Planning

Chapter 14

Assessment of the Initial Situation

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Learning Objectives

- Understand what is important to know at the beginning of the faecal sludge management planning process and identify what information needs to be collected.
- Be aware of the different methods and tools for collecting relevant data and know how to apply them.
- Know how to identify the shortcomings and challenges of an existing faecal sludge management system and be able to describe an enabling environment.

14.1 INTRODUCTION

The assessment of the initial situation, which is the first step in the planning process (Chapter 17), is crucial, as it provides the baseline information for decision-making. This chapter serves as a guideline for process leaders (Box 17.1) on which data to collect and how to carry out this assessment using a participatory approach.

The main goals of the assessment of the initial situation are to set the scene, understand the context, get to know the stakeholders and provide enough information to start elaborating the faecal sludge management (FSM) scenarios, including context-specific design parameters and therefore this stage is characterised mainly by data collection via different means. This data is collected step by step during the exploratory investigation, preliminary studies and feasibility study (see Table 17.1, FSM planning from A to Z), phases which relate in terms of participatory planning stages to the launch of the planning process, the detailed assessment of the current situation and the identification of service options respectively. Useful examples are provided by Dodane (2010) and Larvido and Dodane (2011) for Mahajanga, Madagascar and by Mikhael (2010, 2011) for Freetown, Sierra Leone.

This type of assessment gives a snapshot of the situation at the beginning of the project. It describes the existing service chain, starting with the types of latrines, the formal and informal sludge emptying sector, the organisation of the system and the links between the stakeholders. It also identifies the enabling environment (Section 17.2.1), government support, the legal and regulatory framework, institutional arrangements, skills and capacity, financial arrangements and socio-cultural acceptance.

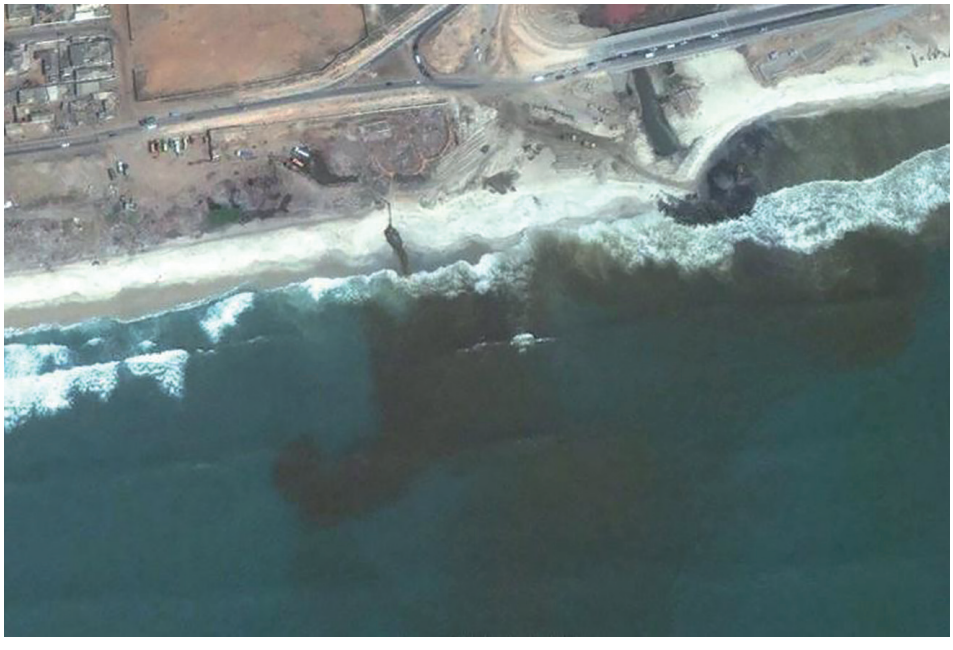

Figure 14.1 Faecal sludge disposal into the ocean, Accra, Ghana (Google Earth, 2010).

If it does not already exist, an enabling environment must be built during the process if the project is to succeed (AECOM and SANDEC/EAWAG, 2010; Lüthi *et al.*, 2011a; Lüthi *et al.*, 2011b; Parkinson and Lüthi, 2013).

This chapter focuses on the information and data that must be collected and provides guidance on the collection procedure. The way to analyse this information and the various scenarios that can be encountered are described in related chapters, especially the chapters *Quantification, Characterisation and Treatment Objectives* (Chapter 2) regarding the design parameters, *Methods and Means for Collection and Transport* (Chapter 4) regarding the profile of manual and mechanical service providers, *Institutional Frameworks* (Chapter 12) regarding the laws, regulations, roles, responsibilities and institutional stakeholders, *Financial Transfers and Responsibilities* (Chapter 13) regarding financial flows and market studies, *Stakeholder Analysis* (Chapter 15) regarding the FSM stakeholders, and *Stakeholder Engagement* (Chapter 16) regarding the involvement tools. The chapter *Planning Integrated FSM Systems* (Chapter 17) helps to place the content of this chapter within the framework of the whole planning and engineering process and details the decision factors that must be investigated for technology selection. Figure 14.2 summarises how the different chapters contribute to the present one.

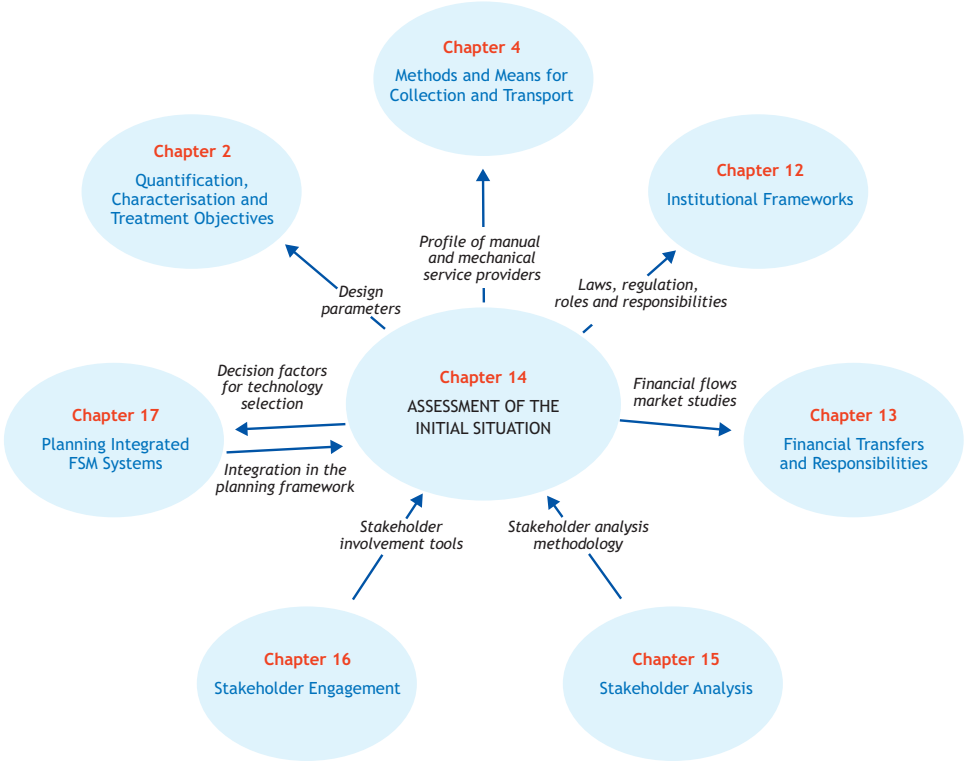

Figure 14.2 Links of the assessment of the initial situation to the other book chapters.

In addition, the human dimension of this assessment should not be overlooked. This is when the first contacts take place and trust starts to be built with the stakeholders. This is crucial for the rest of the project. The role of the local facilitator(s) is very important here, as they help to open doors and gain access to information. It should not be forgotten that data, if it exists, is not always readily available and that getting accurate information usually depends on the goodwill of local partners. Building trust relationships should be the first priority before rushing into data collection.

14.2 TOOLS AND METHODS FOR DATA COLLECTION

Collecting good quality, useful data is often not an easy process, especially in contexts where data is scarce, and either not collected or analysed properly, or, sometimes, hidden or manipulated for political or personal reasons. Governmental agencies usually have some reports, statistics and maps that can serve as a preliminary introduction. However, they should always be considered with care, and therefore the collection of primary data is recommended, if not essential. The best way to get a reasonably accurate estimation is to rely on several sources of information, which can be cross-checked and, if needed, complemented by further research.

The following paragraphs describe different ways to collect the necessary data for the assessment of the initial situation. It is important that the process leaders go out into the field and meet the stakeholders (Chapters 15 and 16), in order to obtain a first-hand grasp of the real situation. There are two main ways to get preliminary impressions: observation and discussion. The discussion is about finding out each FSM stakeholder's perspective and involving them in the project from the start. In that sense, data collection tools are inseparable from the stakeholder involvement tools (Section 16.4). Section 15.3 lists the different FSM stakeholders.

14.2.1 Literature review

The literature review consists of searching for data that already exists (grey literature, i.e. reports and maps, or white literature, i.e. publications). There is no need to 'reinvent the wheel', although existing documents should always be used with caution and the reliability of data assessed. Data quality (especially with statistics) is often questionable, and, in very dynamic contexts, may become quickly outdated.

The main sources of information are usually the different governmental agencies as well as non-governmental organisations (NGOs) and international organisations. It should be kept in mind that many reports, especially written by consultants, are never published officially and cannot be found on the Internet. Individual meetings with the various organisations and agencies are recommended, starting with a few key informants who are able to provide a rough idea of the information that is available.

14.2.2 Semi-structured interviews

Semi-structured interviews are one way to structure discussions aimed at collecting information. The interviewers are the process leaders, usually with facilitator(s), and the interviewees are the FSM stakeholders. Semi-structured interviews can be held with individuals or in focus groups (Section 16.4). They require time and experienced interviewers, but they help to build a solid basis for further work.

Semi-structured interviews are conducted with a fairly open framework which allows for focused, two-way communication (FAO, 1990)[1]. They can be used both to give and to receive information. Not all the questions are designed and phrased ahead of time, hence the 'semi-structured' nature of these interviews. The majority of questions are created during the interview, allowing both the interviewer and the person being interviewed the flexibility to probe for details or discuss issues. This freedom helps interviewers to tailor their questions to the interview context/situation, and to the people they are interviewing. Often the information obtained from semi-structured interviews will provide not just answers, but the reasons for the answers. It also helps process leaders and field staff to become acquainted with community members. Indeed, data collection is not the only purpose of the interviews; it is also an opportunity for discussion, exchange and trust-building.

Semi-structured interviews should be prepared in advance, with key questions listed in an interview guide. Box 14.1 provides basic interview guides for FSM key stakeholders.

[1] For more information on semi-structured interviews:
CLUES Toolbox: Tool T2 – Interview Methods and Questionnaire Examples (www.sandec.ch/clues)
SSWM Toolbox: www.sswm.info/category/planning-process-tools/exploring/exploring-tools/preliminary-assessment-current-status/semi

Box 14.1 : Interview guides for some key faecal sludge management (FSM) stakeholders
(Adapted from Koanda, 2007a; Reymond, 2008)

FSM stakeholders are described in Section 15.3 and 15.4. Guides for semi-structured interviews with municipal authorities/the mayor, municipal technical services and mechanical operators are provided here below. As 'guides', their primary aim is to help the interviewer to remember the important discussion topics.

Interview guide for the municipal authorities/the mayor

1 Importance of sanitation for the municipal authorities (sanitation in general, including wastewater and solid waste)

2 Importance of FSM for the municipal authorities

3 Role of the municipality in sanitation and FSM

4 Financial arrangements
- Finance arrangements for water and sanitation
- Taxes, grants and subsidies
- Management of this budget for water and sanitation

5 Legal and regulatory framework
- Laws and regulations
- Municipal decisions
- Means of enforcement
- If no regulations, is there an opportunity to publish municipal decrees?

6 Current practices
- Existing infrastructure: sewer networks, disposal sites, treatment units
- Sludge pumping trucks: number, property, management
- Public latrines: number, volume, management
- Roles and responsibilities (who is in charge of what – e.g. sewer maintenance, FS collection, solid waste collection)

7 Institutional setup
- Other governmental agencies involved in sanitation – links and relationship with the municipality

8 Socio-cultural acceptance
- Perceptions of the population towards current situation and existing initiatives
- Enduse and resource recovery practices and potential

9 Proposals for improvement, needs of the municipality

Interview guide for the municipal technical services

1 Management of sanitation (wastewater, faecal sludge (FS) solid waste)
- Roles and responsibilities (who is in charge of what – e.g. sewer maintenance, FS collection, solid waste collection)
- Number of staff
- Operating mode

2 Organisation of FSM
- FS collection: practices, number of trucks, staff
- Quantity of collected sludge; records?
- FS disposal sites
- Existing and potential for enduse and resource recovery
- Public places (schools, markets, public latrines, mosques, temples, etc.)
- Number, volume and management of public latrines

3 Organisation of solid waste management
- Collection
- Public infrastructure (market, slaughterhouse)
- Community level (markets, abattoirs, schools, public places)
- Volumes
- Disposal, enduse, resource recovery (soil amendment, fuel, etc)

4 Finance (available resources)
- Municipal budget
- Taxes
- External support

5 Legal and regulatory framework
- Laws and regulations
- Municipal decisions
- Means of enforcement

6 Proposals for improvement, needs

7 Future possibilities in the pipeline

Interview guide for mechanical FS operators

1 General description of the company
- Equipment
- Staff
- Tariffs
- Relationship with the municipal authorities (formal?)
- Juridical status
- Taxes

2 Quantity of sludge collected
   - Capacity of the truck(s)
   - Number of rotations per truck per day/month/year
   - Seasonal variation or any other significant variations in emptying services over time?
   - Availability of records/accounting

3 Types of emptied latrines

4 Emptying frequency

5 Emptying of public latrines?
   - Special mandate from the municipality?
   - If public and private latrines, organisation in terms of timing: sludge removal of public latrines all at same time?

6 Disposal/enduse
   - Disposal sites
   - Discharging in agricultural fields?
   - Collection of dried sludge at the disposal sites?
   - Enduse practices?

7 Partnerships, customers

8 Proposals for improvement

14.2.3 Household-level surveys

Surveys or questionnaires are a way of collecting information systematically, so that data collected from different sources can be easily compared and analysed quantitatively, e.g. using statistics. In FSM, they are especially used to collect data at the household level in order to assess the practices, perceptions and sanitation status (Section 14.3.4). Data collected at this level allows to quantification and characterisation of the FS to be treated (Chapter 2).

Before preparing a survey, it is important to know exactly which data is needed and what it will be used for. The following points are important to be kept in mind (adapted from Tayler-Powell, 1998):

- What is the purpose of the data to be collected and its expected use (e.g. frequency, percentage)?
- Is the information available elsewhere?
- Stick to only the necessary questions, so as not to overburden the persons being surveyed, except for a few contact questions at the beginning to put the interviewee at ease.
- Try to view the questions through the respondent's eyes wording is importantas as is understanding and utilising the social norms, the specific vocabulary, and being aware of context-sensitiveness [2].
- The response or information obtained is only as good as the question is.

[2] For example, a question like 'Do you discharge sludge directly on agricultural fields?' may threaten a truck operator, who is usually aware of the non-conformity – or even illegality - of such a practice; he may then answer 'no', even if he does. Thus, the question should rather be formulated as: 'Some farmers are known to ask for sludge on their fields. Have they ever contacted you, and how?'

Finally, when carrying out a survey, representativeness of the sample is key. Indeed, households may be very different in nature, e.g. in terms of income, cultural background, tenure (owner-occupier versus tenants), and informal versus formal developments. Detailed information on how to build a representative survey can be found in sociological literature (Groves *et al.,* 2009).

Case Study 14.1: Key question areas for the household-level surveys

(Adapted from Koanda, 2007b and Reymond and Ulrich, 2011)

Household-level surveys must be comprehensive but not burden the interviewee, who may then lose focus. They must reflect the integrated approach to sanitation and highlight the practices, constraints and needs of the population.

Figure 14.3 Householder survey, Nile delta, Egypt (photo: Colin Demars).

The following aspects need to be part of the household-level survey in a FSM planning process:

- characterisation of the interviewee: status, family, cultural background, household size
- water supply: water sources, water quality, service quality, water consumption, costs
- hygiene and sanitation:
  - type of on-site sanitation technology (or open defecation), number of users
  - type of emptying services ('what happens when the pit is full') – if no sewers: mechanical/manual, public/private, frequency (winter/summer or dry/rainy season), cost, perception of cost and service, willingness to pay for improved services
  - if sewer network: type of sewers, problems encountered, discharge point
  - greywater management
  - solid waste management: disposal, service, cost
  - stormwater management
  - in rural areas: animal manure management – disposal/enduse practices
- institutional/organisational aspects: who is responsible for each service, positive/negative aspects
- environmental awareness: perception of cleanliness and health impacts, willingness to improve
- communications channels: main information sources, information on consumption habits

14.2.4 Qualitative field observations

While field visits are a powerful tool to expose all the stakeholders to reality, they are also a good way for the process leaders to understand the reality better, to cross-check the available information by observing and discussing with people, and to build trust onsite with the main stakeholders (Figure 14.4). They provide an introduction to the existing sanitation services and an initial understanding of the conditions from the perspective of local residents.

Quantitative household-level surveys are essential for good quantitative data, but freer observation is also very important. This can include site visits, possibly including transect walks, one-to-one semi-structured (narrative) interviews with householders, and focus groups with community members, if necessary specifically focusing on particular vulnerable groups (Section 16.4). Interviewing people leads to information on their perceptions of reality and on what they think they do, but when one wants to know what people really do, one has to observe them.

For observation, transect walks are recommended. Routes are chosen so that they cover the greatest diversity regarding the water, sanitation and agricultural issues (Figure 14.5).

Figure 14.4 Accompanying a faecal sludge service provider at work, Nile Delta, Egypt (photo: Philippe Reymond).

Figure 14.5 Transect walk in Nakuru, Kenya, including discussions with households (photo: Philippe Reymond).

14.2.5 Mapping

Mapping is essential for a clear and extensive analysis of the existing situation, especially when it comes to understanding the city structure (neighbourhoods with different levels of revenues, main axes - Section 14.3.8) and identifying treatment sites (Section 14.4). Mapping has become much easier in recent years with the democratisation of satellite images (e.g. Google Earth) and geographical information systems (GIS) (WSUP, 2011).

A participatory mapping exercise is also recommended, as it is a good way to involve selected stakeholders (Section 16.4). Particularly important is the identification of key elements, such as existing disposal sites or obstacles for emptying trucks (e.g. road segments prone to traffic jams and poor quality roads).

14.2.6 Laboratory analyses

In FSM, where a comprehensive database on FS characteristics does not yet exist, it is usually necessary to carry out sampling campaigns and analyses in order to be able to characterise the sludge on a site-specific basis. Sludge characteristics vary significantly between and even within cities, and it is important to obtain first-hand data (Figure 14.6). Parameters to be measured and types of sampling campaigns are described in Chapter 2.

Figure 14.6 Septage sampling and analysis with portable laboratory equipment in the Nile delta, Egypt (photo: SANDEC).

Figure 14.7 How to read a SWOT analysis matrix (Schall, 2004).

14.2.7 Strengths, weaknesses, opportunities and threats analysis

When carrying out the initial assessment, it is important to clearly determine what are the Strengths, Weaknesses, Opportunities and Threats (SWOT) of the environment in which the FSM system has to be developed, especially the organisational and institutional framework (Chapter 12), as well as the key stakeholders (Chapter 15). The SWOT matrix shows the positive and negative factors that have to be dealt with (Figure 14.7); setting them out clearly in this way makes it possible to take action in order to maximise the potential of the strengths and opportunities while minimising the impact of the weaknesses and threats. The factors can be categorised according to the components of the enabling environment (Section 17.2.1).

Box 14.2 provides an example of a SWOT Matrix.

Box 14.2: Example of a SWOT matrix

A SWOT analysis helps to visualise the positive and negative factors that may influence the FSM project. Examples of questions to be answered are. Are the existing laws enabling (strength/weakness)? Which skills are currently missing (weaknesses)? Which organisation may help implement the project (opportunity)? How organised is the FS private sector (strength/weakness)? Which stakeholder may support/hinder the process (opportunity/threat)?

Figure 14.8 shows what a SWOT matrix could look like for a typical secondary city in a low-income region. This is a simple example for the sake of clarity. However, a SWOT analysis is usually much more exhaustive, and hence it has added value to further categorise the factors, e.g. through the elements of the enabling environment (Section 17.2.1). Further potential challenges linked to stakeholders can be found in Section 15.4 and Chapter 12, Institutional Frameworks. A brief review of challenges and strengths in South-East Asian countries is provided in AECOM and SANDEC/EAWAG (2010).

Figure 14.8 Example of a SWOT matrix.

14.3 DATA TO BE COLLECTED

The following paragraphs detail the data to be collected during the assessment of the initial situation. There is not set way in which to collect the data. Data should be collected from different angles, with a combination of the methods described above, in order to cross-check the various sources.

14.3.1 General context

Understanding the general context helps to obtain a global picture of the situation and to understand the core constraints and potentials of a city. The most important data to be collected is:

- population and demography: number of inhabitants, number of people per household, population density and growth rate, type of housing;
- water and hygiene: drinking water coverage and infrastructure, drinking water sources, types of supply (e.g. networks, taps in houses, fountains, trucks), operators (public/private), prevalence of diseases related to faecal matter;
- physical characteristics: geomorphology, hydrologic basins, areas prone to flooding, type(s) of soil, groundwater table;
- climatic data (Section 14.3.7);
- storm water management;
- main elements of the city structure (as described in Section 14.3.8); and
- local economy: main economic activities in the city, main sources of household revenue, average income.

14.3.2 Sanitation sector

The sanitation sector is the backbone on which FSM has to be built. Understanding the sanitation sector includes obtaining information on:

- sanitation stakeholders and their role (which is presented in Chapter 15);
- collection/treatment/disposal facilities: sewered/unsewered areas, emptying modes (manual/mechanical), organisation (public/private), disposal sites, tariffs, solid waste management, enduses and resource recovery initiatives. (Table 14.2 summarises the relevant information on existing services);

Table 14.2 Relevant Information about existing services (Parkinson *et al.*, 2008)

Latrines and onsite treatment	
Water availability	Information on existing water supply services (including daily consumption per household) can be used to estimate daily wastewater production
Sanitation facilities	Current levels of service (household and shared facilities) including approximate household coverage and number and location of communal or public toilets
Onsite treatment	Types of onsite sanitation system serving households with households connections
Waste collection and conveyance	
Existing sewerage infrastructure	Coverage of sewerage and proportion of household with household connections
Faecal sludge and septage collection services	Coverage and frequency of servicing
Offsite wastewater treatment and reuse	
Wastewater treatment	Location and types of wastewater treatment infrastructure (if any exists)
Discharge or enduse	Location where wastewater and faecal sludge is disposed or endused

- analysis of the institutional framework (Chapter 12). Chowdhry and Koné, (2012) and AECOM and SANDEC/EAWAG, (2010) provide an overview of institutional frameworks in several countries in Asia and Africa;
- analysis of the legal and regulatory framework (Section 14.3.5); and
- financial analysis of the existing situation, i.e. the financial flows between the existing FSM stakeholders (Chapter 13).

14.3.3 Profile of manual and mechanical service providers

Private manual and mechanical service providers are the core of the initial FSM business. They address the needs of the population and have invaluable information about the types of latrines, the characteristics and quantities of sludge as well as the respective seasonal variability and the problems they encounter for collection, transporting and delivering. The interviews should also help in identifying existing and possible discharge sites and transport obstacles in the city, e.g. traffic jam zones (section 14.3.8). In addition it is recommended to team up with service providers for sampling during the FS characterisation and quantification studies, be it latrines or at the outlet of pumping trucks.

The following information should also be collected:

- socio-professional profile;
- frequency of the activity (especially for manual service providers): main/regular/occasional, and why;
- tariffs and tariff breakdown;
- problems encountered, e.g. accessibility, social pressure, health;
- staff and equipment; and
- methods employed.

The profile of FS service providers has been established, for example, in Dakar, Senegal (Mbéguéré *et al.*, 2009), Freetown, Sierra Leone (Mikhael, 2011), and Mahajanga, Madagascar (Larvido and Dodane, 2011). A more global financial analysis of emptying and transportation services in Africa and Asia is to be found in Chowdhry and Koné (2012).

14.3.4 Practices at household level

The household level is where FS is produced and stored and, as such, is a major factor in determining the quality and quantity of the sludge to be treated. Household surveys and interviews with the authorities and manual and mechanical operators should provide the necessary relevant information about the current status (Section 14.2.3 and Boxes 14.1 and 14.2). This includes:

- latrine types;
- emptying mode and means: manual/mechanical, equipment, staff, practices;
- emptying frequency according to each emptying mode;
- seasonal variability;
- number of operators per emptying mode;
- proportion of manual and mechanical emptying
- tariffs; and
- perceptions: which drivers influence the choice of an emptying mode, assessment of tariffs, capacity to pay, willingness to pay for improved services, proposed tariffs.

It should be noted that households usually do not have a clear vision of the volumes of sludge removed.

It may also be worthwhile to ask similar questions to people responsible for non-domestic buildings, such as hotels, restaurants, schools, public toilets and religious buildings. This usually represents a regular and lucrative segment for private service providers.

14.3.5 Legal and regulatory framework

At the national level, there are in most cases general laws and regulations about water, the environment and health. However, it is still rare to find texts specific to FSM, be it at the national or local level (Chapter 12).

Figure 14.9 Faecal sludge manual emptying and burying within the courtyard (photo: Linda Strande).

The information to be collected includes:

- laws and regulations;
- legal structures in charge of application; and
- enforcement.

As laws and regulations are often stringent but not enforced in practice (either because of lack of will, or because they are inappropriate), it is important to take a reality check (Lüthi *et al.*, 2011). One should understand what is tolerated and what is not. The relevant stakeholders should be consulted to determine how reality compares to the written procedures. Building inspectors, plumbers, contractors, municipal engineers and planners, and officials from the relevant ministries (e.g. environment, housing, construction, health, etc.) will all have invaluable information about what they would accept and approve in practice. It is advisable to show the preliminary assessment to the relevant decision makers so that it can be corrected and amended.

14.3.6 Estimation of design parameters

To design a FSTP properly, sludge quantities and characteristics should be estimated on a case-by-case basis, as they vary significantly between cities. Methods to quantify and characterise sludge are explained in Chapter 2 (Section 2.2 and 2.3) and the criteria for the selection of appropriate options are given in Section 17.4 and the related technology selection scheme (Figure 17.10).

All the data related to the formulas, parameters and criteria should be collected. This is a complex process, where several data collection methods are used. The main three are surveys of households and service providers, collection of climatic data, and sampling campaigns.

14.3.7 Climatic data

Climate is a key factor for the selection of treatment options (Section 17.4), especially the amount of rain and its distribution over time. It affects a FSTP in two ways:

- directly, as it affects sludge dewatering; and
- indirectly, as it affects the filling rate of latrines, the emptying frequency and, thus, the quantity and characteristics of the sludge to be treated in the FSTP. Such patterns can be estimated through semi-structured interviews with the manual and mechanical operators, and with households.

The main climatic data to be collected is:

- temperature over time;
- quantity of precipitation, maximum, minimum and distribution over time; frequency of rain episodes; seasonality (e.g. dry and rainy season); and
- evaporation rates, which allow a hydric balance between precipitation and infiltration, and gives an idea of the length of time necessary to dry the sludge. Runoff water can also be added to the balance.

Ideally, daily climatic data should be obtained for a period of 10-20 years for the study area, in order to best understand the variations. If evaporation is not measured, it can be deduced approximately from the temperature, wind and humidity data. Note that there has been very little investigation into the water retention capacity of sludge so far, implying difficulties in forecasting dewaterability.

14.3.8 Spatial data and city structure

It is crucial to understand how a city is organised and around which features. Factors like population density, socio-economic stratification, types of housing, topography, accessibility, traffic, the presence of existing sewer lines and the quality of service provision often influence the sludge emptying patterns (Case Study 14.2). These also have an influence on the selection of locations for treatment sites and transfer stations (Section 14.4). Access, environmental conditions of the potential sites (e.g. prone to flooding, type of soil, groundwater table) and land tenure are all major spatial decision factors.

Understanding the city may also have implications in terms of stakeholder analysis and engagement. Different sub-units may have different private entrepreneurs, be they mechanical or manual service providers, with their specific practices and disposal sites. Different administrative units will have different leaders, whether they are governmental or traditional.

Existing city maps and land registers can provide a considerable amount of relevant information, but they rapidly become out of date as cities expand and new settlements spring up. A common problem is that unplanned informal settlements are literally not on the map. It may therefore be necessary to prepare some simple but accurate up-to-date maps to ensure that these areas are not neglected in the planning of service improvements (WSP, 2008).

Some key questions about the spatial analysis are (modified from WSP, 2008):

- What sanitation infrastructure and services are in place, and how effective are they?
- Where are the sanitation problems most acute?
- Where is there a need for new infrastructure or services, and where is there a need for upgrading?
- Which areas should be prioritised for improvement?
- Where are the potential sites for FSTPs?
- Which areas are inaccessible for mechanical emptying?
- Where are the potential interfaces between these inaccessible areas and the city-level services?

The main outcome should be a clear understanding of the problems to be addressed, both in terms of location and type, at the household, neighbourhood and city levels.

14.3.9 Enduse practices and market studies

Chapter 10 details the potential endproducts and possibilities for resource recovery. The opportunities in a specific context should be investigated from the start, as this may influence the selection of technical options, as shown in the Technology Selection Scheme in Chapter 17.

The best method of finding out how the sludge is currently treated, disposed of or used is through interviews with the different FSM stakeholders. Observation of the disposal, treatment or enduse practices and visits to the corresponding sites are essential (Klingel *et al.*, 2002). The interest of potential endusers should be assessed; and if there is interest, the feasibility should be checked. This encompasses basic market studies, assessment of the willingness to pay, and scenarios for the supply chain. This is because bringing a product to a customer usually has a cost, which potential endusers may not be able to cover.

Figure 14.10 A farmer collecting dried faecal sludge at an informal disposal site in Togo (photo: Philippe Reymond).

Case Study 14.2: Urban complexity

(Adapted from Parkinson *et al.*, 2011)

It is important to think of the city as a patchwork of different domains and physical environments, each of which presents their own challenges and opportunities. A city can be divided into four typical urban settings: (i) informal settlements; (ii) peri-urban interface; (iii) planned urban development areas; (iv) inner-city middle- and high-income settlements (Figure 14.11). Each setting features different physical, spatial, demographic and socio-economic factors, leading to different dynamics and highlighting the fact that a range of sanitation technologies and management schemes are required to solve large-scale urban sanitation deficiencies. Integrating all these different areas and creating interfaces where needed is key in FSM planning.

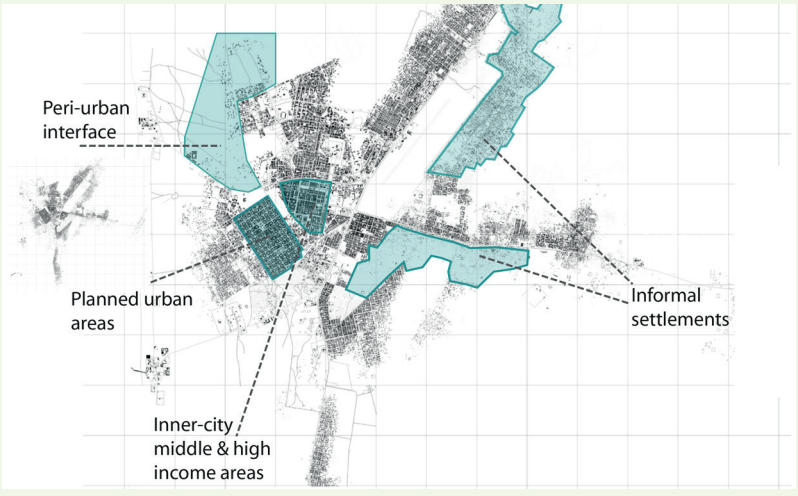

Figure 14.11 Identification of different urban settings (figure: Christoph Lüthi).

Figure 14.12 Two different urban settings (left: Kibera, Nairobi, Kenya; right: Nouakchott, Mauritania).

Box 14.3 provides an interview guide for farmers, which aims to assess the practices and needs of sludge use, their willingness to pay as well as the characteristics of similar products on the market.

Box 14.3: Interview guide for farmers

1 Localisation of the farms

2 Types of crops

3 Fertilisers
- Use of manure (cow, sheep, goat, chicken), sludge, compost, chemicals?
- Efficiency and price of the different fertilisers

4 Disposal / enduse
- Direct discharge on fields
- Transport to disposal sites
- Post-treatment before enduse (e.g. storage, composting)?

5 Health risk perception related to the use of FS

6 Periods when sludge is needed

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
❒	❒	❒	❒	❒	❒	❒	❒	❒	❒	❒	❒

Cross the months where there is a need (X)

7 Periods where the other types of fertilisers are lacking

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
❒	❒	❒	❒	❒	❒	❒	❒	❒	❒	❒	❒

Cross the months where there is a need (X)

8 Conditions for acquisition of treated FS
- price

14.4 CHARACTERISATION, EVALUATION AND SELECTION OF TREATMENT SITES

A well-thought out selection of treatment sites is crucial. There are examples, such as Bamako, where a FSTP was constructed but never used because the site was inappropriate. The selection of sites should be carried out according to city size, city configuration, number of available sites and the spatial distribution of the emptying companies, and several treatment sites should be considered. The optimum plant size has to be determined on a case-by-case basis as it depends on the local context (e.g., labour cost, land price, treatment plant scale, haulage distance, and site conditions, AECOM and SANDEC/EAWAG, 2010).

Existing disposal sites and potential treatment sites should be identified at the beginning of the planning process (Table 17.1), within the framework of the interviews and field visits during the detailed assessment of the initial situation. The evaluation of the identified sites should be carried out before the selection of technical options, as their characteristics may influence the selection.

Figure 14.13 Faecal sludge trucks stuck in traffic, Dakar, Senegal (photo: Linda Strande).

It is fundamental to involve the private collection and transport service providers in the selection process, as they are most affected. Their practices, constraints and needs should be understood, especially:

- their routes and disposal sites;
- the problems they face on the streets (traffic, police fees);
- the average distance and duration of the trips; and
- the money they gain per trip, in total and after deducting the fuel cost and maintenance costs of the trucks.

They will be able to say whether it is *practically* and *financially* possible for them to drive and deliver to the sites listed (see also Section 14.3.3 and Chapter 4).

14.4.1 Identification of treatment sites

The identification of existing sites, former sites and potential sites is carried out through discussions with the key stakeholders. The following stakeholders may be particularly helpful:

Manual and mechanical FS operators: They have knowledge of the discharge sites. It is also important to ask about former sites, or direct delivering to farming areas. It should be borne in mind that they may be reluctant to talk about sites that are illegal.

Endusers: Firstly, areas where sludge is used should be identified. Then, for example, if it is agriculture, farmers can provide information on where they find the sludge. They can also give information about former dumping sites, or temporary sites. It is interesting to cross-check this with the information from emptying service providers. This also gives indications on how the enduse market could be structured.

Table 14.3 Criteria for site evaluation with *sine qua non* (essential) conditions

Criteria	*Sine qua non* conditions
1. Average transport distance for mechanical service providers	Acceptability and affordability for service providers, as defined during interviews
2. Accessibility	Ease of access
3. Surface area	Surface area > 0.3 ha
4. Land ownership and price	Guarantee to be able to buy, at a reasonable price
5. Neighbourhood/potential for urbanisation	Risk of future access due to urbanisation
6. Topography	No risk of flooding
7. Soil type	Free soil (unconsolidated)
8. Groundwater table	> 2 m. deep
9. Opportunities for disposal of treated effluent and sludge	Must have disposal and enduse possibilities

Municipal authorities: The state may own available land. This would be a good option, as the municipality would then immediately be more involved.

Traditional authorities: Very often, land is still in the hands of traditional cultural leaders. They may be willing to provide land for public interest.

Politicians, landowners, town planners, residents, operators and users are all likely to have differing priorities and requirements as to where the infrastructure is located. Decisions may be heavily biased. Political pressures or available space may override what is considered appropriate for the user and host community (Scott, 2013). Siting infrastructure in the wrong location is likely to impact adversely on the long-term sustainability of the service.

It is common for cities not to have an updated land registry. Particular emphasis should be placed on finding out who owns the identified sites. GPS and Google Earth (see also Section 14.2.5) can be valuable tools to reference and assess the areas surrounding the sites and they can replace missing or outdated maps.

14.4.2 Characterisation and evaluation criteria

Nine criteria are proposed in Table 14.3 to characterise and evaluate potential sites, providing a good basis for decision-making. Some circumstances can lead to the immediate exclusion of a site. These are expressed as *sine qua non* conditions; if any of them is not valid, the site is considered as not appropriate.

Additionally the following information should be collected for each existing site:

- when the site is used (seasonality?);
- frequency of use; and
- city neighbourhoods that are served by this site.

Distance from emptying to delivering and accessibility of the site are major issues. A site that is too far away or has poor accessibility may also result in FS operators reverting to the former unsafe disposal sites. Collection service providers and vacuum truck drivers are always aware of haulage time and cost. The haulage of relatively small FS volumes (5-10 m^3 per truck) on congested roads over long distances in large urban agglomerations is financially unfeasible. A site that is too far away implies fewer trips per day, less revenue and more fuel costs for the FS operators. Very often they will add these costs to

the emptying fees, in order to ultimately reach the same revenue. A price hike may then discourage households from using this service and cause them to turn to informal, unhygienic practices.

The surface area needed for a FSTP is determined by its technical design. However, if there is no single site large enough but instead there are several mid-sized sites, splitting the treatment units should be considered.

It is important that the site be bought by the institution in charge of the FSM system. Renting a site for treatment units is not a good option, as it will always be under threat from closure without notice. Land price is often another big issue. This should be kept in mind when preparing the budget for the FSTP.

The immediate environment of the site (ground and surroundings) is also of importance and the following should be taken into consideration:

Neighbourhood - nuisance: A FSTP can generate nuisance, especially bad odours. For this reason, it should be located at an appropriate distance from residential areas. It is also important to consider how the city will develop in the future.

Neighbourhood - synergy: If the site is surrounded by farming areas, the treated effluent may be directly used for irrigation, with the additional value of nutrient recycling. This would also greatly facilitate the enduse of sludge, if farmers are interested.

Topography: The FSTP should neither be threatened by flooding nor by erosion.

Soil type: This particularly affects the costs of excavation. In areas where mechanical means are scarce and most work is done manually, lateritic and other hard soils should be avoided. It is rare to find pedological maps; the soil characteristics should be assessed onsite, with the help of local residents.

Groundwater table: A high groundwater table may jeopardise the lifetime of the concrete and infrastructure. To assess the groundwater table, it is a advisable to look in any nearby wells, or to ask neighbours.

Disposal of the treated effluent also has to be planned. Even if treated, the effluent should not be disposed of directly into water. As mentioned above, it can be used for irrigation, or, if not possible, infiltrated in a leaching field. If wells are present within 100 meters downstream of the FSTP, signs should make it clear that the water is not of drinking water quality (i.e. non-potable).

14.4.3 Number of sites

The average haulage distance from the houses where FS is collected to the FSTP and the actual size of the plant are very decisive variables for the total cost of the disposal system as well as for its efficiency and sustainability (Strauss and Montangero, 2003). Given the difficulty of collecting FS and hauling it across cities to designated disposal and treatment sites, medium-scale FSTP in easily accessible locations may significantly reduce collection and haulage costs (Figure 14.14). Capital, operation and maintenance costs decrease with increasing plant size. However, since larger treatment plants require longer haulage distances between pits and disposal sites, costs escalate for collection a company, which in turn increases the risk of indiscriminate and illegal disposal (Chowdhry and Koné, 2012).

FS treatment can be optimised through levels of decentralisation, as most FSTPs are made up of relatively low-cost and modular treatment technologies. The selection of several sites could be a better match for the logistics of collection and for transport companies, and could lead to lower prices for emptying services.

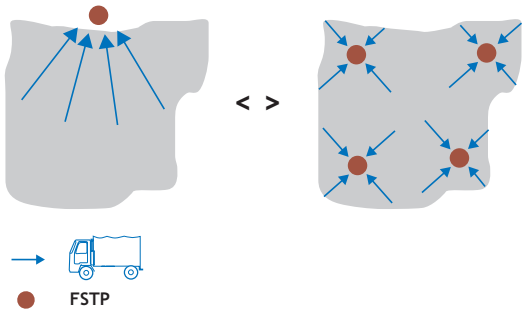

Figure 14.14 Centralised versus semi-centralised approach for site selection (Strauss and Montangero, 2003).

Implementation of several FSTPs implies a more detailed analysis of 'FS basins' (all the points in the city from where the FS is brought to the same area by FS operators; in analogy with hydrological basins) and the quantities that would arrive in each of the plants, in order to reduce the risk of over- or under-design. It would be problematic if, in the case of two FSTPs of the same size, most trucks went to one and not to the other because an important parameter has been missed during the assessment of the initial situation.

14.4.4 Sludge from manual emptying

The issues discussed above are mainly related to mechanical emptying. Manual emptying represents additional challenges, as manual service providers cannot transport the sludge far from the pits. Manual operators mainly work in areas where mechanical emptying is considered too expensive, or where pumping trucks cannot access (see also Chapter 4). It is very often not possible for them to dispose of the sludge safely in the neighbourhood where they work and it is thus important to link them with mechanical service providers.

A solution is to build transfer stations (or underground holding tanks, Tilley *et al.*, 2014) which are accessible to pumping trucks and which are close to where manual service providers work. Light transport gear should be provided so that they can easily bring the sludge to these collecting points. These holding tanks would then be managed as any onsite facility by mechanical operators. Emptying collecting points like these are best financed by the community or the municipal authorities (Figure 14.15).

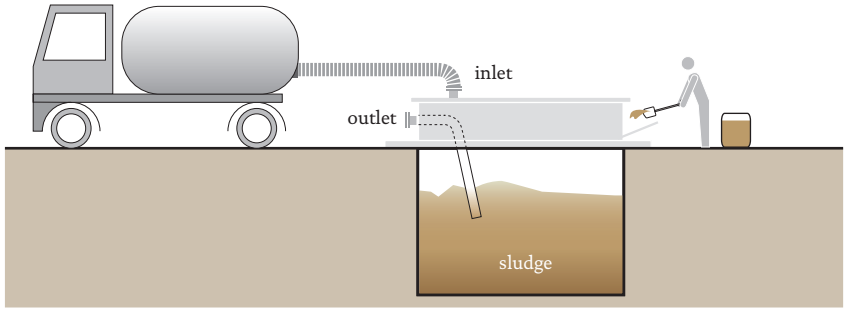

Figure 14.15 Schematic of a transfer station (Tilley *et al.*, 2014).

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End of Chapter Study Questions

1. What types of data need to be collected during the initial assessment phase for FSM?
2. List the climatic data that should be collected in the initial assessment of FSM and explain the importance of this information.
3. When interviewing mechanical FS operators, what key information needs to be obtained from them?