladesh national data on containment collected from updated national surveys following the pilot project replaced the containment assumptions.

Table 8. Analysis assumptions

	Global indicators	Analysis and assumptions used for global monitoring
Toilet facility	Use of improved sanitation facilities	Disaggregation of septic tanks and pit latrines essential. Further disaggregation of wet and dry pits desirable.
	Not shared with other households	Improved facilities shared with other households do not contribute to safely managed sanitation.
Containment	Containment[4] is not overflowing or discharging excreta directly to the surface environment	In the absence of containment data assume that excreta are contained in all latrines and half (50%) of septic tanks. Note: only systems assessed as contained can contribute to safely managed sanitation.
Disposal in-situ	Stored/treated and disposed of in-situ	Contained facilities that have never been emptied are considered stored/treated and disposed in-situ.
	Contained, emptied, disposed of in-situ	Contained facilities that have been emptied and buried are considered disposed of in-situ
Emptying	If containment ever emptied	If onsite is dominant estimates are only made if data available on emptying. 'Don't know' considered never emptied. If sewer connections dominant, in the absence of emptying data 50% of onsite considered safely managed.
Transport	Excreta delivered to treatment facility	In the absence of transport data assume all excreta removed by service providers are delivered to treatment facility. Emptied to 'other/don't know where' are considered unsafe and highlight the problem of unaccounted-for faecal waste.
Treatment	Designed to provide treatment for both solid and liquid phase	In absence of faecal sludge treatment data: - If sewer connections are more common than on-site sanitation, faecal sludge assumed to receive the same level of treatment as sewered wastewater. - If on-site sanitation is more prevalent, no estimate is made unless data are available on faecal sludge treatment.
Reuse	Not included in global indicators for SDG 6.2	- Not assessed

Analysis of multiple data sources

Given the multiple data sources required to inform each steps of the sanitation service chain, it is important to assess how each source can best contribute to national estimates. As shown in Table 2, at least two potential sources exist for every step, requiring decisions on which source to prioritise or contingency plans depending on data quality. Data may serve different analytical purposes, and some sources are better suited to specific uses. Application of data to inform SMOSS estimates could include:

- **Direct estimation of indicators**: the most evident where representative data directly informs the estimate, such as is common with household questionnaires informing indicators S1-S6.
- **Input to ratios or assumptions**: Some data may not be available at a granular per person scale but instead inform aggregate ratios or assumptions that are applied to the population or sub-groups. For example some ratios may apply to certain geographical regions or urban/rural areas, or to households with specific sanitation faicilities, or to specific service provider groups.

[4] Containment is defined as a permeable or impermeable container for storing excreta close to the toilet or latrine. Examples of containments include latrines pits, cesspools, septic tanks, and holding tanks.

- **Validation**: Non-representative data may be used to validate or confirm accuracy of other data sets, such as an inspection confirming household response to sanitation type, or spot checks validating service provider responses.
- **Inform sampling frames**: Administrative data or large-scale household surveys can inform the sampling frame for inspections or service provider surveys (e.g. identify the proportion of tanks accessible or the types of emptying service providers)
- **Joining datasets:** Some questions are included solely to link datasets. For example, identifying emptying providers in household surveys enables matching with service provider data.

Selection of data sources should consider sampling adequacy, including whether data are nationally representative by population groups, geographical areas and service coverage. The JMP includes datasets in its database when they represent at least 20% of the target population [10]. Reliability and quality are also key, as one source often must be treated as the "reference" against which others are aligned. Reliability may differ across indicators, for example households provide accurate information on shared facility use but inspections may generate more reliable data on facility type and containment. The 2017 JMP methodology update provides examples of why some datasets, or particular questions, are excluded from use in estimates [10].

Bringing datasets together

In developing the JMP methods, the taskforce recognized challenges in integrating diverse SMOSS data sources, particularly when they cannot be linked to specific households or facilities [17]. The integration of service provider data with household data was tested in the Malawi and Nepal pilots, which input to the following strategies on the use of administrative data for national estimates, with further details and examples provided in Annex E.

- **Common identifiers:** Integration requires common identifiers or variables in both data sets, enabling exact matches (e.g. household identification) or linkage through a common variable (i.e. administration unit, geographic area). It is important to consider how these datasets will be linked when designing the data collection methods so compatible identifiers are included in both sources.
- **Alignment and reliability:** Consistency with JMP definitions and indicators must be assessed before using secondary or administrative data. Divergent terminology, definitions or methods may impede alignment [19]. Information from small scale studies or those by academic institutions or NGOs should be verified with the national statistical office before inclusion [17].
- **Handling non-response:** A systematic approach is needed to address data gaps or non-responses, which were common in the Serbia, Nepal and Ecuador local government surveys. Non-response may be ignored, assumed comparable to responses, or explored further [20]. However, given that missing data may indicate absence of service or unsafe practices, non-responses should not be assumed to mirror reported data; instead further inquiry or supplementary data collection is recommended.

Nationally representative estimates from non-household data

Transforming administrative data or local government surveys to inform national estimates is more complex than analysis of nationally representative household surveys, as administrative data is often not collected with the intention of statistical analysis. Considerations for analysing non-household SMOSS data are summarized below and in more detail in Annex E.

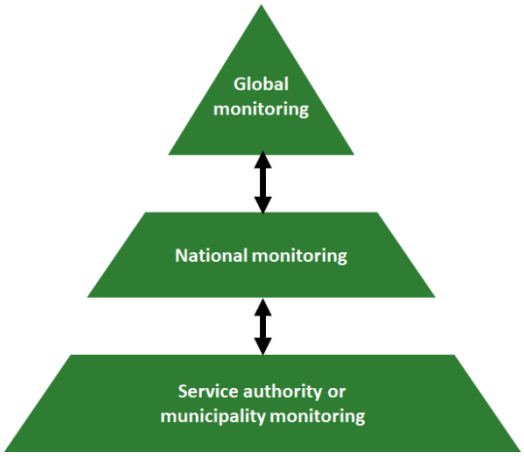
- **Data captured for subs-sets of the population**. Depending on the sampling unit, administrative data or local government surveys may be large scale and represent the national population or they may be limited to certain population sub-sets. For example, local government may only report on formal hosueholds or registered emptying providers and therefore miss the informal sectors. Regulatory data may only be available in areas with a water or wastewater authority, or just cover the

households connected to these. Even if the sample is expected to be national, the representation of the reported data may be restricted. UN-Habitat guidance on nationally representative sampling of cities has many steps applicable to service administrator and provider data for SMOSS [15].

- **Defining service coverage**: A particular challenge for monitoring sanitation is translating data from treatment plants or emptying providers to population relevant estimates. For water supply or wastewater service provision the service area and frequency of service are clearly defined by infrastructure boundaries (location of pipes) and consistent daily services. For on-site sanitation, there is more uncertainty in which areas are served, as there can be multiple providers serving different or same areas of a city or crossing administrative boundaries. Frequency of provision is also uncertain, as most containments do not need to be emptied every year and therefore the frequency of emptying needs to be considered in analysing annual emptying or treatment data.
- **Low response rate.** The Ecuador and Serbia pilots both faced challenges with low response rates for either the entire survey or particular questions. Discussions with stakeholders will be necessary to identify what response rate or representation of the population is acceptable for national estimates. Some countries may have target response rates for national surveys which, if deemed reasonable, should be adopted. Further data collection may be needed to identify if there are trends in the non-response, for example are local governments more likely to not answer than respond truthfully about poor quality or missing services.
- **Varied units:** It is likely that data from service providers or service authorities is reported in units other than population and transformation of data into more comparable units is typically needed. For example, emptying and transport may be reported as cubic meter of sludge or number of trucks, which will need to be converted to a population or household unit. This requires local data on the size of containers and expected quantity of emptied sludge.

Strengthening public data systems

Data at different levels



Monitoring safely managed on-site sanitation operates across interconnected local, national and global levels, each contributing essential data for understanding service performance and progress toward SDG 6.2. At the local level, municipalities, utilities and environmental health officers collect operational data, conduct inspections and oversee sanitation safety plans. Although these indicators are tailored to local needs, their broader usefulness depends on harmonized definitions that allow integration into national and global monitoring. National monitoring systems build on local data as well as national household surveys to assess service levels, inform policies and set national targets that reflect both SDG ambition and country-specific priorities. While governments may track additional or alternative indicators suited to their regulatory context or service models, as part of their commitment to the SDGs, they must still report on core global indicators defined by the JMP.

At the global level, WHO and UNICEF lead the Joint Monitoring Programme — or JMP — which compiles nationally representative data using a harmonized set of core indicators. The JMP tracks global progress toward SDG target 6.2 on safely managed sanitation. By aligning with these indicators, countries can benchmark progress, identify gaps, and contribute to shared global understanding. While fewer

indicators are used at the international level for comparability and practicality, they depend on the accuracy and consistency of monitoring at the national and local levels. Ultimately, monitoring across all levels is essential not only for reporting, but for managing sanitation systems effectively and ensuring no one is left behind.

Data to decision making

Countries collect SMOSS data not only for global reporting but to manage and strengthen sanitation services. High-quality, timely and locally disaggregated data help identify failing systems, communities at risk and progress toward national goals. Monitoring and planning are closely linked: monitoring reveals service gaps, while planning clarifies what data are needed and how monitoring systems should be designed. When aligned with national priorities, SMOSS data inform regulatory decisions, investment strategies and resource allocation, supporting more inclusive and sustainable sanitation services. However, the latest GLAAS report shows that only one-third of countries consistently use monitoring data for planning, indicating a persistent gap between data collection and data use.

SMOSS data serve a wide range of actors. Water and sanitation ministries use them for annual sector reviews and infrastructure planning; health ministries link sanitation data with disease trends to target high-risk areas; regulators use them to enforce standards; and municipalities rely on them for local service planning. Finance ministries use the data to justify investments, while development partners use them to identify service gaps and target support. Aligning indicator definitions and establishing mechanisms to collate and share data are therefore essential.

One of the most **critical uses of SMOSS data is identifying who is being left behind**. Disaggregated data expose inequalities, such as emptying services concentrated in wealthier urban areas while rural and informal settlements remain underserved. Addressing these gaps requires data that cover all service providers, including informal actors. **Strong data systems also support public health, climate resilience** and early warning systems. Building capacity for data use involves creating mechanisms for data sharing, fostering a culture of evidence-based planning and ensuring staff at national and sub-national levels have the skills to analyse and interpret data for decision-making.

Strengthening institutional capacity to use data involves three key elements.

i. Data must be available for use by establishing mechanisms for collating, storing and sharing data between stakeholders.
ii. A culture of data use is needed so that monitoring results inform planning, regulation and progress tracking. Too often, data are collected, published and forgotten. But when used well, they become part of national planning and decision-making. This might mean hosting workshops to interpret findings, using dashboards to track progress, or incorporating SMOSS data into WASH reviews or SDG reporting cycles.
iii. Institutions must assess and build capacity for data reporting, analysis and interpretation. Training should focus not only on data collection but also on understanding indicators, identifying data gaps or biases, and presenting findings in ways that support effective decision-making at national and sub-national levels.

Integrating SMOSS monitoring with regulatory and governance systems

Effective monitoring of sanitation requires coordinated action across the entire sanitation chain, yet responsibilities are often divided among ministries, regulators, utilities and local governments. Because no single institution typically oversees all steps from containment to final disposal, collaboration and alignment of surveys, inspections and administrative systems are essential to produce consistent and usable data.

Clear regulatory arrangements are central to monitoring SMOSS. As shown Figure 6, different regulations apply at different stages: building codes govern containment, utility and occupational standards cover conveyance and treatment, and environmental laws regulate reuse and disposal, amongst others. These duties often fall under separate agencies, creating potential overlap or gaps. Mapping responsibilities as noted in the previous section on data coverage (Figure 4), and mapping regulations as shown below, helps clarify mandates, align indicators and ensure consistent enforcement. Regulators also set reporting requirements for service providers, verify data quality and promote harmonized indicators, functions that become especially important in informal or decentralized systems where monitoring is weakest.

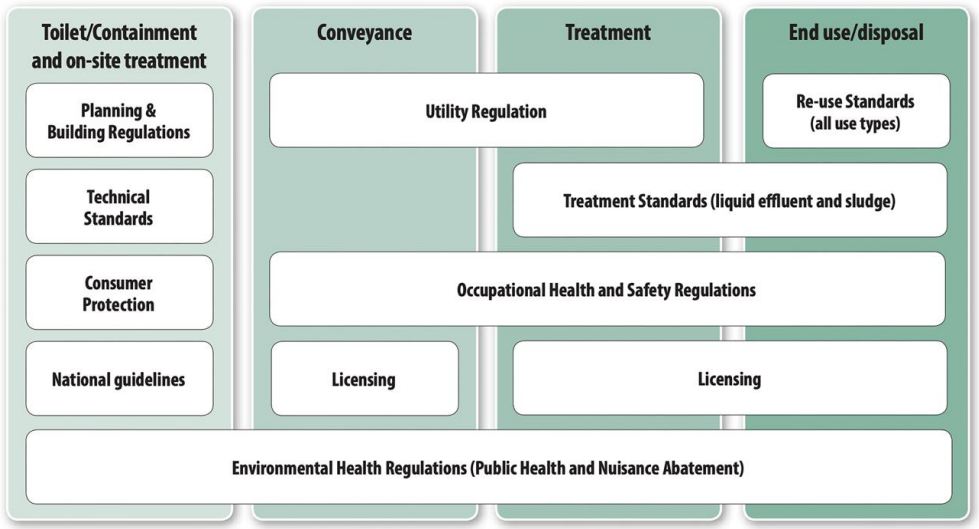


Figure 6. Regulatory mapping across the sanitation service chain [4]

Globally, regulatory oversight for on-site sanitation remains limited. GLAAS 2022 data show that fewer than 30% of countries have fully implemented regulatory functions for on-site sanitation and regulation of faecal sludge management is particularly weak [23]. Strengthening regulatory mandates and institutional capacity is therefore critical which is the basis for the 2025 global Call to Action on strengthening WASH regulatory systems [24]. Robust frameworks should legally recognize both sewered and non-sewered systems, define responsibilities across the service chain, establish risk-based standards adaptable to local contexts, and prioritize underserved groups. The WHO Roadmap for advancing sanitation regulation outlines incremental steps that can be taken, from establishing legal bases and clarifying responsibilities to developing national monitoring, enforcement, compliance and benchmarking systems [25].

Regional initiatives for strengthening regulatory systems for improved SMOSS monitoring have also been part of the M-SMOSS project, including ESAWAS in Africa advancing data-driven regulation through shared indicators that align with SDGs, data collection and reporting tools, and capacity building. Digital tools such as EquiServe and SaniTracker demonstrate how regulators can operationalize monitoring, improve transparency and strengthen oversight.

Finally, SMOSS data must be integrated into regulatory and governance systems. This requires clear roles, agreed methodologies, alignment with reporting cycles, and ensuring that monitoring frameworks explicitly cover on-site and informal sanitation services. Such integration creates the foundation for regular, reliable and risk-informed monitoring that supports improved sanitation services for all.

References

[1] WHO and UNICEF, “Progress on household drinking water, sanitation and hygiene 2000–2024: special focus on inequalities,” World Health Organization (WHO) and the United Nations Children’s Fund (UNICEF), Geneva, 2025.

[2] R. Bain, R. Johnston, F. Mitis, C. Chatterley and T. Slaymaker, “Establishing sustainable development goal baselines for household drinking water, sanitation and hygiene services,” *Water,* vol. 10, no. 2, p. 1711, 2018.

[3] WHO and UNICEF, “Progress on drinking water, sanitation and hygiene: 2017 update and SDG baselines,” World Health Organization and the United Nations Children’s Fund, Geneva, 2017.

[4] WHO, “Guidelines on sanitation and health,” World Health Organization, Geneva, 2018.

[5] A. Peal, B. Evans, I. Blackett, P. Hawkins and C. Heymans, “Fecal sludge management (FSM): analytical tools for assessing FSM in cities,” *J Water Sanit Hyg Dev.,* vol. 4, no. 3, pp. 371-383, 2014.

[6] UN Water, “Monitoring water and sanitation in the 2030 agenda,” UN Water, Geneva, 2020.

[7] B. Harris and J. Pearce, “Understanding Monitoring for SDG6 Across Eastern and Southern Africa: Regional Review,” UNICEF, ESARO, 2021.

[8] M. Alam, V. Schelbert, D. Meili, S. Ferdous and C. Luthi, “Shared Sanitation in Low-income Urban Settlements in Bangladesh,” WSUP, London, 2021.

[9] C. Voorden, “Monitoring SDG 6.2 and 6.3 Case Study 1: Bolivia,” Sustainable sanitation alliance, 2022.

[10] WHO & UNICEF, “JMP Methodology - 2017 update and SDG baselines,” World Health Organization (WHO) and United Nations Children’s Fund (UNICEF), Geneva, 2018.

[11] WHO, “Sanitation inspections: user guide,” World Health Organization and the United Nations Children’s Fund (UNICEF), Geneva, 2024.

[12] WHO, “Sanitation inspections for sanitation systems,” World Health Organization, 2019. [Online]. Available: https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/sanitation-safety/sanitation-inspection-packages. [Accessed 2022].

[13] UNECE, “Guidelines for Assessing the Quality of Administrative Sources for Use in Censuses,” United Nations Economic Commission for Europe (UNECE), Geneva, 2021.

[14] C. Vijayakumar, “ The 2030 Agenda’s data challenge: Approaches to alternative and digital data collection and use,” GIZ, Eschborn, 2020.

[15] UN Women, “Advancing administrative sources of data for monitoring gender-specific Sustainable Development Goals in Africa,” UN Women, Nairobi, 2019.

[16] WHO, “National systems to support drinking-water, sanitation and hygiene: global status report 2019. UN-Water global analysis and assessment of sanitation and drinkingwater (GLAAS) 2019 report,” UN-Water and World Health Organization, Geneva, 2019.

[17] EUROSTAT, “Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Waters and Eurostat Regional Water Questionnaire,” EUROSTAT, Luxembourg, 2021.

[18] UN-Habitat, “National Sample of Cities: A model approach to monitoring and reporting performance of cities at national level,” UN-Habitat, Nairobi, 2016.

[19] UNICEF and WHO , “Core questions on drinking water, sanitation and hygiene for household surveys: 2018 update.,” United Nations Children’s Fund and World Health Organization, New York, 2018.

[20] WHO and UNICEF, “Task Force Report on Methods,” World Health Organization and United Nations Children’s Fund, Geneva, 2015.

[21] UN Habitat and WHO, 2021, “- . For example, the effectiveness of inspections rather than relying on household surveys alone for assessing containment has not been validated, nor has there been comparison between quality of data obtained from FGDs, interviews, log books or administr,” United Nations Human Settlements Programme and World Health Organization, Geneva, 2021.

[22] Statistics New Zealand, “ A guide to good survey design (5th edition),” Statistics New Zealand, Wellington, 2019.

[23] WHO, “UN Water Global Analysis and Assessment of Sanitation and Drinking Water GLAAS 2022 Report,” World Health Organization, Geneva, 2022.

[24] IWA, “Call to Action on strengthening WASH regulatory systems,” IWA and WHO, London, 2025.

[25] WHO, “A roadmap for advancing sanitation regulation,” World Health Organization, Geneva, 2025.

[26] L. Moreno, M. Pozo, K. Vancraeynest, R. Bain, J. C. Palacios and F. Jácome, “Integrating water-quality analysis in national household surveys: water and sanitation sector learnings of Ecuador,” *npj Clean Water,* vol. 3, no. 1, pp. 1-11, 2020.