Cape Peninsula University of Technology

Investigation into institutional, technical and social aspects of sanitation service provision in the policy context of free basic sanitation: a case study of informal settlements of South Africa

by

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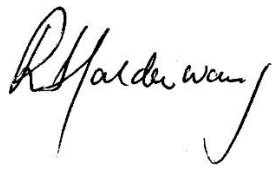
DECLARATION

I, Christophe Muanda, declare that the contents of this dissertation represent my own unaided work, and that the dissertation has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.



pp Chris Muanda **31 July 2020**

Signed in Cape Town **Date**

ABSTRACT

Access to sanitation services is recognised as a human right enshrined in the Constitution of South Africa. It has been translated into the Free Basic Sanitation (FBSan) service policy, through which many informal settlements in South Africa have been provided with basic sanitation facilities. However, for many residents, access to these facilities remains challenging. Although municipalities have attempted to address the persisting sanitation challenges, this has often been done without adequately addressing pertinent core issues around sanitation service provision. As the focus is predominantly on the supply of the facilities to achieve coverage the institutional set up (organisation of sanitation services) and technical (technology selection and appropriateness) and explicit consideration of social (users' practices and behaviours) aspects of the sanitation, service provision has been neglected. As a result, many residents are angry or disappointed in their sanitation facilities and all too often seek undesirable alternative practices. This study examines *how* and *to what extent* the institutional, technical and social aspects of sanitation service provision inform (whether facilitate or hinder) the provision of sanitation services, access and long-term sustainability within the specific policy context of FBSan. A case study approach using both quantitative and qualitative methodologies was adopted. The sample consisted of four hundred and seventeen (417) respondents comprising informal settlement residents, community leaders, municipal officials, sanitation entrepreneurs and civic organisation representatives. The theoretical framework was comprised of the Institutional Analysis Development (IAD) framework and the co-production approach. Data was analysed using content analysis around specific themes.

The data revealed inadequate stakeholder and decision-making processes, inappropriate technology choices and unpredictable and undesirable user practices, which together meant that access to sanitation was denied to far too many residents in our sites of investigation. Our data also shows that sanitation technologies are tightly interlocked with the management arrangements and particular conditions in a given context. These results confirm that the provision of sanitation services within the FBSan policy context is complex in nature and contested because of the various interrelated factors. Deploying facilities without thorough stakeholder engagement on one hand and without a deep knowledge of the specific context of the informal settlement on the other leads to inappropriate facilities. The study proposes alternative institutional and management arrangements which require knowledge of the sanitation practitioners, their roles and responsibilities and the way they engage with residents in informal settlements. The study also suggests guidelines for decision-making processes and for the selection of appropriate sanitation technologies as well as the proper management of sanitation facilities. This study posits that knowledge and understanding of the relationship between institutional, technical, and social aspects of sanitation provision can contribute to a constructive means of improving access and long-term sustainability of sanitation services in informal settlements. This study contributes to a body of knowledge by highlighting the importance of understanding the interconnectedness between institutional, technical and social aspects of sanitation. It uses both the IAD framework and the co-production approach to suggest alternative arrangements for improving sanitation service provision in informal settlements of South Africa.

Key words: Free Basic Sanitation, South Africa, informal settlements, stakeholder engagement, institutional arrangements

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It is with great sorrow that we are writing the acknowledgement to the thesis of a wonderful student. Chris was a dedicated and committed student who brought the Doctoral thesis to its completion in a spirit of excellence. We mourn his departure - death through COVID-19 - and dedicate the thesis to his children whom he loved very deeply. He will be greatly missed. His significant contribution to the sanitation sector will be widely acknowledged in references and citations to his original research publications based on this work. As supervisors it was a privilege to walk this road with him.

Prof Rainer Haldenwang and Prof Jacqueline Goldin

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DEDICATION

I dedicate this work to my children

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

GLOSSARY OF TERMS

Term	Definition
Access	The ability to have or enter and use sanitation facility (e.g. toilet) it at any time of need
Backlog	The total amount of municipal infrastructure and services that should exist in terms of minimum standards, but have not yet been established' (DPLG, 2004)
Basic sanitation	A toilet and hand washing facility
Basic sanitation services	"The provision of a basic sanitation facility which is environmentally sustainable, easily accessible to a household and a consumer, the sustainable operation and maintenance of the facility, including the safe removal of human waste, grey-water and wastewater from the premises where this is appropriate and necessary, and the communication and local monitoring of good sanitation, hygiene and related practices" (DWS, 2016)
Community based organisation	Members of community grouped into an organisation that represents their interests
Chemical toilet	Waterless latrine in which chemicals are used to deodorise human waste and make it innocuous
Civic organisation	Citizens who do not represent the government or the private sector
Compliance	Behaving according to the instructions or prescriptions
Facility	A physical structure provided for a given purpose. In this thesis, this term is used in reference to a toilet
Free basic sanitation	"The provision of affordable ongoing services to at least the basic level of sanitation for indigent households" (DWS, 2016)
Household	A "single person living alone" or a "group of persons who live together"
Implementation	A process where a decision is transformed into practice with tangible outcomes
Informal settlement	Developments comprising housing and spatial layouts non-compliant with conventional building codes and town planning.
Infrastructure	A physical structure needed for the collection, transport and/or safe disposal of human excreta
Institution	Administrative and decision-making bodies
Institutional	Official systems and processes employed to deliver sanitation services in informal settlements
Institutional arrangements	The "formal and informal institutional contexts that help or hinder the successful delivery of the day-to-day activities and operational responsibilities" (Ross *et al.*, 2014). In this study, it refers to the process of delivery of sanitation services to informal settlements
Key informant	Prime respondents (including political and community leaders, municipal and government officials, NGO/CSO and CBO representatives) who have knowledge of the subject discussed in this thesis. They provided key information and opinion reflected in this thesis
Non-government organisation	A non-profit institution that is not a part of the government or a private sector business
Night soil or night pail	Synonym for human waste that is collected in a pail or bucket

Term	Definition
Open defecation	The disposal of human faeces in open areas, such as fields, forests, roadside, beaches, and open bodies of water
Operation and maintenance (O&M)	Day-to-day activities intended to keep the sanitation facility is good working conditions
Oversight	Supervisory role exercised by municipalities over all activities related to the selection and deployment of sanitation facilities in informal settlements
Policies	The "set of procedures, rules and allocation mechanisms that provide the basis for programmes and services" (Elledges *et al.*, 2002).
Respondent	A person being interviewed
Sanitation	"The principles and practice relating to the collection, removal, and disposal of human excreta, refuse and wastewater, as they impact upon users, operators and the environment" (DWAF, 2003). In this thesis, however, emphasis is on excreta disposal; the term 'sanitation' will mostly be used to refer to this practice
Sanitation backlog	Households with no toilets, bucket toilets and unimproved pit latrines
Sanitation facility	is referred to as an amenity intended for the safe disposal of human excreta
Sanitation infrastructure	An amenity or combination of amenities dedicated for the collection, transport, or safe disposal of human excreta
Sanitation practices	The way an individual manages excreta
Sanitation provision	The delivery of sanitation facilities. 'Delivery' in this context includes the supply of individual and/or communal facilities.
Sanitation services	"The collection, removal, treatment and/or disposal of human excreta, and domestic public institution wastewater, and the collection, treatment and/or disposal of municipal, agricultural, mining, and industrial wastewater" (DWS, 2016).
Sanitation technology	Specific infrastructural configurations, methods or services designed specifically to contain, transform, or transport waste to another process, point of use or disposal
Service	The "provision of a facility to contain waste as well as safely to remove it" (DWAF, 2003).
Service delivery	The provision of infrastructure by municipality to individual or communities
Social	Something relating to the community. In this thesis, it refers to as issues related to access to sanitation in informal settlements
Sustainability	The ability of sanitation facilities to withstand regular use while being continuously operational, reliable, and available for users Ability to be maintained indefinitely or at least as per design lifespan
Technical	The action of involving science and expert knowledge. In this thesis, it refers to issues relating to the nature and function of a sanitation technology or facility
Toilet	A facility that allows safe disposal of human excreta
Toilet facility	A facility
Users	Along with 'beneficiary' or 'recipient', terms used in reference to informal settlement residents who have been provided with or use sanitation services. In this thesis, the terms ''users', 'recipient of the service', 'beneficiary' and 'informal settlement residents' are used concurrently
Water services	"Water supply and sanitation services" (RSA, 1997)

Chapter 1 CHAPTER ONE: INTRODUCTION

1.1 Background

Worldwide, access to improved sanitation has been considered one of the burning social issues that has affected, and continues to affect, human wellbeing. For decades the topic has been at the fore of development concerns, resulting in enactment of several resolutions such as the international Bellagio principles, the Millennium Development Goals (MDGs), the Sustainable Development Goals (SDGs) and, closer to home, the eThekwini Declaration. Since the lack of access to improved sanitation has been identified as a cause of child death and a block to economic development, many (developing) countries have made sanitation a national priority.

In South Africa, access to sanitation services is a human right enshrined in the Constitution. It has been translated into sanitation policy that mandates local government to provide Free Basic Services[1] (FBS) including water and sanitation (DWAF, 2001) to all South Africans. Since 1994, the Government of South Africa has provided millions of sanitation facilities to various areas including informal settlements. However, despite the dedication of public officials and the availability of funds, there are still many people, especially those living in informal settlements, who are still lacking access to improved sanitation services. While the South African government strives to ensure universal access to sanitation for all citizens, it struggles to provide adequate sanitation to informal settlements. Despite the institutionalisation of the FBS, residents in informal settlements continue to face many challenges relating to access to adequate sanitation services. These challenges are attributed to a multitude of factors including insecure land tenure, unsuitability of land for human settlements, political interference and limited technology choice, inappropriate technology choice, user behaviours, misaligned institutional arrangements as well as unclear policy (Mjoli *et al.*, 2009; Phaswana-Mafuya, 2006; Mels *et al.*, 2009; Verhagen *et al.*, 2010; Tumwebaze *et al.*, 2013; Robins, 2014; McFarlane & Silver, 2017).

Sanitation policy has been formulated at a national level, delegating the authority to the service provider (municipalities) to ensure service delivery at the local level. In an attempt to secure speedy sanitation provision, municipalities have adjusted and interpreted the policy to suit their own settings (Mjoli *et al.*, 2009). Various approaches to address the sanitation service provision challenges to informal settlements have met varying degrees of success (Lagardien & Cousins, 2004). These challenges are often addressed without clear consideration of the extent to which the relationship between institutional arrangements, approach to technology choice and deployment and user practices inform access and sustainability of sanitation services. Sanitation options are frequently decided by people who have little or no experience of sanitation issues (Tsinda *et al.*, 2013). Decisions concerning residents' access to sanitation have too often been taken without adequate engagement or consultation with the recipients of the services. This mix of issues has exacerbated the sanitation backlog.

The term *informal settlement* (also referred to as *slum*, *shanty town*, *favela*) is defined and used differently by scholars (see City Alliance, 2010; UN-Habitat, 2005a; Malinga, 2000; Wright, 1997). There are different connotations depending on the context by which the settlement has been formed, the living conditions of its inhabitants, the type of infrastructure and the degree of illegality or informality. The term *informal settlement* suggests illegality with reference to land acquisition and occupancy with a lack of respect of building laws and planning regulations. According to the National White Paper on Basic Household Sanitation in South Africa (DWAF,

[1] *Free Basic Services* is defined as "minimum acceptable basic level of sanitation as a toilet for each household".

2001:5), *"sanitation refers to the principles and practices relating to the collection, removal or disposal of human excreta, household wastewater and refuse as they impact upon people and the environment"*. For the purpose of this study, the term *informal settlement* is used in reference to human settlements that have been developed outside legal means on a private or state-owned land, while *sanitation* is used in reference to principles and practices relating to the management of human excreta.

1.2 Rationale for the study

It is well established that improved access to sanitation has far reaching impacts on health, hygiene, economic development, education, livelihood, and human dignity (Hutton & Chase, 2016; Sibiya & Gumbo, 2015). However, lack of access to sanitation remains one of the most pressing challenges faced by residents in low-income informal settlements (Govender *et al.*, 2011; Katukiza *et al.*, 2010; Huchzermeyer & Karam, 2006). Currently 2.3 billion people (approximately 38% of the world's population) lack access to improved sanitation facilities (WHO & UNICEF, 2017). This dire situation causes the death of about 2.2 million people annually (WHO, 2015), and further triggers people to adopt alternative strategies to access sanitation, such as open defecation and use of buckets (Simiyu, 2015; Kwiringira *et al.*, 2014a; Tumwebaze *et al.*, 2013; Katukiza *et al.*, 2010; McFarlane, 2008b; Hogrewe *et al.*, 1993).

This research has been motivated by the increasing sanitation challenges faced by many residents of informal settlements in South Africa. Although, the government has been striving to accelerate sanitation service provision to ensure universal access to all citizens, many people (especially those living in informal settlements) are still lacking access to improved or adequate sanitation services. The implementation of sanitation services in South Africa has been found to be complex for various reasons including nature of the settlements, high numbers of role-players involved and misinterpretation of sanitation policy (Mjoli & Bhagwan, 2008). It is characterised by institutional arrangements where the responsibility to select, deploy and maintain sanitation are made (DWS, 2016). Although these arrangements have been acclaimed worldwide for being progressive, in practice their implementation has been deficient (Mjoli *et al.*, 2009). The deficiencies are mainly related to the overlap of roles and responsibilities of various role-players (especially those directly responsible for the provision and maintenance of sanitation facilities) and poor coordination of activities. This overlap has created institutional fragmentation which in many cases has resulted in chaotic service provision (Mjoli, 2015). The choice of sanitation technology and the level of service to be provided are decided by experts (service providers) who have little or no knowledge of the social implications of a particular sanitation choice nor do they have an adequate understanding of the nature of the settlement where a particular technology is deployed (Mjoli *et al.*, 2009). Furthermore, sanitation technologies are frequently selected by considering cost and availability factors (Crous, 2014) while the sanitary practices (attitudes and behaviour) of recipients and settlement conditions are overlooked (Lagardien *et al.*, 2012b). Users, as recipients of the service, do not take part in the decision-making processes and this negligence results in the rejection, misuse, disregard and even vandalism of the chosen technology and subsequent facilities.

There is an unfortunate disconnect between policy and practical implementation, and between the institutional arrangements, the technology choice and users' sanitation practices. This disconnect has often resulted in poor service provision which in turn means that inadequate and unhygienic sanitation practices (e.g., open defecation, buckets, nightsoil and flying toilets, for example) are used by informal settlement residents. The knowledge gap between service providers (municipalities) and recipients of the service (users) with regard to various sanitation technologies and their context of application has aggravated the current sanitation backlog in a

way that users are rejecting any form of sanitation that does not meet their aspirations. The lack of understanding of the relationship between institutional arrangements, technology choice and deployment, together with sanitation practices on the ground, have contributed to an increasing number of people lacking access to adequate sanitation and to the perpetuation of unhygienic sanitation practices despite the availability of funds and the ostensible commitment by service providers to ensure universal access to sanitation for all. Unhygienic practices threaten the public health of informal settlement residents, those living beyond these settlements and the environment at large.

Studies attempting to unravel everyday realities of accessing and providing sanitation services in informal settlements are relatively new and scarce, most focusing on sanitation demand and hygiene (Mara *et al.*, 2003; Jenkins & Curtis, 2005; Jenkins & Scott, 2007); users satisfaction (Matsebe & Duncker, 2005; Matsebe & Osman, 2012; Roma *et al.*, 2010, 2013; Tumwebaze *et al.*, 2013; Duncker, 2014; Simiyu, 2016a), perception, attitudes and behaviour (Biran *et al.*, 2005); sanitation practices and hygiene (Omambia, 2010); technology selection (Jenkins & Curtis, 2005; Katukiza *et al.*, 2010, 2012; Schouten & Mathenge, 2010;) and access to sanitation (Patel & SPARC, 2015; Okorut *et al.*, 2015b; Simiyu, 2015; Adubofour *et al.*, 2012). This body of knowledge has revealed that sanitation technologies provided to informal settlements scarcely address user needs or settlement conditions, are not context appropriate and are often poorly maintained. The (un)availability of sanitation facilities, knowledge and conditions can perpetuate certain practices amongst users (Biran *et al.*, 2005; McFarlane, 2008a&b; Simiyu, 2015). Some of these practices (e.g. open defecation) are often related to education level and religion (Sara & Graham, 2014); lack of cleanliness, perception of safety, comfort, privacy and habits (Pfadenhauer & Rehfuess, 2014); and non-compliance with use requirements (Sibiya & Gumbo, 2015; Adubofour *et al.*, 2012). This infers that users' sanitation practices are triggered by the (un)availability of facilities and the conditions and social environment (e.g. safety, ease of access) surrounding users. Increasingly, sanitation stakeholders are attempting to provide alternative service provision and institutional arrangement models, particularly in informal settlements.

There is a small but growing body of literature that has explicitly considered the relation between sanitation technology and its mode of operation and user choices; this requires a thorough understanding of the relationship between user practices, technology choice and institutional arrangements and the extent to which these three elements of the service provision inform access to improved sanitation and long-term sustainability of services. Some studies, for instance, reveal that the adoption and sustained use of a sanitation facility are influenced by its specific attributes including cleanliness (Garn *et al.*, 2016) and user cooperation (Sibiya & Gumbo, 2015; Simiyu, 2016a). Jenkins and Scott (2007) show that contextual factors including living environment, policies, age, education, and gender play a role in the adoption of sanitation by a household, while Dreibelbis *et al.* (2013) argue that the adoption of technology is influenced by behavioural, social and psychological determinants. Relatively little is known about how informal settlement residents get access to, maintain and experience sanitation on a day-to-day basis (McFarlane *et al.*, 2014). Improving access to sanitation in informal settlements needs to address not only technology but other aspects that may hinder access, and then to define an approach to address them.

The Western Cape Province was selected to pilot this study because of the large numbers of informal settlements and the variety of institutional arrangements and sanitation technology implemented at a local municipality level. It is also a region with high number of service delivery protests. The South African case is particularly relevant, where the provision of sanitation for low-income residents is predominantly supply-driven yet challenges in accessing sanitation

services persist. This demonstrates that access is not constrained by the absence of facilities per se, but other issues that need to be identified and explored. The choice of the study site was motivated by the idea that much of the failure to improve access to sanitation is strongly correlated to an inadequate understanding of how different sanitation technologies effectively respond to user needs and settlement conditions and how people's practices are taken care of in the selection and deployment of sanitation services. Therefore, understanding the institutional, technical and social aspects governing sanitation service provision can thereby assist in accelerating access to improved sanitation in informal settlements and long-term sustainability of the services.

1.3 Research hypothesis

Since the provision of sanitation services involves stakeholders with various interests and needs, this study builds on two assumptions:

- Understanding the relationship between sanitation practices, technology and institutional arrangements can positively contribute to access to improved sanitation in informal settlements while ensuring long-term sustainability of the services.
- Access and long-term sustainability of sanitation services in informal settlements are informed by coordinated institutional arrangements and consensual technology choice which will in turn result in adequate sanitation practices.

1.4 Aim and objectives of the study

This study examines the institutional, technical and social aspects of sanitation service provision in the policy context of FBS and the extent by which this informs (facilitates or hinders) the provision of sanitation services, access and long-term sustainability. This study is undertaken in a specific context wherein the government has legal obligations to provide free sanitation services (DWAF, 2001) and the public has high expectations and entitlement mentality (Taing *et al.*, 2013). Bearing this in mind, the study objectives pursued are as follows:

- To explore institutional, technical and social aspects of sanitation service provision with specific focus on informal settlements;
- To document, investigate and analyse sanitation user practices (behaviours and attitudes) and values and establish their impacts on access, functioning and sustainability of sanitation services in informal settlements;
- To document, investigate and analyse the practical application of specific sanitation technology, institutional arrangements of existing sanitation provisions and the impact/implication generated on access and long-term sustainability to improve sanitation services in informal settlements; and
- To design and recommend/suggest alternative institutional arrangements based on formal/informal service provider-user co-production practices and collaboration (institutionalised co-production) to improve access and produce sustainable sanitation services in informal settlements.

As such, this study provides a holistic approach on how the institutional, technical, and social aspects of sanitation service provision can inform the provision of adequate and sustainable sanitation services and provide access to all informal settlement residents.

The key research question is as follows:
Are institutional arrangements, selection and deployment of sanitation services and user practices conducive to improving access to adequate sanitation services and their long-term sustainability in informal settlements?

Additional questions explored include the following:

- What are the institutional, technical and social aspects that inform (facilitate or hinder) the provision of and access to sanitation services in informal settlements?
- To what extent have user practices supported or hindered access, functioning and sustainability of sanitation technologies?
- To what extent do the current sanitation technologies provided to informal settlements and their related institutional arrangements respond to user needs and settlement conditions?
- How could institutional arrangements for sanitation services better address access to and sustainability of sanitation services deployed in informal settlements?

1.5 Theoretical framework and research design

The conceptual approach for this study is based on the co-production model. The co-production model is centred on the assumption of an active and participative portion of consumers. It is distinct from traditional models of public service production that render public officials responsible for "designing and providing services to citizens, who in turn only demand, consume and evaluate them" (Pestoff, 2006). Co-production implies that "*citizens can play an active role in producing public goods and services of consequence to them*" (Ostrom, 1999), suggesting that despite local government and related agencies being responsible for the provision of services, efficiency and equity can be achieved without considerable input from the users. Pestoff (2006) remarks that co-production occurs when "*consumers and regular producers undertake efforts to produce the same goods or services*". The concept of co-production has been used to analyse a wide range of issues related to the way institutions and the public work together to provide services (Ostrom, 1999).

In South Africa, Section 152 of the Constitution confirms the rights of communities to be involved in local governance (RSA, 1996). Municipalities are requested to encourage the involvement of communities and civic organisations in local governance. Therefore, the co-production approach was applied in the case study context where the government is constitutionally obliged to provide free sanitation services to under-serviced areas (DWAF, 2001) including informal settlements where residents have high feelings of entitlement (Taing *et al.*, 2013). The co-production model, important as a guide to the study objectives, is applied to understand (i) the inter-relationship between sanitation practices and technology and the extent to which they mutually inform or influence each other; (ii) understanding of the sanitation technology in a multi-stakeholder environment (users and service providers); (iii) understanding the interaction amongst different sanitation actors and the extent to which it informs or influences sanitation practices, technology choice and decision-making process; and (iv) the basis for decision-making processes regarding the selection and deployment of sanitation.

A case study approach (Yin, 2009) has been used in this study because of its strength in investigating "*empirical phenomenon within a real-life context*", especially when the boundaries between phenomenon (in this case access to sanitation) and context are not clearly evident (Yin, 2003). This approach is known to provide better understanding of issues studied when experimental events cannot be controlled by the researcher and when the research questions focus on the *why*, *how* and *what*. The lack of access to sanitation services in informal settlements is a real-life problem that renders the case study approach appropriate for understanding sanitation issues. This approach is justified by the fact that the provision of sanitation services involves different stakeholders including users who interact in situations where individual behaviours cannot be controlled (users and service providers' interface).

A qualitative approach, which allows for an in-depth understanding (Babbie & Mouton, 2001) of issues studied, has been used. A wide variety of techniques including multiple data collection methods such as semi-structured interviews, transect walks, observations and focus group discussions (Saunders *et al.*, 2009; Punch, 2005) and document review were incorporated to attain the study objectives. Five case study informal settlements located in three municipal jurisdictions in the Western Cape were randomly selected. The selection process was based on certain criteria including their municipal location, population size, land tenure, level of sanitation-related protests, reported sanitation challenges, sanitation technology provided, institutional arrangements and application of the sanitation policy.

1.6 Outcomes

The outcomes of this study include the following:

- An insightful understanding of institutional, technical and social issues hindering or promoting the provision of sanitation services in informal settlement;
- An insightful understanding of sanitation users' practices and their impact on access to sanitation and long-term sustainability of the sanitation facility;
- Multi-stakeholder understanding of the applicability of sanitation technologies provided by municipalities to informal settlements;
- An understanding of the relationship between user practices, technology choice and institutional arrangements and associated impact on access and long-term sustainability of the sanitation services; and
- Alternative tailor-made institutional arrangements to address institutional, technical and social issues that hinder access to sanitation and long-term sustainability of sanitation services in informal settlements through the FBSan policy context.

1.7 Structure of the thesis

- *Chapter 1: Introduction* – provides a background and rationale of the study.
- *Chapter 2: Literature Review* – this chapter provides an overview of existing body of knowledge and shade light on the extent of sanitation problem globally and locally.
- *Chapter 3: Research Approach and Methodology* – outlines methods used to respond to address the aim of the study.
- Chapter 4: *Findings: Sanitation service provision in informal settlements: Institutional, technical and social aspects* – outlines key findings emanating from the study objectives.
- *Chapter 5: General Discussion* – discusses findings of the study.
- *Chapter 6: Conclusions and Implications* – provides concluding remarks emanating from this study, highlighting a number of issues that must be addressed to ensure access to adequate sanitation in informal settlements of South Africa. It provides recommendations and pointers for further research.

Chapter 2 CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Informal settlements are a challenge to the modern urban landscape (Huchzermeyer & Karam, 2006). These settlements have become part of an urban landscape in developing countries where large numbers of destitute people seek shelter and make their living. These settlements are often characterised by the lack of basic infrastructure including water and sanitation. The main objective of sanitation is to protect and promote human health so as to ensure a clean environment and prevent diseases (WHO &UNICEF, 2010). A sanitation target was included in the Millennium Development Goal (MDGs) which intended to halve the number of people lacking access to adequate sanitation by 2015. However, this target was not achieved by many countries and subsequently, an estimated 2.3 billion people globally continue to lack access to improved sanitation. The absence or lack of improved sanitation can cause several problems, not only amongst informal settlement residents but also to the economy, human health and to the general environment (Tremolet & Rama, 2012). It has led people to adopt certain detrimental sanitation practices ranging from open defecation to flying toilets (Hogrewe *et al.*, 1993; Simiyu, 2017). These practices and low user acceptance and satisfaction are identified amongst factors associated with the failure and unsustainability of various sanitation technologies deployed to informal settlements (Lagardien *et al.*, 2009a) that have increased sanitation backlogs and environmental pollution. Human waste, when not collected or adequately disposed, may contaminate water supplies (Hammer *et al.*, 2006; Abraham, 2011) and pollute the general environment (Katukiza *et al.*, 2013). The global annual economic loss attributed to the lack of access to water and adequate sanitation is about US$ 260 billion while the total economic gain of meeting the MDGs is estimated to be about US$ 54 billion (Evans *et al.*, 2004). This shows that access to improved sanitation is critical to improving human lives and alleviating poverty, especially in middle and low-income countries.

Over decades, sanitation practitioners and scholars have addressed sanitation challenges from a variety of perspectives. However, this vast body of knowledge has scarcely addressed the relationship between sanitation user practice, technology, and institutional arrangements as a whole. This chapter, in surveying relevant literature, highlights several deficiencies in the current thinking concerning sanitation-related challenges in informal settlements. Specific focus is given to user practices, sanitation technology choice and institutional arrangements. Themes covered include the emergence of informal settlements in the urban landscape where the development, nature of informal settlements and their prevalence in the urban environment at a global level is presented, an overview of the sanitation provision and issues at a global level and in South Africa are outlined, and drivers for sanitation provision in South Africa where the driving forces behind the provision of sanitation services are unpacked. Further, institutional arrangements for sanitation provision, approaches to sanitation provision, sanitation technology choices, and the notion of sustainable sanitation are documented and discussed. The next section presents the emergence of informal settlements in the urban landscape and related sanitation challenges.

2.2 Emergence of informal settlements: characteristics and features

2.2.1 *Development of informal settlements: characteristics and features*

The world's population growth in the next 30 years is predicted to occur in urban areas (UN-Habitat, 2010). This growth is expected to continue in informal settlements around urban nodes in developing countries, which are estimated to encompass approximately 70% of the urban population, with sub-Saharan Africa accounting for 62% of this number (UN-Habitat, 2010). According to UN-Habitat (2015), the number of people living in the informal settlements of developing countries has increased from 689 million in 1990 to 791 million people in 2000 and 881 million people in 2014. This represents an increase of about 28% over the past 24 years (Ibid.). In Sub-Saharan Africa, 59% of the urban population lives in informal settlements, a number expected to reach 1.2 billion (UN-Habitat, 2015). This trend is noticeable in many developing countries including South Africa with its exponential population in informal settlements. According to UN-Habitat (2015), 23% of the South African population live in informal settlements. Informal settlements are a reality that should be considered as the urban landscape.

The development of informal settlements is attributed to numerous factors (Malinga, 2000; Huchzermeyer & Karam, 2006; Martin & Mathema, 2006; UN-Habitat, 2008; Roy, 2009; Schouten & Mathenge, 2010), some of which include colonial and post-colonial policies, failure by government to provide infrastructure, uncontrolled population growth, high rate of urbanisation, poor governance, lack of coherent policies and institutional support structure, increasing poverty and the persistent decrease of competitive opportunities in rural areas. Some of these factors are characteristic of the development of informal settlements in South African. These factors have led to rural-urban and regional migration to urban areas (Makhetha *et al.*, 1998). These migrations, coupled with the natural population growth, have led to the rapid expansion of peri-urban areas with a concomitant demand for housing (ibid.). As a result, informal settlements without proper services have mushroomed in open spaces in the vicinity of towns and townships, bringing with them associated drainage, sanitation, and pollution problems (Malinga, 2000; Kudva, 2009; Saga, 2012). In South Africa, the emergence of informal settlements has been attributed to decades of legal and social inequity (Malinga, 2000; Crous, 2014) as well as natural population growth combined with deficiency in housing, low earnings, and high joblessness (Crankshaw *et al.*, 2001). A study by Moloi and Harrison (2011) reveals that during the apartheid, certain racial groups (predominantly black) were forced to move out of urban centres and settle into underdeveloped areas which lacked basic infrastructure. This led evictees to assemble in underdeveloped areas to erect shelters. Another study by Reintges (2001) attributes the development of informal settlements to the dependence of residents on urban areas for jobs. Moreover, the existence of informal settlements has been attributed to the lack of the provision for accessible and affordable housing for the urban poor (Yap & Wandeler, 2010).

Free standing informal settlements and backyard shacks account, respectively, for 9% and 5% of the total South African population (StatsSA, 2012) which constitute (according to Crous, 2014 and UN-Habitat, 2015) respectively 24% and 23% of urban population. The Western Cape accounts for 12% of the informal dwellings in South Africa (StatsSA, 2012) which were primarily constructed after 1994. Most of the residents from these settlements are migrants from the Eastern Cape who see their informal dwellings as a temporary shelter (Mels *et al.*, 2009) while waiting to be provided with permanent housing.

There are numerous and diverse processes by which informal settlements come into existence, develop, consolidate, and acquire an urban form (Malinga, 2000; Alsayyad & Roy, 2006; Sliuzas *et al.*, 2008; Abebe, 2012). Generally, many informal settlements begin as land invasions with

individuals illegally squatting on the land, while others begin with illegal subdivision and selling of the land by the legal landowner without formal land registration or basic service provision (Wegelin-Schuringa & Kodo, 1996). Some informal settlements develop over time into densely crowded and physically saturated areas (Sliuzas *et al.*, 2008), while others are built literally overnight as a result of large-scale planned invasions (Malinga, 2000). Every informal settlement passes through various stages during its development which include initial occupancy, a transitional stage, attainable secure tenure and absorption or consolidation (Abebe, 2012). Each of these stages has its own particularity. A study by Dinsa Sori (2012) reveals that at the initial stage, informal settlements are populated by few people and lack infrastructure, although in some cases a minimum level of service is provided when the settlement starts taking a certain form. During the consolidation stage, while the number of residents increases, access to available facilities and a significant demand for infrastructure decrease (Dinsa Sori, 2012). The saturation stage is characterised by acute lack of infrastructure and an increasing number of people (ibid.).

The growth of informal settlements, associated with the expansion of the cities themselves, is especially true in sub-Saharan Africa (Huchzermeyer & Karam 2006). This increase in informal settlements is propagated by a lack of sufficient jobs and housing and accelerated rural-urban migration (Mahmud & Duyar-Kienast, 2001; Horn *et al.*, 2001). The combination of economic stagnation and urban population growth has, in sub-Saharan Africa and the developing world, created grave economic conditions, reinforcing the growth of informal settlements (Huchzermeyer & Karam, 2006). Informal settlements, it would seem, are here to stay (Huchzermeyer, 2011)

Since the process by which informal settlements develop and acquire certain form is not steady, their nature and characteristics may vary considerably from one location to another and even within the same city. According to Huchzermeyer and Karam (2006), informal settlements range from high-density, squalid city-centre tenements to spontaneous, peripheral settlements without legal tenure rights. The same study further reveals that regardless of their geographical location, informal settlements are generally characterised by six criteria: the lack of basic services; inadequate building structures and overcrowding; unhealthy and hazardous environmental conditions; insecure land tenure; poverty; and exclusion (Ibid.). Drawing from the definition of informal settlement settlements by the UN-Habitat, other criteria such as lack of secure land tenure, durable housing, sufficient living areas, and access to improved water and sanitation are applied (UNFPA, 2007; Yap & Wandeler, 2010). A study by Crous (2014) maintains that informal settlements are characterised by several issues, including lack of infrastructure and basic services such as water supply and sanitation, social services and overcrowding, crowded housing conditions, and poor public and environmental health. Govender *et al.* (2011) claim that informal settlements are characterised by informal and unplanned settlements which lack infrastructure and sanitation facilities. Although these criteria may vary from one region to another, many other studies (Makhetha *et al.*, 1998; Malinga, 2000; Kohli *et al.*, 2011; Szántóa *et al.*, 2012) admit that the common characteristics of informal settlements are mainly the legal status of their occupancy, spatial location, settlement conditions and social conditions of their residents. Applying these criteria to South Africa, the Department of Environmental Affairs (DEA, 2010) indicates that the general characteristics of informal settlements are either their legal tenure (informality and illegality) or inadequate housing structure. However, this characterisation of informal settlements by the DEA does not consider the settlements' access to basic services. In South Africa, authorities are considering informal settlements *only* from land tenure and housing perspectives while essential services such as water and sanitation are either overlooked or considered temporary measures. Scholars and sanitation practitioners have attempted to unpack the development

(characteristics and features) of informal settlements from social, spatial and infrastructural perspectives.

From a social perspective, informal settlements are often considered as poor people's solution to a lack of affordable housing (Islam *et al.*, 2005) and a legitimate response to real needs (Jenkins, 2006) given that they largely develop outside of government control and do not adhere to strict urban planning and development processes (Hogrewe *et al.*; 1993; Alsayyad & Roy, 2006). These settlements are further characterised by transient and unstable populations, diversity of inhabitants (in terms of their social, cultural, religious backgrounds), ineffective or poor organisation, unhealthy living environment, and a low socio-economic status for residents (Malinga, 2000; Mulenga, 2003; UN Habitat, 2005b; Lüthi, 2012; Mitlin & Mogaladi, 2013). Informal settlements are characterised by different types of inhabitants (Malinga, 2000)[2]. Residents from these settlements often choose to settle in areas populated by people from the same origin with shared values and socio-cultural and religious beliefs (Berg-Schlosser & Kersting, 2003; Malpezzi & Sa-Adu, 1996) and establish residential enclaves based on shared regional or ethnic bonds (Saga, 2012). They can be embedded in territorial division according to their ethnicities and religion, territorial intensity, economic functioning, and time and place of migration (Malpezzi & Sa-Adu, 1996; Berg-Schlosser & Kersting, 2003; Benjamin, 2004; McFarlane, 2008a&b). This can impact the types and level of organisation amongst residents and organisations that develop might be based on ethnic, socio-cultural, or religious bonds.

These social characteristics may impact the level and extent of organisation for both local residents and service providers, given that residents may be influenced by those with whom they share the same beliefs. This often leads to mistrust and misunderstanding between residents, thereby hindering the development of local organisations, and creating social heterogeneity (Mulenga *et al.*, 2004). However, in some circumstances, residents can be socially cohesive and tightly-knit (Smit, 2006) and can generate their own leadership and organisational structures to address and negotiate their issues (Ostrom, 1990; Wegelin-Schuringa & Pugh, 2000; Saga, 2012). Organisation in this context is strongly dependent on how settlements come into existence (Malinga, 2000; Hasan, 2002; Martin & Mathema, 2006). This form of organisation is referred by Stuttaford (1998) as self-governance which highlights how residents establish their own organisation and advocate for their wellbeing. This type of organisation can be fragile in a sense that conflicts of power can easily emerge (Huchzermeyer, 1999; Hasan, 2002). This implies that despite various social problems, temporal social cohesion can evolve to address social issues and needs of residents such as access to services. However, this type of organisation may be strongly embedded along lines of ethnicity, religion or political affiliation and is often weakened with time (Malinga, 2000).

Spatially, informal settlements may be located in the middle or on the outskirts of a city (Malinga, 2000; Birkinshaw, 2008); and often emerge in lands that are not suitable for human settlement purposes, including riverbanks, steep slopes, dumping grounds, abandoned or unexploited plots, along transportation networks, near hazardous and industrial areas and market places, and in low lying areas or wetlands, under high voltage power lines, forests and farmlands, flood plains and

[2]Informal settlement residents can be categorised as *township overspill*, which refers to people whose immediate social origin are in the formal townships and for whom houses are available or too small. *Permanent of semi-permanent* refers to people who have moved from one slum to another over the years. *Forced resettlement dwellers* refer to settlers who were forced to settle back to their homeland and other areas. *Migrant contract workers* refer to people who are looking for opportunities in urban areas and who move out of hostel accommodation into shacks. *Rural urban migrants* refer to people moving into urban environment who have no possession and any source of income in rural areas. *Work seekers from rural areas* refer to a category of people wishing to strategically located to find work, and may not intend to settle permanently. *Socio-economic refugee* refers to a category of settlers from other countries that are prepared to settle permanently or living illegally.

seasonal water logged areas (Lagardien *et al.*, 2012b; Lüthi, 2012; Kohli *et al.*, 2011; Sietchiping, 2005; Mulenga, 2003; Hogrewe *et al.*, 1993). The spatial location is often subject to land availability, tenure, and close proximity to urban centres where employment or income opportunities may be available (Kohli *et al.,* 2011; Ishtiyaq & Kumar, 2011). It can provide an indication of the physical characteristics of the informal settlement and inform the level of service provision. In terms of basic services and infrastructure, the general prospect of informal settlements is reflected through lack of basic infrastructure (Foppen & Kansiime, 2009; Mels *et al.*, 2009; Govender *et al.*, 2011; Crous, 2014), absence of adequate and affordable services (Fabrega, 2007) and planning (Islam *et al.*, 2005). This implies that formal service providers do not often reach these areas, thereby leaving space for informal service providers to provide services.

2.2.2 *Sanitation challenges in informal settlements*

Currently, the sub-Saharan Africa and Southeast Asian countries have large numbers (below 50%) of the population lacking improved sanitation facilities (WHO & UNICEF, 2017). The challenge to provide sanitation services to informal settlements is attributed to many factors which are referred to by Jaglin (2014), IndII, (2013), ADB, (2007) and Phaswana-Mafuya (2006) as institutional, technical, financial, social, educational, structural, and cultural. Previous studies (Phaswana-Mafuya, 2006; Mels *et al.*, 2009; Verhagen *et al.*, 2010; Katukiza *et al.*, 2010; Isunju *et al.*, 2011; Tumwebaze *et al.*, 2013, Pan *et al.*, 2016) have identified and discussed these challenges and their impacts on the provision of sanitation in general.

2.2.2.1 Institutional challenges

Taing *et al.* (2014) and Mjoli *et al.* (2009) have shown that the current failure observed in the provision of sanitation services can be attributed to a number of institutional challenges. Some institutions (DWA & DHS, 2012) and scholars (Lüthi, 2012; Mjoli *et al.*, 2009; Konteh, 2009; Manda, 2009; Mulenga, 2003; Mulenga *et al.*, 2004; Elledges *et al.*, 2002; Makhetha *et al.*, 1998) have acknowledged that the institutional challenges are often related to how different institutions perceive and manage sanitation. The main issues are related to governance, policies and the institutional arrangements that are often unclear and inadequate[3], lack of accountability and ineffective[4] planning (Elledges *et al.*, 2002); poor coordination and lack of clear delineation of roles and responsibilities of stakeholders involved, lack of interaction between stakeholders and fragmented management (Mulenga, 2003) as well as the top-down approach and its emphasis on using socio-technological engineering methods in the service provision (Taing *et al.*, 2014). These challenges are manifest through the fragmentation of responsibilities within the sanitation sector (housed by different government departments) which tend to result in overlapping mandates, poor coordination in statutory rights and responsibilities and inadequate organisations.

The challenges are compounded by political interference (IndII, 2013; Agrawal *et al.*, 2012; Milbert, 2006; Elledges *et al.*, 2002; Robins, 2014; McFarlane & Silver, 2017); low priority given to sanitation which is often regarded as a subset of water, top-down delivery approaches and engineered solutions (Lüthi, 2012; Mulenga, 2003); diverging interest among different sanitation role-players (Lagardien *et al.*, 2009a; Mulenga *et al.*, 2004); colonial spatial and sanitation policies (Letema *et al.*, 2014); lack of community involvement and participation in the decision-making process (Mjoli *et al.*, 2009; Lagardien *et al.*, 2009b; Eales, 2008, Glasbergeren *et al.*, 2007; Mulenga *et al.*, 2004). In South Africa, studies have determined that the provision of sanitation services in informal settlements is impeded by a lack of guidance from national policymakers, municipal incapacity and inflexible institutional processes (Taing *et al.*, 2014), overlapping of responsibility

[3]Institutional arrangements are labeled inadequate because they are broad, not clarifying the roles and responsibilities of various stakeholders involved in the provision of sanitation services in practice.
[4] Not addressing situation or challenges as intended/planned; failing to produce expected outcomes.

and mandates by government departments and the lack of practical guidance for providing these services (Mjoli, 2010) as well as general confusion in the interpretation and implementation of the sanitation policy and legislative framework at various levels of government (Mjoli *et al.*, 2009). Various views and interpretations of policies have exacerbated the entitlement mentality (Taing *et al.*, 2014; COHRE, 2007). Service providers have focused more on a top-down governance model (Mjoli, 2010) which in fact has been negligent to address the sanitation backlogs because of the lack of consideration of user opinions with regard to pertinent needs and actual practices. This discussion shows that institutional issues related to the provision of sanitation services emanate from the disjunction between policy and the daily reality in informal settlements.

While numerous studies have addressed institutional challenges, institutional arrangements and decision-making processes, the extent by which they inform the provision and sustainability of sanitation services has not been adequately articulated. Taing *et al.* (2014) suggest the review of sanitation policy at local and national levels so as to meet the needs of users and implementers, and Mjoli (2010) suggests establishing the level of standard. However, none of these studies has provided guidance on *how*, on the *context* and the extent by which their recommendations should be addressed.

2.2.2.2 Technical challenges

Technical challenges are reflected through the deteriorating infrastructure and low sanitation coverage, inadequacy and limited technology choices, lack of operation and maintenance and non-compliance with operational requirements (Lagardien & Muanda, 2014; Mara & Alabaster, 2008); the lack of or availability of space (Argawal *et al.*, 2012) and alternative sanitation technologies that are readily acceptable by both users and service providers (Lagardien *et al.*, 2012b); lack of knowledge by decision-makers regarding the basic requirements of some technologies they choose (Makhetha *et al.*, 1998); and the legal status of settlements (Taing *et al.*, 2014) that limits the deployment of certain technologies and unevenly distributes facilities within a settlement (Pan *et al.*, 2016). Furthermore, these challenges are related to the selection of suitable technology for the settlements and user expectations (Phaswana-Mafuya, 2006). Sanitation technologies are typically selected without considering user priorities and perceptions (Mulenga, 2003) or opinions, suggesting that sanitation services are provided through a supply-driven approach without prior need or demand assessment. Political interference has negatively impacted the choice and deployment of sanitation services (Mulenga, 2003; Robins, 2014; McFarlane & Silver, 2017). These challenges result in abandonment, misuse of the provided facilities or simply adoption of other sanitation practices – often unsafe. While these challenges reflect real issues faced by informal settlement residents, several studies (e.g., Lagardien & Muanda, 2014 and Phaswana-Mafuya, 2006) have investigated some of these challenges and their impact on sanitation access, even while neglecting to highlight the extent to which they affect the provision and access to sanitation. Although all these issues may be relevant in dealing with sanitation service provision, Okorut *et al.* (2015b) argue that sanitation needs of users can be met only if the barriers that exist to building improved sanitation are understood as this understanding can inform the development of specific and adequate strategies for the local context. As technical challenges related to the provision and access to sanitation are diverse, these are best tackled from a multi-disciplinary approach incorporating user needs, settlement conditions and technological relevance and appropriateness.

2.2.2.3 Financial – economic challenges

International organisations tend to attribute low sanitation coverage to a lack of financing, insufficient investment, low tariffs and cost recovery which render the provision of sanitation unattractive to both the public and private sectors (Katukiza *et al.*, 2012; Mjoli *et al.*, 2009; Paterson *et al.*, 2007; ADB, 2007; Mulenga, 2003; Elledges *et al.*, 2002; Makhetha *et al.*, 1998). Access to sanitation can be further hindered by the poor location of the settlement (in terms of land use), lack of subsidies for facilities for physically challenged persons, inadequate financial and human resources, and tariffs from high demand users (Pan *et al.*, 2016). These challenges can hinder or facilitate the decision-making process for the selection and deployment of sanitation. In South Africa, financial challenges have limited the provision of sanitation services in many settlements in regard to the implementation of toilets (Taing *et al.*, 2014). Clearly, without adequate funds the provision of suitable sanitation services is unlikely.

2.2.2.4 Social and cultural challenges

Social and cultural challenges are primarily related to the lack of recognition, heterogeneity and itinerancy of the informal settlement's population and residential status (Lüthi, 2012; McFarlane, 2008b) that render residents vulnerable. Other social challenges include community resistance to accept or pay for the services, and low hygiene awareness and socio-political issues (Taing *et al.*, 2013; 2014); unplanned nature of informal settlements (Lagardien *et al.*, 2012b; Mels *et al.*, 2009), poor or lack of social cohesion (McFarlane, 2008a & b; van Vliet *et al.*, 2010), high levels of unemployment and poverty (Mitlin & Mogaladi, 2013; Lüthi, 2012), and uncontrolled population density (Hogrewe *et al.*, 1993) that reduces access to sanitation and limits the provision of services due to lack of available space. The position of the sanitation facility and walking distance, privatisation of the facility for personal use, limited access at night, and unaccommodating nature of existing facilities were identified by Pan *et al.* (2016) as critical social issues hindering access to sanitation. Another study by Taing *et al.* (2014) found that service providers and users of sanitation in informal settlements have diverse expectations with regard to the level of services and related responsibilities. Experience of users and providers with regard to the access to sanitation services, institutional arrangements and accountability diverges. Taing *et al.* (2014) further reveals that the appropriateness and suitability of sanitation technology chosen by service providers may not be culturally and socially appropriate or acceptable by users. The lack of consideration of local culture and customs during the selection and provision of sanitation services (Elledges *et al.*, 2002; Mjoli *et al.*, 2009; van Vliet *et al.*, 2010) as well as lack of community participation and involvement on sanitation projects (Phaswana-Mafuya, 2006) exacerbate these challenges.

Furthermore, challenges are aggravated by the top-down governance model instilled in the policies and interventions to address sanitation backlogs and the lack of acknowledgement of the right to sanitation policy (COHRE, 2007). The misconception or misinterpretation of the right to sanitation has exacerbated these challenges, which have resulted in the entitlement to free sanitation (Taing *et al.*, 2013), high expectations with regard to the level of the service (Makhetha *et al.*, 1998) including unlimited access to water for sanitation, connection to municipal sewer, access by all to sanitation services and absolute right and immediate provision of sanitation services (COHRE, 2007). DWAF (2002b) reports that the sustainability of water and sanitation services is ensured when social considerations are given precedence over technical; appropriate technology choice and affordability based on local conditions are paramount. Although cultural practices and preferences may vary from one area to another, there should be a variety of choice for this requirement (DWAF, 1996; Phaswana-Mafuya, 2006). These social challenges trigger many other sanitation related challenges, with ramifications extended to other issues; they are

not, however, properly integrated into the sanitation programme (City of Cape Town, 2008). Therefore, it is necessary to address social issues if sanitation provision is to be successful.

2.2.2.5 Structural challenges

Structural challenges are related to the characteristics set (Phaswana-Mafuya, 2006) and geo-physical setting (Taing *et al.*, 2014) of the settlement which impede the provision of sanitation. Some of these characteristics – poor site condition, lack of water and high population density (Ibid.) – inform the choice of sanitation technology and the level of service.

2.2.2.6 Education challenges

Education challenges include the lack of awareness and hygiene education (Phaswana-Mafuya, 2006). Several previous studies (e.g., Taing *et al.*, 2014; COHRE, 2007; Elledges *et al.*, 2002) have determined that informal settlement residents lack hygiene and awareness education as far as sanitation technologies and their operational requirements are concerned, an educational lack that has exacerbated the entitlement mentality, expectations and negative attitudes towards service providers and services rendered to the settlements. To combat these challenges, DWAF (1994) suggests that the improvement of sanitation requires the development and dissemination of appropriate programmes for promotion, training, and health and hygiene education. Users or beneficiaries of a sanitation services should be informed and, where possible, trained on various aspects related to the provided facilities. Mjoli (2010) notes that sanitation software (which covers education and awareness) has not received sufficient attention as the focus has been primarily on hardware to achieve coverage.

The review of this large body of knowledge confirms that the provision of sanitation services to informal settlements is difficult because of their unique demographic, socio-cultural, financial, institutional, and environmental characteristics. Together these challenges illustrate the complexity of informal settlements and give an indication of the number of sanitation related issues which make coordinated service provision actions difficult. This in turn creates friction between stakeholders (Lüthi, 2012; Elledges *et al.*, 2002). In addressing these challenges, service providers are often interested in technical, financial and to some extent social aspects (hygiene awareness and behaviours) whereas the institutional and social side (as related to understanding user practices and culture) are overlooked.

2.2.3 ***Informal settlement residents' responses to sanitation challenges***

Adequate access to proper sanitation is vital to preserve the spread of diseases within and beyond settlement boundaries. Given the nature of informal settlements and various sanitation-related challenges faced by the residents, the dire consequence can only be the lack or inadequate access to sanitation. The lack of adequate sanitation services has led informal settlement residents to resort to their own means of sanitation through a range of practices. *Sanitation practice* is referred to as the various hygienic means of community members and the knowledge and skills governing this behaviour (Singh, undated). These practices, whether culture or context specific (Elledges *et al.*, 2002), are reflected through the daily management of human excreta, greywater and solid waste.

According to Elledges *et al.* (2002) and Hogrewe *et al.* (1993), the level of sanitation services in informal settlements range from no system (defecation occurs in open areas within or on the boundary of the settlement, or in drainage channels: example of flying toilets in Kenya or night soil in South Africa) through to the use of various technologies such as latrines, dry toilets or waterborne sanitation. Lack of or access to these services constitutes practices which fluctuate from one individual to another. To illustrate these practices, Chaggu (2004) notes that dry pit

latrines have been used for both defecating and bathing despite being designed for working without water. McFarlane (2008b) found that Indian women preferred to defecate in open spaces rather than using untidy toilets. In Uganda and South Africa, shared facilities are not used at night for security reasons (Tumwebaze *et al.*, 2013; Lagardien *et al.*, 2013) and users prefer buckets, plastics or other alternatives. Very often the bucket and plastic content are disposed within a sanitary facility, drainage channel, open drain, gulley, open space, solid waste container, or at a standpipe used for supplying drinking water (ibid.). Mulenga *et al.* (2004) revealed that children in informal settlements are practicing open defecation even in settlements well served with sanitation facilities. These practices (as noted by Kwiringira *et al.*, 2014b and Mulenga *et al.*, 2004) are justified by a general belief that children's excreta are not as harmful as that of adults. In other cases, where sanitation is closer to the household, secured and in good working condition, informal settlement residents are still not using the facility appropriately (Lagardien *et al.*, 2012b; Mulenga, 2004).

These examples have led scholars (Elledges *et al.*, 2002; Kwiringira *et al.*, 2014b; Tumwebaze *et al.*, 2013; Lagardien *et al.*, 2012b) to assert that people's (sanitation) practices are informed by many factors including the availability, access to and conditions of the facilities, familiarity with the technology, security, distance between the shelter and the facility, degree of privacy and number of users. These factors are often overlooked or misunderstood by service providers during the selection and deployment of sanitation services.

Sanitation practices are generally framed as health and hygiene issues by professionals (Singh, undated). However, quite often, service providers have little or no knowledge of the existing sanitation practices of the communities for whom they have responsibility (Makhetha *et al.*, 1998; Hogrewe *et al.*, 1993; Lagardien & Muanda, 2014; Pan *et al.*, 2018). This lack of knowledge may explain why service providers deliver sanitation services that fail to respond to the community's needs or settlement conditions (Lagardien & Muanda, 2014; Kwiringira *et al.*, 2014a). The consequences of the poor understanding of people's sanitation practices are not only abandonment, vandalism, and misuse of provided facilities, but reversion to unhygienic practices such as open defecation that have dire consequences for humans and the environment.

This section of the review has discussed the emergence of informal settlements and related sanitation challenges. Evidence has shown that the emergence of informal settlements results from many factors including migration and urbanisation. These settlements are characterised by a number of features, primarily a lack of basic services such as sanitation that has forced residents to adopt certain less-hygienic practices. The challenge to provide adequate sanitation services is multi-dimensional, encompassing many institutional to social issues. Institutional challenges are mainly related to poor coordination and inadequate institutional arrangements, unclear roles and responsibility of stakeholders, fragmentation and poor administration of service providers and lack of accountability. Technical challenges are related to the inadequate sanitation, technology choice which ignores user opinions, political interference, and lack of proper mechanisms to guide such choice. Financially, the lack of financing, insufficient investment and low tariffs and cost recovery hinder the provision of sanitation. Social and cultural challenges are related to the lack of recognition, heterogeneity and itinerancy of the informal settlement population and residential status. Structural challenges are related to the characteristics and geo-physical setting of the settlement which impede the provision of sanitation. The next section presents an overview of sanitation provision at a global level and in particular, in South Africa, where the extent of the sanitation problem is explored.

2.3 Sanitation service provision: an overview

2.3.1 *Drivers for sanitation services provision*

The United Nations General Assembly and United Nations Human Rights Council adopted resolutions in 2010 that recognise water and sanitation as a basic human right. In South Africa, the provision of sanitation services in enshrined in the Constitution (RSA, 1996). The objectives of sanitation are primarily to promote human health and to protect the general environment (DWAF, 2001; Rosemarin *et al.*, 2008; SuSanA, 2014). The provision of these services is intended to address health risks and environmental pollution emanating from the lack of sanitation (StatsSA, 2016). Sanitation services are essential to the health of a community, with potential ramifications for education and economic prosperity of children and adults in unserved areas such as informal settlements (Bartlett, 2003). Good sanitation practices play an important role in reducing domestic child mortality (Hutton, 2013).

A relationship between poor access to sanitation and inadequate hygiene has been established by Mara *et al.* (2010) and WHO and UNICEF (2012a). Poor sanitation practices have been pointed as one of the causes of water pollution (Govender *et al.*, 2011) and severe environmental pollution if waste is not adequately treated and disposed. Likewise, poor sanitation and hygiene are identified as a cause of death, especially amongst children under the age of five, and socio-economic problems (Mara, 2003) and are the leading cause of faecal borne illnesses such as diarrhoea (WHO & UNICEF, 2006). Sanitation is a significant intervention for elevating living conditions of individuals and reducing or averting diseases and devastating conditions (Elledges *et al.*, 2002). However, the provision of sanitation services is frequently hindered by an assortment of challenges ranging from social to technical (Phaswana-Mafuya, 2006). These challenges, if not addressed, may lead to various negative impacts including waterborne diseases and environmental pollution (Phaswana-Mafuya, 2006) and the perpetuation of the cycle of poverty (DWAF, 1996). Linking sanitation to human dignity and human right has produced positive effects, including the acknowledgement of right to access to sanitation, promotion of sanitation demand and pressure on decision-makers to deliver services as well as development of institutional framework for ensuring that such services are of adequate quality, delivered where needed and accessible to all (Mjoli *et al.*, 2009; de Albuquerque, 2012).

While the main driver for sanitation services is the protection of human health and environment, in South Africa access to sanitation has been driven by political agenda. Political interference has seen efforts to provide sanitation services hindered by politicians in a quest for political support (Times Live, 2012; Robins, 2014). The interference was primarily related to the choice of level of service, access to the service (Phakati & Ensor, 2013) as well the racialised connotations of the porta-potties (a portable on-site toilet) with the bucket system (George, 2008; McFarlane & Silver, 2017), underscoring the need to assess *all* drivers for sanitation service provision to ensure that the provided services are relevant in terms of user needs and expectations.

2.3.2 *Global sanitation situation*

Despite efforts by governments to provide adequate sanitation services to their citizens, the WHO and UNICEF (2017) reported that in 2015, only 39% of the global population (representing 2.9 billion people) had access to adequate sanitation services with around 2.3 billion people still lacking access to basic sanitation services; and nearly one billion people still defecate in the open, with the majority living in sub-Saharan Africa and South Asia. This excludes 892 million worldwide who lack any kind of facilities at all, hence practicing open defecation. Thirty-two percent (32%) of the world's population is now living without improved sanitation, noticeably

worse as compared to the 23% target in the Millennium Development Goals (MDGs) (WHO & UNICEF, 2012b). Evidently, across the globe, and especially within developing countries, governments have failed to meet the 2015 MDG sanitation target. This bleak picture indicates the extent of the problem and urgency of interventions required. New hope has emerged through the Sustainable Development Goals (SDGs) which include an ambitious target to eradicate open defecation by ensuring universal access to adequate sanitation by 2030.

2.3.3 *Sanitation service provision in South Africa*

2.3.3.1 Access to sanitation services as a human right

Sanitation, a human right and key component of primary prevention to ensure better health (WHO, 2009), has recently become one of the South African government development priorities. The right of access to basic sanitation services emerged from the interpretation of the Section 24(a) of the Bill of Rights (Mjoli, 2010; Tissington, 2011) where it is stated that '*everyone has a right to an environment that is not harmful to their health or wellbeing'* Since access to sanitation is acknowledged as a human right, people's access to sustainable sanitation facilities has risen to utmost importance in South Africa (Landman, 2004). Therefore, to ensure citizen wellbeing, the provision of basic services including sanitation is recognised as a need that cannot be overlooked (Mjoli *et al.*, 2009). According to the sanitation policy, local government is obliged to provide basic services including sanitation to *all* citizens including those living in informal settlements as and where needed (RSA, 1996; DWAF, 2001). These basic services are provided free of charge to those in needy communities, including to informal settlement residents (Lagardien & Muanda, 2014) while in the rest of developing world, the opposite holds true: residents have to provide their own services or pay for the provided services. In the quest to achieve this goal, the South African government committed to address water and sanitation service backlogs by 2014 and made great strides in reaching this target.

The introduction of free basic water and sanitation policies and a review of national sanitation policy in South Africa were prompted by several events including the outbreak of cholera in KwaZulu-Natal in 2000 and the 2010 'open toilet' saga (in which residents of informal settlements were provided with unenclosed toilets) in various areas of the country. The open toilet incidents, exposing the weaknesses of the policies surrounding the provision of basic services (McFarlane & Silver, 2017), prompted again the review of already existing national sanitation policy. Although the provision of sanitation services is a human right, the events highlighted above demonstrate the weakness of policy, which in many cases have negative effects on sanitation provision. They indicate the extent of political interference whereby the provision of sanitation services is (mis)used as political tool (Time lives, 2012; McGranahan, 2015; McFarlane & Silver, 2017), thereby resulting in unsustainable, unequitable and failed sanitation service provision.

2.3.3.2 Challenges in the provision of sanitation services

Sanitation provision in South Africa is generally characterised by certain levels of achievements simultaneous with challenges still needing to be addressed. The first democratically elected government in 1994 inherited huge water and sanitation service backlogs from the apartheid regime (Busari & Jackson, 2006). These backlogs were decreased from over 21 million people without adequate sanitation services in 1994 to 18 million in 2001 (DWAF, 2001; DWAF, 1996) and continue to be addressed through the free basic services policy (Mjoli *et al.*, 2009; Essop & Moses, 2009) using a supply-driven approach. Through a supply-driven and technological approach, up to 70% of South Africans have been provided with improved sanitation facilities (StatsSA, 2016). This enormous achievement is attributable to the availability of policies, legislations and other recently developed institutional strategies (Mjoli, 2010).

Despite effort and commitment by the government, an estimated 1.4 million people living in informal settlements still lack access to any form of sanitation service (DWA & DHS, 2012). Recognising the inequality in services provision, the Constitution places the direct responsibility for sanitation service provision at local government level while assigning the national and provincial governments support roles (DWA & DHS, 2012; RSA, 1996). This is in accordance with the Water Services Act of 1997 and National Water Act of 1998 which together establish the right of all citizens to free water and basic sanitation as a strategy to fight poverty and address equity. However, municipalities on whose shoulders the responsibility for service provision squarely lies are faced with the burden of accelerating the delivery while maintaining existing ageing infrastructure amid a burgeoning population and rapid urbanisation (van Vuuren, 2008). The implementation of sanitation services in South Africa has been even more challenging than the provision of water which has been implemented successfully by most municipalities (Mjoli *et al.*, 2009).

The provision of free basic sanitation services was assigned to the local government (DWAF, 2008) while the national government set parameters for the provision of such services (DWAF, 2003). The Department of Water Affairs and Forestry (Now Department of Water and Sanitation) provided support and guidance to local government officials to develop their respective free basic water and sanitation implementation plans. Pan *et al.* (2016) recognise many obstacles – difficulty of implementing the level of service stipulated in the sanitation policy; lack or poor coordination of the service provision's projects; limitations of the re-blocking of the settlement to create space for infrastructure development; and planning challenges related to the nature of informal settlements and number of stakeholders involved in the service provision – as major issues impacting the provision of sanitation in South Africa. The implementation of standardised sanitation solutions is constrained by several issues, including unemployment, fragile social structures, poor management, and inappropriateness of the settlements for housing purposes (Lagardien & Muanda, 2014; Taing *et al.*, 2013). The current supply-driven approach is not conducive to achieve 100% sanitation coverage in South Africa (WSP, 2011) due to the nature of challenges faced by informal settlements throughout the country.

Further to their constitutional mandate to provide basic services, municipalities are also requested to ensure that those services are sufficient and sustainable. However, a number of these municipalities are facing persisting challenges in service delivery (Madzivhandila & Asha, 2012) including sanitation. These challenges are numerous and varied, including institutional capacity, lack of expertise in various fields including project management and engineering, mismanagement of funds, high levels of corruption and lack of public participation (Managa, 2012), political interference (Robins, 2014; McFarlane & Silver, 2017), the conflicting interpretation of proper or dignified toilets (George, 2008; Mjoli *et al.*, 2009) and the aspiration of communities wanting nothing less than individual waterborne toilets like the ones in middle class areas (Robins, 2014; Duncker, 2014) ultimately leading to huge service delivery backlogs. Whilst the Municipal Systems Act (Act 32 of 2000) provides for communities to participate in the integrated development planning and implementation processes of their municipalities in collaboration with other stakeholders (Managa, 2012); however, this provision has not been adequately implemented. Communities are not afforded opportunities to take part in the decision making surrounding their wellbeing.

Whilst South Africa has made important strides in addressing sanitation backlogs since 1994, the target it has set itself for achieving universal access to sanitation services by 2015 and of providing basic services to an estimated 12 million people by 2015 (DWA & DHS, 2012) has not be achieved.

Many challenges remain to ensure access to adequate sanitation services to those living in informal settlements and then to sustain this service provision over the long period (Lagardien *et al.*, 2013).

The challenges emerge mainly from the interpretation of sanitation policies and complicated institutional arrangements, and sanitation as a subset of water (Mjoli *et al.*, 2009); characteristics and features of these settlements viz. fast population growth, lack of urban planning, heterogenic populations and insecure land tenure (Argawal *et al.*, 2012; Lüthi *et al.*, 2011b); as well as local government's inadequate institutional capacity, poor planning, poor allocation of revenue, and lack of support from provincial and national government (Managa, 2012). These challenges, reflected in uneven levels of service (Roma *et al.*, 2010), have generated problems for service providers in delivering adequate services. The City of Cape Town, for example, has used more than 20 different sanitation technologies in various informal settlements within its jurisdiction over the past 15 years. Many of these technologies (while in theory technically sound) were deemed inadequate (Lagardien *et al.*, 2009a; Fabrega, 2007) and to-date only a few remain applicable. This situation is not unique to Cape Town; similar situations occur throughout South Africa leading to the general conclusion that the provision of appropriate services must be balanced with the maintenance of existing infrastructure (StatsSA, 2016) where available.

2.3.3.3 Sanitation backlogs in South Africa – causes and effects

The provision of water and sanitation services to previously un-served communities has been relegated to development priority (Lagardien *et al.*, 2012b) intended to ensure universal access to all citizens. South Africa already achieved the Millennium Development Goals (MDGs) to halve the proportion of the population without sustainable access to improved sanitation three years before the 2015 target. Despite the vast improvements since 1994, and the achievement of the MDGs, many households still lack access to sanitation services as defined by the sanitation policy and legislative frameworks. The percentage of people with access to an improved sanitation facility increased from 49.3% in 1996 to 76.8% in 2013 (StatsSA, 2016). To date, while 76.0% of the South African population living in urban and peri-urban areas has access to basic sanitation (WHO & UNICEF, 2019), significant additional improvement is still required to eradicate the use of inadequate sanitation technologies.

While statistics reflect an increase in number of people who gained access to improved sanitation, there has been a drop in adequate sanitation due to poor operation and maintenance of the facilities (Crous, 2014) and use of provided facilities for purposes other than sanitary which has seen several previously serviced areas re-joining the backlogs (Lagardien *et al.*, 2012b; Duncker *et al.*, 2008). Although the eradication of the sanitation backlogs is quantified by the number of toilets provided, the sanitation backlog refers not only to toilets (Crous, 2014) but the number of people accessing adequate sanitation facilities. The backlog includes not only the provision of sanitation services, but also refurbishment, extension and upgrading, and operation and maintenance of existing infrastructure (DWA & DHS, 2012).

The sanitation backlog was estimated variously at approximately 2.4 million households (DWA & DHS, 2012) and four million households (according to Census, 2011). According to StatsSA (2016) across South Africa, an estimated 13.7% of households use unventilated pit toilets, while 2.2% relied on bucket toilets and 2.4% are without any sanitation (Table 2.1).

Table 2-1: Percentage of household access to sanitation by province (StatsSA, 2016)

	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
Flush toilet connected to sewer	90.5	44.4	63.2	70.1	43.1	43.9	84.4	43.0	20.8	60.6
Flush toilet to septic tank	2.9	2.3	5.9	2.1	3.7	3.8	1.9	2.7	2.8	2.7
Chemical toilet	1.2	5.6	0.3	2.1	14.6	0.9	1.5	3.3	1.6	4.2
Pit latrine with ventilation pipe	0.1	27.7	9.4	6.8	18.3	16.9	2.1	14.7	28.0	12.2
Pit latrine lacking ventilation pipe	0.2	9.6	9.8	11.2	12.2	28.2	6.1	28.8	39.8	13.7
Ecological toilet	0.0	0.4	0.3	0.2	0.7	0.3	0.1	0.5	0.1	0.3
Bucket toilet (by municipality)	2.9	1.3	2.9	2.5	0.4	0.1	2.3	0.2	0.1	0.3
Bucket toilet (by household)	0.8	0.9	1.4	1.4	1.3	0.5	0.4	0.7	0.6	0.8
Other	0.5	1.9	1.1	2.0	3.1	1.5	0.6	3.0	2.0	1.6
None	0.9	5.9	5.5	1.7	2.5	3.9	0.5	3.1	4.3	2.4
Numbers (thousands)	1934	1773	354	947	2876	1249	4951	1239	1601	16923

The specific backlog figures for informal settlements suggest that the number of households lacking access to any form of sanitation services across South Africa has been estimated (depending on the source of information) at about 710, 513 (StatsSA, 2012), and 1.4 million (DWA & DHS, 2012). The sanitation backlog mentioned in Table 2.2 refers to households that are lacking access to improved sanitation facilities.

Table 2-2: Sanitation requirements for informal settlements in South Africa (StatsSA, 2012)

Province	Informal settlement without basic sanitation (%)	Number of households without basic sanitation
Limpopo Province (LP)	84	32,785
Northern Cape (NC)	72	21,060
Eastern Cape (EC)	71	62,026
North West (NW)	71	102,341
Free State (FS)	67	51,510
Gauteng Province (GP)	59	248,223
Mpumalanga Province (MP)	58	43,261
KwaZulu Natal (KZN)	55	74,617
Western Cape (WC)	41	74,690
Total	60%	710,513

While this implies the absence of toilets, people may be using buckets, unimproved pit latrines or practice open defecation. Although this information is based on a projection emanating from the 2011 census, it highlights the extent by which informal settlements are deprived of basic services. The variance in the number observed from StatsSA and DWA & DHS can be attributed to the changing dynamic of informal settlements where the movement of residents is often unregulated.

2.3.3.4 Strategies for addressing sanitation backlogs

The main objective of the SDG 6 is to ensure universal access to adequate and equitable sanitation and hygiene by 2030, and completely eradicating open defecation. Despite large improvements in the provision of water, many households (especially those located in informal settlements) still lack access to safe, affordable, and reliable sanitation services. Although service providers' eyes are turned towards the SDGs, it has been generally reported that the provision of sanitation services in informal settlements is complex (UN Habitat, 2003) due to their unpredictable nature.

In many cases, sanitation services provided to these settlements are not context appropriate (Lagardien & Muanda, 2014), with available facilities either shared (Tumwebaze *et al.*, 2013) or in poor condition or not used properly (Lagardien *et al.,* 2012b).

Despite South Africa meeting the MDGs in 2012, critics believe that the objectives of providing universal access to sanitation for all have not yet been attained. Reasons provided include poor execution of various service provision strategies by local governments (Taing, 2015). In the Western Cape, for example, Taing (2015) found that disputes among the service providers, users, or recipients of the service and civic organisations about broadly framed policy, as well as policy gaps in servicing informal settlements, contributed to the city's failure to achieve national objectives. This study (Taing, 2015: iii) concludes that "*understanding the complex interplay between policy rationales and implementation realities can contribute to more constructive means of effectively providing sanitation services for South African informal settlements*".

From the 1994 introduction of democratic rules in South Africa up to 2008, the national government disseminated numerous policies, laws, regulations, and strategies to support its objective of providing basic sanitation access to the urban poor by 2014. Both the Strategic Framework for Water Services (DWAF, 2003) and the National Sanitation Strategy (2004) strove to eliminate the household sanitation backlog by 2010; however, this target date was shifted to 2014, in line with the Department of Human Settlement's target date for universal access to housing by 2014. This target was not achieved as available services provided in previous areas are almost immediately inadequate once commissioned, thereby increasing the backlog (Lagardien & Muanda, 2014).

Globally, interventions intended to improve access to sanitation have predominantly focused on the hardware (sanitation technology) while neglecting the software side including social (practices, attitudes, and behaviours) and cultural and environmental constraints (Lagardien *et al.*, 2012b). In South Africa, municipalities are currently using supply-driven and engineered technological approaches (which focus on the supply of facilities without community involvement or hygiene and awareness education) to speed up the delivery of sanitation services (Mjoli, 2010; Taing *et al.*, 2013). Although through these approaches up to 76.0% of people's have gained access to basic sanitation, Mjoli (2010) reveals that these approaches are not sustainable because of their failure to promote hygiene and sense of ownership of basic sanitation infrastructure and improve the health of users. This finding by Mjoli has enticed Lagardien and Muanda (2014) to assert that eradicating the sanitation backlog requires a holistic approach that draw from past experiences while considering various aspects of sanitation service provision and needs of users.

This review has demonstrated that South Africa has made significant progress in the provision of sanitation services. Although there are numerous challenges faced by service providers, the Millennium Development Goal (MDG) of halving the proportion of people without safe water supply and adequate sanitation was met before the 2015 deadline. Yet despite this impressive achievement, large groups of the population (mainly those living in informal settlements) are still lacking access to improved sanitation. This is an indication that the provision of sanitation services (especially in informal settlements) is an ongoing process that should be carefully assessed and planned if South Africa is to meet the meet the post-2015 Sustainable Development Goals (SDGs) which focus more on such sustainability issues, use of services and ongoing functioning of services. While the focus of the SDGs is not on service provision per se, service providers should shift their focus by ensuring that the sanitation services provided are sustainable for a longer term (Wilkinson & Duncker, 2014). The eradication of sanitation backlogs is being addressed through supply-driven approaches which in general is in contravention of

sanitation policy despite having reached sanitation coverage of up to 76%. The next section discusses the institutional arrangements for sanitation service provision, outlining an overview of policy and legal frameworks, institutional arrangements and governance issues and their implications into sanitation provision.

2.4 Institutional arrangements for sanitation services provision

2.4.1 *Sanitation service provision – policy framework, strategies, and guidelines*

The provision of sanitation services in South Africa has significantly improved since the democratisation process through enactment of various policies and legislations. The national programme for sanitation provision in South Africa was established in the wake of the new democratic government in 1994 and the Reconstruction and Development Programme (RDP). The sanitation sector in South Africa is currently regulated by three policy documents: The White Paper on Water Supply and Sanitation (1994); the National Water Act of (1997); and the White Paper on Basic Household Sanitation (2001). Since the White Paper on Basic Household Sanitation is predominantly sided on rural sanitation and on-site sanitation systems, the Draft National Sanitation Policy of 2012 was to address this gap by evaluating the entire sanitation value chain. These policies and legislations are hailed as the most progressive in the world since they were established to create an enabling environment for successful service provision. Through this policy, municipalities are given mandates to provide free basic services including water and sanitation to low-income socio-economic groups (Essop & Moses, 2009; DWAF, 2003).

2.4.1.1 The White paper on water supply and sanitation (1994)

The White Paper outlines the institutional framework for water and sanitation provision, which was subsequently legislated in the Water Services Act in 1997. This Act provides the definition of adequate sanitation as "*sanitation services to all which meet basic health and functional requirements including the protection of the quality of both surface and underground water*". The primary principle of the 1994 White Paper is that water services development should be "*demand driven*". While the policy outlined in the 1994 White Paper stressed that sanitation services should be self-financing at a local and regional level, exception was made for government to subsidise poor households unable to afford basic services. Such subsidies include the cost of construction of basic minimum services, but not the operating, maintenance or replacement costs.

2.4.1.2 The National sanitation policy (1996)

The 1996 National Sanitation Policy was published with the sole purpose of clarifying gaps identified in the 1994 White Paper on Water Supply and Sanitation Policy and guiding the development of a national strategy for sanitation. In this policy, the responsibility for the provision of sanitation infrastructure and services was clearly allocated to local government with support from provincial and national government (DWAF, 1996; Tissington, 2011) and roles of the private sector and NGOs outlined. The key highlight of the policy was the definition of sanitation and listing of various types of sanitation technologies used in South Africa stating whether or not they meet criteria of adequate sanitation. Despite some clarifications, Mjoli *et al.* (2009) identified several new gaps, including the lack of policy guidelines for the provision of basic sanitation services to dense urban informal settlements, special provisions for subsidizing basic sanitation services for the severely marginalized groups and operation and maintenance of certain sanitation technologies (ibid.). For these gaps and other implementation challenges, an update of the 1996 sanitation policy was initiated in 2012 and a draft document was completed in 2016.

2.4.1.3 The Water Services Act (1997) and The National Water Act (1998)

The Water Services Act (Act 108 of 1997) and the National Water Act (Act No. 36 of 1998) (RSA, 1998) are the principal policies that regulate water service provision in South Africa and legitimise access to sanitation (RSA, 1997) through environmental protection lenses and irrespective of whether the service is provided to formal or informal areas (Wilkinson & Duncker, 2014). It has been enacted to assist municipalities to undertake their role as water service authorities and to oversee the interests of the consumer. This Act, clarifying the role of water service providers and water boards, affirms the rights to basic sanitation (Tissington, 2011). It also defines basic sanitation and acknowledges the responsibility and authority to manage water and sanitation services. These Acts were enacted with the view to provide guidance for establishing, monitoring, and regulating guidelines to address national sanitation policies, and the setting of criteria to guide sanitation subsidies, to provide minimum sanitation services standards and to monitor sanitation service provision (Wilkinson & Duncker, 2014) while mandating the actual delivery of the sanitation service to the local government. Despite their good intention, the implementation of these Acts has been challenging for various reasons including poor governance (Mjoli, 2015), lack of accountability and overlap of responsibilities amongst various government departments involved in the provision of sanitation services.

2.4.1.4 The White paper on basic household sanitation (2001)

The Free Basic Sanitation (FBS) policy was adopted by the South African Government in 2001 with the primary purpose of promoting affordable access by poor households to at least a basic level of water supply and sanitation services (Mjoli *et al.*, 2009). This policy was intended to ensure the provision of sustainable basic level of water supply and sanitation in rural and informal settlements (DWAF, 2001). This White Paper put more emphasis on demand-driven and community-based approaches with a focus on community participation and household choice to achieve adequate sanitation service provision (DWAF, 2001; Tissington, 2011). The Act recommends that households should receive direct support from municipalities, receive information about operation and maintenance (O&M) and health and hygiene, but should be responsible for choosing an appropriate level of service according to their willingness and ability to pay (DWAF, 2001). Municipalities in turn should receive co-operative support from provincial and national government to fulfil its mandate of providing services (ibid.). However, these directives have been subject to conflicting interpretation between households and local governments (Mjoli *et al.*, 2009), heightening the entitlement mentality amongst communities (Taing *et al.*, 2013) and disregarding various sanitation technologies and household aspirations for their own full flush toilets (Lagardien *et al.*, 2013).

Although this document expressed the need to focus on basic household sanitation provision to communities in low density rural areas and in informal settlements, guidelines were thin for sanitation provision in these areas (DWAF 2001; Mjoli *et al.*, 2009). Given that this policy focuses solely on rural settlements, the strategic framework for water services (DWAF, 2003) which focuses on urban areas was developed; an update to the 2001 White Paper on Basic Household Sanitation was released in March 2016 by the DWS. Key updates included the change of the institutional structure for national sanitation responsibilities, and the proposal for the formation of a National Sanitation Advisory Committee whose role is to assist with coordinating sanitation planning, regulation and policy making between different sanitation stakeholders at the national, provincial, and local levels and civil society, along with an updated national sanitation policy (DWS, 2016). Further to these policy documents, various strategies have been developed and adopted with the view to improve sanitation service provision.

a) The strategic framework for water services (2003)

The Strategic Framework for Water Services (SFWS) (DWAF, 2003) was intentionally developed to clarify several contentious issues outlined in the sanitation policy and the White paper of 2001. For instance, the SFWS defined a basic level of sanitation service slightly differently than the 2001 White Paper by removing household refuse removal (Tissington, 2011) as part of sanitation service. In particular, the SFWS distinguished between an FBSan facility (which is infrastructure-related) and an FBSan service (which pertains to the sustainable operation of the facility), which was previously absent in the White Paper. Another difference is that previously the White Paper policy had stated that each household should have a toilet facility to meet minimum standards (DWAF, 2001), whereas the later SFWS did not include the specification for individual household toilet facilities. The SFWS did however include recommendations for technology choice by suggesting waterborne sanitation was the most appropriate technical solution for dense urban areas near businesses (Tissington, 2011). In contrast, the SFWS suggests that for 'intermediate areas', the choice should be guided by the ability of municipalities to maintain and operate the system sustainability with available funds (DWAF, 2003). However, the SFWS does not prescribe or define the technology to be used as far as basic sanitation is concerned (Mjoli *et al.*, 2009), and left such choice for Water Service Authorities (WSAs) to decide on option that is financially viable and sustainable. Further, the SFWS outlines the roles and responsibilities for WSAs and Water Services Providers (WSPs) and different government departments as well as other stakeholders. It also provides definitions of basic sanitation and sanitation services that were previously defined contentiously.

b) The National Sanitation Strategy (2005)

The National Sanitation Strategy (NSS) was published in 2005 to take into consideration some developments around sanitation – including the 2001 White Paper on Basic Household Sanitation, the 2003 Strategic Framework and the establishment of the municipal infrastructure grant (MIG) to maintain a coherent approach to sanitation service delivery in South Africa. The NSS objective was to facilitate the elimination of the sanitation backlog by 2010, and discusses inter alia the roles and responsibilities in sanitation delivery, planning for sanitation, funding sanitation, implementation approaches, regulating the sanitation sector, and monitoring and evaluation (see DWAF, 2004).

c) The Free Basic Sanitation Implementation Strategy (2009)

The Free Basic Sanitation (FBSan) Implementation Strategy (2009) was developed to guide WSAs in providing all citizens with FBSan by 2014 and to implement their own FBSan policies in line with national policy. The FBSan Implementation Strategy acknowledges that there is a right of access to a basic level of sanitation service enshrined in the Constitution, and that municipalities are obligated to ensure that poor households are not denied access to basic services due to their inability to pay for such services. DWAF (2008) acknowledged the controversial nature of the 'FBSan' concept, due to the lack of user contribution (in terms of the basic care of the facility) despite being justified by policy makers as a poverty alleviation measure for indigent households. The policy stated that "*WSAs have no legal obligation to conform to the FBSan policy*"[5], but may be liable to legal challenges from consumers if they fail to use allocated resources to provide services (DWAF, 2008). To illustrate, a study by Duncker (2014) found that the FBSan might mean to some users that all aspects regarding sanitation, including maintenance and repair, should be free, and

[5] The Free Basic Services Policy of 2001 was introduced following the 2000 local government elections and entitles all households to an agreed level of free basic services. The running costs of free basic services are intended to be met by a municipality's "equitable share" of national revenue, augmented by cross-subsidies and other local taxes levied where necessary and possible. In terms of sanitation, Free basic services are defined as free basic sanitation (government subsidy for a Ventilated Improved Pit (VIP) toilet.

that it should be provided by government. Most aspects of sanitation, apart from cleaning the toilet, are not regarded as the responsibility of the household/owner.

Although this piece of legislation was deemed important, several multi-faceted challenges for implementation became apparent. The City of Cape Town (2008) identifies infrastructure provision, technology choice, and institutional arrangements for operating the services, subsidy arrangements for operating costs, decision process and flexibility in application of the policies as several hindrances to the implementation of the FBS. Other hindrances highlighted by Tissington (2011) relate to the contrasting definition of basic sanitation in the White Paper on Basic Household Sanitation of 2001 and in the Free Basic Sanitation Implementation Strategy of 2009 as well as the absence of a universal approach to be adopted by municipalities for the service provision, and lack of guidance with regard to the provision of sanitation services in illegal settlements and private land. These policies and their related strategies endorsed the national sanitation targets, as outlined in the medium-term strategic framework (MTSF) aimed at increasing the percentage of households with access to a functional sanitation service from 84% in 2013 to 90% by 2019, including elimination of bucket sanitation in formal areas.

Policies and legal frameworks have been developed to enable government to fulfil their legislative mandate in ensuring citizen's access to basic services (Mjoli *et al.*, 2009) and transforming the intention into legally binding and enforceable clauses (Mulenga *et al.*, 2003). These (sanitation) policies are intended to create an enabling environment that will encourage and support increased access to improved sanitation services (Elledges *et al.*, 2002) and generally to ensure that residents have access to living conditions that are not harmful to their wellbeing (RSA, 1996). They establish priorities and provide the basis for translating needs into actions and help create the conditions in which sanitation services can be improved (Elledges *et al.*, 2002). However, translating policies into practice remains a key challenge, perhaps related to the discrepancy between policies and their application in practice (Mjoli *et al.*, 2009; Nawab & Nyborg, 2009); lack of compromise between policymaking (Ekane *et al.*, 2013); and how policies are developed, interpreted and implemented (Ekane *et al.*, 2013; Mjoli, 2010). The implementation of these policies has been uneven at local levels due to the lack of technical, managerial, and financial capacity to address sanitation needs (Elledges *et al.* 2002), the focus on facility construction (Crous, 2014). and the general perception of sanitation as simply a matter of giving sanitation facilities, instead of an integrated approach that encompass institutional and organisational frameworks with social, technical, environmental, educational and financial aspects (DWAF, 2001).

Previous studies (Mjoli, 2010; McFarlane & Silver, 2017) revealed that discrepancies between policies and their application are manifested in the lack of guidelines for the provision of sanitation services in informal settlements and the deprioritising of the severely marginalised groups living in these settlements. These studies found evidence of further discrepancies with regard to the national standards for minimum acceptable level of basic sanitation services and clarification of responsibilities amongst various sanitation role-players. The lack of compromise in the implementation has been attributed to the political interference and inadequacy of resources (Ekane *et al.*, 2013; Robins, 2014; McFarlane & Silver, 2017).

This debate shows that the development of sanitation policies usually occurs at a central Ministry level, with implementation responsibilities at the level of district or local governments that typically have little capacity or insufficient financial resources for effective implementation and monitoring. The integration of other stakeholders in the service provision (located at the micro level) including public and private organisations is often overlooked. Various stakeholders

understand sanitation policies differently (Mjoli *et al.*, 2009), thereby creating expectations (with regard to institutional arrangements and level of service) that hinder the provision of sanitation services. The contradiction is frequently reflected through institutional arrangements and their implementation in practices (Mjoli, 2010; Elledges *et al.*, 2002) and a lack of understanding of the heterogeneity of the needs of informal settlement residents with the various constraints (Joshi *et al.*, 2011). Despite the existence of adequate policies, the provision of sanitation to informal settlements remains a challenge. Free basic water and sanitation are not provided equally or evenly across South Africa (Roma *et al.*, 2010) and provision does not always meet national standards.

2.4.2 *Institutional arrangements*

Access to water and sanitation is a human right recognised in various international laws and national constitutions (COHRE, 2008). While the provision of access to these services is often considered a government responsibility (Ross *et al.*, 2014; Mjoli *et al.*, 2009; Rouse, 2007), the way in which the service provision is organised can vary from one country to another depending on the local conditions and institutional arrangements (Mjoli *et al.*, 2009). The provision of sanitation services, for example, can be heavily controlled by the government (by setting institutional and delivery systems and running them through normal government department as in the case of Botswana and Tanzania), private initiative (in the cases of Pakistan and Lesotho) or a combined approach (private government in Bangladesh) (Mjoli, 2010; Makhetha *et al.*, 1998). It can also be controlled by different government departments as is the case of South Africa and Uganda (Mjoli, 2010; Elledges *et al.*, 2002) which is susceptible to a confusing mix of institutional activities and overlapping of authorities resulting in gaps in sanitation coverage or conflicting directives.

Institutional arrangements are necessary to ensure the efficient implementation of programmes (Mulenga *et al.*, 2003; Tang, 1991) and crucial elements of social interventions including the provision of water and sanitation services (IndII, 2013). They are referred to by Ross *et al.* (2014) as the formal and informal institutional contexts that help or hinder the successful delivery of the day-to-day activities and may involve various actors and different actor arrangements depending on the context (Ekane *et al.*, 2013; Elledges *et al.*, 2002). Institutional arrangements exist at different levels (household, local, provincial and national) and involve various stakeholders – government, private sector individuals or households (Ekane *et al.*, 2013; Elledges *et al.*, 2002), donors and non-government organisations (Mulenga *et al.*, 2003). The multi-level stakeholders, their roles, responsibilities, actions and interactions constitute (according to Ekane *et al.*, 2013) sanitation governance that is necessary to ensure the coordination of actions.

These responsibilities in many cases are scattered across several government departments and their respective support services (Mjoli, 2010; Mulenga, 2003; Elledges *et al.*, 2002). The scattering of responsibilities across different government departments[6] is based on their sectoral interests and involvement (for example health and environmental protection, housing and public services, education and rural development) and with administrative decentralisation to regional and local governments (Rouse, 2007; Elledges *et al.*, 2002) or municipality (Gutterer *et al.*, 2009). Defining the roles of each institution and management strategies allows effective implementation of sanitation policies, thereby increasing sanitation coverage (Elledges *et al.*, 2002).

[6] The provision of sanitation services in South Africa has been from the Department of Water Affairs and Forestry to Human settlements, and from Human Settlements to the Department of Water Affairs and lastly from Department of Water Affairs to the newly created Department of Water and Sanitation. At provincial level, the provision of sanitation services is the responsibility of the Human Settlements Department.

In South Africa for instance, roles and responsibilities for service delivery and informal settlement upgrading have devolved to the three tiers of government including the local government, provincial government, and national government. The local government plays the role of implementing agent, the provincial government as support agent while the national government focuses on monitoring (Crous, 2014). The roles of national, provincial and local government for sanitation provision are allocated in the Constitution and further clarified in the Water Act and Municipal System Act.

The Constitution, the Water Services Act (RSA, 1997) and the Municipal Systems Act (RSA, 2000) assign the local government the responsibility for the provision of sustainable services to communities, with the support of provincial and national government. It has the constitutional mandate to provide potable water and household sanitation services within its jurisdiction (RSA, 1996; DWAF, 1994). The local government is referred to as the water services authority (WSA) which are constitutionally responsible for planning, ensuring access to, and regulating the provision of water services within their area of jurisdiction as well ensuring that all people living within their jurisdiction are progressively provided with *at least* basic water services – the first rung on the water and sanitation ladder (DWAF, 2003).

The provincial and national governments assume constitutional responsibility to support and strengthen the capacity of municipalities in the execution of their functions, and to regulate them to ensure effective performance of their duties (DWAF, 2003). To this extent, the provincial departments could coordinate the construction of water and sanitation infrastructure on behalf of local departments (Tissington, 2011). At national and provincial government levels, there are various departments involved in the provision of sanitation services which include (at national level) the Department of Water and Sanitation, Department of Human Settlements, Department of Health and National Treasury. Each of these departments plays a specific role. For instance, the Department of Water and Sanitation plays the role of national regulator of the water services as per Section 155(7) of the Constitution (DWAF, 2003). It holds legal recourse against non-compliance as well as the option to hand over water service responsibilities to different departments or spheres of government where required (Tissington, 2011). At provincial level, these roles can be shared by several departments as well. For instance, in the City of Cape Town, the provision of sanitation services in informal settlements is shared between the Human Settlements department, Informal Settlements department, the Water and Sanitation department, the Solid Waste department, and the Environmental Health department (Pan *et al.*, 2010). Theoretically, each of these departments plays a specific role in the provision of the services although this may not be the case in practice due to the number of actors involved.

Although the roles and responsibilities of the government departments involved in the sanitation provision are delineated, implementation is all too often inadequate (Mjoli, 2010; 2015) primarily because of poor governance. Contributing factors to poor governance have been identified by Managa (2012) and Mjoli (2015) as lack of institutional capacity; lack of public participation; lack of equitable access to services by all; non-integration of health and hygiene and user education into the programme; lack or poor community participation; and lack of consideration of financial sustainability and environmental sustainability. This has been verified by Pan *et al.* (2016) who found inadequate flow of information between various stakeholders involved in the provision of such services. The inadequacy, incoherence and complications observed in the sanitation sector are often attributed to the scattering of responsibilities amongst various stakeholders without adequately defining their roles and responsibilities and mechanisms for accountability. The lack of clarity on the roles and responsibilities of various players involved in the provision of sanitation services is clearly one of the causes of poor sanitation (Mulenga *et al.*, 2003).

The problem is aggravated within informal settlements where there is a lack of clear institutional arrangement for the provision, operation, and maintenance of sanitation facilities. There is a dearth of clarity on the separation of powers between the political party leadership, municipal councillors, and municipal officials (Mjoli, 2015). Moreover, there is a lack of distinction between the responsibilities of household, community, and municipality (Lagardien *et al.*, 2012b). The relationships between various stakeholders including government, civil society and service providers were not apparent in most policies and related frameworks, despite being central to good governance (Mjoli, 2015). Therefore, stakeholder cooperation where each individual or institution plays their roles should be promoted so as to ensure adequate institutional arrangements (Parigi *et al.*, 2004) as this is a sign of good governance (Mjoli, 2015). Although many governments acknowledge the importance of stakeholders (other than government departments) in the provision of sanitation services, their roles are not often adequately defined or established in the sanitation policy (Mjoli, 2010; Elledges *et al.*, 2002). In South Africa, while the sanitation policy (DWS, 2016) defines and regulates roles and responsibilities of stakeholders, it neglects guidance in the way they should be involved in the service provision process.

To overcome some of the challenges related to the institutional arrangements, Lüthi *et al.* (2011a) and COHRE (2008) suggest the incorporation of other stakeholders, including users, in the selection of suitable sanitation services, while Pan *et al.* (2016) suggest assigning the monitoring roles to Non-Government Organisations (NGOs) and Community-Based Organisations (CBOs) in collaboration with the service providers. Lagardien *et al.* (2009a) and WSP (2007) further suggest the inclusion of local capacity. Although these suggestions may hold value, Pan *et al.* (2016) express doubt with regard to the practical application, arguing that the current institutional arrangements give municipalities the most control over the direction of the development of sanitation services. Mjoli (2015) suggests good sanitation governance where the principles of equity, efficiency, participation, decentralization, integration, transparency, fairness and accountability are observed as key to successful sanitation service provision. However, this body of knowledge has not provided specific pointers on how their suggested concepts would inform the revision of the current institutional arrangements. This discussion underscores the need to re-examine the current institutional arrangements and, where applicable, develop strategies that incorporate all stakeholders while ensuring that the coordination of roles is well defined and practical to implement.

Summary

The South African government commitment to ensure universal access to water and sanitation services was informed by the Constitution and later enacted in the White Paper of Water Supply and Sanitation Policy (DWAF, 1994) where basic services are recognised as a human right. The sanitation sector in South Africa is currently regulated by three policy documents, namely the White Paper on Water Supply and Sanitation (1994), the White Paper on a National Water Policy of South Africa (1997) and the White Paper on Basic Household Sanitation (2001). Since the White Paper on Basic Household Sanitation is predominantly focused on rural sanitation and on-site systems, the Draft National Sanitation Policy of 2016 was developed to address the entire sanitation value chain. Through these policies, South Africa has made significant progress in the field of sanitation service provision since the end of apartheid in 1994. These policies and related legislative frameworks establish measures and strategies to ensure adequate provision of sanitation services. However, their application has been challenging for a number of reasons including inadequate institutional arrangements and poor governance. Although previous studies have addressed these issues, little has been done so far to relook at institutional arrangements as

far as sanitation service provision to informal settlements is concerned. The next section presents an overview of various approaches used in the provision of sanitation services in general.

2.5 Approaches to sanitation service provision

2.5.1 *Determinants of sanitation demands*

The provision of sanitation services is intended to break the spread of diseases and minimise environmental pollution caused by human excreta. The focus of sanitation provision has traditionally focused on the supply of facilities (e.g., latrines), neglecting to address real determinants of sanitation demand (Pearl *et al.*, 2010). The demand for sanitation may be determined by a number of factors, factors which have been scarcely reported as far as sanitation service provision is concerned. The few studies that have attempted to single out these factors have identified prestige and will to adopt modern life (Jenkins & Curtis, 2005), wealth, privacy, security and comfort (Gross & Günther, 2014), social networks, social expectations and power relations (Pattanayak *et al.*, 2009; Hathi *et al.*, 2016; Shakya *et al.*, 2015), locally specific taboos or cultural factors (Drangert & Nawab, 2011; Thys *et al.*, 2015), availability, reliability, cost and convenience, household attitudes (Parry-Jones, 1999) and household income and assets, security of tenure, cost of service, level of education and other local demographic characteristics such as income, gender and community organisations (Mulenga, 2003 citing World Bank, 1998). Further, Jenkins and Scott (2007) found that adoption of sanitation technology is guided by determinants including dissatisfaction with current practices, awareness of sanitation options, and priority of change among competing goals, absence of permanent constraints to acquiring sanitation and absence of temporary constraints to acquiring sanitation. Another study by Jenkins and Curtis (2005) revealed that the prevention of oral disease has no impact on the need for sanitation; rather, varying factors such as lifestyles, local environment, and socio-cultural aspects of excreta handling, and defecation practices have more impact. Regarding access, Simiyu (2016b) argues access to sanitation depends on a number of factors including the location of a facility (as long-distance travel by users to access a facility may contribute to low use), the cost (to access the facility), cleanliness and functionality/reliability (usable anytime needs occur). Users are likely to revert to other alternatives (including unhygienic sanitation practices) if their facilities are not adequately managed (Simiyu, 2016a).

2.5.2 *Approaches to sanitation services provision*

In recent years, many approaches have been developed to address the provision of sanitation services coverage. Mjoli (2010) claims that there are six approaches used internationally to address the sanitation provision in various contexts: (i) hardware solution, (ii) community-led approach, (iii) no aid approach, (iv) aid development approach, (v) technological approach and (vi) privatisation approach. Other studies suggest additional approaches such as (vii) supply driven (viii) and pro-poor sanitation subsidies (Komives *et al.*, 2005), (ix) demand-driven and demand-responsive approach (Mjoli *et al.,* 2009; Breslin, 2003; Mulenga, 2003) and (x) partnership (Eales, 2008; Schaub-Jones, 2005).

These approaches have strengths and weaknesses, are not mutually exclusive, and vary in terms if context of application. The *hardware model* entails the allocation of subsidy funding to hardware and health and hygiene education but fails to address the institutional issues related to governance and technical expertise (Mjoli, 2010). In contrast, the *community-led approach* which includes the community-led total sanitation (CLTS) (Lagardien *et al.*, 2013; WSP, 2007; Kar, 2005) and household centred environment sanitation (HCES) (Lüthi *et al.*, 2010; EAWAG, 2005) is limited to community capacity building so the community can make all relevant decisions on sanitation technology choices based on available local resources and affordability to the

households (Mjoli, 2010). However, this model is restricted by the notion of community empowerment for behavioural change and planning and does not inform or provide guidance on the selection of an adequate sanitation technology.

The *no aid approach* opposes the subsidy and encourages households, including the poor, to pay for the service so as to ensure good management and maintenance (DWAF, 2003). In the context of informal settlements, this model may not be viable given that residents have different needs and priorities. Contrary to the no aid approach, the *aid development approach* is based on uplifting all households, including the poor, to benefit from improved sanitation services by involving them in the sanitation development and decision-making processes (Wootton, 2015). The *technological approach* (also referred to as the supply-driven approach), focusing more on providing sanitation technologies as a response to sanitation challenges (Mjoli, 2010), has been criticised for overlooking end users' needs (Jenkins & Scott, 2007) and failing to address sanitation challenges faced by informal settlement residents. The *privatisation approach* entails consigning the provision of the service to stakeholders other than the public entity. Lastly, the *partnership approach* allows the service provider, users and interested parties to develop relationships which allow users to play certain roles rather than being passive actors or recipients (Taing *et al.*, 2013; Schaub-Jones, 2010; 2005; Eales, 2008). The *pro-poor sanitation subsidies approach* emphasises the allocation of funds to the poor with the view of achieving universal access to basic services (Komives *et al.,* 2005; WSP, 2007). However, this approach has failed because of the lack of a mechanism to identify, distinguish and select the poor (Mjoli *et al.*, 2009).

The *demand responsive approach* grants a more significant role for the communities in selecting sanitation technology options that are affordable, so as to ensure that the facilities are both used and maintained in the long term (Mjoli *et al.*, 2009; Mulenga, 2003). This model was determined as irrelevant in some countries (like South Africa) where government is mandated to provide free sanitation services to the public (Mulenga, 2003). Further to these approaches, scholars have summarised these approaches into two decision-making models, namely top-down, and bottom-up approaches (Sabatier, 1986; Pillay *et al.*, 2006). The *top-down model* implies that the highest level of hierarchical system decides any matter related to the provision of service (e.g. policy, technology choice and deployment) (Sabatier, 1986) while communities are regarded as recipients or passive beneficiaries (Mulenga, 2003). In contrast, the *bottom-up model* is a public-driven model which allows recipients of the service to strategize through interactions and together take decisions related to their wellbeing (Sabatier, 1996; Pillay *et al.*, 2006).

In South Africa, the Strategic Framework for Water Services (DWAF 2003) provides a comprehensive review of policies, legislation, and strategies with respect to the provision of water services in South Africa, seeking to align them and outline the changes in approach needed to achieve policy goals (Tissington, 2011). The SFWS emphasised supply-driven sanitation provision (in a top-down approach), unlike the demand-driven sanitation provision (a bottom-up approach) previously emphasised in the sanitation White Paper of 2001. Demand-driven sanitation provision was based on international best practice (DWAF 2001). This supply-driven approach (still currently used) is associated with the municipality as responsible for the sustained servicing of the sanitation services. Yet, although the lack of poor sustainability of the sanitation services provided through top-down supply driven programmes has been reported in literature (Still *et al.*, 2009), the Free Basic Sanitation policy and the legacy of apartheid have brought a sense of entitlement in thinking that government is responsible for service delivery (Taing *et al.*, 2013).

The comparison of these approaches reveals that while they are broad, their relevance can be context specific, implying that approaches that were successful in creating a demand for sanitation

in one given context might not be suitable for another because of the changing contexts and conditions of the settlements. There is no one-size-fits-all approach for providing sanitation services. A purely technocratic or social approach to sanitation provision may not be advisable either. Adequate approaches to sanitation service provision should consider various aspects including social, technical, and institutional. Regardless of the approach adopted, previous studies (McGranahan, 2013; Patel, 2015; Tukahirwa *et al.*, 2013) advocate for the involvement of users. Such involvement is believed to reduce cost, diminish tension, and guarantee the use and sustainability of the infrastructure (ibid.)

2.5.3 *Overview of the approaches to sanitation services provision in South Africa*

The provision of sanitation services in South Africa is characterised by a top down supply driven approach which has achieved high coverage rates. Through this approach, up to 70% of the South African population have been provided with adequate sanitation (StatsSA, 2016). While supply-driven approaches to delivery have dominated the development sector for many years, this method of service delivery is not preferred (Mjoli, 2015) because it neglects to consider user views and opinions. According to UN-HABITAT (2005a), this approach has failed to deliver water and sanitation services to the poor for a number of reasons including the lack of accountability, inefficiency, non-responsiveness to demands of poor households and provision of unsustainable sanitation systems. This sentiment was echoed by Crous (2014) who found that one of the issues that has hindered the provision of sanitation services in South Africa is the backlog that has created an emphasis on eradication through the provision of toilets and sanitation infrastructure.

The emphasis on eradication has forced service providers to overlook crucial stages of the service provision including planning and post-implementation (Lagardien *et al.*, 2012b), focusing more on the implementation phase which entails the deployment of infrastructure. According to the Section 151(e) of the Constitution, the planning stage should include community participation (RSA, 1996) while the post-implementation stage should include operation and maintenance (O&M), but this has been neglected, with neither quality assurance nor O&M plans in place (DWAF, 2007). In response to these failures, international development agencies have adopted a demand-responsive approach (Mulenga, 2003) to create an enabling environment for the participation of poor households in decision-making processes regarding the choice of water and sanitation technologies and related service levels (Mjoli, 2015). Although demand-driven and community-based approaches are recognised by the policies (DWAF, 1994), Mulenga (2003) found these approaches inadequate to the context of South Africa where the free basic sanitation policy is predominant. Similarly, other approaches discussed in section 2.5.2 have also their limits. The failure of other options and the dominance of the supply-driven approach are attributed to the political context where municipalities are pushing to meet targets while pursuing their political agenda (Taing *et al.*, 2013). The predominance of the supply-driven approach is also attributed to the need to ensure universal coverage of sanitation for all.

2.5.4 *Decision-making process and tools*

The selection and deployment of sanitation technologies is not an easy decision (RSA, 1996; DWAF, 1996). Difficulties are related to the types of sanitation technology that fit local conditions. Several studies have shown that the choice of a technology may be influenced by many factors including service costs, economic status of communities and households, willingness to pay for the service, water availability, convenience, status, and perception of health impacts (Lagardien *et al.*, 2012b; Mels *et al.*, 2009; CoCT, 2008; Fabrega, 2007; Elledges *et al.*, 2002). The appropriateness of a sanitation technology in a given context is often defined in a top-down manner that does not reflect user needs (Joshi *et al.*, 2011). The selection is guided by criteria

developed by those who have little or no knowledge of the sanitation issues in a particular context. This may explain the dismal performance of sanitation programmes. To improve this performance, the choice of sanitation should fit with the practices, concerns and capacity of users (Murphy *et al.*, 2009; Schouten & Mathenge, 2010).

Responding to this demand, scholars, and sanitation practitioners (Table 3) have developed various decision-making processes to assist in the selection and deployment of sanitation technologies.

Table 2-3: Summary of decision-making processes for the selection of a sanitation technology

Author	Stages				
Brikké & Bredero (2003)	Request for improved services	Participatory assessment	Data analysis	Stakeholder engagement	Formal agreement on the technology
Yiougo *et al.* (2012)	Assessment of the status of existing sanitation	Assessment of technologies options	Assessment of users' priorities	Evaluation of feasible combinations	
Holden *et al.* (2005)	Confirmation of goal and objectives of the sanitation deployment	Analyse constraints and promoters	Outline outputs (technology selection)		
Nayono *et al.* (2011)	Analysis of stakeholders and sanitation policy	Distance-to-target analysis on sanitation conditions in the region	Examination of physical and socio-economic conditions	Contextualisation of the technology assessment process	Sustainability-oriented technology assessment
WSP (2008)	Settlement survey and services,	Consultation and need assessment	Identification of appropriate technologies,	Development of costed options	Reaching consensus on preferred options
IWA (2006)	Defining the context	Identifying technical options	Determining the feasibility of the options		
Kvarnström & Petersens (2004)	Problem identification	Identification & investigation of the boundary conditions	Setting the terms of requirement for a technology	Analysis of possible solutions and	Selection of the most appropriate solution
DWAF (2007)	Undertaking land use planning	Decision of future settlement	Selection of most appropriate technical solution & level of service	Formulation of funding and cost recovery strategy	

A comparison of different decision-making processes reveals the following emerging consensus amongst scholars regarding the steps of a typical decision-making process: (i) understanding of the existing context and condition of the settlements with regard to environmental, social and institutional issues; (ii) examining existing technologies; (iii) reviewing technical and management options; (iv) assessing different sanitation options; and (v) selecting the sanitation technology. The common point of agreement is that the first and last steps entail the assessment of existing conditions and sanitation technologies within the settlement and the selection of the feasible technology (Yiougo *et al.*, 2012; Nayono *et al.*, 2011; WSP, 2008; Kvarnström & Petersens, 2004). The intermediary stages are different and lack common agreement amongst sanitation practitioners with regard to the purpose and outcomes.

The final outcome of the decision-making process is the selection of a sanitation technology. A review of these processes has shown that the selection of a sanitation technology requires support

tools to guide decision makers. A decision-making support tool (Table 4) can be a guideline for design specifications, technical briefs, technical guides, frameworks or any other information sources or material that supports institutions in making informed decision for the selection of a technology (Malekpour *et al.*, 2013). It compares and contrasts several options and assists the decision makers in selecting the most appropriate for a specific situation (Palaniappan *et al.*, 2008; Mara *et al.*, 2007).

Over the years, scholars have developed a variety of decision support tools to assist institutions to choose appropriate sanitation technologies. The review of these decision-making tools shows that various techniques, ranging from algorithm to statistical software or spreadsheets and probabilistic methods, are used to determine the optimum sanitation technology. Each of these tools makes use of certain criteria to select the best sanitation option for a given context. These criteria (depending on the tool's designer) cover technical functionality, financial, socio-cultural, institutional, health and environmental issues. Once again, these criteria may not be applicable to all contexts (Murphy *et al.*, 2009).

Criteria used to determine the appropriate sanitation technology are varying. Some scholars (van Buuren, 2010; Zurbrügg & Tilley, 2007; Loetscher & Keller, 2002) suggest criteria such as technical functionality, health and environmental protection, financial and socio-cultural aspects to determine the best sanitation arrangements. In contrast, Malekpour *et al.* (2013); Tayler (2000); Mara (1996); Winblad and Kilama (1985) and Kalbermatten *et al.* (1982b) rely on probabilistic approach using criteria related mainly to exposure to health risks, accessibility, sustainability, and reliability but overlooking institutional arrangements. Still another group (Lagardien *et al.*, 2012a; Katukiza *et al.*, 2010; Fabrega, 2007; Branfield & Still, 2009; Lahdelma *et al.*, 2000) combine technological, financial, environmental, and social sustainability and to some extent institutional determinants to determine appropriate sanitation technology, to inform user acceptability or functioning challenges that may emerge from the use of such technology.

These tools are primarily intended for decision-makers as there are no specific criteria that sanitation users can rely on to make informed choices regarding the types of technology. Criteria that determine the relevance of a given sanitation technology from user and service provider perspectives are not perceptible in these decision-making tools. This lack of clarity is apt to generate expectations that lead to rejection of the selected sanitation technology. The next section presents a review pertaining to the choice, relevance, and acceptance of sanitation technologies.

Table 2-4: Overview of sanitation decision making tools (adapted from Malkpour *et al.* 2013)

Developer	Decision-making support tool	Approach	Remarks
Tayler (2000)	Flow diagram in ordering sanitation choices	An algorithm that leads to a sanitation option through a set of questions which have Yes or No answers	Certain answers (Yes-No) are required in every stage to move to the next stage in the decision-making process, while the reality often deals with a range of probabilities and possibilities. The result of such algorithms is a certain sanitation option that comes in the end.
Mara (1996)	Technology selection algorithm		
Winblad & Kilama (1985)	Algorithm in Sanitation without Water		
Kalbermatten *et al.* (1982a)	Algorithm for selection of sanitation technologies		
Malekpour *et al.* (2013)	Probabilistic Evaluation Framework	Probabilistic method that incorporate uncertainty based on risks level	Probability and likelihood of the event may not occur as predicted; hence prediction may not lead to expected outcomes. This approach excludes financial and operational aspects but focus on social and technical aspects.
Katukiza *et al.* (2010)	Technical data associated with multi-criteria analysis	Pre-assessment based on technical data followed by multi-criteria analysis	This approach considers only data based on technical criteria and environmental compliance while other criteria are not associated.
Lagardien *et al.* (2012a)	Sanivey – a tool used to predict the acceptance and functioning of sanitation technologies.	Multi-criteria assessment tool	Much emphasis on operation and maintenance and issues that may hamper the acceptance and functioning of a sanitation system.
van Buuren (2010)	SANCHIS – a predictive tool using pre-defined criteria to determine sanitation technology	Quantitative multi-criteria analysis using SMARTS	Single values are used for scoring of options and a probable range of values is not directly implemented in the method.
Fabrega (2007)	Settlers – is a quantitative criteria analysis that uses technical determinants for selecting sanitation technology	Quantitative criteria analysis	Criteria used to determine the sanitation technology are predominantly technical
Branfield & Still (2009)	WhichSan - A model (based on conjunctive elimination approach)	Excel spreadsheet developed by using certain criteria to rate and provide the cost of sanitation technology	Results emerging from the application of the model point more on constraints than the technology choice.
Zurbrügg & Tilley (2007)	NETSSAF Aid - provides criteria for evaluation and classification of low-cost sanitation technologies	Multi-criteria analysis with qualitative rating of sanitation options against different criteria	The criteria are technology-specific, and the same outcome is always derived regardless of the situation. Distinction among the devoted ratings is vague in such qualitative judgments
Loetscher & Keller (2002)	SANEX - a predictive tool using pre-defined criteria to determine sanitation technology	Computerised tool using a quantitative multi-criteria analysis with discrete or continuous ratings	The rating method is not transparent to users of the tool. The ranking is pre-determined, and the rating overlooks the existence of a range of possibilities thus limiting flexibility.
Lahdelma *et al.* (2000)	Multi-criteria decision analysis (MCDA)	Ordering of alternatives ranging from the most to the least preferred technology	This tool considers technical, economic, social, and ecological criteria and put more emphasis on participatory process.

2.6 Sanitation technologies: choice, relevance and aceptance

2.6.1 *Sanitation technologies and their relevance*

Many sanitation technologies have been developed to respond to the lack of sanitation infrastructure in both peri-urban areas and informal settlements. These technologies range from emergency sanitation, such as chemical toilets, to conventional full water-borne sanitation (Table 2.5).

Table 2-5: Classification of sanitation technology (Adapted from Lagardien *et al.*, 2012b)

Conveyance		Use (can be water or non-waterborne)		
Waterborne	Non-waterborne	Individual	Shared	Communal
Pour flush	UDDT	Pourflush	Chemical toilet	MobiSan
Low flush	Pit latrine	Low flush	Container toilet	Ablution block
Full waterborne	VIP	Full waterborne	Enviroloo	Kayaloo
Porta-potty	Chemical toilet	UDT	Full waterborne	CAB
Aqua-privy	Container toilet	Pit latrine	Low and pourflush	
Vacuum	Nowac	VIP		
	Enviroloo	Peepoo		

Many studies (Simiyu, 2015; Lagardien & Muanda, 2014; Katukiza *et al.*, 2012; 2010; Lagardien *et al.*, 2012b; Chinyama *et al.*, 2012; Schouten & Mathenge, 2010; Still *et al.*, 2009; Vinnerås *et al.*, 2009; Tilley *et al.*, 2008; Paterson *et al.*, 2007; CoCT, 2008; Austin *et al.*, 2005; Scott, 1998; Hogrewe *et al.*, 1993;) have considered sanitation technologies from various perspectives ranging from operational and maintenance requirements, context of use, cost and user acceptance. However, previous studies (e.g., Lagardien *et al.*, 2012; Lagardien & Muanda, 2014) have found that the application of new sanitation technologies (mainly to informal settlements) are lacking a framework for assessing performance and functionality based on user perspectives.

The review of a number of these studies shows that sanitation technology can be classified broadly according to the conveyance system[7] (CSIR, 2001), location of the treatment[8] (Tilley *et al.*, 2008), context of use and permanency of the structure[9] (Lagardien *et al.*, 2012b). This classification can inform the choice of suitable option considering the context (meaning characteristics and features of the settlement). Each sanitation technology has its own characteristics, features, operational requirements, and associated costs. The context of use may vary from one area to another depending on the local conditions and the context in which the technology is applied (Murphy *et al.*, 2009). However, such use can be limited by many issues: technical, socio-cultural, institutional, or financial (Malekpour *et al.*, 2013). Clearly, determining suitable sanitation technology can be difficult given the varying nature of informal settlements.

A sanitation system comprises functional elements (Tilley *et al.*, 2008) implying toilet, containment/conveyance, treatment and disposal or reuse (Table 2.6).

[7] Namely water and non-water-based treatment meaning may require a conveyance (to take excreta away from the source of generation).
[8] On or off-site refers to the treatment location.
[9] Individual or shared (noting that shared facilities can be local, communal and public) and, the type or stability of the structure (permanent and mobile).

Table 2-6: Functional elements of sanitation system and technology (after Tilley *et al.*, 2008)

Functional elements	Technology option		
Toilet	Pour flush Low flush	Waterborne Full flush	Porta-potty Urinal
Collection and storage	Septic tank Digester Porta-potty	VIP UDT Storage tank	Pit (single/ twin) Baffled reactor Vault/Cartage
Treatment	Septic tank Waste stabilisation pond UDT	Baffle reactor Digester VIP Pit (single/ twin)	Wetland Activated sludge Composting chamber
Conveyance	Simplified sewer Condominium Tank lorries Tank	Conventional sewer Settled sewage Solid free sewer Jerry can	Human or motorised emptying and transportation
Disposal	Leach fields Pond	Soak pits Burial	Soakaway Drainage field
Use	Composting Biogas	Greywater Treated effluent	Struvite

Each of these elements may have a distinctive technology with different operational requirements (ibid.). To ensure adequate functioning, the responsibility for these functional elements may be assigned to one or more stakeholders (McConville, 2010), requiring institutional arrangements so as to connect different actors involved. The level of service and institutional arrangements should be adapted to local conditions (Murphy *et al.*, 2009; Elledges *et al.*, 2002). This implies that local conditions and user needs should be considered and that institutional arrangements are dependent on the type of sanitation system and its functional elements. The number of functional elements of a technology can indicate the activities required to ensure the functioning, the number of actors involved and specific arrangements (Lagardien & Muanda, 2014). Since these different functional elements of a sanitation system are interlinked, specific actor arrangements may be required to ensure adequate functioning of the technology.

In this vein, scholars and sanitation practitioners have examined the relevance of various sanitation technologies from different perspectives (Lagardien & Muanda, 2014; Lagardien *et al.*, 2012b; Naranjo *et al.*, 2010; Still *et al.*, 2009; Murphy *et al.*, 2009; Tilley *et al.*, 2008; Austin *et al.*, 2005; Scott, 1998). Findings from these studies reveal that the relevance of a sanitation technology can be context specific. Each technology has its own operational requirements based on its functional elements. Standards that determine the appropriateness of a sanitation technology are context based, sometimes contradictory and frequently impossible to achieve in practice (Murphy *et al.*, 2009). Further, the predominance of one sanitation technology over another can be explained by many factors including personal preference, available resources, context of use, political environment, operating and capital costs, availability as well public perception (Katukiza *et al.*, 2012; Thye *et al.*, 2011; Still *et al.*, 2009; Austin *et al.*, 2005; Howard *et al.*, 2003). Flores *et al.* (2009) and Schouten and Mathenge (2010) suggest that environmental, economic, and socio-cultural dimensions should be applied to determine the relevance of a sanitation technology. A study by Tumwebaze *et al.* (2013) revealed that the availability of a sanitation does not necessarily implies its use. User satisfaction criteria such as nature and type of facility, number of people sharing, and cleanliness inform access. In an informal settlement context, Ambole (2016) suggests that resident needs be considered as far as selection of technology is concerned. Again, selection of sanitation technologies must take local context into account; institutional arrangements should be adapted to the requirements of the technology.

2.6.2 *Service levels and technology choice*

2.6.2.1 Service levels

The level of service and technology choice, key elements guiding the provision and access to sanitation, are linked to the determinants of sanitation demand discussed in the previous section (2.5.1) and must be commensurate with the community's needs and capacity to finance, manage, and maintain them. According to DWAF (2001), households are responsible for the selection of appropriate level of services, guided by a number of factors including willingness to pay and responsibility for the operation and maintenance. Although this may not often be the case in the context of informal settlements, Murphy *et al.* (2009) and Elledges *et al.* (2002) suggest that the level of service and institutional arrangements be adapted to local conditions. The level of service is informed by various factors including spatial location of the settlements (Ishtiyaq & Kumar, 2010), nature and legal status of the land, and characteristics of the settlement (Phaswana-Mafuya, 2006), households and service provider expectations (Taing *et al.*, 2014), planning, density of the settlement and coordination amongst various stakeholders involved in the provision of services (Pan *et al.*, 2016). The choice of an appropriate technology should be based on a case-by-case basis so as to provide a socially and environmentally acceptable level of service with full health benefits at an affordable cost.

A suitable level of service and sanitation technology is one that responds to user needs and settlement conditions. While DWAF (2001) affords households the right to select the level of service and sanitation technology, this policy has been criticised for its lack of consideration of household knowledge and understanding between various level of services and sanitation technologies and their context of application. To avert tension between households and local government, the City of Cape Town (2008) has come to the fore by categorising the level of service for sanitation services as follows:

- *Inadequate:* when there is no access to sanitation. In this context, residents would either share facilities with other residents, supplied at a basic or full level of supply, their sanitation facilities, or would provide for themselves – often through unhygienic means. In many instances these residents are serviced by the municipality through the weekly removal of "black bucket" containers.
- *Essential:* when partial access to sanitation (with a ratio of more than five households per toilet) as dictated by site-specific constraints (e.g., high-density settlements).
- *Basic:* two scenarios exist:
  - "The provision of a shared toilet at a ratio of not more than 5 families per toilet";
  - "The provision of appropriate health and hygiene education".
- *Full:* on-site waterborne, conservancy tank or suitable waterless technology.

This proposed level of service has been aligned with the Strategic Framework for Water Services (DWAF, 2003) that defines *basic sanitation services* as the provision of a basic sanitation facility, the sustainable operation of this facility and the communication of good sanitation, hygiene and related practices. However, sanitation technologies and types of facilities are often communal or shared with a ratio higher than the one indicated. They vary in terms of their technology and nature, and include amongst many other buckets, chemical toilets, pit latrines, ventilated improved pit toilets, dehydrating and composting toilets, vacuum toilets, simplified sewers, anaerobic toilets, MobiSan, Kayaloo, porta-potties, aqua-privies, variances of waterborne toilet-pour flush toilet, full flush toilets with septic or conservancy tanks, flush toilets with small bore solids, free sewers, urine diversion toilets, and flush toilets connected to a sewer and central treatment works (Lagardien & Muanda, 2014; Lagardien *et al.*, 2012). Each of these technologies has a documented level of success and shortfall (e.g., Still *et al.*, 2009; Lagardien & Muanda, 2014).

However, while some of these technologies are not aligned with the Joint Monitoring Programme (JMP) definition[10] or list of improved sanitation (Table 2.7), they are still deployed in many developing countries, including South Africa.

Table 2-7: Classification of sanitation facilities (adapted from JMP, WHO & UNICEF, 2014)

Improved sanitation facilities	Unimproved sanitation facilities
Flush toilet	Flush or pour flush to elsewhere
Flush or pour flush to: - Piped sewer system - Septic tank - Pit latrine	Pit latrine without slab or open pit
Ventilated improved pit (VIP) latrine	Bucket
Pit latrine with slab	Hanging toilet and hanging latrine
Composting toilet	No facilities or bush or field (open defecation)
	Shared or public facilities

2.6.2.2 Sanitation technology choice

Although it is recognised that adequate sanitation is about people and their personal dignity, the provision of such service is a human right. The choice of a given sanitation technology is not an easy decision that should be made by engineers only, as it is important to involve the beneficiaries of the services in choosing, planning, and implementing sanitation improvements that meet their needs and aspirations (City of Cape Town, 2008). According to DWAF (1996), a sanitation technology decision is best as a c concerted effort by users and service providers.

The choice of sanitation technology is influenced by many factors, including affordability to the household, O&M requirements, sustainability, improvements to health, compliance with environmental protection regulations and ability of community-based contractors to implement (Lagardien & Muanda, 2014; DWAF, 2001). Further, Crous (2014) argues that the selection of an appropriate technology requires a compromise between effectiveness, affordability, capacity to operate and maintain, life-cycle costs, consumer acceptability and environmental impact. Crous (2014) further contends that the most appropriate sanitation technology for each informal settlement will depend on a range of factors including financial, institutional, settlement permanency, environmental and social issues. The Strategic Framework for Water Services (DWAF, 2003) suggests that selected sanitation technology be safe, reliable, environmentally sound, easy to keep clean and afford privacy and protection against the weather. It must be well ventilated, keep smells to a minimum, prevent the entry and exit of flies and other disease-carrying pests, enable safe and appropriate treatment and removal of human waste. Further, DWAF (2007) indicates that a municipality must consider certain criteria including the availability of water services, the proximity of sewer mains, the suitability of soil and geology for the different types of on-site services, the availability of local materials and skills, and the actual funds available for the services or that can be sourced through grants and loans in their selection of appropriate technology for the settlement.

Other studies differ slightly, suggesting criteria such as acceptability, cultural and religious beliefs, preferences, level of knowledge and awareness, sensitivity, hygienic practices and expectations, socio-technical preferences, affordability and long term sustainability (Phaswana-Mafuya, 2006) as well as understanding operational requirements, willingness to take responsibility for the system and invest in capital and recurrent costs (Lagardien *et al.*, 2012a) and consideration of the

[10] An improved sanitation facility is defined as one that hygienically separates human excreta from human contact (WHO & UNICEF, 2012) Any facility shared by more than one household is considered unimproved.

various dimensions of sustainability which include institutional, social, technical, financial and environmental factors (Mjoli, 2015). Furthermore, DWAF (2007) advised that other aspects – permanence of the settlement, technical aspects, financial costs, design, expectations and environmental considerations – are valuable to consider in the choice of sanitation technology. Still *et al.* (2009) and Parkinson *et al.* (2008) advised that factors such as settlement density, land status and perceptions of risks by both users and service providers should be taken into account, while COHRE *et al.* (2007) suggest criteria such as ease of access, privacy, dignity, cleanliness and healthy environment. DWAF (2003)[11] suggests that the choice of sanitation technology benefits from community participation where users are informed about all available technical options and related financial and operational implications. However, most users are not aware of available sanitation technologies, their advantages and disadvantages or their operational requirements (Dunker, 2014). Users have limited knowledge about sanitation technologies and therefore must rely on hearsay, what other users believe the technology does or does not do. According to Dunker (2014), reports related to sanitation technologies are frequently aimed at technical practitioners, not decision-makers or users. Because of the dearth of adequate communication, decision-makers and users are unlikely to have sufficient understanding of the reality of the technology and its potential benefits and shortfalls in various contexts (ibid.).

In terms of informal settlements, previous policies and strategic frameworks have remained vague about sanitation technology choice. Although the 2016 draft update to the National Sanitation Policy takes the stance that municipalities need to provide services on private land (DWS, 2016), municipal level policies still need to be developed. However, there is a concern from municipal officials that providing services to informal settlements will encourage more illegal occupation (Taing *et al.*, 2013) and be considered an unendorsed granting of tenure rights (Graham, 2005). The location of informal settlements, land status and ownership and the way it should be used all have a significant impact on the level and type of service to be provided.

This discussion shows that there is a plethora of criteria and factors necessary to consider when selecting sanitation technology for a given context. The applicability of these criteria may be context specific, or even not applicable in certain contexts (e.g. supply-driven context).

2.6.2.3 Typical sanitation technologies and facilities for informal settlements

Informal settlements have their unique challenges. While these challenges may vary from one area to another, it is widely reported that the most predominant form of sanitation in informal settlement is on-site shared sanitation facilities (Schouten & Mathenge, 2010; Foggit *et al.*, 2019) which do afford dignity and comfort to users (Katukiza *et al.*, 2012; Tumwebaze *et al.*, 2013). Communal shared sanitation facilities are not improved sanitation (WHO & UNICEF, 2014) despite being viewed as a solution for areas where individual facilities cannot be provided. In South Africa, van Vuuren (2014) claims that pour flush toilets are suitable for informal urban areas in South Africa compared to conventional toilets and VIP latrines. Contrary to this study, however, Tumwebaze *et al.* (2013) and Katukiza *et al.* (2010) report that the VIP toilet is the preferred sanitation option in informal settlements. These contradictory opinions reflect the complex nature of sanitation service provision in informal settlements. Although true in certain contexts, other studies (Tilley *et al.*, 2008, Paterson *et al.*, 2007) caution that sanitation facilities must be context appropriate and cost-effective: there is no one-size-fits-all sanitation technology universally applicable to informal settlements. Suitable levels of service and sanitation technology are those that respond realistically and beneficially to user needs and settlement conditions.

[11] According to DWAF (2003) municipalities are legally mandated to provide temporary basic services while reasoning that waterborne sanitation is the 'most appropriate, financially viable and sustainable technical solution' in high-density urban areas, and should be 'regarded as a basic level of service'.

Replication of sanitation technology from one settlement to another, even within the same municipality, may not necessarily be feasible without prior investigations (Schouten & Mathenge, 2010).

Although a wide variety of sanitation systems are used in South Africa, individual household waterborne sanitation facilities are considered the highest level of service provided to most of formal households (Duncker, 2014; Taing *et al.*, 2013). They use communal or shared water and non-waterborne, which are emergency, basic or interim levels of service (depending on the sanitation type and local authority definition) common in most informal households (Taing *et al.*, 2014; Lagardien *et al.*, 2012b). These interim levels of service are regarded as 'backward' (Matsebe & Osman, 2012) due to the general feeling that they lack comfort and privacy as compared to private household facilities in formal areas (Duncker, 2014). Guidance in the Strategic Framework for Water Services (DWAF, 2003) suggests that informal settlements be provided with an interim basic level of water and sanitation service. However, further guidance has not gone forth regarding the level of service and technology type, hence opening room for speculation and entitlement mentality.

Although the level of service provision should comply with certain conditions (as defined by DWAF, 2003), Jenkins and Scott (2007) insist on the inclusion of user preferences as an important factor of successful implementation. Water and sanitation technologies should be selected in a concerted manner, not in isolation (DWAF, 2003). To date, communal sanitation facilities (water or non-waterborne), the predominant types of sanitation provided to various informal settlements, are widely used because of constrained locations, topography of the sites and ground conditions (Schouten & Mathenge, 2010). Their implementation has rendered successes and failures depending on local context and various factors including the presence of a caretaker, access control and user awareness. Despite their low acceptance level, communal shared sanitation facilities are believed to work better when co-produced with the community (McGranahan, 2015). Such co-production is believed to elevate a sense of ownership (Simiyu, 2016a) which in turn increases access while ensuring long-term sustainability of the facility.

2.6.3 *Users' acceptance of sanitation – attitudes and perceptions*

Providing people with toilets is insufficient, if measures to ensure that people accept, understand, and properly use and maintain the toilet are disregarded. Although a sanitation technology may be technically and financially sound, and designed according to standards, its acceptance is actually the main factor informing access and appropriate use, a critical step in ensuring that the facility is maintained in good working condition (Lagardien *et al.*, 2012b). Such acceptance is typically driven by several factors: attitudes, perceptions, expectations, and aspirations (Duncker, 2014). Only a few studies have addressed these issues; in particular Jenkins and Scott (2007), Schouten and Mathenge (2010), Duncker (2014), Taing (2009) and Gounden (2008) have demonstrated that the acceptance of a sanitation facility is guided by individual attitudes, perceptions and expectations. Of these three, Ignacio *et al.* (2018) claim that attitude is the most important driver determining how a particular sanitation technology is used – or abused.

User perception towards the use of a technology is influenced by factors such as user demand, perceived ease of use and usefulness of a sanitation technology (Ignacio *et al.*, 2018), beliefs (Nawab *et al.*, 2006) and non-technical aspects such as affordability or cleanliness of the facilities (Roma *et al.*, 2010), types of technologies and facilities, level of knowledge and awareness, relationships between users and service providers and understanding of the process of providing such services (Lagardien *et al.*, 2012). Another study by Matsebe and Osman (2012, citing Drangert, 2004) indicates that the acceptance of a technology is guided by socio-cultural factors

including diversity of cultural and societal norms; individual values; people's beliefs, attitudes, and practices; religious conventions; user preferences; and established practices. User acceptance can also be influenced by the aesthetic aspects of the technology (Drangert, 2004) and other factors such as prestige, comfort, safety, cleanliness, and convenience (Jenkins & Curtis, 2005; WSP, 2004; Jenkins & Scott, 2007). Schouten and Mathenge (2010) found that user acceptance of sanitation facilities is informed by various factors including safety, affordability, appurtenances (such as bathroom) and most importantly, cleanliness. While these findings were confined to informal settlements in Kenya, a study by Tumwebaze *et al.* (2013) in Kampala also suggests that acceptance of a sanitation facility is informed by the nature and type of the facility, its cleanliness and number of users sharing.

In South Africa, several studies (e.g., Duncker, 2014; Lagrdien *et al.*, 2012b) have shown that user aspirations have several negative effects on the acceptance of sanitation facilities provided to their settlement. For instance, users expect to be provided with individual waterborne sanitation facilities, which according to many is a sign of equality. Such aspirations bring disappointment towards any alternative sanitation technology regarded as sub-standard. Further, Duncker (2014) has shown that the level of knowledge, understanding and awareness may impact the acceptance and sustained use of a facility, a sentiment further elaborated by many (Lagardien *et al.*, 2012b; Mjoli, 2010; Lagardien & Muanda, 2014) indicating that many recipients of free basic services lack knowledge and understanding of various sanitation technologies and their context of application, cost, implementation requirements and challenges. This has led users to reject sanitation facilities provided to their settlements. Other studies have highlighted that user acceptance of and sustained use of sanitation facilities are guided by non-technical aspects including affordability or cleanliness (Roma *et al.*, 2010), informed by closeness of the facility to the house, personal habits (or practices) and understanding of dignified sanitation (Roma *et al.*, 2013).

While this large body of knowledge documents only factors that contribute to user acceptance, Jenkins and Scott (2007) indicate that the decision to adopt a sanitation technology is sequential and ranges from preference, intention and choice. The lack of social acceptance of a sanitation technology or facility type has often resulted in rejection, damage or destruction of facilities, and vandalism (Mels *et al.*, 2008; Still *et al.*, 2012), further obstructing access and increasing sanitation backlogs.

Interestingly, affordability has not been regarded as an issue in a predominantly supply-driven context, demonstrating that attitudes and perceptions are more important factors informing the acceptance of sanitation technology. Attitudes and perceptions of different persons can differ depending on a number of factors including perceived benefits and use of the facility through to personal feeling and beliefs. This underscores the need to involve users in all stages of the decision-making process as far as the provision of sanitation services is concerned. Such involvement is believed to enhance the acceptance and sustainability of the facilities and allow for continued use and functioning of the facilities (Schouten & Mathenge, 2010). The next section presents an overview of the notion of sustainable sanitation and its relevance to this study.

2.7 Notion of sustainable sanitation: an overview

2.7.1 *Definitions*

While several studies have attempted to define the *sustainability,* there is no commonly agreed definition that can be generally used to define this concept. Depending on the context, *sustainability* is defined in the development context as paradigm that seeks to satisfy the survival and prosperity needs of present and future human populations (WCED, 1987) or a normative construct that is value-laden and political (Movik & Mehta, 2010). In terms of service provision,

The Bellagio Principles, eThekwini Declaration and Sustainable Development Goal (SDGs) reflect several aspects of sustainability. In the context of sanitation, the term *sustainable sanitation* defines a sanitation system that is economically viable, socially acceptable, and technically and institutionally appropriate; it should also protect the environment and the natural resources (SuSanA, 2014), be able to operate for a prolonged period despite varying conditions and deliver lasting benefits (Lagardien & Muanda, 2014; WaterAid, 2010). The Strategic Framework for Water Services (DWAF, 2003) definition of *sustainability* is drawn mainly in the context of affordability.

2.7.2 *Understanding of sustainability and their defining criteria*

The Millennium Development Goals (MDGs) focused on halving the number of people without improved sanitation. Today, the focus is on the Sustainable Development Goals (SDGs) where goal 6 is 'to ensure availability and sustainable management of water and sanitation for all'. Over decades, scholars (Hellström *et al.*, 2000; Balkema *et al.*, 2002; Kvarnström *et al.*, 2004; McConville & Mihelcic, 2007) have developed sustainable sanitation assessment criteria. From the review of these criteria, six dimensions for evaluating sustainable sanitation were identified: (i) environmental; (ii) economic; (iii) technical; (iv) institutional (which includes political considerations); (v) socio-cultural; and (vi) health and hygiene.

2.7.2.1 Environmental sustainability

According to Pan (2016), environmental sustainability relates to the desire to alleviate negative effects on the natural environment associated with the lack of or inadequate sanitation, and how the sanitation service chain fits into ecological cycles. Sanitation technology should not pollute the environment (Mjoli, 2015). Central to the environmental sustainability is the reduction of the amount of resources required (land, water, energy, construction materials) to provide sanitation, and minimisation of the negative impact on water quality while considering the potential for resource recovery of water, energy and nutrients. Previous studies (Hellström *et al.*, 2000; Balkema *et al.*, 2002; Kvarnström *et al.*, 2004) have documented a number of criteria and indicators of environmental sustainability. These include land use, construction materials, energy, chemicals, fresh water used, chemical and biological oxygen demand, impact of eutrophication, hazardous chemicals, contribution to global warming, odour, and resource recovery (water, nutrients, energy, and organic materials).

2.7.2.2 Economic sustainability

According to Mjoli (2016), the cost of sanitation services must be affordable to both users and service providers. The economic sustainability of a sanitation service needs to be assessed prior to selecting a particular type of system and is often one of the most heavily weighted criteria for sustainability. It may provide an indication of whether users require sanitation subsidy, prior to deciding on the selection of sanitation technologies and service levels (Mjoli, 2015). Criteria that can be used to examine economic sustainability include annual cost of the system, ability, and willingness to pay, local development potential and time required by users to access or maintain facilities (Hellström *et al.*, 2000; Balkema *et al.*, 2002; Kvarnström *et al.*, 2004). According to Pan (2016), the cost of a system (which includes capital, O&M and servicing and support costs) is amongst the most important economic sustainability criteria to consider. It is one of the deciding criteria frequently cited by municipal officials for the selection of sanitation system. However, this criterion is irrelevant in the context of Free Basic Sanitation (FBSan) where users do not pay for the service.

2.7.2.3 Technical sustainability

Technical sustainability refers primarily to the consideration of the physical conditions, facilities and infrastructure required to support ongoing sanitation services. It is ensured when criteria

such as local technical skills to support the operation and maintenance is available (Mjoli, 2015) and the selected technology is robust (in terms of risk of failure, effect of failure, structural stability, sensitivity to shock loads or abuse), flexible and adaptable (to different conditions/user groups), allows for the possibility of local skills and materials for construction and operation and maintenance, complex in terms of construction and operation and maintenance, compatible with existing systems, easy to monitor and durable in terms of lifetime (Hellström *et al.*, 2000; Balkema *et al.*, 2002; Kvarnström *et al.*, 2004). Although all these criteria may be important, it is worth noting that the robustness of the sanitation system is the one that is often considered by service providers since misuse and vandalism are significant issues facing sanitation provision in informal areas of South Africa (Lagardien & Muanda, 2014). All of the criteria mentioned link to the notion of technical 'appropriateness', a relative concept that is dependent on the context in which it is applied (Pan, 2016).

2.7.2.4 Institutional sustainability

Institutional sustainability is linked to the policies, 'institutional culture' and management capacity and arrangements conducive to supporting sanitation service delivery (Pan, 2016; Mjoli, 2015). It is examined using certain criteria including compliance with institutional requirements, clarity of institutional responsibility and legal acceptability (Hellström *et al.*, 2000; Balkema *et al.*, 2002; Kvarnström *et al.*, 2004). With regard to the clarity of responsibilities, Mara *et al.* (2007) suggests that the assignment of responsibilities should be discussed at the initial stage of the project and, where applicable, re-evaluated at the implementation and post-implementation stages.

2.7.2.5 Socio-cultural sustainability

The provision of sanitation services is intended to ensure that users have access to facilities all the time. In sustainable sanitation literature, social acceptability of a sanitation technology is one of the most important socio-cultural sustainability criteria (Lagardien *et al.*, 2012; Kalbermatten *et al.*, 1982a; Kvarnström *et al.*, 2004; Panesar *et al.*, 2011) because of its relationship with the social and cultural norms and behaviours of a given society (Pan, 2016). Socio-cultural sustainability is defined by a number of criteria including convenience (comfort, personal security, smell, noise, attractiveness), appropriateness to local culture, perception of the system, and ability to address awareness and information needs (Hellström *et al.*, 2000; Balkema *et al.*, 2002; Kvarnström *et al.*, 2004). To understand socio-cultural sustainability, user preferences may relate to religious beliefs and cultural norms (e.g., such as anal cleansing practices and use of facility) (de Bruijne *et al.*, 2007; Tilley *et al.*, 2008) and level of privacy (Lagardien *et al.*, 2012). User habits can therefore evolve over time to adapt to changing circumstances (de Bruijne *et al.*, 2007). As such, Mjoli (2015) suggests that preferences and perceptions should therefore be considered in the service provision planning. This can be achieved only through an assessment of user needs (Pan, 2016) and settlement conditions (Lagardien & Muanda, 2014) as well as involvement of users in the selection of the sanitation technology options (Nance & Ortolano, 2007). This assessment can also assist with understanding the priorities of user groups which may either help or hinder the social acceptability of sanitation services (Lüthi *et al.*, 2011a). Devine (2009) stresses the importance of identifying and defining behaviours that should be improved and identifying whose behaviour needs to be changed prior to deciding on the deployment of sanitation services. Such an approach is believed to assist not only with the selection of an appropriate technology, but also with the design of adequate sanitation services which meet the needs of users while considering settlement conditions.

2.7.2.6 Health and hygiene sustainability

Health and hygiene are typically associated with the socio-cultural aspects of sustainability discussed above. Criteria applied to define this sustainability aspect of sanitation include risk of infection, risk of exposure to toxic substances and hygiene promotion programmes (Hellström *et al.*, 2000; Balkema *et al.*, 2002; Kvarnström *et al.*, 2004). Improving health is one of the main objectives or drivers for sanitation. However, access to water and sanitation facilities is not always sufficient to ensure sustained health improvements without associated hygiene promotion (Potter *et al.*, 2013). To be considered 'improved', a sanitation facility must act as a barrier between humans and their excreta (WHO & UNICEF, 2013) to prevent health risks. Although all these criteria may be sound from the general perspectives, their applicability in the context of informal settlements and in a situation where the Free Basic Service (FBS) and strong feelings of entitlement are prevalent may be challenging (Taing, 2015; Pan *et al.*, 2018) as many households are more interested in making a daily living than seeking access to toilets.

In view of the number of sustainability criteria outlined above, it is evident that they cannot be generalised. Each case should be examined according to the local context. There is a need for developing multi-dimensional sustainability criteria or improving the existing criteria that can be incorporated into the current institutional framework for the selection and deployment of sanitation as far as informal settlements are concerned. As far as sanitation provision in informal settlements, sustainability criteria should be thoroughly analysed so as to match the context in which they are or will be applied.

2.8 The co-production and the IAD framework

2.8.1 *Overview of the co-production*

The co-production concept was introduced in the United States of America in the 1960s when the economy shifted its focus from the production of goods to a service economy (e.g., banking) in which consumers and producers worked together to create value. This approach is centred on the assumption of an active and participative portion of consumers, distinct from traditional models of public service production that render public officials responsible for "designing and providing services to citizens, who in turn only demand, consume and evaluate them" (Pestoff, 2006: 506). The co-production model was first used to describe the possible relationship between service providers and the users of the services (Pestoff, 2006) where users were afforded opportunity to contribute their knowledge towards the improvement of the services they received. According to Ramsden (2010), co-production shifts the delivery model of public services from an inefficient approach to one that provides opportunities to put these to use in their lives.

The concept of co-production can take various facets and moments. According to Pestoff (2006), in some contexts the concept of co-production has been referred to as co-governance (when third-party actors participate in planning and provision of public services), co-management (implying collaboration between state and third-party actors in the provision of public services) and co-production (known in a narrow sense as citizens' participation in the production [at least in part] of the public services required for their wellbeing). Boyle and Harris (2009) define co-production as a means of delivering public services in an equal and reciprocal relationship between professionals, people using services, their families, and their neighbours. Co-production implies that citizens can play an active role in producing public goods and services of consequence to them (Ostrom, 1999). Despite government agencies assuming responsibility for the provision of services, efficiency and equity cannot be achieved without significant input from citizens (Ostrom, 1993).

Co-production occurs when "*consumers and regular producers undertake efforts to produce the same goods or services"* (Pestoff, 2006: 507), when consumers are engaged in the development of a service or product, thereby ensuring the quality, and enhancing the value (Grönroos, 2011) when users and specialist knowledge is combined to design and deliver services (Ramsden, 2010). Its occurrence is apparent when consumers are able to personalise their experience while using an organisation's service and in return undertake specific tasks needed by the organisation (Piligrimiene *et al.*, 2015). This process requires active collaboration between consumers and producers to create value (Janamian *et al.*, 2016). This body of knowledge shows that co-production shifts the balance of power, responsibility, and resources from the service providers to consumers by involving them in the delivery of their own services.

A co-production arrangement between the state or government and citizens is part of a broader process of changing service providers – consumers' relations. According to Llanos-Arias (2015), a key element of co-production is its attempt to bridge the divide between governments and community members by mobilising knowledge for various purposes. This approach to grass-roots co-production draws on local expertise, not just as a means of collecting technical information but also as a way to raise the capacity of the poor to make claims on the governments (Ibid.) Pestoff (2006) understands co-production as an option for improving public productivity while seeing co-production in terms of its outcomes including cost reduction, improvement of the quality of services and expansion of citizens' participation in decision-making processes for public services. This underscores the importance of stakeholder participation and interaction as a key element of the co-production that must not be overlooked.

Although co-production has been hailed for its strong potential relationship with efficiency (Ostrom, 1993) as it offers the opportunity for people to discuss and agree on issues pertaining to their wellbeing, it has been criticised on numerous occasions as well. Critique of co-production claims that broader efforts and experimentation with participation in decision making have faced a perpetuating power imbalance between participants and continuous centralisation (Taylor, 2007). Boltanski (2011) argues that the opening of the agenda setting and decision making as articulated in the discourse of the co-production mask new forms of state control, as state power is reproduced at a distance from or beyond the state. Swyngendouw (2005) argues that through co-production the state establishes the rules of the game that enable it to determine the parameters for local solutions, seen as a mean of recentralisation. Moreover, co-production is criticised for being inscribed by the existing distribution of power and creating privileged pathways and access for the more powerful while colonising the less powerful, silencing, marginalising, and ignoring alternatives (Joshi & Moore, 2006; Alford, 2009). It is viewed as a technique used to make citizens more responsible for aspects of welfare for which the state is responsible (Duroze & Richardson, 2016) or a strategy to de-professionalise certain municipal services that are highly unionised. While Duroze and Richardson (2016) argue that co-production is about equality and diversity, critics argues that some consumers are more likely than others to devote time, money, and energy to service production, and so the benefits of co-production tend to be twisted.

2.8.2 *Co-production in the provision of sanitation services in informal settlements*

The provision of large-scale infrastructure using a top-down technological approach is one the main challenges hindering access to adequate sanitation in informal areas (Satterthwaite *et al.*, 2015). Supply-driven is and remains one of the most used approaches for sanitation service provision in many countries (Lüthi *et al.*, 2010) including South Africa. This approach, generally resulting in failure to ensure universal sanitation coverage, has prompted researchers to explore

alternative. Along these lines, several scholars (e.g., Adubofour *et al.*, 2012; Chinyama *et al.*, 2012; Lagardien & Muanda, 2014) have conducted research in quest for alternative solutions for sanitation challenges resulting in a number of good sanitation technologies and interventions, although several have failed (Morales *et al.*, 2014; Hendriksen *et al.*, 2012). Since many technologies have failed to meet their intended purposes, scholars (Lagardien *et al.*, 2012a; Murphy *et al.*, 2009) have suggested that sanitation provision should not be considered as merely a technical problem, but rather an amalgamation of several aspects including social and institutional. This supply-driven approach has been one of the causes of the failure of sanitation interventions (Mulenga, 2004). Since this approach and many other have failed, scholars of all boards (e.g., Ostrom, 1999; Ambole, 2016; Pan, 2016; Patel, 2015; Taing, 2014; Tukahirwa *et al.*, 2013) and development agencies have come to the fore to address this gap by widening the sanitation discourse. Offering a wide range of contributions covering socio-technical and institutional perspectives on sanitation where users have come to the forefront of their approaches, they argue that the involvement of users in this process is empowering, guaranteeing the sustainability of the service. Although this body of knowledge has suggested the involvement of users in decision making concerning the selection, deployment, and management of sanitation services, many of these studies remains silent on how and the extent by which users should be involved in the decision-making process.

Since access to sanitation is a personal issue that involves dignity and personal feelings, it is believed that user involvement in the service provision process is important. Ambole (2016) argues that informal settlement residents should be involved in various phases of the implementation of sanitation services based on their capacities and resources. The intention is to afford users involvement in the design and implementation of their own services (Patel, 2015; Tukahirwa *et al.*, 2013; Joshi *et al.*, 2011). According to Ambole (2016), the social and institutional approaches regard sanitation service provision as a package that include users (as customers), service providers (as public services) and infrastructure development (provision of services). In view of the current approaches of service provision, McFarlane (2014) suggests a re-conceptualisation of sanitation, whereas O'Reilly and Louis (2014) propose that the social arrangements that support sanitation technologies to be addressed, and Ambole (2016) adds the incorporation of sustainability considerations in the selection of sanitation options for informal settlements. In informal settlements, re-conceptualisation of sanitation and addressing social arrangements imply considering user needs and settlement conditions.

While Ambole (2016) has echoed what has been voiced previously, it does not, however, give guidance on how such engagement should be made despite suggesting the co-production as a model. Further, Ambole (2016) believes that co-production can be a useful model for ensuring sustainable sanitation service provision in low-income areas.

The use of co-production in the provision of sanitation services is not new. This concept has been used by Ostrom (1996) to illustrate the success of the co-production in the sanitation projects in Brazil and Nigeria and has been advocated by Mitlin (2008) using the Orangi project in Pakistan to demonstrate how residents of informal settlements can co-produce their own sanitation services. McGranahan (2015) believes that co-production can achieved low-cost sanitation. Otsuki *et al.* (2013) indicate that co-production in the field of sanitation should be viewed as reflexive community discussions that are influenced by policy and institutional frameworks, suggesting that communities should be afforded opportunity to deliberate to allow residents to access sanitation services. With regard to public services (such as sanitation), co-production involves communities and authorities in the joint design and delivery of services (Ramsden, 2010). In South Africa, the sanitation policy sees sanitation as a cohesive approach that considers

organisational, technical, financial, environmental, social, and educational frameworks rather than just the provision of toilets (DWAF, 1996). This can be achieved only if people are afforded the opportunity to be part of the service provision process (McConville & Rosemarin, 2012). Co-production has been demonstrated through user involvement in the sanitation provision process from design to the implementation of sanitation technologies (Ambole, 2016) despite facing challenges attributed to the contentious nature of these settlements. In Enkanini and Klipheuwel informal settlements, for example, residents were remunerated for their involvement in the installation of the sewer reticulation system, construction work and operation and maintenance (O&M) of the anaerobic digester (Ambole, 2016). This example, while signalling a starting point for user participation, does not align with the concept of co-production which is funded on the premise of voluntary participation.

Since co-production relies on community participation, the contexts of informal settlements may not be conducive due to various constraints including time, poverty, and a survival mode of life. The main challenge of user participation is therefore to ensure that decisions emanating from such gatherings are based on informed choice (Ambole, 2016) and that elements of public good and public interest take precedence over individual interests (Zurbrügg & Tilley, 2009). Ambole (2016) asserts that co-production in sanitation service provision as far as informal settlements is concerned rests on the assumption of capacity in the settlement for self-management or co-financing for implemented projects. However, this may not be the case given the diversity and fluidity of residents of informal settlements. As opposed to a supply-driven approach, in practice informal settlement resident participation and involvement in co-production can be difficult to achieve because of the broader nature and extent of the consultation and time it may take (Ambole, 2016). In addressing these gaps, Zurbrügg and Tilley (2009) suggest the adoption of a systemic and integrated view where a wide range of approaches and solutions for sanitation improvement are integrated. It is also suggested that participation be representative where relevant stakeholders with different interests and diverse roles be involved (Ambole, 2016). Ramsden (2010) suggests the involvement of diverse user groups, collaboration with community-based organisations, engagement of carers and working with small social enterprises. There should prior identification, consultation, and certification of social groups to ensure equitable representability.

2.8.3 *The Institutional Analysis Development (IAD) framework*

The Institutional Analysis Development (IAD) framework is a multi-tiered map used to analyse and test behaviours in diverse situations that occur in a multi-stakeholder environment (Ostrom, 2005), in this case the provision of sanitation services. It has been used to analyse common pool resources (Ostrom, 1994), local management of common resources (Benson *et al.*, 2013; Clement & Amezaga, 2013; Rudd, 2004), onshore fisheries (Osrom, 1994) and irrigation (Tang, 1991) as well as local and metropolitan public services and governance (Polski & Ostrom, 1999). The IAD framework underlines key insights on institutional, technical, and participatory aspects of collective interventions, or the commons problem, and their resulting effects. The components of the IAD framework include (a) contextual factors, (b) action arena[12] (which cover actors and action resources), (c) patterns of interaction[13], (d) outcomes and (e) evaluation criteria (Ostrom, 2005).

[12] Refers to the social space where participants with diverse preferences interact, exchange goods and services, solve problems, dominate one another, or fight (among the many things that individuals do in action arenas).
[13] Patterns of interaction refer to the structural characteristics of an action situation and the conduct of participants in the resulting structure (Polski & Ostrom, 1999).

The analytical focus of the IAD is grounded on an "action situations or arena", where interests of the different stakeholders' conflict and planned initiatives are (re)shaped to leave space for social choices and decisions to take place. Three broad categories of variables influencing the action arena include (i) institutions or rules that govern the action arena, (ii) the characteristics of the community or collective unit of interest, and (iii) the attributes of the physical environment within which the community acts (Ostrom, 2005). The action arena comprises action resources and actors and is characterised by seven types of variables: (i) the participants in the situation, (ii) the participants' positions, (iii) the outcomes of participant decisions, (iv) the costs and benefits associated with outcomes, (v) actions and outcomes linkage, (vi) participant control in the situation, and (vii) types of information generated (Ostrom, 2005). The action situation refers to a social space where the actors or participants interact, solve commons problem, and exchange goods and services (Ostrom, 2007; Ostrom *et al.*, 1994). The variables essential to evaluating actors in the action arena are (a) their information processing capabilities, (b) their preferences or values for different actions, (c) their resources, and (d) the processes they use for choosing actions (Ostrom, 2005). In applying the IAD framework, the analyst assumes that the structure of the action situation is fixed in the short-term. Ostrom (2009) indicates that the existence of an action situation lies in actors in positions which reflect the number of possible roles that are available in this recurring interaction situation. As such, actors have choices within the existing structure. In the study of outcomes from collective choice situations, actors are influenced by institutional arrangements, socio-economic conditions, and the physical environment (Anderson, 2015).

Although the IAD framework has been hailed as the most progressive means for analysis of institutional matters which use institutional and stakeholder assessment to link theory and practice, it has been criticised for a number of weaknesses. For instance, a study by Cole (2014) revealed that the IAD framework has failed to develop clear evaluative criteria or explore complex relations between formal rules and current working rules. Rules related to the action resources and actors are often overlapping, thereby stirring a mix of confusion. This overlap can be overcome by developing relations amongst actors which may inform the development of such rules (Cole, 2014).

2.9 Summary and conclusion

2.9.1 *Development of informal settlements and sanitation challenges*

The literature review shows that in many developing countries informal settlements emerge as the predominant type of settlement. Their emergence and growth are attributed to rapid urbanisation which has seen growing numbers of migrants in urban areas, thereby increasing the demand for infrastructure such as water and sanitation. Informal settlements are characterised by a number of features, the most predominant being poor living conditions, lack of or inadequate infrastructure and unclear legal status. Large numbers of residents from these settlements lack access to adequate sanitation services which have induced them to adopt certain sanitation practices that have detrimental effects on both human health and the general environment. The challenge to provide adequate sanitation services is multi-dimensional and covers many issues ranging from technical to social.

2.9.2 *Sanitation technologies and institutional arrangements*

Although many countries have developed sanitation policies and regulatory frameworks, access to sanitation remains a challenge for many informal settlement residents. These policies and regulatory frameworks are considered weak (not reflecting the realities on the ground) and

sometimes contradictory[14]. Institutional arrangements (where available) are often complicated; the responsibilities for sanitation services remain with government and are shared by different departments and their support services. The roles of various departments involved in sanitation are not clearly defined, a fragmentation of responsibilities that has resulted in chaotic organisation, as there is no leading agency responsible for sanitation provision. While policies often acknowledge the importance of the involvement of stakeholders other than government departments, their involvement in sanitation provision and decision-making processes is not often considered in practice. The roles and responsibilities of these stakeholders and the extent of their involvement are not clear, not documented and consequently their application in practice is not evident. Existing sanitation provision approaches are not adequately adapted to informal settlement conditions. Many sanitation technologies deployed in informal settlements consist of different functional elements which have operational requirements that must be met in order to ensure adequate functioning.

2.9.3 *Decision making process for sanitation service provision*

The selection and deployment of sanitation is not an easy decision. Several decision-making processes and tools developed comprise steps for selecting a sanitation technology for a given context. The selection of sanitation technologies is often the final step of this process and is made by applying particular criteria: technical, health and environmental protection, social, economic and financial, and institutional categories. As they are context specific, they vary from one area to another depending on the context in which the sanitation services are provided and local conditions. In general, these criteria are broad and neglect a careful assessment of the conditions of informal settlements, given the dismal record of current sanitation programmes in these areas.

2.9.4 *Notion of sustainable sanitation*

This review has demonstrated that the notion of sustainable sanitation is subjective, requiring the consideration of multiple dimensions. Although this notion is important in the sanitation service provision jargon, the six dimensions of sustainability (viz. environmental, economic, technical, institutional, socio-cultural and health and hygiene) and subsequent criteria are broad. This implies that the context in which the notion of sustainability has been used does not factor local conditions (e.g., informal settlements) and perspectives of those being served; hence the importance of including the perspectives of multiple stakeholder groups and developing criteria that respond to local conditions.

2.9.5 *Knowledge gaps*

Scholars and practitioners worldwide have developed a large body of knowledge to address sanitation issues from different perspectives. Many of them have focused on a wide range of issues including sanitation delivery approaches and strategic frameworks (Lagardien & Cousins, 2005; Cros & Morel, 2005; Kar, 2005; Tayler, 2005; Mulenga, 2003; Wright, 1997), demand and hygiene practices (Jenkins & Scott, 2007; Mara *et al.* 2010); sanitation policy and regulatory framework (Mjoli *et al.*, 2009, van Vliet *et al.*, 2011; Huchzermeyer, 2003; Marx, 2003; Elledges *et al.*, 2002), sanitation technology, operation and maintenance and innovation (Lagardien & Muanda, 2014; van Buuren & Hendriksen, 2010; Still, 2009; Tilley *et al.*, 2008), decision making and technology choice (Katukiza *et al.*, 2013; 2012; 2010; Chinyama *et al.*, 2012; van Buuren, 2010; Zurbrügg & 2007; Loester & Keller, 2002), sanitation financing model (Toubkiss, 2008), sanitation governance (Lüthi, 2012; Mjoli, 2015; Allen *et al.*, 2008; Oosterveer, 2009; Milbert, 2006); and partnerships (Eales, 2008; Schaub-Jones, 2005; Huchzermeyer, 1999).

[14] The new policy for sanitation provision in informal settlements is contrary to the land and spatial development framework.

Although some of these scholars do address institutional, social and technical issues, and have acknowledged their influence on the provision of sanitation, on the whole this large body of knowledge has scarcely and only inadequately addressed them. The relationship between these three elements of the sanitation service provision and the extent by which they inform or hinder access and long-term sustainability of sanitation service in the policy context of the FBSan has not been thoroughly discussed in the literature. There is limited information regarding the extent and manner in which people's sanitation practices influence or inform the provision of sanitation services in informal settlements. In addition, institutional arrangements for different sanitation technologies and the basis for decision making regarding the selection and deployment of sanitation are also inadequately addressed. The knowledge gaps identified through the review of the literature can be articulated as follows:

(a) *Sanitation practices:* there is a dearth of studies that provide an understanding of the connection between sanitation practices and sanitation technology and vice-versa and the way in which these practices influence or inform the choice of sanitation technology.
(b) *Sanitation technology:* criteria that can be used to determine the preference and relevance/appropriateness of sanitation technologies from user and service provider perspectives (in a strictly supply-driven context where the service provider is constitutionally liable to provide free services and the user has high feelings of entitlement) are not elucidated in the literature.
(c) *Institutional arrangements:* as related to different sanitation technology and facilities provided to informal settlements have not been adequately addressed. The connection between different types of sanitation technologies and management systems is not adequately documented.
(d) *Institutional arrangements:* there is little or no understanding of (i) the functions, roles and responsibilities of various sanitation role-players; (ii) the roles of government in relation to the regulation of sanitation services in particular; and (iii) alternative institutional designs, including forums, structures and other bodies that can better address the coordination and implementation of sanitation service provision.
(e) *Decision-making process:* the decision-making process and the level of involvement of various sanitation stakeholders is not evident. Factors that drive the decision-making process, available information that can assessed in the decision-making process and the ways the final decision regarding the selection of the sanitation technology and deployment of facilities should be made are not clearly discussed in decision-making tools. While many decision-making tools advocate the involvement of stakeholders (other than government departments), their roles, responsibilities and level of involvement have not been sufficiently addressed or adequately articulated.

The subsequent chapter provides an outline of the approach and methods used for this study.

Chapter 3 CHAPTER THREE: RESEARCH APPROACH AND METHODOLOGY

This chapter outlines the approach and methodology used to collect and analyse the research findings. The research design and methodology used to address the study objectives are outlined and the rationale for the selection of the study areas and their description thereof are presented. Further, the approach for the collection of data, the sources of data and other relevant information are identified and justified, their relevance and application as well as data analysis methods discussed. Lastly, the limitations, significance, and contributions of the study as well as ethical considerations are outlined. A summary of the chapter outlining key highlights ends this chapter.

3.1 Research design

The research design is an important aspect in any research if a problem is to be addressed appropriately. To maximise information required for this study and minimise gaps, a case study approach (Yin, 2009) used a mixed methods approach (Tashakkori & Teddlie, 1998; De Vos, 2002; Creswell & Clark, 2007) where both qualitative and quantitative data collection techniques and multiple data sources were applied.

3.1.1 *The case study approach*

A case study approach was deployed as it is well suited to the complex, unstable nature and dynamic of informal settlements. Case study research is about identifying a topic that lends itself to in-depth analysis in a natural context using several sources of information (Algozzine & Hancock, 2006). Used to illuminate a decision or set of decisions: why they were taken, how they were implemented and with what result (Yin, 2009), it is appropriate because it allows for a detailed examination of the specific context where actions are taking place. This approach has been selected because of its strength in investigating phenomenon within a real-life context, when the boundaries between phenomenon and context are not clear (Crowe *et al.*, 2011; Yin, 2009). The case study approach provides an opportunity for the study population (in this case, residents of informal settlements) to voice their concerns and identify or propose solutions (Neuman, 2011). This approach is acknowledged as providing a better understanding of issues studied when experimental events cannot be controlled by the researcher and when the research questions focus on *why*, *how,* and *what*. The type of research questions developed for the purpose of this study (Appendix A) and the degree of focus on existing events satisfy these requirements and justify the employment of a case study approach.

According to Welman *et al.* (2005), a research design dealing with the investigation of empirical phenomenon is concerned with understanding social and psychological phenomena from the perspectives of people involved. Such design enables the researcher to not be solely confined to the statistical analysis of data, but also understand the behavioural conditions of the respondents in their own settings (Zainal, 2007). The case study approach is intended to respond to broader research questions, especially when dealing with stakeholders who have different interests, agendas and needs (Welman *et al.*, 2005). It is suitable for conducting research which involves many variables of interest because it relies on multiple sources of evidence and benefits from the use of specific theoretical propositions to guide data collection and analysis (Baxter & Jack, 2008).

The lack of access to sanitation services in informal settlements is a real-life problem that renders the case study approach appropriate for understanding sanitation challenges faced by informal settlement residents. This approach is justified by the fact that the provision of sanitation services involves an array of stakeholders including users who interact in situations where individual

behaviours cannot be controlled (user and service provider interface). In this study, the researcher has no control over the events occurring within the real-life context in all the five study areas during the study period. This lack of control over real-life events justifies the use of the case study approach, which is anticipated to provide evidence of the relationship between practices, technology, and institutional arrangement (decision-making process).

The case study approach responds to broader research questions especially when dealing with stakeholders who have different interests, agendas and needs. It is suitable for conducting research which involves numerous variables of interest because it relies on multiple sources of evidence and benefits from the use of specific theoretical propositions to guide data collection and analysis (Stoecker, 1991; Baxter & Jack, 2008). According to Baxter and Jack (2008), the case study approach can be explanatory, descriptive, exploratory, multiple, instrumental, intrinsic, and collective. A case study design includes both single and multiple case study design types (Yin, 2009). The multiple case study was the most suitable design for this study to capture in-depth data from five different case studies (multiple) and from various groups of respondents – non-government, civic and community-based organisations (NGOs, CSOs and CBOs) and institutions (manufacturers, vendors, municipalities) (embedded – unit of analysis). Based on the study aims, the exploratory case study provides insight into issues or helps refine a theory by in-depth study of the operation of the theory in a case (Stake, 1995). In this study, the case studies should be viewed as exploratory and descriptive (Kothari, 2006). Descriptive survey research designs are often used to develop theory, identify problems with current practice, justify current practice, make judgments, or determine what others in similar situations are doing (Sekaran, 2003). In this study, they are used to identify and understand practices (Orodho, 2003) that may facilitate or hinder access and long-term sustainability of sanitation services in informal settlements, and to prompt recommendations likely to contribute to the improvement of sanitation service delivery in informal settlements.

Despite this strength, the case study approach has been criticised for lack of robustness in that it allows biased views to influence the findings of the study (Yin, 1984). To address this weakness, preliminary steps (Yin, 2003; Stake, 1995) including the assessment of the appropriateness of the case study, selection of a good case and development of a good research design, were applied. These steps inform the selection of case studies, definition of scope of the case study and the design of data collection protocol (*ibid.*). They are followed by two phases: (i) data collection, preparation and analysis phases to test research theory through collection of data, preparation and analysis for an individual case study (Yin, 2009); and (ii) the development of a case study database (to ensure reliability and validity of data to be collected) and to draw cross-case conclusions from the comparison of cases, modifying research theory and developing new approaches or writing case studies report (Yin, 2003; 2009). In this study, the validity of data was ensured by establishing a chain of evidence through collecting information using various sources (interviews, focus group discussions and observations), developing a case study protocol based on Yin's (2009) model and consistent cross-checking and data review by key informants (see section 3.5.4.2). Qualitative data, multiple sources of data and data collection methods such as observation, interview and questionnaire are incorporated (Saunders *et al.*, 2009; Punch, 2005) to ensure a thorough understanding of the specific case under investigation, taking into consideration important factors such as context, location and complexity (Punch, 2005).

3.1.2 *Approach to data collection*

Sanitation practices are a very personal and potentially sensitive issue which require appropriate methods of investigation. The application of the case study approach combined with the co-production model discussed in the theoretical chapter of this thesis, and the IAD framework

(discussed below), is believed to grant informal settlement residents the opportunity to respond on issues pertaining to sanitation access, technology choice and institutional arrangements as related to the implementation of sanitation in their settlements. Since this study focuses on understanding the relationship between sanitation practices, technology and institutional arrangements and the impact on access to sanitation and long-term sustainability, a mixed method comprising both qualitative and quantitative research methods was chosen based on its ability to capture complex and rich data.

The qualitative research approach has been defined as a systematic way of analysing 'socially meaningful action' (Neuman, 2011) or a study aimed at describing a situation, phenomenon, problem or event (Kumar, 1999). It is a comprehensive description for all forms of social investigation that rely primarily on qualitative data including ethnography, case study research and narrative inquiry or research that aims at understanding the meaning of human action (Schwandt, 2007). The qualitative approach does so by directly observing people, and in the case of this study, the observation of the sanitation facilities and hygienic practices related to access to sanitation, all to derive an empathetic understanding of the social, technical, and institutional environment that has led to the observed situation. Qualitative research allows in-depth inquiry into subjects that may be difficult or impossible to study using experimental design or quantitative measurement (Yin, 2011). The qualitative method does not focus on measurements but rather on explanation and description (De Vos, 2002) to gather as many diverse options as possible. According to Miles and Hubermann (1994), qualitative research, requiring intense contact with a life situation, is typically reflective of the everyday life of individuals, groups, societies, and organisations. Qualitative research taps into feelings, experiences, social situations, or phenomena in their real world by studying them in their natural setting (Terreblanche *et al.*, 2006).

A qualitative study design was used as it is deemed appropriate to provide the researcher with in-depth understanding of the institutional, technical, and social aspects of sanitation service provision, particularly in the context where local governments (municipalities) are constitutionally obliged to provide basic services, and recipients (or residents) have strong feelings of entitlement. In terms of water and sanitation research, qualitative research generates information to help understand and improve the sanitation service provision (Winch *et al.*, 2000). It provides an understanding of people's personal experiences of phenomena as described by the respondents (Schwandt, 2007; Johnson & Onwuegbuzie, 2004) while enabling the researcher to identify the contextual factors of the setting as they relate to the phenomena under study. However, qualitative methods are criticised as time consuming, and for findings that may not necessarily be helpful in assessing other settings as they are restricted to a particular context, may be subject to the researcher's bias and can be quite easily influenced by personal perceptions. Quantitative data was collected using a survey to supplement qualitative data, providing statistical data which can indicate the extent of the problem.

Data collection methods included both primary and secondary sources using various tools, including a semi-structured interview schedule, observation and field notes and focus group discussions (see Figure 3.3 and further explanation in section 3.5). Multiple methods are recognised as a common approach to secure in-depth understanding of a research topic. Because of the recognised difficulty of achieving objective reality, both in quantitative and qualitative research methods, the multiple methods focus attempts to secure an in-depth understanding of the phenomenon in question (Denzin & Lincoln, 1998, in Goldin, 2005 De Vos, 2002). Goldin (2005) deploys this approach in her work on trust and transformation in the water sector, applying triangulation as an alternative method of validation (Denzin & Lincoln, 1998). The basis

for using multiple methods is thus to collect the data to triangulate evidence from multiple perspectives. Triangulation is a principle of observing from multiple perspectives (Tellis, 1997a&b) which, according to Saunders (2009), is an alternative method of data validation whereby several methods are used to validate particular findings. In our own study, data is triangulated and cross-checked to attain objectivity and replicability. This is justified by the pursuit of the researcher to comprehend the relationship between phenomena, which in this case comprise sanitation practices and technology, institutional arrangements related to different sanitation technologies provided to informal settlements, interactions between users and service providers and decision-making processes for the selection and deployment of sanitation services. The quantitative data collection method helped quantify the number of respondents who provided a particular response in relation to the study objectives.

3.2 Conceptual approach: the co-production model

3.2.1 *The co-production model and applicability to this study*

van Eijk and Steen (2014) observe that the engagement of citizens in the production of public services has escalated in importance in the study of public policy and public management. This engagement has assumed the concept of co-production, where service providers and citizens interact on a voluntary basis to improve public service provision (Pestoff, 2006). These actions on the part of the citizens include contribution in terms of time, effort, and information to provide public services or produce goods (Alford, 2009). As co-production is based on the principles of equality, diversity, access, and reciprocity (Duroze & Richardson, 2016), under the co-production model, everyone has an opinion and nobody is more important than another, everyone is afforded opportunity to participate in the debate, and there is no barrier for participation. The participative enquiry and process is regarded by Palmer and Walasek (2016) as the main value of co-production, which according to Pohl *et al.* (2010), enables the knowledge and expertise of different stakeholders to be valued based on respect, openness, and deliberation. Co-production, then, is an alternative pathway to realise changes within the context of existing institutions (Boltanski, 2011) while stimulating the conditions for successful outcomes. The provision of public services is not exclusive to public administration. There are several forms of service provision models (including supply driven and demand driven) that were especially developed in recent decades. In each of these models, a number of stakeholders are integral at various levels of responsibility. These stakeholders may have different interests, opinions and expectations, making the co-production model an ideal approach for ensuring the interests of all parties are taken into account in the production or development of the solution.

The concept of co-production is based on the principle that public services can dramatically increase resources, transform the way they operate and enhance effectiveness when the service provider works alongside the users or consumers (Joshi & Moore, 2006). The concept of co-production has been used to analyse a wide range of issues relating to how institutions and public collaborate to provide services (Ostrom, 1999) and a wide range of matters relating to the social and wellbeing of the citizens. For example, it has been used in the water sector in Venezuela, Nicaragua, and Colombia to design different types of arrangements and partnerships between citizens and the state that have resulted the process of citizen organisation and mobilisation (Llanos-Arias, 2015). It has been used in the health care sector to examine and implement new ways to improve care (Turakhia & Combs, 2017), to address water supply and sanitation issues (Gómez-Bustos, 2012) and public safety and security activities (Warren, 1984) as well as public service provision (Silvestre *et al.* 2016). This body of knowledge has revealed that co-production is motivated by the social cohesion and needs for citizens to ensure their own wellbeing. Co-production effort is accepted when the interests and wellbeing of the citizens are at stake (Ostrom,

1999). These examples reflect an expression of active citizenship and a challenge to market-oriented models for service provision (Silvestre *et al.*, 2016) and underscore the importance of co-production as model that can achieve negotiated outcomes as far as public service provision is concerned. It is clear from the discussion above that co-production is used to evaluate social, technical, and institutional issues affecting the wellbeing of citizens, take actions, develop solutions and generate interventions. It is an ideal tool (in this study) for addressing citizen wellbeing when considering access to sanitation – one of the burning social challenges faced by South African government as a whole and municipalities responsible for the provision of this essential service.

Since the provision of sanitation services in South Africa involves various stakeholders including service providers and users, and the sanitation policy made provision for public engagement to enable collaboration for finding solutions, the use of co-production inherent. This study focuses on understanding the relationship between informal settlement residents' sanitation practices, technology choices and institutional arrangements, each requiring interaction between various stakeholders; co-production is an apparent tool for guiding the study objectives. Co-production, as aforementioned, has become an important tool in this area of knowledge precisely because it is grounded on citizen engagement in the provision of public services (van Eijk & Steen, 2014) while enabling service providers to plan and make decisions alongside users. This approach has arisen from the inefficiencies of the previous models (e.g., top-down, supply-driven approaches) in which citizens are regarded as recipients of services and their opinions or inputs are ignored or under-valued (Silvestre *et al.*, 2016).

Co-production is applied to this study to better understand issues relating to inadequate access to sanitation and formulate solutions. Its application is intended to (i) provide an understanding of the institutional, technical and social aspects of sanitation and the extent to which they inform (support or hinder) access to sanitation services in informal settlements; (ii) understand users' sanitation practices; (iii) assess the applicability of sanitation technologies and facilities provided to informal settlements; and (iv) co-produce alternative institutional arrangements for sanitation service provision in informal settlements. The ultimate goal is to develop (through co-production) alternative institutional arrangements that weigh both user and service provider views and opinions. Co-production is applied, in this study, in a complex context where the government is constitutionally obliged to provide free sanitation services to under-serviced areas including informal settlements and where residents hold fervent feelings of entitlement.

3.2.2 *Application of the co-production in context*

Acknowledging both the strengths and weaknesses of co-production, it was deemed important to explain its application in the specific context of this study. While co-production remains the conceptual approach for this study, its application was achieved through the application of a model borrowed from the Institutional Analysis Development (IAD) Framework developed by Ostrom (Figure 3.1) to understand the institutional, technical and social aspects of sanitation service provision and the extent by which they inform access and sustainability of sanitation services in the policy context of the FBSan.

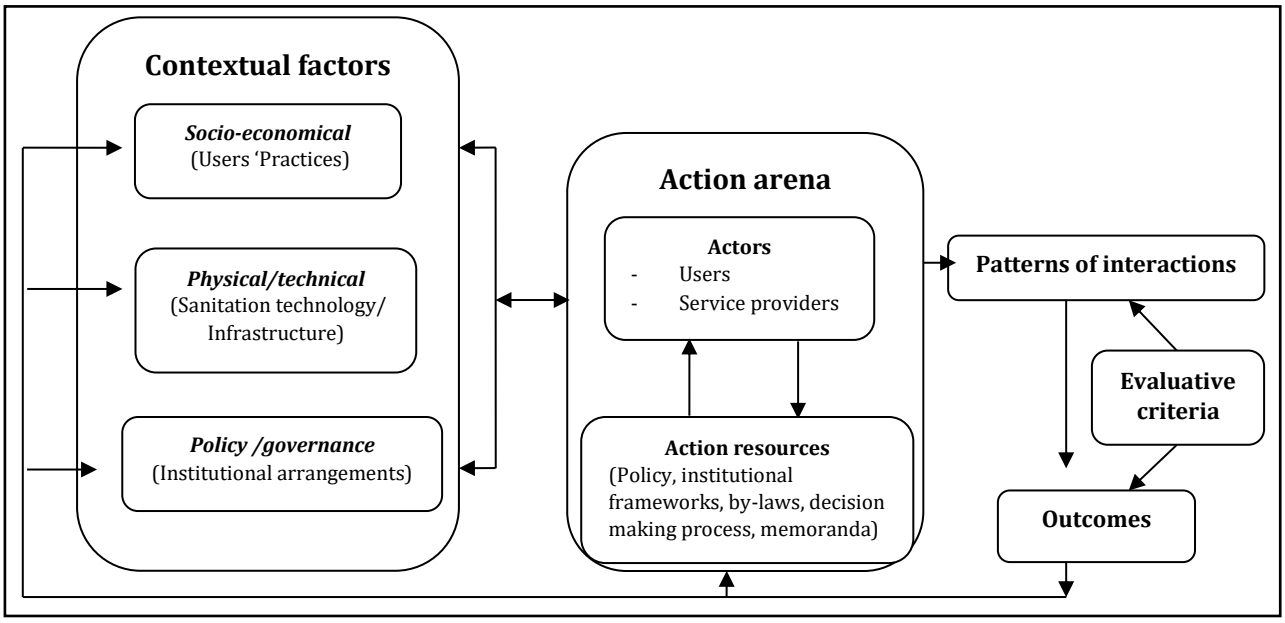

Figure 3-1: The IAD framework (adapted from Ostrom, 2005)

The IAD framework was applied to this study based on the process suggested by Polski and Ostrom (1999). This stepwise process entails defining and analysing the contextual factors, identifying actors and action resources within the action arena, identifying topics or issues that are debated, describing the patterns of interactions, and describing and analysing the outcomes of the interactions, as presented below.

3.2.2.1 Identification and analysis of the contextual factors

The contextual factors related to this study comprise the decision-making process for the deployment of sanitation services, sanitation technology (types and operational requirements, for instance), criteria for the choice and related institutional arrangements, and informal settlement resident sanitation practices. The analysis of these contextual factors was related to the variables (considered as unit of analysis) which include municipal location, land tenure, decision-making processes for selection and deployment of sanitation technology (at municipal level), technology choice and institutional arrangements at municipal level. The analysis intended for the sanitation policy is applied at case municipality level, how these municipalities located in the same province understand the sanitation policy as far as deployment and choice of sanitation technology is concerned, and what inform sanitation practices in informal settlements located in a same or different municipal jurisdiction and on different types of land tenure?

3.2.2.2 Identification of actors

The actors were identified through a threefold process: desktop study (to identify key stakeholders involved), interaction with key stakeholders (to identify other stakeholders) and selection of suitable stakeholders. In the later stage, a number of criteria – involvement in the sanitation service provision, residing in the informal settlements, participating willingly in the study – were used to select actors (see section 3.5.2). Identified actors – municipal officials, informal settlement residents, sanitation vendors/manufacturers, community leaders, non-government organisations (NGOs) and civil society organisations (CSOs) – were grouped into three categories including service providers (municipality, sanitation vendors and contractors), recipients or users (informal settlement residents) and advocacy group (community leaders, NGOs and CSOs).

3.2.2.3 Integration of the analysis in the action arena

The integration of the analysis in the action arena (that comprises actors and action resources) was achieved by introducing the themes and unit of analysis to all stakeholders. Actors, informed about the contextual factors and unit of analysis, were requested to provide their input. After introducing the themes and unit of analysis, actors were afforded opportunity to inform themselves, consider alternative courses of action, make decisions, take action, and experience the consequences of these actions. The action arena in this study involved actors (informal settlement residents, advocacy groups and sanitation service providers – both private and government) and action resources (institutional framework, sanitation policies and decision-making processes). The outcomes of this stage were the identification of the patterns of interactions: (including but not limited to) sanitation practices, access to sanitation, stakeholders and their roles, actions, level of influence and power relation, sanitation technology choice and institutional arrangements. The evaluation criteria (outlined above) then determined whether the patterns of interaction (i) were affected by the contextual factors (in this case sanitation practices, technology and institutional arrangements) and the extent to which they are affected; (ii) are aligned/supporting or contradicting/hindering the action resources (e.g., policy); and (iii) what action should be taken to ensure that the context factors are responding to user needs and settlement conditions.

3.2.2.4 Identification and outlining of the outcomes of the interactions

A thematic analysis was used to identify key themes emerging from the interaction of actors. The outcomes emanating from the patterns of interactions were identified and grouped according to themes and related sub-themes for ease of analysis.

3.2.2.5 Analysis and evaluation of the outcomes

The outcomes of the interactions were analysed by comparing the outcomes to the action resources. The evaluation of the outcomes covered the processes applied to incorporate information in the decision-making process relating to actions to be taken when deploying sanitation services, power relations and influence of different stakeholders, the way practices have informed technology, and vice versa. Content analysis (section 3.5.4) was used to evaluate the outcomes. By following the steps in the IAD framework (Figure 3.1) and using the action arena as the unit of analysis, the analysis systematically follows the path of decision making from project initiation up to the implementation and post-implementation phases. When the action arena and its associated rules are evaluated against the background of sanitation service provision initiatives in terms of their structure, management, and outcomes or performance in community engagement, the results can provide useful guidelines for decision-makers regarding the types of sanitation facilities and how, where, and when to deploy such facilities. Therefore, our approach is first to analyse what was planned as official interventions and which administrative set up has been installed, then compare the planned changes and the actual ones. The findings of the final analysis and evaluation were considered as a value proposition and further used to develop the draft institutional arrangements which were presented to all stakeholders (or actors) for validation.

3.3 Case study area: description and rationale for the selection

3.3.1 ***Rationale for the selection of case study areas***

This study was undertaken in five informal settlements in three municipal jurisdictions in the Western Cape (Figure 3.2). All these settlements were low income and lacked or relied on poor sanitation facilities. Given the unplanned nature of informal settlements, study zones (within each of the selected settlements) were established as starting points for data collection. The case study

sites were purposely selected and used to investigate the variance of the level of services as well as the different institutional arrangements in each case. The informal settlements were therefore randomly (and purposely) selected based on the number of constants and variables described below:

a) Constants

All case study informal settlements are located in the same province and are subjected to the same provincial administrative policy and by-laws.

b) Variables

Although the selected case study informal settlements are in the same provincial jurisdiction, they fall under different municipal jurisdictions. Each of the three municipalities selected have sanitation service delivery backlogs and unique, contextual challenges.

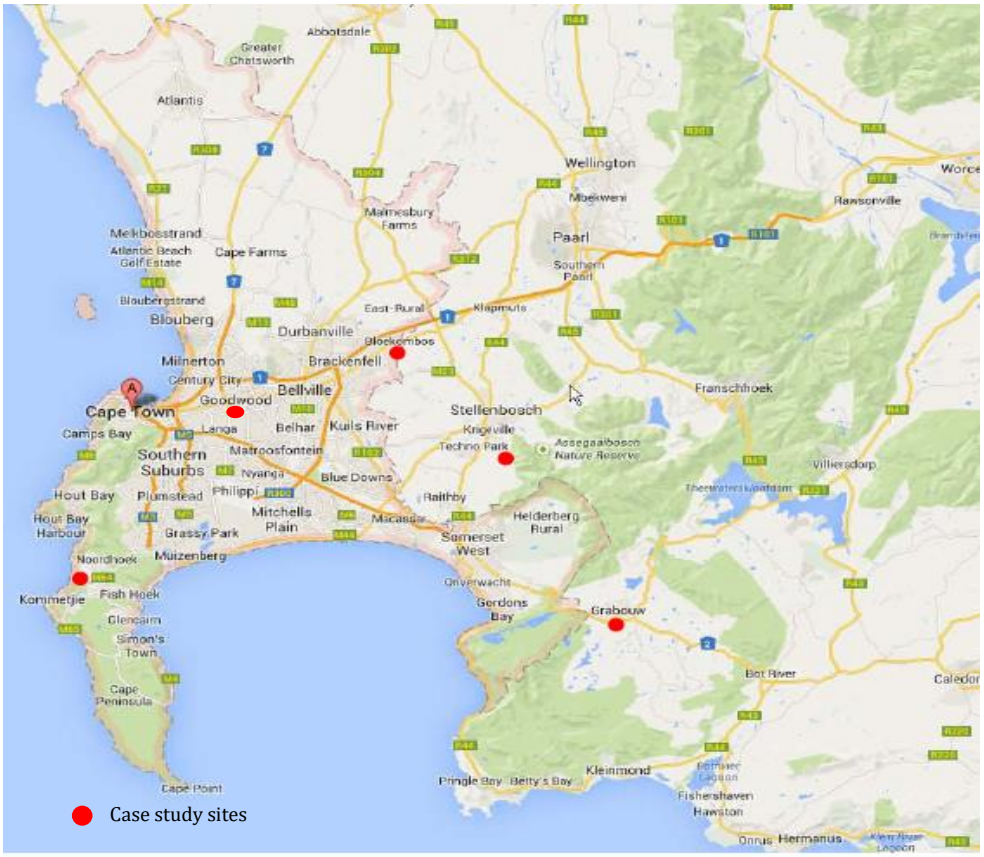

Figure 3-2: General map of the study area (Courtesy: Google Map, 2019)

The study derives information based on five informal settlements selected based on similar characteristics. These variables were used to compare different case studies in relation to the study objectives. A description of the five selected sites follows below.

3.3.2 *Description of the selected case study informal settlements*[15]

3.3.2.1 Pook se Bos (A)

Pook se Bos informal settlement, located at the intersection of Pook and Turfhall Roads, is 15 km from Cape Town in an area called Rylands, Athlone. Pook Se Bos is a small settlement in this large

[15] Throughout this thesis, alphabetical identifiers are used to present the study informal settlements **A**: Pook se Bos; **B**: Masiphumelele Wetlands; **C**: TRA Wallacedene (Embacweni); **D**: Enkanini; and **E**: Zola (Roidakke).

area, located on private land in an industrial area which restricts the service provision of sanitation. This informal settlement was established in early 1996 by a small group of casual workers (mainly coloured) employed by a manufacturing business in the Rylands area. The settlement is surrounded at one side by a road, at one side by a graveyard, and at the back by wetlands on the one side and dry land on the other. The actual population of the settlement is not precisely known, but the total number of household dwellings is 190 (based on the latest roof count by the City of Cape Town). Depending on the source of information, the total population of Pook se Bos varies around 484 (as reported by municipal officials) and 500 (as reported by the community leader) and 590 (as per the latest community census of 2016). The population is comprised of casual and seasonal workers, the vast majority of whom are unemployed and living on a social grant. Since the settlement was established on private land, temporary sanitation infrastructure comprising chemical toilets were provided. Due to the high occurrence of misuse and cost of maintenance, chemical toilets were replaced in 2009 by a communal urine diversion sanitation facility called MobiSan – the first large-scale communal urine diversion toilet in the world (Lagardien *et al.*, 2012). This facility comprises 14 toilet cubicles (two for children, five for males and seven for females) as well as thirteen 13 male urinals. In addition, porta-potty (individual portable toilet) was provided in 2013 for disabled and elderly people and for those residents situated far from the MobiSan facility. Water is supplied through five standpipes, with two containers available for the discharge of solid waste. There are no formal greywater disposal facilities.

3.3.2.2 Masiphumelele Wetland (B)

Masiphumelele (meaning 'we will succeed' in Xhosa) informal settlement is situated in the Southern suburbs, 35 km south of Cape Town in Ocean View. This settlement is located in a municipal marsh land unsuitable for human development due to the high risk of flooding during the rainy season. This informal settlement was developed by disgruntled residents of Masiphumelele, mainly backyard dwellers and newcomers in the area who could not afford to rent. According to the latest roof count by the City of Cape Town, the number of informal dwellings is 2,422. The exact number of residents varies from one source to another. The estimates provided suggest 12,000 (as reported by the community leader), 7,200 (as reported by municipal officials) and 9,000 (as per the latest census report), a variation attributed to the changing nature of the settlement that sees an increase of residents during summer season and decrease during winter due to flooding. The settlement is populated by unemployed people who often live on a social grant, informal trade, or seasonal work. Masiphumelele wetland was firstly provided with two container toilets (during its early stage in 2000) and only one standpipe and individual bucket toilets. Later in 2008, the informal settlement was connected to a sewer network and equipped with centralised toilet blocks and four water standpipes. Available services include water (supplied through standpipes), eight communal (full flush water borne) sanitation blocks comprising a total of 143 toilets, and shaded laundry washing posts and gulleys for drainage of greywater located in front of toilet blocks. Containers are furnished in each section of the informal settlement for solid waste disposal. These facilities are operated and maintained by the City of Cape Town while the daily cleaning of toilets occurs through the municipal janitorial services.

3.3.2.3 TRA Wallacedene or Embacweni (C)

Wallacedene TRA is an informal settlement located in the Kraaifontein area, 40 km from the City Centre of Cape Town. Wallacedene has several residential areas, one of these the TRA (temporary resettlement area). Wallacedene, also known as Embacweni, is intended for the temporary relocation site for residents who were removed from the initial land to make way for a new housing development. However, the TRA, although initially a temporary area, continued to grow by accommodating more people, including those who did not receive housing and newcomers to

the area. Originally located on private land, and partially a wetland, this land of approximately 6.35 hectares has been acquired by the City of Cape Town and has 1,212 dwellings erected (according to the latest count by the City of Cape Town). The number of residents, estimated from various sources, indicates about 5,000 inhabitants (reported by the community leaders) and 6,000 (reported by municipal officials). In this instance, StatsSA only provides figures for the total population of the entire area, making it difficult to disaggregate the actual population of the TRA and the rest of the area. A study by Stellenbosch University in 2015 found that the average household size in TRA Wallacedene varies between six and eight. According to local leaders, the average household size is actually between four and five. According to the Stellenbosch University study, the total number of people ranges between 6,500 and 9,600. The area is mainly populated by a Xhosa speaking population and a small number of coloured residents. Many of the residents are casual and seasonal workers, municipal cleaners, or informal traders. Wallacedene TRA has been provided with basic infrastructure including water stand posts and ten communal (full flush waterborne) sanitation block comprising a total of 241 toilets. Containers have been furnished for discharging solid waste and gulleys (next to toilets) for discharging greywater.

3.3.2.4 Enkanini (D)

Enkanini (meaning 'taken by force' in Xhosa) informal settlement, situated at the edge of Stellenbosch, 45 km northeast of Cape Town, specifically in Stellenbosch (the Cape Winelands District Municipality, is located on municipal land situated between Kayamandi and a natural reserve. Formed in 2006 by migrants from the Eastern Cape who initially lived in the neighbouring Kayamandi township, Enkanini informal settlement was initially a series of shacks erected in the open space next to the township. There is a conflicting report regarding the number of dwellings (shacks) and people living in this settlement. As with the other settlements, different sources have their own statistics that often diverge. The number of informal structures is 2,492 (according to CORC, 2012), 2,500 (according to community leaders) and 2,650 (according to municipal officials referring to Stellenbosch municipality, 2013). Another source (Tsama Hub) estimates the number of residents as ranging between 8,000 and 10,000 people. This informal settlement is divided into nine sections which according to CORC (2012) have a total number of informal structures equal to 439 (section A), 520 (section B), 258 (section C), 213 (section D), 144 (section E), 243 (section F), 154 (section G), 341 (section H) and 182 (section I).

Enkanini has been furnished with 36 water standpipes positioned at the sanitation facility. The settlement was connected to a sewer network in 2009 – with eight centralised toilet blocks (comprising ten toilets each). During the early development of the settlement, there were no sanitation services at all, and residents were forced to use the bush and wetland surrounding the area. After the recognition of the settlement by authorities, bucket toilets were provided to each household and later replaced by chemical toilets. Due to the high occurrence of vandalism, these toilets were replaced by container toilets which in turn were often misused and vandalised (theft of doors and other metallic devices). Given that these toilets were not maintained, secured, or dignified, residents adopted other practices such as open defecation, use of neighbouring facilities or night soil until the Kayaloo sanitation technology (a communal portable waterborne sanitation comprising 10 toilet block each) was introduced. To date, only five toilets blocks are operational (but lacking doors, latches, blocked or lacking pedestal). Other sanitation infrastructure privately owned in the area includes one Enviroloo dry toilet (located at a crèche) and VIP toilet (at the Stellenbosch University Research Office). Currently Kayaloo is the main sanitation technology provided to Enkanini. It should be noted that those living in the new settlement extension do not yet have access to any service. This area is not serviced; hence residents choose either nightsoil or open defecation.

3.3.2.5 Zola or Rooidakke (E)

Grabouw, one of the eight towns that constitute the Theewaterkloof district municipality in the Western Cape of South Africa, is situated 80 km east of Cape Town on the N2 national road and has five recognised informal settlements including Roiddakke, Iraq, Marikane and Zola. These informal settlements are located on government land – a Cape nature reserve (Figure 1) only partially suitable for human development. The population (predominantly seasonal workers from the Eastern Cape) is significantly influenced by the dependence on agriculture and manufacturing sectors. Zola informal settlement was initiated in 1993 following the eviction of settlers from the land previously occupied. The number of people living in this area is not precisely known because of the transient nature of migrants (most of them seasonal workers who move from one town to another seeking job opportunities). The current population of Zola informal settlements is estimated (according to the community leaders) at about 900 people (predominantly Xhosa) living in about 235 informal structures (IDP, 2014). The exact number of residents is not precisely known by municipal officials.

Like many other informal settlements, different sanitation infrastructure was provided during different developmental phases. These include bucket toilets, chemical and container toilets and now communal waterborne toilets of two types: communal flush toilets and Kayaloo. Prior to the provision of these services, open defecation, and the use of nightsoil (also known as night pails) were practiced widely. Currently, Zola informal settlement is furnished with four water standpipes, three communal waterborne sanitation facilities comprising a total of 58 toilets of which only 24 are functional. Despite the availability of sanitation facilities, the use of nightsoil and open defecation are still widely practiced, especially during night.

3.4 Research steps and methods

3.4.1 ***Study population and research respondents***

3.4.1.1 Study population

The study population consists of adults above 18 years of age. To be eligible, respondents were subjected to a number of criteria including being a resident of informal settlements, service providers (municipal officials), contractors (who provide service on behalf of municipality), sanitation manufacturers and civic organisations working directly or indirectly to attain sanitation provision in informal settlements. Respondents in this research were selected in two phases using purposive and snowball sampling methods (Morgan, 2008). Respondents were drawn from two units of analysis. The first is the service provider (in this case municipal officials and their affiliates) within each of the three municipal jurisdictions (City of Cape Town, Stellenbosch and Theewaterkloof) and secondly, the public (in this case residents, their leaders and civic organisations) within each of these five informal settlements. Eligible respondents were residents of case study informal settlements, community leaders, non-government organisations (NGOs), community-based organisations (CBOs) and civil society organisations (CSOs), contractors, municipal officials, janitors and sanitation manufacturers or vendors[16].

3.4.1.2 Sampling

Sampling is defined by Kumar (1999) as a process of selecting a few (a sample) from a bigger group (the sampling population) to become the basis for estimating or predicting a fact, a situation or outcome regarding the bigger group. Two types of sampling methods, namely purposive and snowball sampling, were used in this study. The purposive sampling approach, also known as judgemental, selective, or subjective sampling, is a non-probability sampling technique that is used to identify stakeholders who are knowledgeable and experienced in the field of study. A non-

[16] Sanitation manufacturers, vendors, janitors and contractors are referred to as sanitation entrepreneurs.

probability sampling is suitable for research that follows qualitative, mixed methods, and even quantitative research designs (Onwuegbuzie & Collins, 2007), particularly useful in exploratory research where the aim is to discover the existence of a problem in a quick and inexpensive way (*ibid.*). Non-probability sampling techniques can be viewed in such a way because units are not selected for inclusion in a sample based on random selection, unlike probability sampling techniques (*ibid*). Their use is justified by many factors, the most important being the lack of access to a list of the population under study, the changing nature of the study area and uncontrolled population patterns (Neuman, 2003). Unlike probability sampling, the goal is not to achieve objectivity in the selection of samples, or necessarily attempt generalisations (i.e. statistical inferences) from the study sample to the wider population of interest (Onwuegbuzie & Collins, 2007). Instead, researchers following a qualitative research design tend to be interested in the intricacies of the study sample (*ibid*).

A non-probability sampling technique is suitable in three situations: (i) a researcher has a choice to select a sample that will provide the information sought; (iii) a researcher has access a sample that is difficult to locate; and (iii) a researcher intends to identify a particular class sample so as to obtain in-depth information related to the study (De Vos, 1998; Neuman, 2003). Purposive sampling allows the researcher to sample a small number of participants by using different non-probability sampling techniques, such as critical case sampling, homogeneous sampling and more (Neuman, 2003). However, it has a limitation in that judgement lies solely with the researcher, increasing the risk of bias (Onwuegbuzie & Collins, 2007).

Snowball sampling is a non-probability-based sampling technique that can be used to gain access to such populations. It is particularly appropriate when the target population is hidden or hard-to-reach (Faugier & Sargeant, 1997) which is the case with transient and unstable populations in informal areas. Snowball sampling techniques, involving individuals recruiting other individuals to take part in a piece of research, was adopted to find respondents based on their ability to provide information related to the sanitation issues experienced in informal settlements. This method has been criticised, however, because of lacks first-hand identification of the right person, but relies on recruited individuals by recruiters and the unknown or secretive nature of some social groups. This gap was mitigated by cross-checking and subjecting snowballed respondents to the eligibility criteria discussed above. This cross-checking weeded out unsuitable candidates, leaving a sample of suitable respondents required for the study.

Respondents used in this study were purposively selected to meet the informational needs of the study (Patton, 2002; De Vos, 1998) and to reflect a range of people meeting the two main categories (users and service providers). The selection of respondents involved in the study was based on the researcher's judgement: the intention was to select respondents with a specific purpose in mind (Neuman, 2003) and in this case, those who are knowledgeable regarding sanitation, who play certain roles in sanitation provision (reference is made to institutions) and those residing in the study areas or being affected by lack of, or poor access to, sanitation (informal settlement residents, community leaders). The selection criteria included demographics such as gender, age, occupation, level of education and income level as well as variation in location and other socio-demographic characteristics.

According to Mouton (2001), a typical case study sample involves fewer than 50 cases. However, due to the minimal control over the number of respondents and the multiple (embedded) design types of the study, a consistent sample was drawn with respect to size. In this case, the sample was not intended to be statistically representative, as indicated by De Vos (1998) and Onwuegbuzie and Collins, (2007), but to guarantee the inclusion of different groups and

categories of informal settlement residents. Specifically, a range of 60 to 80 respondents was targeted (Morse, 1994; Creswell, 1998; Kuzel, 1992) for each of the five informal settlements.

Respondents in each case study informal settlement were identified through a three-step process that started with the consultation of 'key informants' including community leaders, NGOs, CSOs, CBOs, municipal officials[17] and sanitation entrepreneurs[18]. These respondents were identified during the preliminary field work through which observation and informal interviews were conducted with community leaders, 'willing' residents and organisations operating in informal settlements. A snowball sampling method expanded the number of respondents to attain the required number and to ensure that all stakeholders are represented. This was achieved by asking the initial group of respondents, referred to as 'key informants', to identify individuals in their community who they thought met the criteria mentioned above. The third step in the process entailed the confirmation of the eligibility (determined by the criteria presented above) of each of the purposively selected respondents.

Eligible respondents were then categorised according to certain criteria – their positions, interests, rights, responsibilities, relationships, and levels of influence – using the stakeholders' power tool (Reed *et al.*, 2009; Mayers, 2005) to ascertain their level of participation in sanitation concerns. Depending on the size of the settlement and willingness of respondents to be part of the study, the number of respondents recruited in each case study varied between 77 and 92 (as depicted in Table 3.1).

Table 3-1: Sample size of study respondents

Category	Municipal jurisdiction					∑
	City of Cape Town			Stellenbosch	Theewaterkloof	
	A	B	C	D	E	
Municipality	1	1	1	2	2	7
Residents	71	70	76	82	84	383
Comm. leaders	1	2	2	1	2	8
Contractors	0	0	0	1	0	1
Janitors	2	2	2	2	0	8
Manufacturers	1	0	0	1	0	2
CBOs	1	1	0	1	0	3
NGOs/CSOs	1	1	1	2	0	5
	78	77	82	92	88	417

Respondents (in the category of residents) included male (46% n = 176) and female (54% n = 207) with an age range between 18 and over 60 years. They were predominantly unemployed (32.5% n = 124), informal traders (12.3% n = 47), casual workers (36.7% n = 141), pensioners (5.6% n = 21) people with disabilities (2.4% n = 9) as well as other non-classified (10.7% n = 41). Other respondents selected included seven municipal officials, eight community leaders, one contractor and eight cleaners, two sanitation manufacturers, two non-government organisations, three community-based organisations, and finally, three civic organisations.

3.4.2 *Data collection methods – tools and their application*

The study activities lasted six months including sixty (60) intervallic field workdays during which surveys, interviews, observation and FGDs were conducted. In attempting to answer the research questions of this study, a range of data collection tools, as described in the research design, were

[17] Municipality and municipal officials are also referred to as service providers.
[18] Sanitation manufacturers and contractors are also referred to as entrepreneurs or sanitation entrepreneurs for their roles as service providers acting for or on behalf of municipalities.

deployed. Data was collected from five informal settlements in the Western Cape Province that exhibited low socio-economic attributes including low income and lack of or poor sanitation facilities (see profile of study settlements in section 3.4.2). Given the unplanned nature of informal settlements, study zones within each of the selected settlements were established so as to delimit the study area and function as starting points for data collection. This was intentional to minimise overlaps and exclusion given the unplanned and congested habitations in such settlements.

Since this study involves the assessment of the institutional, technical, and social aspects of sanitation, multiple data sources were required (as suggested by Saunders *et al.*, 2009; Punch, 2005) to alleviate weaknesses of the case study approach and ensure sufficient data collection. The data collection process was undertaken in several phases over a period between March 2017 to June 2018. The first phase (March to May 2017) was the initial stage during which relevant documents were identified, accessed, and reviewed and important information related to the study collated. This phase was also used to identify and liaise with key informants in all study areas and extract relevant information. The second phase (June to August 2017) entailed the expansion of the initial sample of informants where stakeholders were formally identified and those who were eligible were recruited for the study.

The third phase (October to December 2017) was dedicated to the first phase of data collection. A series of interviews (face-to-face, individual and group) with service providers, advocacy groups and sanitation manufacturers, vendors and contractors were undertaken. The fourth phase (December 2017 to April 2018) was dedicated to focus group discussions and observations in each of the five study areas. Follow-up interviews and observations (November 2017 to June 2018) constituted the fifth phase of data collection which was intended to collect additional information following the initial collation. The final stage was the validation workshop (September 2018) where key stakeholders gathered to validate information and findings of the study. Two major data sources, namely primary and secondary (Figure 3.3), have been used in this study.

3.4.2.1 Primary sources

Primary sources are first-hand information that is not readily available but obtained through interactions with study respondents using various methods and techniques. Primary data was collected using an ethnographic approach (Kawulich, 2005) and multiple methods and techniques including interviews (individual semi-structured, face-to-face, and telephonic), surveys, indirect and participant observations, focus group discussions and field notes (Babbie & Mouton, 2001).

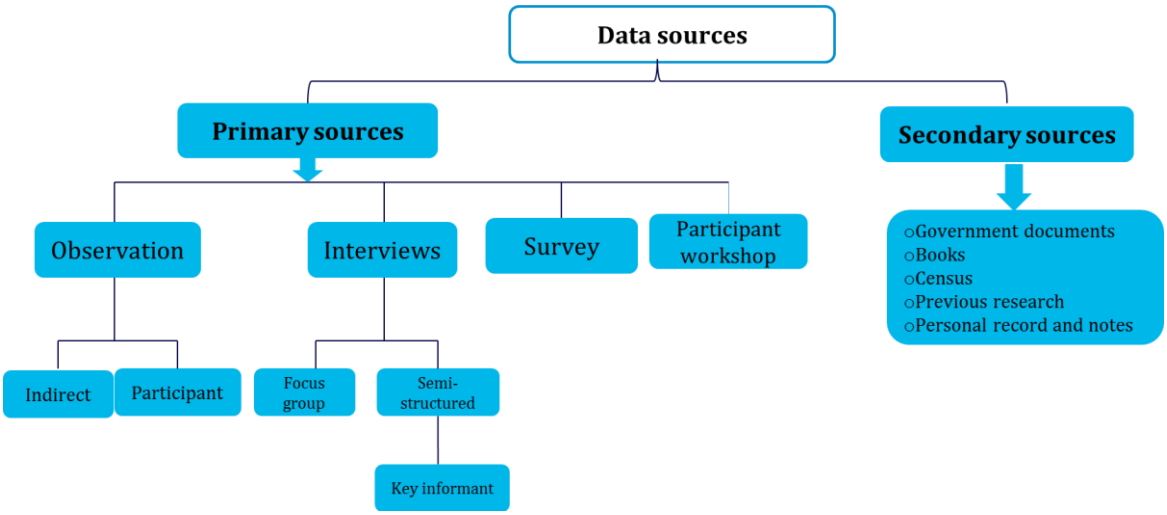

Figure 3-3: Data sources and collection methods

a) Interviews (semi-structured)

An interview, a verbal conversation between people with the goal of gathering relevant information, is used in qualitative research as a structured method for capturing a multitude of stakeholder views (Kvale, 1996). Interviews offer more flexibility with regard to the question content and facilitate the interviewer to unobtrusively observe respondents and their surroundings (Gubrium & Holstein, 2001). Semi-structured face-to-face interviews can be used to collect information from a wide range of people (Bernard, 2006). Semi-structured interviews enable researchers to cover the topic of interest in-depth and to better discern the situation at hand (Cavestro, 2003). In so doing, the researcher, although exerting minimal control, and is able to steer the discussion to cover the topic of interest and capture different practices, opinions, beliefs and behaviours (Bradley, 2009). It is best suited to answer questions related to perceptions, social relations and to answer *why* questions that are usually difficult to answer through standardised questionnaires.

The interview schedule (designed in accordance with the co-production framework discussed in the theoretical chapter of this thesis) was organised under different themes pursued by the study and used to gather data from different categories of respondents. Questions (covered in the semi-structured interview guide, Appendix A) were purposively tailored according to the position, roles, and influence of each respondent within the sanitation provision sector or decision-making process. Individual and group interviews were conducted as appropriate for each group of stakeholders (Beitin, 2012). Due to the nature and stature of various interviewed stakeholders, the questions asked followed a similar progression but could include all or only some of the questions from the original list. In total, five self-administered and two telephone interviews, five group and 11 individual interviews were conducted with respondents excluding informal settlement residents. In general, there was no major difference except where questions were directly related to the use of the facility and the feelings of informal settlement residents. The questionnaire was administered by the researcher primarily through face-to-face and telephone interviews. Where conditions did not permit, or in cases of more than one respondent, group interviews (in the form of mini focus group discussions) were organised. This type of interview was conducted primarily with NGOs and CBO/CSO representatives and community leaders.

The interviews were conducted in sequence, firstly with municipal officials, sanitation entrepreneurs, CSOs and CBOs and community leaders. On average, key informant interviews

lasted 60 minutes. Collected data was captured on the questionnaire sheet, and then recorded and transcribed into a report that was further verified and analysed for completeness. Follow up interviews were conducted when collected data was deemed insufficient, contradictory, or absent. During the interviews, respondents were requested to provide (where available) any document or evidence that could substantiate their responses. Included amongst documents accessed were court (order) documents related to the status of the land, memoranda, by-laws, minutes, and deliberation decisions as well as statistical information related to the number of dwellings, facilities and maintenance schedule. The content of interviews with informal settlement residents is outlined in Appendix C.

b) Survey

Prior to the focus group discussions (FGDs), a survey was disseminated throughout the five informal settlements using the same questionnaire described above. Three hundred and eighty-three (383) residents from the five informal settlements were involved in face-to-face surveys. Seven municipal officials were involved in a self-administered survey and returned complete questionnaires. The intention was to collect quantitative data to supplement qualitative evidence by providing statistical measures to provide an indication of the extent of the problem under investigation. The results of the snap survey are outlined in Appendix B.

c) Focus group discussion

A focus group, a method to congregate people from similar or varied backgrounds or experiences to discuss a particular topic of interest (Krueger, 1988), has been used to understand *how* or *why* people hold certain beliefs or opinions about a topic or programme of interest (Krueger, 1988). Focus group discussions (FGDs) are beneficial for exploring the meanings of survey findings that cannot be explained statistically and a range of opinions on a topic of interest (Stewart & Shamdasani, 1990; 1998). It can be useful in providing insight into different opinions among different parties involved in a given process, thus enabling the process to be managed more smoothly. The strength of this method relies on allowing the participants to discuss (whether agreeing or disagreeing with each other). Such discussion sheds light on how participants think about an issue, the range of opinions and ideas, as well as the inconsistencies and variations that exist in terms of beliefs, experiences, and practices (Morgan, 1988). This method is justified by the need to capture respondents' perspectives and glean for more in-depth information pertaining to the study's aims and to better understand investigated issues. It was used to capture views of various stakeholders, validate information gathered and formulate recommendations.

The FGD was adopted in this research to glean insights into various sanitation related issues experienced by residents. Given the complex nature of informal settlements and the fluidity of their residents, FGDs were conducted in each of the case study informal settlements. A total of five focus group discussions were conducted with all qualifying, eligible residents who were available and willing to participate. Respondents of each of the FGDs were divided into four groups of 17 to 21 people each. Depending on the level of engagement and discussion arising during the session, the average time required to conduct an FGD ranged between 90 to 120 minutes. While targets for the FGDs were 60 participants per study area, there were in fact more than that expected (Table 3.2). The sample studied was not intended to be statistically representative; it represents between five and 15% of the study's settlement populations.

Table 3-2: Number of FDG respondents in relation to the total population of the study area

Informal settlement	Total population	Number of respondents	%
A	450	71	15.78
B	1,370	70	5.11
C	900	76	8.44
D	1,200	82	6.83
E	1,374	84	6.11
	4,794	383	7.99

The high level of attendance is attributed to the willingness of residents to participate in the research and voice their concerns, motivated by the array of challenges associated with access to basic services, lack of access to sanitation and poor living conditions faced by residents.

The FGD was facilitated by the principal researcher and co-facilitated by three assistants. The questionnaire was handed to each participant with those unable to read or write assisted by the research assistants. Themes pertaining to the research (refer to Table 3.3 in section 3.4.3.1) were presented and stakeholders were asked to provide their input and discuss responses. Facilitation by the principal researcher entailed reading the question and asking respondents to tick the right answer or provide their own answer with further explanation in cases where the proposed responses were inadequate. Co-facilitators were to provide guidance to respondents (without interfering in the process) by explaining the questions posed by the facilitator and encourage the completion of the questionnaire.

Information provided by respondents was collated. This process involved, firstly, the verification of the completeness of the questionnaire handed back by respondents, and secondly, capturing demographic information. This was followed by reading, coding, and capturing responses in a spreadsheet where similar responses were placed on one side and different or neutral answers on another side. Similarities and differences were captured and noted for further analysis. The final document containing respondents' responses was drafted based on stakeholder input.

d) Observation and field notes

The ethnographic approach (observing interaction between people who are going about their everyday lives and performing normal activities) was used to better understand informal settlement residents' sanitation practices. Observation, a method for gathering data when conducting social-ethnographic studies, gives a systematic description of the events, behaviours and artefacts of observed people (Marshall & Rossman, 1989). Observation as a data collection method is classified as indirect or participant. Participant observation entails extended involvement in the daily lives of people (or social groups) under study (Guest, 2014) allowing researchers to share the same experiences as those under observation. Indirect observation entails the collection of information through visual means without interference in the daily operation of the subject or activities of the study population.

In the context of this study, both participant and indirect observation were used so as to have an experience of the sanitation practices, contextualise the condition of the facilities, ascertain the situation on the ground and broaden understanding of residents' sanitation behaviour and practices (e.g., access to facilities, use of facility, for example) beyond verbal representations. These observations allowed for a better interrogation of the results obtained from interviews, FGDs and documentary review. Observation was undertaken during two phases: (i) the researcher observed informal settlement residents' daily activities without interference over a period of three days; and (ii) the researcher was involved in the daily activities in the informal settlement for a period ranging between two and four days in each of the selected case study sites.

The observation checklist (Appendix D), covering five observable themes including availability of infrastructure, conditions and access, resident sanitation practices and maintenance, was developed and other observable aspects of the study were used. There was no interference around the issue of access and the daily functioning and operation of the facility during the observation, and no direct questions were asked of people who were observed. Since there was more than one sanitation facility in all study areas (except informal settlement A), three assistants (acting as observers) were deployed at randomly selected facilities. Where facilities were close to each other, the observer was posted at a crucial position with adequate views of both facilities and could recording information carefully. Observation was supplemented by visual documentation comprising field notes and photographs. Observation and field notes and visual renderings provided an accurate view of people's culture and practices, allowing the researcher to describe and contextualise people's feelings and perceptions, the interactions between people and the interactions between people and sanitation facilities.

During and after this period, the researcher remained connected to residents and took part in activities that were happening in the study areas, when appropriate. Follow up observations and site visits were conducted weekly (between March and September 2018) or whenever there was an event occurring on site. The intention of each follow-up observation was to check whether any new development or change in the current setting of the study area might have occurred. In this way, the researcher was connected to the case studies on a daily basis, using existing networks to gather information in an iterative manner for the duration of the research.

The researcher also spent time at service provider and other stakeholder offices to interact on various issues and activities pertaining to the provision of sanitation service. Issues discussed included the deployment of services, operation, and maintenance, monitoring and evaluation, decision-making processes, technology choice and institutional arrangements. Regular visits were maintained during the study period. The intention was to collect any additional information that may inform the study aim and supplement data previously collected.

e) Validation

The aim of this study was to ascertain the relationship between sanitation practices, technology and institutional arrangements and the extent to which they support or hinder access to sanitation and long-term sustainability. The ultimate goal is to produce a set of institutional arrangements that incorporate users and service provider perspectives while considering user practices and settlement conditions. Validation is a process by which the researcher goes back to the source to ascertain the integrity of data (Babbie & Mouton, 2001) by checking any source of error. The validation workshop (where eligible respondents gathered) was convened with the intention of discussing the final findings and outcomes of the study. The validation process was undertaken in two phases: (i) the validation of the findings which was undertaken in each of the study areas; and (ii) the validation of the final findings (study outcomes) where only a sample of representatives of each respondent group was invited.

Respondents attending the final validation process were selected according to their roles, position, function, and their knowledge of the sanitation sector. Findings and outcomes of the study were handed to respondents and presented by the principal researcher. During the validation process, respondents were invited to express their views on the findings and give input into what they thought the proposed institutional arrangements should be. Inputs emerging from this engagement were captured and further analysed. The final outcomes of the analysis were used to inform recommendations from which the proposed institutional arrangements emerged, as stipulated in the study objectives.

3.4.2.2 Secondary sources

Secondary data is defined as information that is already available but needs to be extracted in a meaningful way (Brannen, 1992). In this study, secondary data was collected through a desktop study during which various documents were reviewed to extract relevant information. The desktop study began with the clustering of documents related to the study according to their content and type of information contained. Collated documents included census information, articles, journals, books, magazines, news articles, NGO/CSO reports, policy documents, government gazettes, circulars, by-laws, institutional arrangements, legal frameworks, the Constitution of South Africa, guidelines for the selection and deployment of sanitation services, Water Service Development Plans, and Integrated Development Plans[19], the National Development Plan, strategic framework, legal documents and other literature sources. Additional secondary data was obtained from NGOs and organisations wherein vision and mission statements, regulations and other legal documents were recorded. All documents were reviewed, and information was extracted, collated, and grouped according to the study objectives. This review served as background information and main sources of information on both scholar, government, and practitioner concepts of sanitation service provision, further enabling the consideration of relevant theories and concept for this study.

The document review process thus focused on documents and reports covering the provision of sanitation in the informal settlements. The review provided information on the policy context for sanitation provision, institutional and governance processes and outlined key issues pertaining to the study, identifying gaps, and responding to research questions developed for this study. The intention was to gain an understanding of the South African policy context for informal settlement sanitation services. Details are presented in Appendix E.

3.5 Data analysis

3.5.1 ***Data analysis***

The process of data analysis, as written by Neuman (2011), is referred to as a way of systematically organising, integrating, and examining data to search for patterns and relationships. Content analysis was used in this study because of the nature of the research where numerous respondents were involved and multiple data sources used. According to Stewart and Shamdasani (1998), content analysis comprises procedures for collecting and organising information from any form of communication that carries meaning in a standardised format which makes inferences about the characteristics and meaning of information. This approach involved the identification of study themes and sub-themes following multiple readings of the qualitative data (e.g. interview and field notes). Content analysis is a basic technique that involves counting the frequency and sequencing of particular words, phrases, or concepts to identify key words and themes (Welman *et al.*, 2005). This basic technique allows the researcher to rely on the recurrence of words and themes (Neuman, 2003) and identify those that are significant to the study. Welman *et al.* (2005) consider this technique inductive because the identified themes are not imposed by the researcher but emerge from the collected data. Content analysis is regarded as a non-reactive technique because the process of placing words, messages, or symbols in a text to communicate to a reader or receiver occurs without influence from the researcher who analyses its content (Neuman, 2003). The choice of content analysis for this study is justified because the extensive interaction between the researcher and respondents produced information that is assumed to be a true reflection of people's feelings and concerns regarding the issues discussed.

[19] The Integrated Development Plan (IDP) is a mandatory 5-year strategy document which outlines priority development areas for the municipality.

Content analysis was applied using the framework advanced by Graneheim and Lundman (2004) to identify manifest and latent content in the discussion and interview scripts (Kondracki *et al.*, 2002). Data analysis for this study was undertaken once data from both primary and secondary sources had been collected. Primary data was analysed thematically using the content analysis method. This stepwise analytical process commences with consideration of the subject as a whole. The analysis started with the sorting and collation of data and culminated in manual coding[20]. These initial codes where then grouped into emerging themes which in turn were further divided into sub-themes. This was followed by the evaluation of each theme and a comparison between themes with an interpretation of the findings. Data collected through the documentary review and experience pertaining to the provision of sanitation, policies, and regulatory framework (at local, provincial and national levels) was thematically analysed using content analysis. The analysis was intended to check and potentially corroborate evidence gathered from interviews, focus group discussions and observations. Emerging themes and sub-themes (depicted in Table 3.3) were identified after reading all FGDs and interview responses.

Identified themes and sub-themes were compared for consistency, after which they were further analysed. Sub-group analysis which involved examining the themes and sub-themes in relation to FGDs and various key informants' interviews (municipal officials, community leaders, sanitation manufacturers and vendors, contractors) was conducted. In attempting to understand the relationship between user practices, technology and institutional arrangements, the analytical comparison – a technique that contrasts between agreement and difference (Neuman, 2011) – was used.

Table 3-3: Themes and sub-themes emerging from the analysis of data

Themes	Sub-themes
Institutional, technical, and social aspects of sanitation	○ Institutional aspects of sanitation ○ Technical aspects of sanitation ○ Social aspects of sanitation
Sanitation practices and related impact on access and sustainability of services	○ Sanitation infrastructure provided and used in informal settlements ○ Resident sanitation practices and reasons for their adoption ○ Impact of sanitation practices on access, functioning of facilities and long-term sustainability of services ○ User and service provider valuation of sanitation services provided to informal settlements ○ Relationship between sanitation practices and technologies
Applicability of sanitation technologies to informal settlements, institutional arrangements and impact on access	○ Perspectives on types and features of sanitation technologies provided ○ Knowledge of operational requirements of sanitation facilities ○ Understanding and perspectives on institutional arrangements for sanitation services ○ Impacts of sanitation stakeholder perspectives on access and sustainability of sanitation services
Institutional arrangements for sanitation service provision	○ Proposal for improving institutional arrangements

Descriptive analysis was used to analyse quantitative data. The descriptive statistical tools were used in describing the data. Microsoft Excel was used to generate quantitative reports through

[20] Coding was in accordance with Braun and Clarke's (2006) six-step approach to analyse data. The coding was performed by reading data, generating, and inserting initial (numerical) codes into the transcripts. Thereafter, codes were grouped into emerging potential themes. The identified themes were defined, refined, and named. The selected themes were analysed to form the basis for the discussions and observations in this thesis.

tabulations, percentages, and measures of central tendency. All responses were presented in tabulated formats to facilitate comparison. Percentages were used because of the ease of simplifying data by reducing all the numbers into range between 0 and 100 and translating data into a standard form with a base of 100 for relative comparison (Cooper & Schindler, 2003).

3.5.2 *Reliability and validity*

Scholars have been debating whether the concept of validity should be applied to qualitative studies. Although a number of studies (e.g., Winter, 2000; Creswell, 1998) have rejected this concept, many others (e.g. Merriam, 1998; Neuman, 2011) note that validity suggests truthfulness of the data while reliability is applicable when a study is consistent, reasonably stable over time and across researcher methods. In this study, reliability and validity were applied as measures for credibility of research, and triangulation is supported in this regard (Tellis, 1997b; Saunders, 2009). As previously mentioned (section 3.5.1), the validity of data was ensured by establishing a chain of evidence by collecting data from a range of sources including interviews, focus group discussions and observations (Saunders, 2009), developing a case study protocol based on Yin's (2009) model, and consistent cross-checking and data review by key informants. Daily briefing and debriefing sessions were organised before departure to sites and after data collection to ensure that instructions are provided and observed, and challenges resolved that may have been encountered during the day. Data gathered during the day was then checked for completeness by cross-checking responses against the questionnaire. This has the advantage of filling weaknesses or gaps in data that might occur for a given method, thereby strengthening the overall quality of the results.

3.6 Ethical considerations

This study was approved by the ethical committee of the Engineering Faculty of the Cape Peninsula University of Technology (ethical clearance approval in October 2017 – Appendix F). Clearance (Appendix G) was obtained from the local municipalities and local leaders in all five informal settlements. To obtain the necessary cooperation and support, the research was introduced to relevant stakeholders within and outside the five settlements. Stakeholder structures were identified and visited to explain the purpose of the research. Community leaders and NGO/CSO and CBO representatives were asked to escalate information to their bases to present the study and determine the expected contribution from settlement residents. Permission was obtained from the authorities and respondents in the form of written consent (Appendix H) for the interviews (Munhall, 1988; Field & Morse, 1985). Where condition was not permitting (e.g. FGD where a large group of respondents gathered), verbal informed consent was obtained from all respondents in their language. Respondents were informed about the strict confidentiality of their responses and the rights to which they were entitled (including their right to decline to answer any question if not comfortable), the legal liabilities of their participation, privacy of information provided, and their right to withdraw from the interview, survey or FGD at any time should the topic make them uncomfortable. They were advised on their status as volunteers and informed that no reward would be given for their participation.

3.7 Limitations of the study and sources of errors

This study is confined to the provision of sanitation services in informal settlements of South Africa in general and the Western Cape in particular. It has been carried out in a context where local government is obliged to provide Free Basic Services (FBS) to citizens including informal settlements. The study includes only aspects related to institutional, technical, and social aspects of sanitation service provision in a broader context. Any other aspects not related to the themes

highlighted above, including design and technology assessment, policy, economic factors and health and hygiene, as well as the analysis of broader macro-social influences such as ethnicity, religion, beliefs, political affiliation, and social status, are beyond the scope of this study. Since the case study approach was used to guide this research, subsequent findings may not be generalised (Mouton, 2001). The use of the purposive sampling method to select respondents might have a certain level of bias which may influence results. Given the lack of control over the study population and transient nature of informal settlements (in terms of movement of people) our findings may be limited in terms of time and space. While the outcomes of this research are confined to the specific context of the Western Cape, replication may only be possible provided that the study areas exhibit similar characteristics.

3.8 Summary

This chapter has outlined the approach and methodology for collecting data and other relevant information required to address the aim of this study. The qualitative research approach using multiple (embedded) case study design has been used, an approach suggested because of its strength in investigating empirical phenomenon within a real-life context, especially when the boundaries between phenomenon (in this case access to sanitation) and context are not entirely evident. The use of various research methods and tools for this study provided an opportunity to capture and produce authentic data from the respondents. The interviews, observations and FGDs provided a unique opportunity to test the usefulness of the theoretical framework – the co-production and IAD framework. Using the ethnographic approach elicited a better understand of various respondents involved in the provision of sanitation services and contextualised issues being investigated. The combination of the co-production model and the IAD framework has been suggested as a framework for data collection and to guide the development of appropriate institutional arrangements that consider both user needs and settlement conditions. Collected data was thematically analysed using categorical aggregation analysis which involved the clustering of narrative texts extracted through the semi-structured interview schedules and FGDs into sub-themes. Findings were subsequently triangulated and interpreted to draw conclusions. This study makes some contribution towards establishing such a framework.

The next chapter presents the data gathered for the investigation across the five informal settlements.

Chapter 4 CHAPTER FOUR: FINDINGS: INSTITUTIONAL, TECHNICAL AND SOCIAL ASPECTS OF SANITATION SERVICE PROVISION

4.1 Introduction

The provision of sanitation services is complex because of the numerous factors that require consideration. It is informed by several aspects – institutional, technical, and social – which equally impact access and sustainability of the services.

This chapter presents findings of the research. The chapter addresses the socio-demographic profile of the respondents and the study areas, and the themes emanating from the study objectives: (i) institutional, technical and social aspects of sanitation service provision; (ii) sanitation practices (behaviours and attitudes) and related impacts on access, functioning of facilities and sustainability of sanitation service provision; (iii) applicability of sanitation technologies provided to informal settlements; and (iv) alternative institutional arrangements for sustainable sanitation service provision in informal settlements. Both quantitative and qualitative data related to each of the themes above are presented in Appendix B and C, respectively.

Key respondents[21] involved in this study included users, community leaders, municipal officials, non-government organisations (NGOs) and civil society organisations (CSOs) and community-based organisations (CBOs), sanitation entrepreneurs (manufacturers, vendors or contractors). These respondents were involved in one or more phases of this study based on their level of involvement in the sanitation provision process. Results presented in this chapter reflect the views of the respondents, researchers' observations across the study settlements and review of various statutory documents including municipal documents, sanitation policy, frameworks and guidelines.

4.2 Socio-demographic information of the respondents and profile of the study areas

4.2.1 *Socio-demographic information*

The demographic characteristics of the respondents are presented in Table 4.1.

Table 4-1: Demographic information of respondent's category of users

Attributes				
Gender	Male (54.0%)	Female (46.0%)		
Age	36-50 yrs (41.3%)	>50 years (21.9%)	6-35 years (19.1%)	18-25 yrs (17.8%)
Level of education	None (21.9%)	Primary (44.1%)	Secondary (32.6%)	University (1.3%)
Disability	Disability (7.8%)	None (92.2%)		
Religious beliefs	Christians (68.2%)	Muslims (12.3%)	Animists (14.4%)	Other (5.2%)
Origins	Rural (64.7%)	Urban (35.3%)		
Social/racial group	Xhosa (59.6%)	Coloured (18.0%)	Suthu (13.0%)	Others (9.4%)
Duration of stay	<2 yrs (15.1%)	3-5 yrs (23.2%)	6 - 10 yrs (32.4%)	11-20 yrs (19.8%)
				>20 yrs (9.5%)

There were 383 respondents under the user (informal settlement resident) category of which 46% (n = 176) were female and 54% (n = 207) male. Most of these respondents belong to the age group ranging between 18–60 years and above, with various levels of education, income and

[21] The terms *respondents, participants, interviewees* and *informants* are used interchangeably in reference to the persons involved in this study and to protect their identity for ethical purposes. The terms *user*, *informal settlement resident*, *recipient* or *beneficiary of the sanitation facilities* are also used interchangeably, comprising mainly people living in the case study informal settlements.

employment status. Most residents were IsiXhosa (59.6% n = 187), coloured (18% n = 69), Suthu (13% n = 50) and people from other tribes and neighbouring countries (9.4% n = 36). The most spoken languages were IsiXhosa (78.6% n = 301) and Afrikaans (12.4% n = 48). English was not popular amongst residents and was spoken only in instances when the local language was not understood. The reported years of residency include less than 2 years (15.1% n = 58), 3 to 5 years (23.2% n = 89), 6 to 10 years (32.4% n = 124), 11 to 20 years (19.8% n = 76) and above 20 years (9.4% n = 36).

4.2.2 *Profile of the study areas*

The study area comprised five informal settlements spread across three municipal jurisdictions including the City of Cape Town (informal settlements A, B and C), Stellenbosch (informal settlement D) and Theewaterkloof municipality (informal settlement E), all located in the Western Cape Province of South Africa (Table 4.2). These informal settlements are characterised by a number of features and a transient population. The exact number of residents is not known.

Table 4-2: Profile of the study informal settlements

	Case study informal settlement				
	A	B	C	D	E
Approximate population[22]	600	9,000	3,000	8,000	5,500
Density	High	High	Medium	High	Medium
Land status	Private	Municipal	Municipal	State owned	State owned
Predominant ethnic group	Coloured	Xhosa	Xhosa	Xhosa	Xhosa & Suthu
Predominant religion	Muslim/ Christian	Christian	Christian	Christian	Christian
Sanitation technology	Non waterborne	Waterborne	Waterborne	Waterborne	Waterborne
Category of facility	MobiSan (mobile)	Ablution block (permanent)	Ablution block (permanent)	Kayaloo (mobile)	Ablution block & Kayaloo
Sanitation facility type	Communal	Communal	Communal	Communal	Communal
Year the facility was provided[23]	2009	2004 & 2016	2007 & 2017	2004 - 2012	2008 & 2018
Use patterns[24]	Separate	Mixed	Mixed	Mixed	Mixed
Management arrangement	Caretaker	Janitor	Janitor	Cleaner	None
Municipal location	Cape Town	Cape Town	Cape Town	Stellenbosch	Theewaterkloof

The settlements are located either on private land (as the case of informal settlement A), municipal or state-owned land (for the other four) and are characterised by high population density and a mixed population from various racial and ethnical groups as outlined in Chapter 3. They are further characterised by the availability of basic infrastructure including water and sanitation facilities that are shared by residents free of charge. In all five informal settlements, municipalities are responsible for the deployment, operation, and maintenance (O&M) and monitoring and evaluation (M&E) of the facilities.

4.3 Institutional, technical, and social aspects of sanitation service provision

4.3.1 *Introduction*

The provision of sanitation services does not only imply the supply of facilities (Crous, 2014). It involves the incorporation of several aspects including institutional, technical, and social (Phaswana-Mafuya, 2006; Sinharoy *et al.*, 2019) prior, during and after the deployment of facilities. Each of these aspects has several implications on the provision of sanitation services which need to be thoroughly examined. This section of the research attempts to advance the

[22] Information obtained from community leaders based on latest local house count.
[23] Second year indicates the upgrading or addition of new facilities.
[24] *Use pattern* is referred to as the way access and use of the facilities are organised. The use pattern can be either organised according to the age, gender and physical conditions of user or according to the use of the facility (e.g. defecating, showering, disposal of night pails or urinating).

debate related to the institutional, technical, and social aspects of sanitation service provision and the extent by which they inform access and long-term sustainability of services. Key themes covered include (i) institutional aspects of sanitation; (ii) technical aspects of sanitation; and (iii) social aspects of sanitation. The content of outlined in this section arises from both quantitative (Appendix B.1) and qualitative (Appendix C.1) data collected across the five informal settlements.

4.3.2 *Institutional aspects of sanitation*

The provision of sanitation services in South Africa has been institutionalised through various policies and legislative frameworks[25] outlined in Chapter 2. The institutional aspects of sanitation presented in this section are related to the way the sanitation service provision is organised and managed. They are concerned with the regulatory framework governing the provision of sanitation services, stakeholders involved, decision-making processes, power relation, coordination, and management. Our findings depict the actual situation which provides an indication of the extent to which these policies and frameworks are adopted by different sanitation stakeholders. Themes covered include (i) respondent knowledge of the principles guiding the provision of sanitation services; (ii) stakeholders involved, their roles and involvement in the sanitation service provision; (iii) power relations amongst different stakeholders; (iv) factors informing the decision to select and deploy sanitation facilities; and (v) the decision-making process.

4.3.2.1 Overview of the sanitation provision – guiding principles and stakeholders

While the provision of sanitation services is institutionalised, views were sought from respondents to document their knowledge with regard to the guiding principles. Different views were captured, with the most significant being the Constitution of the Republic of South Africa. Municipal officials pointed to the Constitution, policy, and municipal by-laws while community leaders mentioned only policy. Representatives from NGOs/CSO and CBOs were aware of sanitation policy and municipal by-laws. The responses from residents across case study settlements were as follows: mayoral decision (52.5% n = 201), policy (13.3% n = 51), municipal by-laws (3.1% n = 12), the Constitution (9.4% n = 36) and 'don't know' answer (21.7% n = 83). Views about mayoral decisions included:

> *The mayor is often there to discuss with us when we require service through mass actions and strike, so all decisions to provide services lay on her hands*. (Resident of informal settlement C)

While users' statements were confirmed by municipal officials, they however explained that there are many other considerations and processes the mayor may consider prior to taking a decision. These processes are often unknown to users and other civic organisations.

> *The mayor's decision is made in line with the sanitation policy and other legal and statutory frameworks…this is not a mayor's sole decision.* (Municipal official A)

For users, NGO/CSO and CBO representatives, the Constitution, policies, and municipal by-laws claimed to be used by municipal officials have generated nothing than more misery and poor services. The application of the policy and legal framework has brought confusion and human rights abuse instead of easing sanitation backlogs. Municipal officials, however, explained that these factors have assisted them in making informed decisions as they provide the framework for

[25]According to Tissington (2011), the legislative and policy framework for sanitation in South Africa include Constitution (1996), White Paper on Water Supply and Sanitation Policy (1994), National Sanitation Policy (1996), Water Services Act (1997), Housing Act (1997), Municipal Systems Act (2000), White Paper on Basic Household Sanitation (2001), Strategic Framework for Water Services (2003), National Sanitation Strategy (2005), Free Basic Sanitation Implementation Strategy (2009) and National Sanitation Policy (2016).

the selection of appropriate and acceptable sanitation solutions, timeously deployed facilities and decreased sanitation backlogs. NGO representatives argued that they have initiated this process in some instances through legal actions when officials denied users' demands. Some respondents (mainly users) disagreed by indicating that the use of regulatory documents for the deployment of facilities is not always evident or substantive.

4.3.2.2 Stakeholders – their roles and level of participation in the service provision

According to municipal officials, stakeholders involved in the service provision are officials (from various departments including provincial Water and Sanitation Department, Human Settlement, and Environmental Health, and municipal services such as Engineering, Solid Waste, Road and Stormwater), users (as recipient of the services), community leaders (as representatives of the community), civic organisations (NGOs/CBOs and CSOs as advocacy groups) and sanitation entrepreneurs (manufacturers and vendors) acting on behalf of the municipalities as either advisors or suppliers of services.

> *We are working with various groups of people including users, their leaders and some NGO or CBO. There are other stakeholders who are only providing services on behalf of municipality but are not involved in any decision-making process.* (Municipal official A)

However, NGO/CSO and CBO representatives denied direct involvement in the sanitation provision process. They mentioned that their involvement is informal and limited to the provision of legal or general support to informal settlement residents. This position was confirmed by the community leaders across the five study settlements pointing out users, municipal officials and community leaders as the only stakeholders involved in the provision of services.

> *During the sitting, only municipal officials, their advisors and community leaders are involved in the discussion.* (Community leader A)

Informal settlement residents indicated that they are not directly involved in the sanitation service provision, but their community leaders are:

> *We are not directly involved in the process, but community leaders are representing our voice.* (Resident of informal settlement A)

This view was supported by another resident who indicated that their involvement is limited, occurring only when there are mass actions during which grievances are reported to municipal officials. Further interaction with respondents – coupled with our field observations – show that municipal officials directly involved in sanitation service provision are those dealing with the deployment of facilities, operation, and maintenance (e.g., Engineering Services or Informal Settlement Unit). Other services were involved indirectly to deal with awareness (e.g., Environmental Health), stormwater (Road and Stormwater) and solid waste management (Solid Waste). The provincial departments including Human Settlement and Environmental Health were working in isolation, having no direct links with those responsible for deploying facilities in informal settlements (Appendix E.1). NGOs/CSOs and CBOs were not directly considered as stakeholders, while residents were often perceived as passive recipients represented by their community or political leaders (e.g., councillors). The roles played by the sanitation stakeholders were subject to contrasting views amongst respondents. Municipal officials recognised their roles as service providers, including the provision of services, O&M and M&E of facilities, while the daily operation of facilities, including cleaning and keeping the facility safe is dedicated to users.

> *Our roles are defined in the sanitation policy and only limited to the provision of services, operation, and maintenance.* (Municipal official C)

This view was not shared by users (Appendix B.1.1) who felt that they were only recipients of the service:

> *The municipality is constitutionally obliged to provide us with the toilets we want and maintain them when they are not working. We are poor and cannot afford to pay for it.* (Resident of informal settlement D)

A CBO representative added that their roles are primarily to advocate on behalf of users, monitoring the settlements and reporting user issues and demands and assisting when required. The community leaders felt that their roles are similar to those of NGOs/CSOs and CBOs in addition to being the community representatives at various spheres of government (local, provincial and national):

> *We are mandated to represent our communities at various levels with regard to various issues including service provision. We are the voice of our community and act on their behalf in accordance with the mandate given to us.* (Community leader C)

A CSO representative pointed out the ambiguous nature of the roles played by various government departments and services in the provision of sanitation services:

> *Indeed, the roles of the national or provincial governments as stipulated are not manifested into practices… very often, we observe that some decisions are made at provincial or national level instead of local level*…. (CSOs representative C)

The level of participation in sanitation service provision depends on stakeholder contributions in each of the four phases of the sanitation service provision[26] (Table 4.3).

Table 4-3: Stakeholders: roles and level of participation

Stakeholders	Roles	Level of involvement or participation
Municipal officials	Service provision, O&M, M&E	All phases: Public participation, technology choice, Deployment of facilities, O&M, M&E
Sanitation entrepreneurs	Service provision, O&M, technical advisors	All phases but mainly planning, implementation and post-implementation
Residents or users	Recipient of services, M&E	Initiation phase: Public participation,
Dept. water and sanitation	None	None
Dept. Human settlement	None	None
NGOs/CSOs	Advocacy and activism	Initiation and post implementation phases: Public participation, advocacy
CBOs	Advocacy and activism	Initiation and post implementation phases: Public participation, advocacy
Provincial government dept.	None	None

For instance, municipal officials (from Engineering Services) were involved at all four phases because of their technical expertise, while user involvement was dependent on the emergency of the situation and was often limited to inception meetings during which their grievances, needs or requests are presented or reported to relevant officials. Users are further involved to a lesser extent when it comes to decision making (through their representatives) and only when seen as necessary, as illustrated below:

> *The involvement of other stakeholders is subject of many factors which are considered on a case-to-case basis. In case of emergency, services are provided without prior consultation, and in normal situation, only users or their representatives are involved.* (Municipal official F)

[26]The four phases include: phase 1 Project initiation; phase 2 Planning; phase 3 Implementation; and phase 4 Post-implementation.

The participation of sanitation entrepreneurs was conditioned by the nature of interventions required by municipalities, whereas the Environmental Health Services and civic organisations would only be involved at the post-implementation stage, both formally and informally.

Despite implicitly acknowledging community leaders, CBO an NGO/CBO representatives as sanitation stakeholders, municipal officials admitted that their participation was limited. Their participation in the decision-making process was conditioned by their relationship with local residents, their level of knowledge of the settlement and contribution towards the wellbeing of residents and legal obligations. Users pointed out the following factors: involvement in community matters (36.8% n = 141), right to know (23.5% n = 90), activism (21.4% n = 82) and legal obligations (12.6% n = 48). While concurring with users, CBO and NGO/CSO representatives indicated that municipal officials are using factors such as allegiance to or affiliation with their political party as key criteria for deciding which stakeholder would be consulted.

Although there were some contradictions regarding sanitation stakeholders and their roles, our observations and interactions with all respondents showed that the provision of sanitation services is likely to involve stakeholders from various backgrounds. For instance, the role of users was limited to the use of the facility and reporting issues such as breakdown, theft and vandalism to relevant municipal officials or their leaders. The decisions to select a sanitation technology and deploy facilities were made by municipal officials without prior consultation or engagement with other stakeholders, including users. There were more than four different municipal services involved directly or indirectly in the service provision. For instance, the provision of sanitation facilities and operation and maintenance was duly undertaken by Engineering Services either directly or through support services or sanitation entrepreneurs, while awareness was provided by Environmental Health Services, solid waste collection by Solid Waste Services and any issue of flooding and drainage was dealt with by the Road and Stormwater department.

The coordination role was devolved to the municipal officials in accordance with the sanitation policy. These municipal officials were accountable for each and every issue under their jurisdiction. Through our interaction with respondents as well as our participant observation, it was evident that in fact there was poor co-ordination between government departments, municipal services, or other stakeholders. The relationship between stakeholders (mainly users and municipal officials) and between municipal services and the provincial or national government departments was a tense one although in the ideal, they were supposedly collaborating. In general, there was little evidence of any coordination between different levels of government and each service providers appeared to be working in isolation.

4.3.2.3 Stakeholder power relations

Different stakeholders involved in sanitation service provision do not have the same level of influence and power. The provision of sanitation service and the management of facilities were dominated by municipal officials due to their constitutional roles as service providers. Other stakeholders (e.g., users, CBOs, NGOs/CSOs and community leaders) have limited power which in many cases has no direct impact on the sanitation service provision. For instance, the power of users was restricted to presenting their grievances to municipal officials or community leaders, while community leader power was limited as intermediaries between users and municipal officials. NGOs/CSOs and CBOs were generally powerless. However, their power and influence became apparent only in instances where they took the municipality to court to oblige them to provide services.

Our own observation confirmed that municipal officials do in fact have absolute power to decide on any matter related to service provision with or without prior consultation with other stakeholders. The power relation between various stakeholders involved in the service provision was imbalanced, as other stakeholders did not have any decisional power. The power relation amongst stakeholders had serious impact on the decision-making process. Users, community leaders and civic organisation representatives all felt a lack of consultation and information sharing, and that there was unilateral rather than consultative decision making when it came to choices of sanitation technologies. Users further felt that any decision made by municipal officials without prior consultation was challenged.

4.3.2.4 Factors informing the decision to provide sanitation facilities

Municipal officials and sanitation entrepreneurs revealed that the sanitation policy and other municipal by-laws provide a legal framework as the basis for any decision to provide sanitation services. These are compounded with several other factors including the availability of funds, availability of technology, requirements of the technology in terms of O&M, conditions of the settlements (type and nature of the settlements, status of the land), capital and maintenance costs, ease of use and aesthetics.

> *Users often want individual waterborne sanitation facilities even when the conditions [land status, space, availability of bulk services like sewer] are not permitting this. So we have no alternative other than providing services that respond to available funds, settlement conditions and cost-effectiveness.* (Municipal official D)

However, this view was disputed by other stakeholders who indicated that the provision of sanitation services happens ad hoc, lacks transparency, and has no legal or technical rationale. Users were of opinion that the basis for any decision pertaining to the provision of sanitation service is guided by the personal feeling of municipal officials (61.2% n = 234), availability of funds (22.4% n = 86), cost of the facility (9.4% n = 36) and policies (4.9% n =19). Only 2.1% of the respondents mentioned ease of operating and maintenance (O&M).

> *The way sanitation technologies are chosen and deployed is not clear…. These people do things according to their mood and feelings.* (Resident of informal settlement C)

Community leaders mentioned that it was a mix of policy and personal feelings of municipal officials that determine sanitation.

A large majority of users (93.4% n = 358), NGO/CSO and CBO representatives and community leaders felt that factors such as municipal by-laws, sanitation policy and other legal frameworks or guidelines were inadequate to form the basis of a decision-making process or assist municipal officials in making informed decisions. Municipal officials and sanitation entrepreneurs, on the other hand, believed that these factors were adequate to inform their decision. The review of available municipal documents shows that there are documents that presumably guide the choice of level of services (e.g., CoCT, 2014; DWAF, 2007). The level of services developed by a particular municipality has been adapted for each context and used for the selection and deployment of facilities. The CoCT (2014) highlighted that the levels of service and subsequent technology types are selected based on the land types and availability of bulk infrastructure. It has also recommended further context for the level of services and servicing frequency (Table 4.4). In Stellenbosch, the process was similar to the City of Cape Town, with the only difference that the level of service was decided based on the nature and conditions of the settlement.

In Theewaterskloof, the services were provided based on the availability of funds and technology. However, users and community leaders considered these measures impractical, and residents

found it difficult to understand why informal settlements located within the same municipal jurisdiction are provided with different levels of services.

All respondents (excluding municipal officials and sanitation entrepreneurs) felt that the decision-making power vested in municipal officials highly influences the selection and deployment of sanitation services.

> *We don't have any clue or knowledge with regard to the technology to be deployed, type of facilities and timeframe for such deployment...very often things happen by surprise.* (Community leader D)

Municipal officials, however, acknowledged that lack of involvement of other stakeholders in the final decision stage of sanitation service provision is primarily due to their lack of knowledge around sanitation technologies, the O&M requirements and related financial implications and context of application. They further suggested that their involvement causes delays and escalates unnecessary tensions.

> *If other stakeholders are involved, their lack of knowledge may create unnecessary delays to the provision of services.* (Municipal official D)

This view was contested by users and community leaders who reported that the decision is often made only after mass action, as illustrated in the statement below.

> *The only language officials understood is protests and violent mass actions...once this happens, services are provided within a short time.* (Resident of informal settlement E)

Despite diverging views, the decision-making power vested in municipalities appeared to play a significant role in the selection, deployment, and management of the facilities. The coordination roles devolved to municipalities have an influence on all decisions.

Table 4-4: Level of service matrix for informal settlement (adapted from CoCT, 2014)

Category	Land type	Bulk infrastructure	Space availability	Recommended level of service	Servicing frequency
A	Government land, occupation permitted	Available within economical distance	Adequate	Waterborne sanitation Use ratio of 1:5 toilets per household	Reactive maintenance upon report of defective infrastructure
			Inadequate	Sewered ablution facility (toilets, showers, wash basins) with a janitorial service to be supplemented by porta potties on demand for nighttime use.	Reactive maintenance upon report of defective infrastructure
		Not available within economical distance	Adequate	Communal container or dehydrated toilets to technology specific household ratios	Reactive maintenance upon report of defective infrastructure, User's ratio is technology dependent Containerised technology serviced three times a week Dehydrated toilets serviced monthly Conservancy tank serviced monthly
			Inadequate	Conservancy tank ablution facility with janitorial service, supplemented by porta potties on demand for night use or Porta potties or single use dehydrated toilets allocated at a ratio of 1:1, each with specified cleaning arrangements and usage training	Reactive maintenance Conservancy tank serviced weekly or Reactive maintenance Regular emptying/cleaning service of three times per week
A2	Private land, occupation permitted	Not applicable (no capital investment on private land)	Adequate	Communal container or dehydrated toilets to technology specific household ratios.	Reactive maintenance upon report of defective infrastructure, User's ratio is technology dependent Containerised technology serviced three times a week Dehydrated toilets serviced monthly
			Inadequate	Conservancy tank ablution facility with janitorial service, supplemented by porta potties on demand for night use or Porta potties or single use dehydrated toilets allocated at a ratio of 1:1, each with specified cleaning arrangements and usage training	Reactive maintenance Conservancy tank serviced weekly or Reactive maintenance Regular emptying/cleaning service of three times per week
B	Adverse physical conditions, occupation permitted	Not applicable	Adequate	Communal container or dehydrated toilets to technology specific household ratios	Reactive maintenance upon report of defective infrastructure, User's ratio is technology dependent Containerised technology serviced 3 times a week Dehydrated toilets serviced monthly Conservancy tank serviced monthly
			Inadequate	Conservancy tank ablution facility with janitorial service, supplemented by porta potties on demand for night use or Porta potties or single use dehydrated toilets allocated at a ratio of 1:1, each with specified cleaning arrangements and usage training	Reactive maintenance Conservancy tank serviced weekly or Reactive maintenance Regular emptying/cleaning service of three times per week
C	Prohibited occupation	Not applicable	Adequate	Communal container or dehydrated toilets to technology specific household ratios	Reactive maintenance upon report of defective infrastructure, User's ratio is technology dependent Containerised technology serviced three times a week Dehydrated toilets serviced monthly
			Inadequate	Conservancy tank ablution facility with janitorial service, supplemented by porta potties on demand for night use or Porta potties or single use dehydrated toilets allocated at a ratio of 1:1, each with specified cleaning arrangements and usage training	Reactive maintenance Conservancy tank serviced weekly or Reactive maintenance Regular emptying/cleaning service of three times per week

4.3.2.5 Decision-making process

Despite some disagreement regarding the factors that inform the decision making to select and deploy sanitation facilities, all respondents acknowledged the existence of the institutional processes that assist municipal officials to make informed decision. While in agreement that the decision-making process is initiated and concluded by municipal officials because of the power vested in them, other stakeholders were of opinion that the decision-making process (as currently implemented) is exclusionary and lacks transparency.

Municipal officials outlined steps of the decision-making process as: (i) sanitation need assessment; (ii) settlement conditions assessment; (iii) inventory of available sanitation technologies and facility types; (iv) technology choice; and (v) deployment and post-deployment of facilities. While concurring with municipal officials, other stakeholders (except sanitation entrepreneurs) labelled the decision-making process across their municipalities as biased, discriminatory and inconsistent. Their arguments were based on the fact that the decision-making process was not fairly applied to all settlements, was not inclusive and lacked transparency.

4.3.3 ***Technical aspects of sanitation***

Technology is one of the main components of sanitation provision as it is the interface between users and excreta (Tilley *et al.*, 2008). Its selection requires adequate knowledge of the technical aspects related to the functioning, use patterns and O&M. In this study, technical aspects of sanitation revolved around issues associated with appropriateness and management arrangements of sanitation technologies and facilities in relation to the context their deployment. More details of quantitative data are reported in Appendix B.1.2.

4.4.3.1 Sanitation technologies and facilities provided to informal settlements

A wide range of sanitation technologies have been implemented in various informal settlements across South Africa. Across the five study informal settlements, sanitation facilities provided included the MobiSan (informal settlement A), communal flush toilet (informal settlement B, C and E), Kayaloo (informal settlement D and E) and porta-potties (informal settlement A and C). These facilities varied in number and type of technology as well location within the settlement, as presented in Table 4.5; further details are presented in Appendix E.2.

Table 4-5: Characteristics of sanitation facilities in informal settlements

Sanitation infrastructure	Informal settlement				
	A	B	C	D	E
Facility (toilet block)	1 (13)	11 (132)	12 (144)	8 (80)	3 (30)
Urinal	13	0	0	0	0
Bucket disposal hub	1	0	0	0	0
Location	Back	Throughout	Throughout	Throughout	Throughout
Use	Communal	Communal	Communal	Communal	Communal
Access	Separate	Mixed	Mixed	Mixed	Mixed
Type	Dry	Waterborne	Waterborne	Waterborne	Waterborne
Category	Mobile	Permanent	Permanent	Mobile	Mixed
Management/Cleaning	Caretaker	Janitors	Janitors	Contractor	Users /nobody
Frequency of cleaning	Twice daily	Twice daily	Twice daily	Twice daily	Ad hoc
Solid waste disposal	Container	Container	Container	Drop off	None
Greywater disposal	Gulley	Sewer	Gulley	Sewer	None

The MobiSan (meaning mobile sanitation) is a mobile communal urine diversion and dehydration type of sanitation technology provided to informal settlement A. The communal flush toilet (also referred to as ablution block or communal toilet) is a communal waterborne sanitation facility

commonly used in informal settlements across South Africa. It was deployed in four of the five informal settlements. Kayaloo (meaning 'toilet for our home') is a name given to a special type of mobile (structure) full flush waterborne sanitation facility used mostly in informal settlements in the Stellenbosch municipality (informal settlement D) and now in Theewaterskloof municipality (informal settlement E). Mobile communal ablution blocks (CAB) have been previously implemented in various informal settlements across the eThekwini municipality. Recently a pilot facility has been deployed to informal settlement B, but was not yet in use by the time of concluding the data collection. Porta-potties are individual portable, self-containing "non-waterborne" facilities (not connected to a sewer) that have been provided to several informal settlements across the Western Cape to compensate for lack of the officially recognised facilities. They are also being deployed in a number of settlements to cater to children, physically challenged individuals, those who cannot access existing facilities because of their disability, age, sickness or personal reasons and those who object to the use communal facilities as well as night use because of security concerns or when the facilities may not be accessible. Despite the availability of these facilities, pit latrines and full flush toilets connected to a stormwater drain or connected to a pit, buckets or night pails and plastic bags were in use across all five informal settlements.

Throughout the five settlements, there were other scattered facilities, including the gulley for the disposal of greywater, container or drop off facilities for disposal of solid waste and storm water channels. However, the most used was the toilet while others (greywater disposal and solid waste) were not used as intended. Greywater and solid waste were disposed behind or between shacks and in any open space. Night pails and plastics containing human excreta were being disposed at greywater or solid waste disposal facilities. Despite the availability of sanitation facilities, most users (94.8% n = 363) claimed that they were not responding to their needs or the conditions of their settlements.

4.4.3.2 Knowledge and understanding of operational and use requirements

Respondents were asked to share their knowledge of sanitation facilities provided to the study settlements in terms of their types and operational requirements or use patterns. For instance, users (76.5% n = 293) from all study areas except informal settlement A recognised their sanitation facilities as communal or shared waterborne. In informal settlement A, users (78.0% n = 55) recognised their facility as mobile communal or a shared dry sanitation facility. Other respondents were aware and knowledgeable of the sanitation technologies and facilities provided to each of the five informal settlements. They knew, for example, that the provided facilities were communal and either waterborne or non-waterborne, equipped with a permanent or mobile superstructure.

In terms of operational requirements and use patterns, a large number of users (76.0% n = 291) were knowledgeable of the operational requirements and had adequate knowledge of the use patterns. In informal settlement A (where the MobiSan is deployed), a group of users (31.0% n = 22) reported having little or no knowledge of the operational and use requirements[27] of their facilities:

> *Honestly, I don't know how this toilet operates … I use my bucket and discharge content inside there.* (Resident from informal settlement A)

[27] Use requirement is referred to as the prescripts or terms of use of a given sanitation facility. Often UDT requires users to abide by use requirements including sitting when urinating or not mixing urine and faeces.

This lack of knowledge was confirmed by the caretakers as the majority of the MobiSan users exhibited insufficient knowledge of the operational requirements despite the availability of information posters and frequent reminders by the caretakers.

> *Drunkards, unaccompanied children, and some male users do not abide to the use requirements. Very often, they mix urinate with faeces, which cause bad smell.* (Caretaker 2).

In many cases, male users, drunkards, and children were reported by the caretakers as non-compliant. A large number of users discarded their bucket contents containing unconventional anal cleansing materials such as newspaper and sanitary pads into the toilet bowl without flushing. In informal settlement A, the caretaker reported the use of water for anal cleansing or discarding of bucket contents in the urinal in a facility that was supposed to work without water.

Despite the apparent knowledge of the sanitation facilities, users (94.8% n = 363) and other respondents (excluding municipal officials and sanitation entrepreneurs) found the operational requirements of facilities unmanageable. Reasons provided include the lack of access control, the sharing use patterns (male and female) and uncontrolled number of users. Many users (93% n = 357) believe that individual waterborne is the only sanitation technology suitable for their settlements because its ease of use.

4.4.3.3 Impact of the sanitation service provision on access

Across case study settlements, some users (48.3% n = 185), their community leaders, CBO and NGO/CSO representatives acknowledged that the provision of facilities in their settlements has somehow positively contributed to access to sanitation. Municipal officials felt that the intended purpose to ensure access to sanitation to residents of previously unserved areas had been achieved and according to them, negative impacts are minimal compared to the consequences of a complete lack of access to sanitation. However, certain categories of users (e.g. physically challenged individuals and children) felt that the provision of sanitation facilities had not improved their plight and as a result, they resorted to the use of buckets or open defecation.

4.4.3.4 Technical challenges associated with the deployment and use of sanitation facilities

According to users, the significant challenges included the ratio of facility vs. users (54.8% n = 210) and untidiness (17% n = 65). Many users (85.4% n = 327) insisted that these two challenges have impeded access as the number of users far exceeds that of facilities. NGO/CSO representatives felt also that the choice of sanitation technology and type of facility, as well as the positioning (or location) of the facility within the settlements, were problematic. Municipal officials and sanitation entrepreneurs admitted other challenges such as difficult settlement conditions, density, lack of understanding or non-compliance with the use ratio, operational and use requirements, frequent breakdowns, and costs of maintenance, repairs, and replacement. Lastly, municipal officials see the nature of the land and tenure status as a key influencing factor that determines the level of service and type of facility to be deployed: many of these settlements are located on land unsuitable for human settlement. The provision of services on private land requires consent from the landowner, but many are reluctant to give such consent as the land occupation may then become permanent:

> *Informal settlement residents become resistant and aggressive when informed that the land they occupy cannot be upgraded, hence proper infrastructure may not be provided. The only solution to address their sanitation needs is to relocate them to other settlements that offer opportunity for upgrading.* (Municipal official B)

These views were echoed by community leaders who added other challenges including the inappropriateness of the technology or facility to their conditions, non-compliance with the use patterns and difficult use requirements, unaccommodating nature of the design of the facility for certain user categories (e.g., disabled) and lack of basic or essential features (e.g. night pail disposal, shower, sanitary bins). Our own observations confirmed that many facilities lacked doors, locks, and ventilation.

Stakeholders (other than municipal officials and sanitation entrepreneurs) view these challenges as a result of the way that municipalities use their power to decide on the type of sanitation technology and subsequent deployment without prior consultation with stakeholders. The selected technologies and facilities were often inappropriate to users and the conditions pertaining to their settlements. These technical challenges were amongst other multiple causes of users' reversion to unhygienic sanitation practices (e.g., open defecation). Furthermore, they are pinpointed by users (80.9% n = 310) as impacting access. NGOCSOs and CBO representatives insist that these challenges are affecting both users and municipalities in a sense that they reduce access and perpetuate unhygienic practices amongst users while prompting municipalities to undertake frequent costly maintenance, repairs or replacement works. One municipal official protested that these challenges are deliberately created by users to force municipalities to provide services that they deem fit rather than considering various factors such as status and condition of their land and requirements of their preferred technologies.

4.4.3.5 Management arrangements for sanitation facilities

Although municipalities are responsible for the deployment of sanitation facilities to informal settlements, the management arrangements of facilities varied. For instance, cleaning was either undertaken by the caretaker (informal settlement A), janitors (informal settlement B and C), contractor cleaners (informal settlement D), residents or nobody (informal settlement E). The frequency of cleaning varied from one settlement to another depending on local arrangements. For instance, the facilities managed by the caretaker were cleaned twice daily, while where janitors and contractors were in charge, cleaning occurred twice during weekdays and not on weekends and public holidays. In settlements with no municipal cleaning services, residents themselves resorted to cleaning some facilities that were later padlocked and privatised for the sole use of those involved in the cleaning, and their families. In many cases, the main cleaning activities included sweeping the floor, rubbing the toilet bowl and disinfecting and unblocking pipes. The maintenance of the facilities was randomly undertaken by the municipality or their appointed contractors whenever issues such as blockages, leaks and vandalism were reported.

4.3.4 ***Social aspects of sanitation***

Social aspects of sanitation describe social issues related to the lack of or the provision of sanitation services that have evolved within informal settlements. For instance, the emergence of informal settlements and related sanitation issues, challenges associated with the lack of or deployment of sanitation facilities and impacts constitute social aspects of sanitation.

4.3.4.1 Emergence of informal settlements and municipal response

The way the five informal settlements came into existence was similar. Each started with land invasion after which more and more deprived people, friends, relatives, and those sharing the same culture, beliefs and language gathered in the same place and built their shacks. Municipal officials and community leaders thought that these five informal settlements had been in existence for over 20 years, with settlement A the oldest one (Appendix B.1.3). Local authorities responded to the emergence of these settlements in different ways. Users (mainly those who have been there since the beginning of the settlement), community leaders, and CBO and NGO/CSO

representatives provided an instructive timeline of the service provision. Interestingly, across the five informal settlements, authorities responded in the same manner by either issuing eviction threats, evicting residents, or tacitly accepting the occupation. The latter was guided by violent mass protests and other actions, such as sit-ins, by residents.

In the beginning, residents relied on various alternatives including open defecation, use of buckets and plastic bags or use of facilities located in other settlements, malls, and public buildings, after which emergency sanitation facilities were provided. These were primarily chemical toilets that were eventually upgraded to container toilets, and later to other water or non-waterborne technologies and facility types (communal equipped with mobile or permanent superstructure).

> *At the beginning it was not easy because of eviction threats we received daily. Only after few years, they provided us with chemical toilets, and then container toilets that were not maintained regularly. These toilets were frequently vandalised until the MobiSan was installed.* (Community leader A)

The response of municipalities to the emergence of informal settlements was to provide services only after other institutions had cleared the way for them to do so. The type of infrastructure corresponded to the status of the settlement and related ground conditions.

> *We are not responsible for the eviction of illegal land occupiers. Our services are limited to the provision of services in accordance with the municipal guidelines when other institutions have cleared all legal issues.* (Municipal official B)

4.3.4.2 Challenges associated with the lack, deployment, access and use of sanitation facilities

Contrary to the institutional and technical challenges, users and community leaders indicated that social challenges started with the lack of facilities (at the initial or occupancy stage) and the provision of inadequate facilities (e.g., chemical toilets) that were poorly maintained. This situation led to the occurrence of unhygienic practices such as open defecation and use of buckets, poor sanitary conditions characterised by smells and breeding of rodents. After the settlements were recognised by local authorities, basic services including water and sanitation were provided. However, these interventions did not completely eradicate all social challenges. For instance, at the transitional stage, users still cited inadequate numbers of functional facilities (75.7% n = 290), poor conditions of the facilities (66.1% n = 253), few facilities vs. large number of users (60.8% n =233), poor hygiene (52.5% n = 201), safety (71.3% n = 273) and other unspecified reasons (2.9% n = 11) as the most substantial social challenges emerging in the settlements. Community leaders and NGO/CSO and CBO representatives concurred with these views, adding theft of parts of the facilities, vandalism and misuse of facilities.

The consolidation stage (during which the settlements attained secure tenure with the municipality's Human Settlement department), users and community leaders identified high numbers of users, untidiness of facilities, lack of or inadequate access, misuse, vandalism, and theft as key social challenges. NGO/CSO and CBO representatives suggested security concerns, lack of privacy and increasing health problems due to the poor conditions (in terms of cleanliness) of facilities. Some challenges, according to municipal officials, that may have occurred (e.g., safety and increasing access) were minor and did not impact access. This view, however, was not shared by many of the respondents who used the 1:5 (facility–user) ratio that is not working in practice to exemplify their views on technical challenges. These challenges were felt by users (81.2% n = 330) as impacting access to facilities, while municipal officials indicated the cost of maintenance.

Regardless of the developmental stage of the settlements, social challenges occurred for various reasons: the negligence by municipal officials to address the needs of residents (48.3% n = 185),

lack of user education (58% n = 222), poverty (7.8% n = 30), conditions of the settlements (3.1% n = 12) and other unspecified causes (1.8% n = 7). Community leaders attributed the social challenges to the lack of education, lack of social cohesion and failure by municipal officials to attend to reported issues. NGO/CSO and CBO representatives believed that social challenges originate from poor communication, poverty, indifference and negligence by officials, and the general lack of knowledge regarding the use of facilities amongst users themselves. Municipal officials conceded that social challenges do exist, but insisted that they are not only a result of lack of education and poverty but also factors such as poor hygiene education, lack of social cohesion and lack of sense of ownership and responsibility:

> *Because of the lack of education and awareness, many users perceive that baby nappies, sanitary pads and other materials can be dumped into the toilet, and any other sanitation facilities that is not full flush waterborne is substandard.* (Municipal official A)

The increasing social challenges (related to access to sanitation) were addressed by municipalities differently across the five study settlements. In most of the case responses, users (64% n = 245) indicated the increase in number of facilities as a response to their sanitation challenges. Some users (70.5% n = 270) responded that these challenges were addressed by municipal officials, while others (21.7% n = 83) indicated informal settlement residents. Municipal officials attributed the difference of approach for addressing social challenges to the severity and urgency of the challenges.

Impact of social challenges on facilities and sanitation service provision

Most users (88.5%, n = 339) acknowledged that social challenges have a negative impact on their lives and on their access to sanitation:

> *Facilities are being vandalised daily, and access becomes more and more uneasy ... so the only option is to use the bucket or the bush.* (Resident of informal settlement C)

According to the CBO representatives, social challenges have aggravated users' already fragile living conditions and environment. Such deterioration of the living condition and environment perpetuates a vicious cycle of vandalism, misuse of facilities and theft of parts. All respondents acknowledged that social challenges have severely contributed to the increase of the number of dysfunctional facilities which has, in turn, resulted in costly maintenance. The number of dysfunctional facilities has contributed to the lack of access to sanitation, which has resulted in poor hygiene (26.4% n = 101), poor living conditions (10.7% n = 41), diseases (58.4% n = 224) and poverty (2.9% n = 11) and other unspecified consequences (1.6% n = 6). Municipal officials were concerned about the deterioration of human health (diseases) and environmental pollution caused by the lack of access to sanitation facilities, the cost associated with maintenance and repairs as well as the reversion of residents to unhygienic sanitation practices.

4.3.5 *Summary*

The institutional aspects of sanitation entail the way municipalities (as service providers) and other stakeholders are organised in the delivery of sanitation services. While acknowledging that the provision of these services involves various actors, their roles and responsibilities were not well defined. The extent of their involvement, and the stages of the decision-making process were also not agreed upon. Municipal officials were the ones who determined the rules of the game. There was a disagreement amongst respondents on the extent of their power and its influence on the decision-making process as well as knowledge about the use of available legal frameworks that guide and inform decisions surrounding sanitation.

There is a technical aspect of sanitation which is about understanding the types of sanitation technologies and facilities furnished to informal settlements, their operational requirements, use and related challenges, whether facilities respond to needs and settlement conditions as well as impact on access and sustainability of the services. Respondents demonstrated a solid understanding of sanitation technologies and the type of facilities available to informal settlements. Their concerns surrounded access and use of these facilities. Residents were concerned about the type of selected technology, the operational requirements as well as the location of sanitation facilities. These concerns were further compounded by the non-compliance with use requirements, poor conditions of facilities, high and uncontrolled number of users and a high number of dysfunctional facilities.

The social aspects of sanitation centre on access and use of the facility. Municipal response to the emergence of informal settlements varies from one area to another, and in many cases can be either eviction or tacit acknowledgement of the right of residents to be in a particular place, only eventually followed by the provision of emergency facilities. All respondents acknowledged that the development of informal settlements is accompanied by a range of social challenges including overcrowding, lack of adequate facilities, misuse, vandalism, lack of hygiene and safety. In general, social challenges have been reported to impact severely on access, functioning and sustainability of the facilities. The next section presents findings of users' sanitation practices (behaviours and attitudes) and associated impact on access and sustainability of sanitation services in informal settlements.

4.4 Sanitation practices (behaviours and attitudes) and related impacts on access, functioning of facilities and sustainability of sanitation services

4.4.1 *Introduction*

Access and use of sanitation facilities are amongst numerous sensitive issues related to service provision. The ways individuals manage their excreta constitute sanitation practices that are very often difficult to disclose. This section of the thesis presents findings related to users' sanitation practices and related impact on access and functioning of facilities and sustainability of sanitation services. Themes covered include (i) access and use of the provided sanitation facilities and (ii) informal settlement residents' sanitation practices and their impact on access and long-term sustainability of services. Details of quantitative and qualitative data are provided in Appendix B.2 and C.2, respectively.

4.4.2 *Access and use of the provided sanitation facilities*

4.4.2.1 Sanitation facilities: access, use and condition

Although all informal settlements have been provided with sanitation facilities (section 4.3.3.1), everyday access to sanitation remains heterogeneous across time of the day and location. Apart from informal settlement A (where the facility opens between 5h00 to 22h00), most of the facilities across the study informal settlements remained open all day and night. Most residents (92.2% n = 353) used the available facilities provided to their settlements on a number of occasions. Amongst the various facilities available in informal settlements, toilets emerged as the most used (72.3% n = 277), followed by greywater disposal (52% n = 199) and solid waste disposal (49.6% n = 190).

The average distance between the municipal provided toilet facilities and households varied from one settlement to another depending on the number of the facilities and their location. Users estimated the average distance to be between 50 < 200 m (27.9% n = 107), 200 < 500 m (22.5% n = 89), <50 m (14.4% n = 55), 500 < 750 m (11.4% n = 44), >750 m (8.4% n = 32) and no answer

(15.4% n = 59). The location of the facility was decided (by municipal officials) by considering factors including the availability of lighting and space, security and closeness to bulk infrastructure (e.g., sewer or water supply). However, some users (66% n = 253) claimed to have been affected by the walking distance, giving various reasons such as safety concerns (64% n = 245), disability (19.1% n = 73) and weather conditions (7.8% n = 30).

Access and use of toilet facilities (Table 4.6) was unrestricted, and all residents were entitled to use the facility free of charge. However, 58.5% (n = 224) still found use difficult for various reasons. In contrast, a small number of residents reported using either the bucket system (9.4% n = 36), unspecified facilities (6.5% n = 25) or none of the facilities provided (8.1% n = 31).

Table 4-6: Access and use of sanitation facilities within the study settlements

Sanitation technology	Informal settlement					∑
	A n (%)	B n (%)	C n (%)	D n (%)	E n (%)	n (%)
MobiSan (dry toilet)	46 (64.8)	-	-	-	-	46 (64.8)
Communal flush toilet	-	56 (80.0)	58 (76.3)	-	30 (35.7)	144 (62.6)
Kayaloo (flush toilet)	-	-	-	65 (79.3)	22 (26.2)	87 (52.4)
Porta -potties	12 (16.9)	-	2 (2.6)	-	-	14 (9.5)
Bucket toilet	6 (8.5)	5 (7.1)	7 (9.2)	6 (7.3)	12 (14.3)	36 (9.4)
Unspecified	1 (1.4)	4 (5.7)	5 (6.6)	7 (8.5)	8 (9.5)	25 (6.5)
None	6 (8.5)	5 (7.1)	4 (5.3)	4 (4.9)	12 (26.2)	31 (8.1)
Total	71 (100)	70 (100)	76 (100)	82 (100)	84 (100)	
Note: Data in this table concerns only facilities strictly used by residents.						

These unspecified facilities were identified to be either open defecation, use of plastic bags or bucket, full waterborne toilet illegally connected to stormwater drain or unlined pit latrines and ditches. Illegal waterborne toilets were predominant in informal settlement C, while pit latrines and ditches were in informal settlement E. Access to the facilities was not only intended for defecation. Users accessed the facility for other purposes including the discharging night pails or greywater and/or showering (27.5% n = 105), defecating and discharging night pail (57.4% n = 220), disposing night pails only (22.7% n = 87), defecating only (13.1% n = 50) or personal hygiene (6.8% n = 26). Those not using the provided facilities in their settlements less frequently reported having access to off-site facilities located at their workplace, public places (e.g. shopping malls, clinics or public buildings) and other informal settlements.

The frequency of access and use of the toilets' facilities varied from one user to another. The frequency of use included frequent daily use (44.1%, n = 169), once a day (13.1%, n = 50), twice a day (12.8%, n = 49), thrice a day (5.2%, n = 20), once weekly (5.2%, n = 20) and scarcely (19.6%, n = 75). Access was also temporal with peaks (from 5h00 to 9h00 and 17h00 to 19h00) and off-peak periods (after 9h00 up to 17h00, and after 19h00 until 5h00) as represented in Figure 4.1.

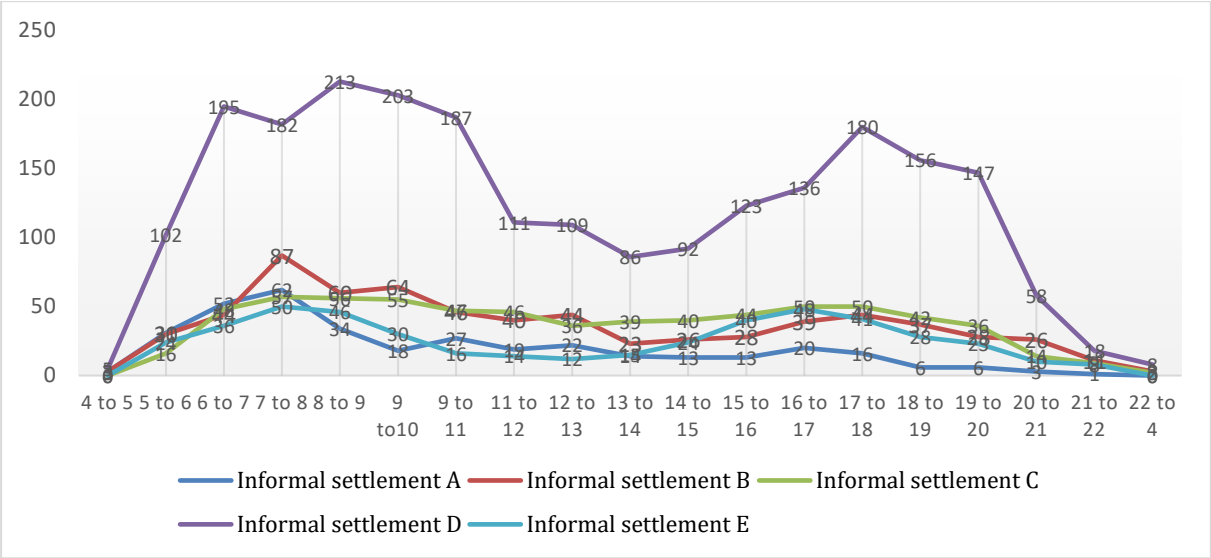

Figure 4-1: Average daily access to sanitation facilities across the study areas

The condition of the sanitation facilities across the informal settlements was a subject of disagreement between respondents. Although rated satisfactory (clean and usable) by municipal officials and sanitation entrepreneurs, other respondents rated them as dirty and unusable. For instance, users labelled their toilets as very dirty (27.2% n = 104), dirty but usable (21.7% n = 83) and dirty and unusable (17.2% n = 66). The general condition of facilities varied from one settlement to another as depicted in Table 4.7.

Table 4-7: Users rating of the condition of their sanitation facilities

Condition of the sanitation facility	Informal settlement					∑
	A n (%)	B n (%)	C n (%)	D n (%)	E n (%)	n (%)
Very clean	12 (16.9)	6 (8.6)	4 (5.3)	14 (17.1)	2 (2.4)	38 (9.9)
Clean and usable	37 (5.1)	11 (15.7)	13 (17.1)	12 (14.6)	7 (8.3)	80 (20.9)
Dirty but usable	10 (14.1)	26 (37.1)	18 (23.7)	18 (22.0)	11 (13.1)	83 (21.7)
Dirty and unusable	6 (8.5)	9 (12.9)	10 (13.2)	18 (22.0)	23 (27.4)	66 (17.2)
Very dirty	4 (5.6)	15 (21.4)	29 (38.2)	16 (19.5)	40 (47.6)	104 (27.2)
Don't know	2 (2.8)	3 (4.3)	2 (2.6)	4 (4.9)	1 (1.2)	12 (3.1)
Total	n = 71	n = 70	n = 76	n = 82	n = 84	383 (100)
Note: Data in this table concerns only officially recognised facilities strictly used by residents.						

Our own observation showed that only half of facilities were operational, and their condition ranged between good to very poor depending on the time of the day during which they have been cleaned. In areas where cleaning was undertaken by janitors and contracted cleaners, facilities were clean immediately after cleaning but within a matter of hours the facility would once again be dirty. In informal settlement A where the caretaker was a municipal employee, the facility was generally clean and pleasing to use. However, in all settlements, the condition of facilities was even poorer over the weekend and public holidays when the caretakers, cleaners and janitors are not available.

Another argument unfolded around the reasons for the poor condition of sanitation facilities. In areas where the facilities were not clean, respondents attributed the poor condition to different factors. Some of the complaints are directed at other users rather than those responsible for cleaning the facilities:

The facility is often dirty even after being cleaned because many residents dispose their buckets without flushing. Sometimes the content of the bucket can spill over, thus restricting the next user to use the facility. (Resident of informal settlement C)

On the same note, municipal officials argued that,

The unhygienic condition of the facilities is a result of misuse, vandalism and theft by the same users - because they consider that these facilities belong to the municipality, and they do not have any responsibility. (Municipal official)

In other cases, a community leader indicated,

The untidiness of these facilities is due to the lack of attention by officials who don't provide sufficient maintenance and cleaning services. (Community leader 1)

4.4.2.2 Challenges associated with access and use of sanitation facilities

Throughout this study, it was understood that respondents have an extremely different understanding of the causes underlying the state of sanitation access in informal settlements. Some of the challenges were related to the institutional, technical, or social aspects of sanitation (section 4.3). Access was generally easy during the off-peak periods, and up to 58.5% (n = 224) felt that it was difficult during peak periods, evening, nighttime and weekends for a number of reasons, as reported in Table 4.8.

Table 4-8: Reported causes of difficult and poor access to sanitation facilities

Contributing factors for access	Informal settlement					Σ
	A n (%)	B n (%)	C n (%)	D n (%)	E n (%)	n (%)
Number of users	22 (31.0)	13 (18.6)	20 (26.3)	22 (26.8)	21 (25.0)	98 (25.6)
Number of facilities	3 (4.2)	6 (8.2)	2 (2.6)	10 (12.2)	15 (17.9)	36 (9.4)
Condition of facilities	5 (7.0)	13 (18.6)	17 (22.4)	8 (9.8)	18 (21.4)	61 (15.9)
Safety concerns	28 (39.4)	22 (31.4)	20 (26.3)	26 (31.7)	24 (28.6)	120 (31.3)
Location of the facility	6 (8.5)	10 (14.3)	7 (9.2)	7 (8.5)	2 (2.4)	32 (8.4)
Waiting time	5 (57.0)	2 (2.9)	4 (5.3)	6 (7.3)	3 (3.6)	20 (5.2)
Don't know	2 (2.8)	4 (5.7)	6 (7.9)	3 (3.7)	1 (1.2)	16 (4.2)
	71 (100)	70 (100)	76 (100)	82 (100)	84 (100)	383 (100)

During peak periods, access was difficult because of the large number of users, number of available facilities, cleanliness of the facilities, safety concerns and lack of privacy. In many cases, facilities were out of order and even if noted on paper, they were set aside for a certain number of users based on municipality defined ratio. Difficult access over weekends was attributed to safety concerns, poor condition of the facility (untidiness), misuse and theft of facility's parts (e.g., metal locks and doors). The high occurrence of misuse and vandalism over the weekend was attributed to the poor conditions of the facility due to the absence of janitors or cleaners who only work during weekdays. Misuse and vandalism were attributed to drunkards and users of intoxicating substances who often ignore the basic use requirements of the facility. The theft of the facility components was attributed to the high rate of poverty and unemployment amongst residents of the settlements. For municipal officials, the misinterpretation of the sanitation policy and the general perception that the Free Basic Services policy has failed to specify the minimum acceptable standard for sanitation services have created expectations:

Given the dynamic nature of informal settlements and urgent need for services, it is difficult to plan and service. We can only address urgent needs which in this case are access to water and sanitation. Where these needs are addressed, residents often do not consider them as

theirs; this attitude is conducive to misuse, theft and vandalism, which become problematic for both residents and officials. (Municipal official A)

The number of users has an enormous influence on the time taken to access the facility, as depicted in Table 4-9. For instance, the minimum waiting time reported by users was less than five minutes (5.7% n = 22) while the maximum was between 31 and 60 minutes (3.4% n = 9). These claims were disputed by sanitation entrepreneurs and caretakers who indicated that the average waiting time was less than 10 minutes.

Table 4-9: Waiting time during peak period (6:00 to 8:00)

Waiting time (min)	Informal settlement					Σ
	A n (%)	B n (%)	C n (%)	D n (%)	E n (%)	n (%)
< 5	10 (14.1)	4 (5.7)	6 (7.9)	2 (2.4)	0 (0.0)	22 (5.7)
5 to 10	30 (42.3)	38 (54.3)	46 (60.5)	29 (35.4)	6 (7.1)	149 (38.9)
11 to 20	28 (39.4)	22 (31.4)	21 (27.6)	36 (43.9)	26 (30.9)	133 (34.7)
21 to 30	2 (2.8)	3 (4.3)	3 (3.9)	12 (14.6)	46 (54.8)	66 (17.2)
31 to 60	1 (1.4)	3 (4.3)	0 (0.0)	3 (3.7)	6 (7.1)	13 (3.4)
> 60	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Don't know	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	71 (100)	70 (100)	76 (100)	82 (100)	84 (100)	383 (100)

Our own observations revealed average waiting times during the peak period ranging between 10 and 15 minutes. Where dedicated night pail disposal facilities were available, the waiting queue was lesser than 10 minutes. It was obvious that it will take time when an individual accesses the facility to dispose a night pail and at same time use the facility to defecate. The heterogenic nature of informal settlements where people of different cultures, backgrounds, and religions, have to share the same facilities is also problematic. Difficulties emerged as some cultures and religions do not allow male and female, in-laws, or children to share the same facility with their parents. Some of these challenges are further elaborated in section 4.4.3.2.

Although many users reported having access and using the provided sanitation facilities (for either defecating or discharging night pails), these were not without risks. In all informal settlements, there were risks around the safety of users (24.5% n = 94): fear of contamination (28.2% n = 108), fear of sickness (28.2% n = 108), loss of dignity and privacy (15.1% n = 58) and unspecified risks (4% n = 15). One resident admitted,

Every time I use these toilets my private parts become itching. (Resident of informal settlement C)

For other respondents, risks associated with the use of the facilities are typically related to the fear of infection or contamination, and an acute fear of being harassed, raped, or killed. While the risks and problems associated with the use of the facilities were evident, some residents claimed to have reported to the municipal call centre (35.2% n = 135) and community leaders (23.8% n = 91) while others (22.5% n = 86) did not nothing about it. The reporting process varied from one settlement to another. For instance, problems encountered are reported either to the community leaders (informal settlement A and E), the contractor (informal settlement D) or directly to the municipality using the toll-free number (informal settlements A, B, C and D). The toll-free number for reporting issues was only accessible or free from a landline telephone, and mobile cell phone calls were charged. There charges incurred for phone calls have discouraged most of residents to report issues related to their facilities.

4.4.3 *Sanitation practices (behaviours and attitudes towards sanitation facilities)*

Since most respondents have identified challenges and risks associated with access and use of the sanitation facilities, it was deemed necessary to understand users' sanitation practices, their extent and causes and impact on access and sustainability of sanitation services. More details of quantitative and qualitative data are provided in Appendices B.2.2, B.2.3 and C.2, respectively.

4.4.3.1 Sanitation practices: their extent and causes

The facilities provided to informal settlements are not the only ones used for sanitation purposes. In all five settlements, the use of existing facilities is combined with a variety of alternative practices. Sanitation practices varied in terms of their magnitude as outlined in Table 4-10. Unknown or non-reported sanitation practices were observed as either the use of illegally built pit latrine ditches or flush toilets connected to stormwater drains.

Table 4-10: Self-reported and observed sanitation practices[28] across informal settlements

Sanitation practices	Informal settlement					Σ
	A n (%)	B n (%)	C n (%)	D n (%)	E n (%)	n (%)
Use of provided facilities	46 (64.8)	56 (8)	58 (76.3)	65 (79.3)	52 (61.9)	277 (72.3)
Use of night pail (bucket)	6 (8.5)	5 (7.2)	7 (9.2)	6 (7.3)	12 (14.3)	36 (9.4)
Use of porta-potty	12 (16.9)	0 (0.0)	2 (2.6)	0 (0.0)	0 (0.0)	14 (3.7)
Use of offsite facilities	1 (1.4)	4 (5.7)	5 (6.6)	7 (8.5)	8 (9.5)	25 (6.6)
Open defecation	4 (5.6)	3 (4.3)	2 (2.6)	2 (2.5)	7 (8.3)	18 (4.7)
Use of plastic bags	1 (1.4)	1 (1.4)	1 (1.35)	1 (1.2)	3 (3.6)	7 (1.7)
Unknown	1 (1.4)	1 (1.4)	1 (1.35)	1 (1.2)	2 (2.4)	6 (1.6)
Total	71 (100)	70 (100)	76 (100)	82 (100)	84 (100)	383 (100)

While these practices were acknowledged by respondents, municipal officials considered (mis)use of existing facilities, use of inappropriate anal cleansing materials (such as newspapers and leaves), disposal of sanitary pads, nappies, solid waste and greywater in the toilet bowl or on the floor as recurrent sanitation practices amongst informal settlement residents.

Users rated their sanitation practices as acute (49.6% n = 190), low (23.5% n = 90), medium (22.7% n = 87) and unrated (4.2% n = 16). These practices occurred both during day or night depending on the attitude of the resident, local conditions, and the circumstances which an individual is facing. The day or night use of buckets, plastic bags and porta-potties were the predominant practices adopted by almost every resident including children, adults, elderly and physically challenged people (Table 4.11). In many cases, day use is an option when access to existing facilities is limited or difficult. In this instance, many people resorted to open defecation, porta-potties or use of buckets or plastic bags during any time of the day. Respondents across the study settlements indicated that the most predominant of these day practices was the use of buckets (90% n = 345), followed by the porta-potty (65% n = 249), plastic bags (23% n = 88) and open defecation (26.9% n = 103). It was noticed that the use of porta-potties was subject to their availability, and their use were predominant in informal settlement A. Those who rejected the porta-potties, or the available facilities resorted to other means including buckets, own pit latrines or flush toilets as previously mentioned.

[28]Sanitation practices are classified as day and night use according to the time of their occurrence. Results presented in Table 4.10 cover only day practices. Night pails were being used at night due to perceived security concerns.

Table 4-11: Categories of residents who have adopted certain sanitation practices

Category of residents	Informal settlement					Σ
	A n (%)	B n (%)	C n (%)	D n (%)	E n (%)	n (%)
Children <12	21 (29.5)	14 (20.0)	11 (14.5)	14 (17.1)	17 (20.2)	77 (20.1)
Girls <18	9 (12.7)	11 (15.7)	14 (18.4)	16 (19.5)	12 (14.3)	62 (16.2)
Boys <18	3 (4.2)	4 (5.7)	2 (2.6)	5 (6.1)	2 (2.4)	16 (4.2)
Adult males	6 (8.5)	8 (11.4)	10 (13.2)	6 (7.3)	14 (16.7)	44 (11.5)
Adult females	20 (28.2)	21 (30.0)	25 (32.9)	30 (36.6)	26 (31.0)	122 (31.9)
Elderly & physically challenged	3 (4.2)	4 (5.7)	3 (3.9)	5 (6.1)	4 (4.8)	19 (4.9)
Everyone	4 (5.6)	6 (8.6)	5 (6.6)	3 (3.7)	7 (8.3)	25 (6.5)
Don't know	5 (7.0)	2 (2.9)	6 (7.9)	3 (3.7)	2 (2.4)	18 (4.7)
Other	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	71 (100)	70 (100)	76 (100)	82 (100)	84 (100)	383 (100)

Night use occurred after the sun set and up to the early hours of the morning. Reported night practices included the use of night pails (90% n = 345) and porta-potties (65% n = 249), open defecation (18% n = 69), use of plastic bags (38% n = 146) and use of provided facilities (2% n = 8). Those having self-made facilities used buckets at night due to safety concerns. The night use of the provided facilities and that of plastic bags were predominantly practiced by males (between 18 and 45) while night pails and porta-potties were predominantly used by females, children and physically challenged respondents.

> *Open defecation is practiced by almost everyone especially children, drunk people and some adults (males and females). It takes place in open spaces, bushes, and in-between and behind shacks.* (Community leader A)

Open defecation occurred in the early hours of the morning, during daytime when there are few residents in the settlements, evenings when it starts getting dark and after hours when the facility is closed (e.g. informal settlement A). Where night pails were used, the content was disposed either in the toilet, trench/gulleys or bush and open spaces between or behind shacks or at the water standpipe gulley. Users of plastic bags disposed them at solid waste disposal facilities, open spaces or behind shacks and occasionally on the rooftop of a neighbour's shack. In contrast, the porta-potties were collected twice a week, transported, emptied, cleaned and returned to the users by municipal contractors.

4.4.3.2 Reasons for adopting sanitation practices

All respondents including users (94% n = 360) concurred that informal settlement resident sanitation practices have been informed by context specific factors including sanitation challenges and risks associated with access to sanitation facilities (Table 4.12 and Appendix B.2.3). These factors were ascertained through observation. A number of these factors are associated with the sanitation challenges and risks associated with access and use of the sanitation facilities.

Safety concerns (fear of being robbed, raped, or even killed) are linked to a number of social issues including poverty and joblessness. The lack of lighting within the settlement and inside the facility, and night walks between shacks to the facility were perceived as safety concerns:

> *Thugs are waiting in the dark to rob people… What is the point of going somewhere where you know that you will be a victim?* (Resident of informal settlement B)

Table 4-12: Self-reported reasons for adopting sanitation practices within the study area

Reasons for poor sanitation practices	Study settlement					Σ
	A n (%)	B n (%)	C n (%)	D n (%)	E n (%)	n (%)
Safety concerns	30 (42.2)	22 (31.4)	23 (30.3)	26 (31.7)	24 (28.6)	125 (32.6)
Cleanliness (poor condition of facility)	0 (0.0)	14 (20.0)	12 (15.8)	10 (12.2)	13 (15.4)	49 (12.8)
High no. of users & long waiting queues	0 (0.0)	9 (12.9)	10 (13.2)	8 (9.8)	11 (13.1)	38 (9.9)
Lack of privacy and comfort	0 (0.0)	6 (8.6)	8 (10.5)	9 (11.0)	8 (9.5)	31 (8.1)
Long walking distance to the facility	9 (12.7)	3 (4.3)	0 (0.0)	12 (14.6)	5 (6.0)	29 (7.6)
High number of blocked toilets	0 (0.0)	6 (8.6)	12 (15.8)	0 (0.0)	8 (9.5)	26 (6.8)
Fear of contamination	11 (15.5)	3 (4.3)	0 (0.0)	0 (0.0)	7 (8.3)	21 (5.5)
Unavailability of facility at time of need	0 (0.0)	4 (5.7)	4 (5.2)	6 (7.3)	2 (2.4)	16 (4.2)
Lack of choice/alternative	7 (9.9)	2 (2.8)	0 (0.0)	0 (0.0)	5 (6.0)	14 (3.7)
Position/location of the facility	6 (8.4)	0 (0.0)	0 (0.0)	7 (8.5)	0 (0.0)	13 (3.4)
Lack of dedicated facilities for other use	0 (0.0)	1 (1.4)	7 (9.2)	4 (4.9)	1 (1.2)	13 (3.4)
Personal feelings, religion and beliefs	8 (11.3)	0 (0)	0 (0.0)	0 (0.0)	0 (0.0)	8 (2.0)
Total	71 (100)	70 (100)	76 (100)	82 (100)	84 (100)	383 (100)

It is noteworthy that during the transect walks, two incidences of robbery, two assaults, one harassment and one incident of verbal abuse were witnessed during off-peak and evening times. During our research, two deaths, both related to night access to sanitation, occurred in an adjacent informal settlement. These incidences sparked a wave of panic that understandably deterred many residents from using the facilities at night. Participant observation showed that night practices were associated with the safety issue as most informal settlements are prone to gang violence.

The condition of the facility (understood in the context of this study as the level of cleanliness) also informed sanitation practices. Most of the facilities across the study areas (except informal settlement A) were dirty and unusable over the weekends (Saturday and Sunday) and public holidays due to the absence of cleaners:

> *These toilets are always dirty and unusable…so I prefer using something else as using these toilets may cause sickness.* (Resident of informal settlement E)

The number of functioning toilets was much lower than that of users. The demand for sanitation facilities exceeded supply at peak times (5h00 and 9h00) as there were few facilities available to use. There was imbalance between the number of functioning facilities and that of users, which forced residents to queue, waiting for their turn to access the facility. Since waiting time is an issue, some users also feel that the use of night pails (buckets) and their disposal at the facility is more effective.

> *Because of the large number of users and long waiting, using my bucket is more safe because of the unhygienic conditions of the toilet after being used by many people.* (Resident of informal settlement B)

Similarly, a community leader explained,

> *It is hard to wait for such a long period or walking a long distance to access toilet. People may prefer an alternative in order to relieve themselves.* (Community leader of informal settlement D)

The user–facility ratio of 1:5 claimed by officials was not observed. For instance, users reported a much more detrimental ratio of 1:20 and even 1:30 in some cases. In all five informal settlements, there were fewer facilities than what there were supposed to be.

> *Look for yourself, these toilets are standing there but cannot be used…They are still counting that our settlement has toilets.* (Resident of informal settlement E)

Some of the few functioning facilities were padlocked by individuals to prevent residents who were not close family from using the facility. Those who could not access existing facilities resorted to open defecation and the use of plastic bags. In some instances, residents were able to build pit latrines or a waterborne toilet.

> *Some of the facilities are locked or closed in the evening, and we are left without any other option than using anything at our disposal.* (Resident of informal settlement A)

In certain areas, in fact, there were no longer any functioning sanitation facility in place at all.

> *All toilets have been vandalised and municipal workers have removed everything…only empty blocks are left…Where should we go then?* (Resident of informal settlement C)

The lack of privacy and comfort are associated with a number of sanitation practices, a serious issue as many users (especially females) felt uncomfortable in accessing facilities that have no features such as lock or doors.

> *Can you comfortably use this toilet where everyone in looking at you? There is not even a lock, what can happen if somebody just opens that door?* (Female resident of informal settlement B).

Almost half of the facilities across the study settlements did not meet basic privacy requirements (e.g. locks, door), and were therefore seen as compromising the dignity of users. These facilities were also shared by both male and female users – and it was often disconcerting for a female to be in the queue with men to use the same facility. Female users were reluctant to share facilities with males who are not their relatives and were even cautious to access facilities when male users are around. This factor was a deterrent for many female users.

The long waiting time is also coupled with privacy issues:

> *Even when you have access, there are people there watching and waiting for you to finish, hence I feel shy and feel that my privacy is not respected.* (Resident of informal settlement C)

Most of the females, as well as the elderly, were not comfortable accessing the facility and felt it was undignified to do so.

The large number of blocked toilets attributed by respondents to the lack of knowledge of the operational requirements of a given sanitation technology, theft of parts, misuse and vandalism have left many facilities in a state of disrepair, greatly reducing the number of functioning facilities:

> *Many residents have opted for open defecation because of the lack of maintenance of the facilities, vandalism and theft by residents and outsiders.* (Community leader of informal settlement D)

Hygiene and health constraints have played a part in shaping users' sanitation practices as (mainly female) users view the toilets as filthy. They justified their practices over the fear of contamination. Inadequate cleanliness of facilities has stimulated the perception that using communal facilities leads to infection:

> *Every time I use this toilet my private parts start itching and after visiting the clinic, I will be informed that I contracted an infection. I decided to defecate in the bush just behind my house.* (Female resident of informal settlement A)

Closure of the facility, especially where the caretakers were managing the facility and the opening and closing of facilities, users were compelled to seek alternative means to meet their sanitation needs.

> *Some of the facilities are locked or closed in the evening, and we are left without any other option than using anything at our disposal.* (Resident of informal settlement A)

For many other residents, their practices are justified by the lack of alternative or choice as many of the facilities in their settlements are either far from their homes, non-functional or not adapted to their physical conditions.

> *Most of toilets are not working…where they are working, there is a long queue which make access very difficult.* (Resident of informal settlement E)

Available alternatives such as porta-potties were intended for those located some distance from the facility, physically challenged and elderly. However, this alternative was rejected across the study areas except informal settlement A where a small number of residents have accepted its use. Other off-site alternatives including facilities located at public places, buildings or shopping centres were commonly used by some residents but only during specific times of day (e.g., during working hours).

> *I always use facilities at my workplace because they are cleaned.... When I'm at home, I prefer to use bucket than those dirty toilets.* (Resident of informal C)

In all five informal settlements, the location of the sanitation facility was either at the front side between shacks or at the back side of the settlement. While municipal officials claimed that the positioning of the facility is guided by the local contexts (e.g., space, safety concerns, settlement conditions), some users believed it was actually guided by the level of political support. According to these users, facilities are located where the ruling party has more members, far from their homes or in areas prone to vandalism, theft, or robbery. Therefore, the location is, for many users, a deterrent that shapes their personal practices.

> *There so many bad people that side of the toilet…. Every day I could hear people screaming after being robbed, even stabbed.* (Resident of informal settlement E)

During the course of the study, a newly built facility (a CAB) was torched and destroyed because of the lack of agreement amongst residents with regard to the location. Due to the location of the facility, walking distance between individual houses and the facility plays an evident role in shaping users' everyday practices. Despite most facilities being located within <200 m, the location the facility and subsequent walking distances were regarded by users (58% n = 222) as a deterrent for physically challenged individuals and children:

> *It is hard for many residents (mainly elderly) to walk a long distance to access toilet. People may prefer an alternative in order to relieve themselves.* (Community leader)

The unavailability of facilities for other use (e.g., urinating, disposal of night pails, hand washing) compounded by the dwindling number of functional facilities and high user-facility ratio has exacerbated the conditions of the existing facilities:

> *Since everyone is using bucket or plastic at night, I think there should provide facilities this purpose…. And long waiting queue and misuse may be reduced significantly.* (Resident of informal settlement D)

A small group of respondents claimed that sharing the provided toilets with others goes against their personal feeling, cultural or religious beliefs.

> *I personally feel uncomfortable to share a toilet with other people who are not close family or friends.* (Resident of informal settlement B)

In one of the five informal settlements where the urine diversion dry sanitation facility (MobiSan) was deployed, the appropriateness of the sanitation technology contributed to shaping users' practices:

> *As Muslim practitioner, I have to perform ablution after visit the toilet…. Now I'm being told that this toilet does not require water. This toilet is not comfort to our religious obligations.* (Respondent of informal settlement A)

The design of the facility was unsuitable for certain categories of users (e.g. Muslims, or physically challenged individuals). Some facilities lacked features such as the access ramps for disabled, hand wash facilities and dedicated facilities for disposal of night pails:

> *These toilets cannot be used by a disabled person because there is no ramp, and the toilet cannot accommodate a wheelchair.* (Resident of informal settlement A)

More broadly, users claim that most of the unhygienic practices (e.g. open defecation) are a response to the failure of the technologies:

> *When people are unfamiliar or do not understand how a technology operates, they have no choice than using what is at their disposal or they can afford being hygienic or unhygienic.* (Community leader of informal settlement E)

Municipal officials feel that the technology is adequate, but has been made improper by users:

> *Many users have little or no knowledge of certain technologies [e.g. Urine Diversion Toilet]. Without an education campaign, the use of these technologies may become a cause of concern, hence leading people to adopt other practices such as the bucket system or plastic bags.* (Municipal official A)

Municipal officials responded that sanitation technologies are selected based on certain somewhat general factors; they cannot afford to provide technology specific to each and every resident:

> *We cannot provide facilities based on individual profile and status…. This may not be possible for various reasons including space, cost and management.* (Municipal official B)

Municipal officials, sanitation entrepreneurs and the caretaker of one of the facilities noted that sanitation technology choice is a significant contributing factor for certain practices only when users lack understanding, fail to understand or deliberately ignore the operational requirements. In other instances, when users are not informed about which technology works best, they tend to choose a 'quick fix' that suits their needs best. There is a negative feedback loop because the inappropriate technology then results in dysfunctional facilities which in turn prohibit or limit access.

The lack of understanding of, or compliance with, the operational and use requirements of the facility, lack familiarity and type of technology emerged as drivers informing user practices. A few respondents indicated that some sanitation technologies (e.g. urine diversion toilets) were basic and inappropriate because their use requirements were complicated for many users. Less than half of the users (49.6% n = 190) acknowledged that some of their sanitation practices were informed by unfamiliarity with the technology, admitting that the lack of understanding of the use requirements of a given technology may lead to the avoidance or reluctance to access and inappropriate use which led many to seek alternatives.

I cannot use something that I am unfamiliar with, instead I will go to the one that will make me feel comfortable. (Resident of informal settlement A)

Some of the reasons provided for non-compliance were more gender specific. For instance,

It is difficult for male users to sit or lift the toilet lid when urinating.... They prefer the standing position which often results in missing the target and ends up messing the toilet seat. (Caretaker of informal settlement A)

Community leaders pointed out lack of hygiene education and awareness as drivers for some of the sanitation practices observed across the settlements:

Some residents accessing toilets use newspaper for anal cleansing and leave the facility without flushing…. In such cases, blockage is likely to occur and damage the whole system (Community leader of informal settlement C)

Aside from lack of awareness, residents' sanitation practices are perceived by municipal officials as a means of resident protest against the current technology selection:

Sanitation practices are intentionally adopted by some residents as a way to pressurise municipalities to provide individual facilities or speed up the settlement upgrading process. (Municipal official B)

NGO/CSO and CBO representatives attributed these practices to the disjuncture between user demands and quality of service provided and the suitability of the technology (in terms of comfort and accessibility by all categories of users including children and vulnerable people). They further pointed out the negative perceptions about the capacity of municipalities to provide adequate services that consider user demands and expectations and settlement conditions as reasons for the occurrence of a number of these practices.

All respondents acknowledged that sanitation practices outlined above not only result from inadequate sanitation choice; there might, in fact, be other underlying reasons. Our interaction with respondents and our participant observation of their behaviour, show that users have a particular attitude towards existing facilities coupled with political interference and an entitlement mentality emanating from their interpretation of the Constitution and sanitation policy and from personal aspirations to have their own toilet. These attitudes drive their behaviour around sanitation practices. Interestingly, some of these practices were taking place in areas where facilities were in fact clean, safe and closer to the residents' houses.

Regardless of the nature of sanitation practices and reasons for their adoption, respondents acknowledged some of these practices (e.g., open defecation) as unhygienic. These practices have an impact on access, functioning of facilities and long-term sustainability of sanitation services as a whole (Appendix C.2) as well as on human and environmental health (Appendix B.2.4). For instance, using newspaper for anal cleansing can lead to blockages of sewers which impacts the functioning of the facility. The sustainability of a facility affected by unhygienic practices can mean frequent and expensive maintenance, thereby resulting in a reduction of the number of facilities and delays and interruptions of the FBSan provision.

Diverging views on the way these unhygienic practices could be addressed were presented. User views (outlined in Appendix B.2.5 and C2) differed from views of municipal officials. For instance, users believe that,

> *The only way to address our current practices is to ensure that individual facilities are provided to each and every resident within the settlement.* (Resident of informal settlement A)

Municipal jurisdictions also responded differently to the impact of sanitation practices. For instance, the City of Cape Town responded by (i) introducing janitorial service (where it was not available) or efficiency monitoring where such a service was available; (ii) providing temporary alternatives such as porta-potties; (iii) introducing a dedicated maintenance team; (iv) replacing existing facilities by introducing new technologies (e.g., container toilets with communal waterborne facilities); and (v) deploying additional facilities. Stellenbosch municipality responded by (i) contracting a cleaning service; (ii) delegating the monitoring and evaluation to residents and their community leaders; and (iii) conducting regular maintenance. The Theewaterskloof municipality responded by (i) introducing a new sanitation technology (Kayaloo) and (ii) delegating the operation and maintenance tasks to Engineering Services.

The next section examines whether various sanitation technologies provided to informal settlements are applicable to the local context and respond to user needs, compatible with existing institutional arrangements and the extent of their impact on access. This query extends to understand whether these technologies have contributed to improving access to sanitation.

4.5 Applicability of sanitation technologies provided to informal settlements, institutional arrangements, and impacts

4.5.1 *Introduction*

As stated in the previous section, all informal settlements studied have functional sanitation facilities that are either waterborne or non-waterborne, mobile, or permanent in terms of their top structure. Despite the availability of the facilities, users, community leaders and CBO, NGO/CSO representatives as opposed to municipal officials and sanitation entrepreneurs felt that they are not meeting their intended purpose. This section of thesis documents respondents' perspectives on the applicability of sanitation technologies provided to informal settlements, institutional arrangements and related impacts on access and long-term sustainability of sanitation services in informal settlements. Themes covered include (i) respondents' perspectives on the applicability of sanitation technologies and facilities; (ii) respondents' valuation of sanitation technologies and facilities; and (iii) implications of institutional arrangements on access and sustainability of the services. Details of quantitative and qualitative data are documented in Appendix B.3 and C.3, respectively.

4.5.2 *Perspectives on the applicability sanitation technologies and facilities*

Although (communal water or non-waterborne) sanitation technologies are provided across the study's informal settlements, respondents were requested to provide their views on their applicability.

4.5.2.1 Sanitation technologies

Across the five settlements, two types of sanitation technologies, namely water and non-waterborne, were deployed. Waterborne facilities were divided into two categories, namely mobile and permanent, with regard to their type of superstructure. These technologies were examined using respondents' self-defined applicability criteria (Table 4.13).

In terms of the easiness of use, MobiSan emerged as an inapplicable technology as many users did not know how to use it. The applicability of the MobiSan and porta-potties were questionable from an operational requirement perspective. For many users, these facilities were not user-friendly, as access was not guaranteed for physically challenged residents and their use and operational requirements infringed on personal dignity and privacy.

> *This toilet is bad because of smell, uncomfortable to use because wind blowing under the vault, and does not cater for our elderly and disabled.* (Resident of informal settlement A)

Table 4-13: Users views on the applicability of sanitation technologies

Applicability criteria	Sanitation technology			
	MobiSan	Communal flush toilet	Kayaloo	Porta-potty
Operational requirements	No	Yes	Yes	No
Easiness of use	No	Yes	Yes	Yes
Compliance with policy	No	Yes	Yes	No
Meeting users' needs and aspiration	No	Yes	Yes	Yes
Relevance to settlement conditions	No	No	No	No
Easiness of O&M	Unsure	Yes	Yes	Unsure
Management	Yes	No	Yes	Yes

Compliance with the use requirements was another issue as many users felt that some technologies were more technically user-friendly than other. Many users preferred using buckets than complying with the use requirements of some facilities.

> *Some users even dare to squat instead of sitting, hence ending by breaking the toilet sit…. Some others use wrong anal cleansing materials such as newspaper, while other dispose nappies and sanitary pads, hence causing blockages.* (Contractor cleaner 2)

Municipal officials acknowledged that operational and use requirements are not properly upheld:

> *Operational requirements are being ignored by residents to force municipality to provide individual facilities.* (Municipal official C)

Compliance with policy was another criterion that identified non-waterborne sanitation technology as non-compliant with the sanitation policy. Users even evoked the section of the sanitation policy that suggests the minimum level of sanitation service as a waterborne sanitation to justify their arguments. In contrast, users acknowledged that the communal flush toilet and Kayaloo were compliant and non-compliant simultaneously. Compliance was understood for waterborne sanitation technologies, and non-compliance for not being an individual facility. NGO/CSO and CBO representatives concurred with users, while municipal officials argued that the policy does not prescribe the provision of waterborne technology for informal settlements.

All sanitation technologies (except the one in informal settlement A) did meet users' needs and aspirations, simply as being waterborne. Users viewed only waterborne sanitation technologies as applicable to the conditions pertaining to their settlements. The easiness of the O&M made waterborne sanitation technologies (communal flush toilet and Kayaloo) applicable from users' perspectives. The easiness of O&M was viewed from the soft maintenance perspective, which for many users it is limited to the cleaning and unblocking the toilets. In contrast, municipal officials and sanitation entrepreneurs maintained that waterborne sanitation is difficult to maintain, especially when users are not abiding to the strict operational requirements.

In terms of management, users view the applicability of a sanitation technology in terms of the availability of the caretaker or contractors' cleaners who are responsibility for the daily care of the facilities. While this view was shared by municipal officials and other stakeholders, they

cautioned that the appointment of permanent caretaker should not be seen as pre-condition for sanitation technology applicability. Our interactions and assessment of the sanitation technologies showed that their applicability was context specific. In all cases, both technologies were applicable from technical perspectives because of the temporary nature of the settlement and status of the land. Despite the technologies being waterborne, the applicability from social perspectives was not achieved as many users wanted it to be extended to individual waterborne facilities.

4.5.2.2 Sanitation facilities

The two sanitation technologies (water and non-waterborne) culminated into communal facilities. Their applicability was evaluated in terms of (i) access; (ii) relevance of the sanitation technology and facilities to user needs and settlement conditions; (iii) user preferences; (iv) use and operational requirements; (v) institutional and management arrangements; and (vi) sustainability (as detailed in Appendix B.3.4). The overall results presented in Table 4.14 reveal that sanitation facilities provided to informal settlements are negatively valued by users.

Table 4-14: Users valuation of sanitation facilities provided to informal settlements

	Valuation criteria					
	Access n (%)	Relevance n (%)	Preference n (%)	Use n (%)	Management n (%)	Sustainability n (%)
Yes	119 {31.1)	14 (3.7)	2 (0.5)	210 (54.8)	133 (34.7)	39 (10.2)
No	224 (58.5)	359 (93.7)	368 (96.1)	137 (35.8)	240 (62.7)	332 (86.7)
Don't know	40 (10.4)	10 (2.6)	13 (3.4)	36 (9.4)	10 (2.6)	12 (3.1)
	383 (100)	383 (100)	383 (100)	383 (100)	383 (100)	383 (100)

The communal sanitation facilities were viewed by users (58.8% n = 224) as not applicable because of difficulties experienced with access (as depicted in Appendix B.3.2) and municipal officials and sanitation entrepreneurs' access (as criterion) in terms of the number of facilities provided. They insisted that the ratio of one facility for five households has facilitated and guaranteed access for all residents, thus rendering the provided facilities applicable from an access point of view.

The relevance of the sanitation facilities was differently understood by respondents. For instance, users view relevance in terms of their own pre-defined and agreed criteria, with the most predominant features as noted in Table 4.15 and Appendix B.3.1.

Table 4-15: Users understanding of the relevance of a sanitation facility

Indicators of relevance	Informal settlements					Σ
	A n (%)	B n (%)	C n (%)	D n (%)	E n (%)	n (%)
Accessibility	5 (7.0)	6 (8.6)	8 (10.5)	4 (4.9)	8 (9.5)	31 (8.1)
Features	32 (45.1)	31 (44.3)	37 (48.7)	40 (48.8)	42 (50.0)	182 (47.5)
Low O&M	2 (2.8)	1 (1.4)	1 (1.3)	2 (2.4)	2 (2.4)	8 (2.1)
Easiness of maintenance	1 (1.4)	1 (1.4)	0 (0.0)	1 (1.2)	0 (0.0)	3 (0.8)
Low cost	2 (2.4)	0 (0.0)	0 (0.0)	4 (4.9)	0 (0.0)	6 (1.6)
Other - specify	2 (2.4)	1 (1.4)	2 (2.6)	1 (1.2)	4 (4.8)	10 (2.6)
Don't know	27 (38.0)	30 (42.9)	28 (36.8)	30 (36.6)	27 (32.1)	143 (37.3)
Other - specify	5 (7.0)	6 (8.6)	8 (10.5)	4 (4.9)	8 (9.5)	31 (8.1)
	71 (100)	70 (100)	76 (100)	82 (100)	84 (100)	383 (100)

Other indicators including the friendliness of use, O&M, easiness of maintenance and cost were of least relevance to users. The proposed essential features included shower (52.3% n = 203), lighting (31.1% n = 119), safe-lock (11.3% n = 43), sanitary features (3.4% n = 13) and ventilation (1.2% n = 5). The choice of the proposed features by users is justified by their aspiration to a certain level of comfort (34.5% n = 132), privacy (27.6% n = 106), security (21.4% n = 82) and attractiveness (12.3% n = 47), while (4% n = 16) did not have any opinion.

For many users (82.4% n = 322) and CBO representatives, the proposed features (if incorporated) will be sufficient to temporarily address their demands and improve access while waiting on the deployment of individual facilities:

> *I think if there is a shower and light, people can easily access and use the facility.* (Resident of informal settlement D)

Municipal officials based the relevance on the capital cost, ease of maintenance, and O&M, not in terms of features:

> *As long as residents aspire for individual facilities; the incorporation of the proposed features may not be a long-term solution.* (Municipal official C)

Community leaders viewed relevance in terms of features, accessibility, and ability to withstand extensive use while NGO/CSO representatives viewed relevance in terms of compliance with user needs and conditions of their settlements.

Preference for individual sanitation facilities emerged as a key demand of informal settlement residents (as depicted in Appendix B.3.3).

> *As long individual full flush waterborne toilets are not provided, these things (communal toilets) are unsafe to use during day or night.* (Resident of informal settlement E)

In stark contrast, other respondents (excluding community leaders and users) argued that the conditions pertaining to informal settlements (e.g. overcrowding, lack of space and bulk infrastructure) do not allow for individual facilities.

> *Residents' needs are to have individual waterborne sanitation facilities, which are not possible given the context and nature of area they are living.* (Municipal official C)

Reasons for user preference for individual waterborne facilities varied from one settlement to another. In some settlements, for example, it was informed by comfort (38.1% n = 146), dignity (26.4% n = 101), features (18% n = 69), safety (8.9% n = 34) and cleanliness (5% n = 19). In other settlements, user preference was motivated by user needs (56.9% n = 218), right to a choice (20.1% n = 77), comfort (9.4% n = 36), privacy/dignity (4.7% n = 18) and aesthetics (5% n = 19). Many users insisted that,

> *Government must provide us with sanitation facilities of same standard as those living in formal areas…. And I want nothing else than my own full flush waterborne toilet.* (Resident of informal settlement A)

The community leaders confirmed user preference for individual waterborne sanitation stating,

> *Residents want nothing else than individual full flush toilet as stipulated in the policy... nothing else will not be accepted.* (Community leader D)

NGO/CSO and CBO representatives, justified user preference for individual facilities to the poor conditions of communal facilities due to the uncontrolled number of users:

> *These toilets are shared by so many people indiscriminately, and they are often blocked, filthy and unsafe to use during winter and at night.* (CBO representative)

Contrastingly, municipal officials and sanitation entrepreneurs argued that the supplied facilities may not be their preferred choice, but they are relevant to the conditions of these settlements.

For many respondents, the communal sanitation facilities were not applicable to informal settlements because of the unselective use patterns that constrained female users and children from accessing the facilities. In other cases, users felt that the use requirements made some facilities inapplicable:

> *There is no access control and many users have limited or no knowledge of how to use these toilets…because there is no awareness campaign.* (Resident of informal settlement A)

In terms of institutional arrangements, users (62.7% n = 240) reported several inconsistencies in the management of their facilities. For many respondents, the inapplicability of communal facilities in an informal settlement context is attributed to inadequate facility management. Facilities are open and used uncontrollably by everyone; those in charge of cleaning have no control over access or use of facilities. Other inconsistencies regarded the way the responsibilities for managing the facilities were assigned. Users and civic organisations felt that the facilities are managed by people who are not knowledgeable of their needs or social issues. This has been compounded by the low response to reported issues (e.g., breakdowns, vandalism, or theft), shoddy maintenance, poor customer service and ineffective monitoring and evaluation.

Sanitation facilities provided to informal settlements did not meet the five sustainability criteria[29] and indicators. In terms of the environmental sustainability, users, NGO/CSO, CBO representatives and community leaders insisted that the facilities are not environmentally friendly:

> *There is huge smell coming from these toilets, and large volume of sewage flowing through every day.* (Resident from informal settlement E)

Despite being robust and durable in terms of their superstructure, not all facilities met the technical sustainability criteria because of the inability of some features (toilet bowls, doors, locks) to handle many users and not being adaptable to the needs and practices of users, or secure enough to ensure safe access and use. Not all facilities met the economic sustainability criteria because of the free nature of the sanitation service provision, where the cost of the facility and related maintenance are supposedly absorbed by the municipalities. All respondents except municipal officials and sanitation entrepreneurs acknowledged that the health and hygiene criteria were not met, as many people accessing the facilities were complaining of various infections and sanitation-related diseases. In contrast, municipal officials insisted that health and hygiene issues reported by users and their representatives were either imaginary or a result of the lack of compliance with the use requirements, misuse, and unhygienic practices.

Not all facilities met the socio-cultural sustainability because of their inability to offer the necessary level of comfort, dignity or security required by users, and the inability to accommodate certain categories of users such as children and physically challenged individuals. These views were disputed by municipal officials and sanitation entrepreneurs arguing that the provided facilities were sustainable for the context where they are deployed. In summary, across the five study settlement, users (69.4% n = 266) rated the level of sanitation services within their respective municipalities as poor and inappropriate because of the lack of response to their

[29] Sustainability criteria include environmental, technical, economic, health and hygiene, and socio-cultural indicators (adapted from Hellström *et al*., 2000 and Kvarnström *et al.,* 2004).

aspirations (of having individual waterborne toilet). Despite the availability of waterborne sanitation technology, users felt that it is applicable only when individual and not communal facilities are provided.

4.5.3 *Respondents knowledge and perspectives on institutional arrangements*

Most users (94.5% n = 362) believed that institutional arrangements as currently formulated were unfair and discriminatory towards users. In contrast, municipal officials across the board understood the current arrangements at both municipal and facility levels as the process that guides the provision and management of services. They regarded this process as compliant with the sanitation policy and adequate for addressing sanitation issues (Appendix E.1).

> *Due to the unpredictable nature of informal settlements, involving users in the institutional process may promote further land evasions and proliferation of informal settlements.* (Municipal official B)

NGO/CSO representatives understood the institutional and management arrangements from legal perspectives, adding that the policy and legal frameworks provide a platform for municipalities to furnish services that are compliant with user needs and living conditions. However, these prescripts of the policy have never been implemented:

> *The current institutional arrangements are unconstitutional because of being not inclusive as stipulated in the sanitation policy and other legal frameworks.* (CSO representative)

A CBO representative understood the institutional and management arrangements as mandated to municipalities to provide and manage infrastructure:

> *Since these facilities are communal, there should be at least permanent staff including caretaker, security and cleaners at the facility…their presence is believed to reassure users.* (CBO representative)

An NGO representative explained that the lack of information dissemination observed between municipal departments involved in the sanitation service provision has fragmented the responsibilities:

> *There is no coordination and information sharing between the informal settlement services and other services such as solid waste, road and stormwater, environmental health etc. Each of these services work in isolation.* (NGO representative)

For the community leaders, institutional and management arrangements were developed to provide users and their representatives a platform to decide on matters of importance for their wellbeing. However, as these requirements have never been implemented and users remain side-lined, critical decisions are taken without their input or participation:

> *If these arrangements were adequate enough, we should not experience such high number of dysfunctional facilities.* (Community leader of informal settlement E)

Sanitation entrepreneurs labelled the institutional arrangements as tailored to promote the entitlement mentality because of users' limited responsibility over the provided facilities and lack of a sense of ownership:

> *These arrangements are not adequately framed due to fact that users are left out and not given any responsibility…. Such arrangements promote entitlement mentality whereby everyone want to be served without making any contribution.* (Sanitation manufacturer)

All respondents (excluding municipal officials) felt that the current institutional and management arrangements are not enforced nor monitored. Despite these claims, municipal officials insisted that the institutional arrangements are well formulated and suitable to the context in which they are implemented.

4.5.4 *Implications of institutional arrangements on access and sustainability of sanitation services*

Despite the difference in understanding of institutional and management arrangements, respondents foresaw a number of implications around access and sustainability of the service provision as a whole. For instance, the majority of users (89.6% n = 343) believed that their exclusion and that of other stakeholders from the institutional and management arrangements will lead to the failure of the service provision:

> *We are not concerned in whatsoever way in everything they are doing … their services are due to fail as long we are being excluded from the entire process.* (Resident of informal settlement A)

The non-involvement of stakeholders other than municipal officials has prompted the rejection, misuse and vandalism of the municipal provided sanitation facilities:

> *The high number of dysfunctional facilities is a result of some individuals taking decisions on behalf of us, without even knowing or considering our needs and aspirations.* (Resident of informal settlement E)

An NGO representative maintained that inadequate institutional arrangements can contribute to the increasing number of dysfunctional facilities, poor maintenance, vandalism and theft. While some of these claims were genuine, municipal officials believed that the impact of the current institutional arrangements was exaggerated. Despite the requirements of the sanitation policy and other statutory frameworks to involve users in the decision-making process, no evidence of their involvement was found in practice.

4.5.5 *Summary*

All five informal settlements were provided with either water or non-waterborne sanitation technologies and communal facilities equipped with mobile or permanent superstructures. Their features were not similar but varied according to the technology and nature of the settlements. Respondents rejected the idea that communal facilities that were not waterborne toilets were acceptable and applicable to informal settlements. In rating the facilities provided to informal settlements, respondents did not share the same point of views. Users rated the provided facilities as inadequate while service providers view these facilities as adequate and appropriate to the context of their deployment. Respondents' perspectives on a number of issues related to the provision and nature of sanitation facilities were not converging. This difference of views has divided users and service providers, thus leading to the refusal to use, abandonment or misuse and vandalism of the facilities. The subsequent section presents respondents' suggestions for the improvements or development of alternative institutional arrangements for the provision and management of sanitation infrastructure in informal settlements.

4.6 Alternative institutional arrangements for sustainable sanitation services

4.6.1 *Introduction*

Institutional arrangements related to the selection, deployment and management of sanitation facilities have been generally labelled by respondents as inadequate or ineffective, fragmented, non-compliant with the sanitation policy or unaligned with the use requirements and operational requirements of sanitation facilities provided to informal settlements. Having outlined the institutional arrangements in each of the three municipal jurisdictions (section 4.3 and Appendix E.1), respondents were asked to suggest amendments or alternative arrangements to inform sustainable sanitation service provision in informal settlements. The co-production model and IAD framework were used to assist respondents in presenting their viewpoints or suggestions for alternative arrangements. Based on the IAD framework, respondents were involved in the discussion in the action arena using action resources (in this case, findings of this study, sanitation policies, institutional frameworks, municipal by-laws, decision-making processes, and memoranda) to co-produce knowledge that should be further used to improve existing institutional arrangements or develop new ones.

This section of the thesis presents an overview of the outcomes of the interactions between respondents using the co-production model and IAD framework. Key themes covered include (i) value propositions to address the institutional, technical, and social issues of sanitation; (ii) alternative institutional arrangements for the provision of sanitation services in informal settlements; and (iii) the extent of the application and limitations of alternative institutional arrangements.

4.6.2 *Value proposition to address institutional, technical, and social aspects of sanitation*

4.6.2.1 Institutional aspects of sanitation

Although respondents exposed contradictory views regarding the institutional aspects of sanitation (section 4.3), they did, however, agree that these should be revisited to ensure that decisions are consensual and inclusive. Views were sought from respondents to provide suggestions that may strengthen the current institutional aspects of sanitation provision. Requested propositions were related to the institutional challenges, stakeholders, their roles, and their implementation in practices. Details of user input are outlined in Appendix C.4.

Respondents suggested that any stakeholders who had a vested interest because the facilities impacted on their personal wellbeing should be involved in the management of these facilities. Despite some disagreements, respondents suggested thirteen criteria to determine the profile of sanitation stakeholders: (i) being a resident of the informal settlement; (ii) having knowledge of the area and issues; (iii) having knowledge of residents' sanitation practices; (iv) being a volunteer; (v) willing to be involved; (vi) being involved in service provision matters; (vii) having knowledge of the sanitation service provision processes; (viii) being vested in community matters; (ix) being able to communicate; (x) being capable of facilitating discussions; (xi) being apolitical and neutral; (xii) having knowledge of different sanitation technologies; and finally, (xiii) being reliable and available when required.

On the legal aspects around the provision of sanitation, one CBO representative added,

> *A sanitation stakeholder should at least be knowledgeable of the social, technical and legal issues surrounding the provision of sanitation services.* (CBO representative A)

Respondents agreed that the selection of stakeholders should be a component of the sanitation provision process by assuming their assigned responsibilities during each phase of the sanitation provision process. The roles and responsibilities of stakeholders involved in the sanitation service provision were documented using the Lagardien et al.'s (2012) framework adapted to include the initiation, planning, implementation and post-implementation phases. Using the co-production and IAD framework, respondents presented differing views after which they arrived at a broad agreement by proposing the roles and responsibilities each qualifying stakeholder should play in each of the four phases of a sanitation service provision, as summarised in Table 4.16. Respondents further suggested the introduction of regular public meetings, the establishment of a steering committee and an organisational structure as well as accountability measures as a way of strengthening their roles and responsibilities.

The current institutional arrangements pinpoint the existence of at least three municipal services that are directly or indirectly involved in the provision of sanitation services (as previously highlighted). All respondents agreed that the extent and level of participation in the decision-making process should be guided by the roles and responsibilities assigned to each qualifying stakeholder. They agreed to categorise the level of involvement for qualifying stakeholders as (1) decision making – wherein the stakeholder has decision making power; (2) provision of inputs – wherein the stakeholder provides input for consideration but not necessarily binding (3) no involvement – wherein the stakeholder may not take direct part in the process but has a right to be informed; and (4) not involved – wherein the stakeholder is not involved at all. Respondents agreed that the coordination role should be assigned to the municipal department directly involved in the provision of services. For instance, the coordination role was assigned to the Sanitation Service department (in the case of the City of Cape Town) and Engineering Services (in the case of Stellenbosch and Theewaterskloof municipalities).

Since the provision of sanitation services was vested in municipal officials, other stakeholders were of the opinion that they were not given a fair shake at being part of the process. User groups (comprising users, CBOs, and community leaders) suggested the "equal to equal" power relation wherein they should be considered a partner who has a "say" or can contribute towards the provision of the services intended for their use.

> *I believe that we should be treated as equal because of our knowledge of the area where we are living…. Such knowledge can provide insightful information that may assist the service providers to make informed decision with regard to the sanitation service provision.* (Users' representative F)

They further added that their power should focus primarily on judging and reporting actions of municipal officials to ensure transparency, accountability, and fairness in the provision of sanitation services:

> *Our roles are to provide assistance so as to ensure that there is a balance between the needs and aspirations of the residents, and the capabilities of the service provide to deploy services in a sustainable manner.* (NGO representative C)

These views received mixed feelings amongst municipal officials. Some felt that civic organisations have certain power given their informal roles and involvement in the sanitation service provision process:

> *They are being involved at certain stages of the service provision but not at the final decision stage due to their inflexibility and failure to understand municipal processes related to the provision of services.* (Municipal official C)

Table 4-16: Suggested roles and responsibilities of sanitation service provision stakeholders and level of involvement

Phase of the sanitation service provision	Users group or their representatives	Municipal officials (a) (b) (c)	Sanitation entrepreneurs	CBOs/NGOs/CSOs
Initiation	Provision of support to the service providers Facilitate access and engagement with residents Provide information related to needs and aspiration of users	Project initiation (a)(b) Need assessment (a) Liaison with residents (a) Oversight & coordination (a)	Technology cataloguing Knowledge dissemination	Project facilitation Social facilitation Legal advice to residents Provision of legal advice Community awareness Advocacy roles
Level of involvement	1	1	4	2
Planning: Preliminary investigation and decision-making process	Facilitate information gatherings (status quo and practices) Facilitate liaison between residents and service providers Provide information required for the selection of technology Contribute towards the selection of sanitation technology Provide guidance to determine appropriate location of the facility	Project planning (a) (b) Investigation (a) Preliminary information (a) Design of facility (b) Technology selection (a) (b) Site information (a)(b) Community interaction (b) Oversight & coordination (a)	Technical advice Technology selection Deployment strategies Maintenance service requirements Maintenance training	Social facilitation Knowledge dissemination Community advisory Community awareness Technology promotion Advocacy roles
Level of involvement	2 & 4	1	2 & 4	2 & 4
Implementation: Deployment of facilities or construction of facilities	Assistance to identify local labour force Assistance in the deployment or construction of facilities Assistance to conduct awareness or education (if any planned)	Deployment of facilities (a) Monitoring (a) (c) Oversight & coordination (a)	Technical advice Level of service Facility implementation	Social facilitation Legal support/guidance Community awareness Advocacy roles
Level of involvement	2	1	2	4
Post-implementation (monitoring)	Monitoring access and functioning of the facility Reporting issues related to the operation of facility Provide assistance in maintenance	Maintenance scheduling (a) Monitoring (a) Health & Hygiene (c) Oversight & coordination (a) Reporting (a)	Technical advice Technical interventions Maintenance of facilities Reporting	Community awareness Legal support /guidance General monitoring of institutional arrangements Reporting
Level of involvement	2	1	2	2
Municipal officials included (a) Sanitation Service Department, (b) Human Settlement Department (c) Pubic and Environmental Health Department				
Level of involvement: **1**: Decision making - **2**: Provision of inputs or guidance (but have no power of decision) - **3**: No involvement but right to be informed about decision made (but no power of decision) - **4**: No involvement				

Others felt that they are legally obliged to engage CBOs and NGOs/CSOs at all phases of the service provision so as to make informed decisions with regard to the service to be provided:

> *The policy suggests the incorporation of stakeholders other than service providers or government departments in the decision-making process…. Therefore, we shall abide to these regulations by ensuring that those involved are truly representing the interests of users.* (Municipal official B)

In terms of decision-making process, through co-production, respondents suggested alternative processes (Table 4.17) for potential use at each of the four phases of sanitation service provision. The suggested decision-making processes provide involved stakeholders with three guiding elements: (i) factors to consider for their decision; (ii) type of decision to be taken; and (iii) outcomes expected from their decision.

Table 4-17: Decision making process for the deployment of sanitation facilities

Phase	Factor to consider	Decision to be taken	Expected outcomes
Initiation (a)	What is the problem? What is the extent of the problem? How urgent is the problem? Who is or should be involved	Nomination of stakeholders Site investigation Stakeholders appointment Timeframe for reporting	Problem identified Nature of the problem known Timescale to address the problem known Stakeholder(s) identification/involvement
Planning (b): Preliminary investigation and decision-making process	How the identified problem will be solved? What is required to solve the problem Who should be involved? What role(s) will stakeholder(s) play? How will stakeholder(s) play their roles? How will stakeholders' roles be managed? How long will the task(s) be performed?	Problem identified and causes Investigation plan & methods Stakeholders' appointment Investigation timeframe Proposed solutions Technology selection Implementation timeframe	Pointers to solving the problems Materials/methods/tools to solve know Stakeholders(s) identified and involved Stakeholders' roles defined Stakeholders' tasks allocation completed Accountability measures identified Timescale for completing task(s) established
Implementation (c): Deployment of facilities or construction of facilities	How the identified problem will be solved? What is required to solve the problem Who should be involved? What role(s) will stakeholder(s) play? How will stakeholder(s) play their roles? How will stakeholders' roles be managed? How long will the task(s) be performed?	Final solution Implementation timeframe Stakeholders' appointment Completion timeframe	Pointers to solving the problems Materials/methods/tools to solve know Stakeholders(s) identified and involved Stakeholders' roles defined Stakeholders' tasks allocation completed Accountability measures identified Timescale for completing task(s) established
Post-implementation (d): (monitoring)	How the identified problem will be solved? What is required to solve the problem Who should be involved? What role(s) will stakeholder(s) play? How will stakeholder(s) play their roles? How will stakeholders' roles be managed? How long will the task(s) be performed?	Stakeholders' appointment O&M report Monitoring report Accountability statement	Pointers to solving the problems Materials/methods/tools to solve know Stakeholders(s) identified and involved Stakeholders' roles defined Stakeholders' tasks allocation completed Accountability measures identified Timescale for completing task(s) established

4.6.2.2 Technical aspects of sanitation

Since all respondents acknowledged the existence of technical challenges associated with the provision, operational requirements and use of the facilities, they believed that these could be addressed. They provided several suggestions which were primarily related to the accessibility, relevance, preference, use, operational requirements, institutional and management arrangements, and sustainability.

In terms of access, respondents agreed that it can be improved by considering the needs and practices of residents. The only way to overcome challenges relating to access is to weigh the number of users against that of facilities, evaluate the use pattern by splitting access to facilities according to gender, age and physical conditions, and provision of access control. Municipal officials and sanitation entrepreneurs recommended appropriate use and compliance with the use requirements as the only means that could improve access. In terms of relevance, there was no general agreement regarding criteria, as depicted in Table 4.18, based on their own understanding of relevance.

Table 4-18: Suggested criteria to determine the relevance of a sanitation facility

Criteria	Stakeholders category				
	Municipal officials	Users & representatives	Sanitation entrepreneurs	CBO	NGO/CSO
Design of the facility		✓		✓	✓
Features		✓		✓	
Adapted to user practices		✓		✓	✓
Easiness of access		✓	✓	✓	✓
Suitable to local condition	✓	✓	✓	✓	✓
Low O&M and capital cost	✓		✓		✓
Easy to maintain	✓		✓		✓
Policy compliant	✓	✓	✓	✓	✓
Security	✓	✓	✓	✓	✓
Compliance with user needs (preference)		✓		✓	✓
Compliance with settlements conditions	✓	✓	✓	✓	✓
Meeting the condition of deployment	✓		✓		

User entitlement to free sanitation facility and settlement conditions were used to justify the incorporation of user preference as criterion that should be evaluated when choosing a sanitation technology and facility. This user preference criterion was viewed by users in terms of certain attributes including features (23.8% n = 91), safety (21.1% n = 81), dignity and privacy (18% n = 69), friendliness of use (17.2% n = 66), comfort (12% n = 12) and personal feeling (4.2% n = 16) while 3.7% (n = 14) were unsure. Community leaders suggested that preference be examined in terms of the ability of a facility to response to user needs and aspirations, while CBO and NGO/CSO representatives suggested safety, dignity and privacy, and comfort. In contrast, municipal officials and sanitation entrepreneurs felt that preference should be given to cost of the preferred technology and type of facility, willingness to pay for the service and responsibility for the O&M. In terms of compliance with the use and operational requirements, respondents suggested the introduction of awareness campaigns prior and after the deployment of facilities. While acknowledging the existence of the level of service matrix for informal settlement (section 4.3.2.4), respondents failed to agree on factors that should be considered in the choice of sanitation facilities (as depicted in Table 4.19), arguing instead that their proposed factors (presented in Table 29) complement the existing framework for the selection of the level of service at municipal level.

Table 4-19: Suggested factors for consideration in the choice of sanitation facilities

Factor	Respondents				
	Municipal officials	Users	City leaders	CBOs	NGOs/CSOs
Preference		✓	✓	✓	✓
Aesthetics and privacy	✓	✓	✓	✓	✓
Relevance to user needs and settlement	✓	✓	✓	✓	✓
Capital and maintenance costs	✓				✓
O&M requirements and their extent	✓				✓
Availability of the technology	✓				
Friendliness of design and ease of use	✓	✓	✓	✓	✓
Compliance with policy	✓		✓		✓
Availability of fund	✓				
Status and nature of the land and space	✓				
User demands and aspirations		✓	✓	✓	✓
Availability of essential features		✓	✓	✓	✓
Robustness	✓			✓	✓
Safety		✓	✓	✓	✓
Closeness to users		✓	✓	✓	✓

4.6.2.3 Social aspects of sanitation

There were no agreed suggestions to address the social aspects of sanitation that are hindering the provision of sanitation services except for upgrading of the settlement, user education and user awareness. Respondents provided their views on mitigation actions to address social challenges (as depicted in Table 4.20).

Table 4-20: Mitigation actions to address social challenges related to sanitation provision

Factor	Respondents				
	Municipal Officials	Users	City leaders	CBOs	NGOs/CSOs
Upgrading of the settlement	✓	✓	✓	✓	✓
Provision of appropriate facilities	✓	✓	✓	✓	✓
Provision of individual facilities		✓	✓	✓	
User education and awareness	✓	✓	✓	✓	✓
Relocation to other settlements		✓		✓	
Monitoring of the facilities	✓	✓	✓		
Implementation of joint monitoring plan			✓	✓	
Maintenance of facility	✓	✓	✓		✓

4.6.3 *Alternative institutional arrangements*

The institutional, technical, and social aspects of sanitation surround the way sanitation stakeholders are involved in the selection, deployment and management of sanitation facilities. Respondents acknowledged that institutional, technical, and social aspects of sanitation are embedded into the four phases of the sanitation service provision and are perceptible at both municipal and facility levels. Having unpacked all these aspects by eliciting some propositions for their improvement, this section of the thesis was concerned with the elaboration of alternative institutional arrangements for the provision of sanitation services and management of facilities in informal settlements through the policy context of the FBSan.

While it is acknowledged that the reality of sanitation services in South Africa functions on a variety of co-existing service levels, a multi-stakeholder, integrated institutional arrangement where several stakeholders are involved at various developmental phases of the service provision are required to ensure that decisions are concerted and mandatory. Since institutional

arrangements entail the setting of roles and responsibilities, and their implementation thereof, it is understood that such roles and responsibilities are enacted at institutional level, implemented, and enforced at the facility level. The proposed institutional arrangements outlined in Table 4.21 evolve around the four phases of the sanitation provision.

The roles and responsibilities outlined on these alternative institutional arrangements entail the decision-making process for the selection and deployment of facilities. The decision to select a sanitation technology and facilities should be guided by the decision process using applicable criteria as suggested in the previous section.

Table 4-21: Suggested institutional and management arrangements for the provision of sanitation services and management of facilities

	Roles and responsibilities at institutional level				Roles and responsibilities at facility level		Oversight or coordination
Project phase	Users or their representatives	Municipal officials	Entrepreneurs	CBOs/NGOs/CSOs	Roles & responsibility	Stakeholders involved	Stakeholders involved
Initiation	Provision of support to the service providers Facilitate access and engagement with residents Provide information related to needs and aspiration of users	Project initiation Need assessment Liaison with residents Oversight & coordination	Technology cataloguing	Project facilitation Social facilitation Legal advice to residents Provision of legal advice Community awareness	Identification of possible position/ location of the facility within the settlement	Municipal officials (engineering services) Community leaders	Municipal officials (human settlement)
Involvement level	1	1	4	2			
Planning: Preliminary investigation and decision-making process	Facilitate information gatherings (status quo & users' sanitation practices) Facilitate liaison between residents & service providers Provide information required for the selection of technology Contribute towards the selection of sanitation technology Provide guidance to determine appropriate location of the facility	Project planning Investigation Preliminary information Design of facility Technology selection Site information Community interaction Oversight & coordination	Technical advice Technology selection Deployment strategies Maintenance training	Social facilitation Knowledge dissemination Community advisory Community awareness Technology promotion	Identification of training needs Identification of potential trainees Development of training technical schedules Develop social & awareness training schedules	Municipal officials (assisted by sanitation entrepreneurs) Users group & their representatives, assisted by CBOs Sanitation entrepreneurs NGOs/CSOs and CBOs assisted by sanitation entrepreneurs or municipal services	Municipal officials (engineering & environmental heal) Users & CBOs representatives Municipal officials (engineering services) Municipal officials (environmental health)
Involvement level	2 & 4	1	2 & 4	2 & 4			
Implementation: Deployment of facilities or construction of facilities	Assistance to identify local labour force Assistance in the deployment or construction of facilities Assistance to conduct awareness or education (if any planned)	Deployment of facilities Monitoring Oversight & coordination	Technical advice Facility implementation	Social facilitation Legal support, guidance Community awareness	Conduct technical training Develop social & awareness training schedules	Sanitation entrepreneurs NGOs/CSOs and CBOs assisted by sanitation entrepreneurs or municipal services	Municipal officials Municipal officials (environmental health)
Involvement level	2	1	2	4			
Post-implementation: (monitoring)	Monitoring access and functioning of the facility Reporting issues related to the operation of facility Provide assistance in maintenance	Maintenance scheduling Monitoring Health & Hygiene Oversight & coordination Reporting	Technical advice Maintenance of facilities Reporting	Community awareness Legal support, guidance Monitoring	Develop schedule and conduct cleaning & routine maintenance Develop schedule and conduct awareness campaigns	Sanitation entrepreneurs (contractors or janitors) NGOs/CSOs and CBOs assisted by community leaders	Municipal officials (engineering services) Municipal officials (environmental health)
Involvement level	2	1	2	2			

4.6.4 *Summary*

This section of the thesis overviewed the outcomes of the interactions between the respondents during which views were sought to suggest alternative institutional arrangements for the sanitation facilities provided to informal settlements. Respondents acknowledged that institutional, technical, and social issues of sanitation can be addressed by ensuring that relevant sanitation stakeholders are involved in all phases of the sanitation provision and subsequent decision-making processes. The selection and involvement of stakeholders should be guided by certain principles, including knowledge of the sanitation problems, informal settlements, and their residents. In terms of institutional arrangements, the current arrangements are not bolstering access to sanitation or sustainability of the services as many facilities are not adequately managed. In addressing these deficiencies, respondents suggested the roles and responsibilities of stakeholders involved in the provision of sanitation services, their level of involvement at both municipality and facility levels. While these arrangements emanate from the concensus of stakeholders and are designed for any type of informal settlement and facility (except individual), some respondents cautioned that their applicability may be limited if stakeholders do not substantiate their assigned roles or in the absence of an adequately framed accountability and disciplinary mechanism. The next section presents the discussion of results.

Chapter 5 CHAPTER FIVE: GENERAL DISCUSSION

5.1 Introduction

Although sanitation is referred to as the practice of safe disposal of human excreta, in practice, it is a pluralist notion (McFarlane & Silver, 2017) because of the viewpoints of different stakeholders and broad perspectives it offers. It has been discussed from various perspectives including technological (Schouten & Mathenge, 2010; Katukiza *et al.*, 2012), religious (McFarlane *et al.*, 2014), gender (Winter *et al.*, 2018), socio-cultural (Jewitt, 2011) health and hygiene (Jenkins & Scott, 2007) and so forth. While these studies have added a significant contribution to the sanitation field, the discussion has been in a broader context where users or landowners provide facilities and as such, are irrelevant to a FBSan paradigm.

This study shows that sanitation service provision in the policy context of FBSan is strongly influenced by institutional, technical, and social aspects, informing a persisting sanitation backlogs in informal settlements of South Africa. In this study, sanitation service provision is analysed from institutional (organisation of sanitation service provision and management), technical (technology choice and appropriateness) and social (behaviour and practices) perspectives in the specific context where municipalities are legally mandated to provide facilities to users free of charge. This chapter presents the analysis and interpretation of findings outlined in Chapter 4. The IAD framework grounds the discussions and engages with the notion of co-production, in particular with ways in which the current approach to sanitation service provision, technology choice and related institutional arrangements could ensure that the provided facilities are responsive to user needs, practices and settlements conditions in a sustainable manner. The discussion, evolving around the institutional, technical, and social aspects of the sanitation services provision through the lens of the Free Basic Sanitation policy, addresses whether and in what ways these factors hinder or support the provision of sanitation services. It elaborates on how challenges related to access to sanitation, user sanitation practices and institutional arrangements could be addressed, and proposes specific institutional arrangements for the provision of sanitation services in informal settlements.

The chapter is structured around the following themes: (i) institutional, technical, and social aspects of the sanitation service provision; (ii) sanitation practices and related impacts on access, use and sustainability of sanitation services; (iii) applicability of sanitation technologies provided to informal settlements; and (iv) alternative institutional arrangements for sanitation service provision in informal settlements.

5.2 Institutional, technical, and social aspects of sanitation service provision in informal settlements

5.2.1 *Institutional aspects of sanitation*

This section, to discuss the institutional aspects of sanitation, is structured around the following themes: regulations and guiding principles for sanitation service provision; sanitation stakeholders – their roles and responsibilities; decision-making processes; and municipal approaches to sanitation service provision.

5.2.1.1 Regulations and guiding principles for sanitation service provision

The provision of sanitation services in South Africa, institutionalised through various policies and institutional frameworks (Tissington, 2011), involves multiple stakeholders (DWAF, 2003; Ambole 2016). However, studies (Mulenga, 2003; Mjoli *et al.*, 2009; Taing, 2015) have highlighted several weaknesses of the existing sanitation policy, which prompted the revision and subsequent enactment of the 2016 sanitation policy. About 52.5% (n = 201) of users in our study view the service provision as regulated or guided by other factors, including the mayoral decision, instead of by policy. Some respondents felt that the lack of flexibility of the policy, exclusive power vested in municipal officials and erroneous interpretation of the sanitation policy have erected barriers to sanitation provision in informal settlements, and that considerations should be made to change to suit the prevailing context of informal settlements if universal access to sanitation is to be achieved. This way of thinking can be justified, in part, by the frequent interventions of the mayor whenever service provision protests flare up. In these situations, the mayor often responds to user demands by authorising the provision of services. These findings underscore the importance of revisiting some clauses of the policy and addressing contentious issues which have brought negative consequences on the service provision as a whole.

5.2.1.2 Stakeholders involved, their roles and responsibilities

There is a legitimate debate about the involvement of stakeholders other than municipal officials in the sanitation service provision based on their abilities to provide input. In the case of sanitation, the quality of stakeholders and their roles can facilitate or hinder the provision of sanitation services as a whole. Similar to previous studies (DWAF, 2003; Ambole, 2016; Mjoli, 2015), this study confirms an array of stakeholder involvement in the sanitation service provision at both municipality (as institution) and settlement level (where the facility is located). At the municipal level, there are municipal officials from various municipal services including Human Settlement, Water and Sanitation, Solid Waste and Environmental Health and, to some extent, community leaders and sanitation entrepreneurs. Provincial and national governments officials were not (in practice) directly involved. Users and other stakeholders including NGO/CSO, CBO representatives were not acknowledged as genuine stakeholders.

User involvement has been advocated as a way of guaranteeing the use and sustainability of facilities (McGranahan, 2013; Patel & SPARC, 2015), of promoting development activities (Mulenga, 2004) and because of their knowledge of their settlements (Simiyu, 2016). While scholars are divided regarding the involvement of users in service provision, our study reveals that the non-involvement of other stakeholders (mainly users) was contrary to the DWS (2016)[30] and Chapter Seven of the South African Constitution that recommends municipalities to encourage the involvement of communities in local governance. Although recommended by scholars (Mulenga, 2004; McGranahan, 2013; Patel & SPARC, 2015) and the sanitation policy (DWS, 2016), critiques point out that the involvement of all stakeholders, often time consuming, requires intensive consultation with stakeholders who may know little about sanitation provision processes and who lack knowledge about appropriate sanitation technologies (Salter, 2008; Simiyu, 2016) and available sanitation technologies (Mara, 2007). In the FBSan context, user involvement is regarded as the cause for the delay or disregard of municipal supplied facilities because of the multiple ways people view sanitation service provision when political contestation is occurring (McGranahan & Silver, 2017). It is also seen as problematic in an environment where laws and regulations guiding the urban planning are functional (Lagardien & Muanda, 2014).

[30] Stakeholders officially recognised as involved in the management of sanitation services in South Africa include Department of Water and Sanitation, municipalities, community-based organisations, users and any other organisation that provide services (e.g. education and training institutions, professional bodies, contractors, NGOs, manufacturers, research and development institutions (DWS, 2016).

These arguments have been used by municipal officials to exclude users and other stakeholders from the sanitation service provision. The non-involvement of some stakeholders as demonstrated in this study may lead to conflict, as reported in India (Reddy & Snehalatha, 2011) and Ghana (Appiah & Oduro-Kwarteng, 2011). In this study, the proliferation of self-supply of facilities and adoption of certain sanitation practices that are frequently non-compliant with standards set by the government and the joint monitoring programme (JMP) was identified. Most of the policy documents (in theory) stress collaboration between sanitation stakeholders, but this has never been materialised. The non-involvement of stakeholders other than municipal officials in the sanitation service provision appeared to be a strong reason for the failure to sustain the provided sanitation facilities and the reason that long-lasting solutions to sanitation challenges experienced in informal settlements were absent. Whilst the debate on whether stakeholders' involvement facilitates or hinders the sanitation service provision will continue, there is no doubt that engaging users and other stakeholders in a meaningful and transparent ways is crucial in alleviating the negative impact of the lack of consideration of the institutional, technical and social aspects of sanitation service provision. However, stakeholder engagement should not be the only driver for success or failure of the sanitation service provision, nor is it a silver bullet for solving all sanitation related challenges.

The roles and responsibilities of stakeholders were not adequately defined or known by users. For instance, the City of Cape Town (2008) specifies the roles of municipalities (as service provider), provincial government (as support agent) and national government (as coordinating agent). However, the roles of NGOs/CSOs, CBOs and community leaders were poorly defined as their ability to provide assistance was limited. At both municipal and settlement levels, stakeholders played different roles at various phases of sanitation service provision. Municipal services involved in service provision play different roles and work in isolation. Their roles include planning and project implementation (Human Settlement Department), provision of interim service and O&M (Water and Sanitation Department), collection of solid waste (Solid Waste Department) and monitoring of health risks at facilities (Environmental Health Department) which often overlap confusingly. Contrary to other studies that advocate for the assignment of decision-making roles to users (Robeyns, 2003; Mulenga, 2004; Joshi *et al.*, 2011; Lüthi *et al.*, 2011a; Simiyu, 2016) this was not the case in the FBSan policy context. While written into the policy and legislative frameworks (e.g., DWAF, 2003; 2007), stakeholders (other than municipal officials) play the least or no role at all, despite their presence and actions in the service provision macrocosm. Contractors and sanitation manufacturers work on behalf of municipalities and the assignment of these roles and responsibilities corroborate Hendriksen *et al.* (2012) and Mjoli's (2015) studies that show that municipalities act as service provider and regulatory body. These findings infer that the type of stakeholders, their roles and responsibilities, and level of their involvement in the sanitation service provision should be determined by the context in which facilities are deployed. For instance, where facilities are deployed by individuals or NGOs/CSOs (as in the case of Uganda, Kenya), municipalities may play the roles of regulators. In the context where facilities are provided by municipalities (as in the case of South Africa), their roles as regulator and service providers is apparent. While stakeholders other than municipal officials may have important roles to play in the sanitation service provision, municipalities continue to hold the dominant portion of control.

Sanitation provision in South Africa requires intensive coordination because the number of stakeholders involved whose roles and responsibilities often overlap. However, this study and many others (Mulenga, 2003; Taing, 2015) reveal a dearth of effective coordination amongst the municipal services involved in the sanitation service provision. In terms of coordination, there is

contestation between various stakeholders involved in the provision of sanitation services, fragmentation, and lack of coordination. There is so far no interaction amongst municipal services, and between municipal officials and civic organisations as well as between municipalities and the provincial and national governments, a situation leading to a confusing mix of institutional activities which result in overlapping responsibilities, and thereby conflicting directives. This underscores the need to adopt collaborative approaches that promote the participation of all in the sanitation service provision. Although the coordination process might be time consuming, it is believed to be imperative for success in a context such as water and sanitation where multiple stakeholders are involved. Power relation is determined by the roles and responsibilities assigned to each stakeholder. In this instance, municipal services in charge of water and sanitation services were the most involved in the process, and unsurprisingly, have more decisional power than other stakeholders. Municipalities retain the power to provide and maintain facilities (hardware aspect) rather than to raise awareness (software aspect). The provincial or national governments are more interested in supporting the infrastructure delivery, and less involved in the field.

These findings illustrate the discrepancies between the policy statement and its implementation in practice. Mistrust is prevalent amongst municipal services and between municipal services and other stakeholders, underscoring the importance of revisiting the institutional arrangements to ensure the representation of all stakeholders and that roles and responsibilities are established and implemented. It is now understood that addressing the sanitation service provision issues require the involvement of *all* stakeholders.

5.2.1.3 Decision-making process and basis for decision

Our study has shown that the decision-making process did not follow the formal procedures set by the sanitation policy and municipal by-laws. The interpretation of the prescripts of the service provision legislation has led to the short-circuiting of the process which, according to users, CSO and CBO representatives, has resulted in the arbitrary exercise. The short-circuiting of the established process was justified by the emergency nature of informal settlement and demands for sanitation services as well as the right given to a municipality to govern on its own initiative and local government affairs of its community in accordance with national and provincial legislation. This short-circuiting has resulted in the development of tailor-made municipal by-laws (e.g., CoCT, 2014 – level of service matrix) which are aligned to the sanitation policy and DWAF (2007) guidelines. Their decision-making process was totally different from those suggested in the literature (e.g., Holden *et al.*, 2005; Nayono *et al.*, 2007; IWA, 2006; DWAF, 2007). For instance, the level of service (as outlined in these by-laws such as CoCT, 2014) was guided by factors including the type of land, density, availability of bulk infrastructure and space that differ from one settlement to another.

Municipalities have since deviated significantly from their own guidelines and those of the national government to provide facilities. For instance, in discharging their legal responsibilities, municipalities have adopted supply-driven and infrastructure-driven approaches through which the level of service, technology choice and facility type are decided by municipal officials without prior consultation with other stakeholders. These approaches, labelled by Beck (2009: 11) as "decide-announce-defend" have been criticised for not emphasising user acceptability (Mjoli & Bhagwan, 2010; Lagardien & Muanda, 2014) and for not encouraging public debate and deliberation (Mjoli *et al.*, 2009). Despite the sanitation coverage achieved using the supply-driven and infrastructure-driven approaches, many informal settlement residents are still lacking access to improved sanitation facilities. This persisting lack of access to sanitation facilities is symptomatic of the complexity of the sanitation service provision in informal settlements. Similar

to Seymour (2013), this study shows that supply-driven approaches adopted by municipalities have not captured user insights, but rather left users unable to express their preferences for specific technology and its attributes. As a result, the selection and deployment of appropriate sanitation technology and facilities are disconnected from the needs and practices of users. The supply-driven and infrastructure-driven approaches, typical of the FBSan policy, have become the norm to ensure a speedy delivery of facilities and coverage.

This analysis corroborates findings from previous studies (Mjoli & Bhagwan, 2008;2010; Mjoli *et al.*, 2009; Lagardien *et al.*, 2009) that illustrate municipalities' non-compliance, lack of common interpretation or misinterpretation of the sanitation policy and other legislative frameworks in the exercise of their duties. Our findings support previous studies that have attributed the persisting challenges in the provision of sanitation services to a number of institutional challenges (Taing *et al.*, 2014; Mjoli *et al.*, 2009) and how different institutions perceive and manage sanitation including governance, policies and institutional arrangements (Elledges *et al.*, 2002), a lack of accountability and poor planning (Taing *et al.*, 2014) as well as fragmented management, poor or lack of coordination (Mulenga, 2004; Pan *et al.*, 2016) and supply-driven and infrastructure-driven approaches used to provide services, municipal incapacity and inflexible institutional processes (Taing *et al.*, 2014) as well as political interference (Robins, 2014; McGranahan, 2015; McFarlane & Silver, 2017). Like previous studies (Okurut *et al.*, 2015a; Ambole, 2016), this study joins the call for the development of a socio-technical and institutional approach that conceives sanitation provision as a service delivery package comprising services such as public services and infrastructure development and, importantly, that understands the sanitation provision as a service that includes both hardware (technical) and software (socio-institutional) issues.

5.2.2 *Technical aspects of sanitation*

The technical aspects of sanitation are related to the appropriateness of sanitation technologies and facilities in terms of compliance with user needs and settlement conditions and prescripts of the sanitation policy and legislative frameworks. Despite achievements in South Africa in terms of the provision of sanitation services, the quality of the facilities and subsequent management have been subjects of discontent amongst the users.

5.2.2.1 Sanitation technology and facilities

As posited by Tilley *et al.* (2008), as technology is an interface between users and excreta, its selection should be carefully made by evaluating certain factors that are dependent on each local context. While there may be several sanitation technologies, only a few including flush toilet, pour-flush toilet, piped sewerage, septic tank, ventilated improved pit (VIP) latrine, pit latrine with a slab and a composting toilet are considered by WHO and UNICEF (2017). In South Africa, informal settlements are provided with either waterborne or non-waterborne sanitation, equipped with a permanent or mobile top structure. Regardless of their types, users did not appreciate the sanitation technology provided to their settlements. In the FBSan context, the choice between water and non-waterborne technology and communal use often led to equity challenges, as some residents perceived this as a sign of discrimination and unfairness. The perceived discrimination and unfairness may justify the high rate of vandalism and misuse at various facilities and violent service delivery protests. Most residents in the formal areas have individual waterborne facilities, thus enticing those in informal settlements to aspire to similar standards. The deployment of temporary (e.g., porta-potties), mobile facilities (e.g., MobiSan, CAB) or unfamiliar technologies (e.g., UDT) that are not individual waterborne can develop a perception of social injustice, as users perceive these technologies as sub-standard. The supplied facilities were not accepted because of the perceived failure to meet user demands and

aspirations for individual waterborne toilets. In many cases, mobile facilities were perceived as a symbol of the temporary nature of informal settlements.

The problem of providing different levels of service to different settlements of the same municipality denotes a socio-economic inequality, which for many users perpetuates perceptions of discrimination based on spatial differentiation patterns. In general, it is understood that the precedence of engineering solutions over other aspects of sanitation (e.g., social and institutional) demonstrates the lack of clear guidance on sanitation provision in informal settlements. The context in which sanitation services are provided is a significant factor for consideration as far as compliance with the policy is concerned.

5.2.2.2 Understanding and compliance with the use and operational requirements

Regardless of the sanitation technology deployed, users in general have certain knowledge of the sanitation technologies and facilities provided to their settlements and demonstrated some level of understanding of their operational and use requirements. Despite this apparent understanding of the operational and use requirements, compliance was another issue. Contrary to previous studies that noted that the sustained use of sanitation facilities requires cooperation from all users (Simiyu, 2016) and facility attributes such as cleanliness (Garn *et al.*, 2016), this was not the case in the FBSan context where users are simple recipients of the services. In informal settlement A, for example, non-compliance was attributed to the lack of or insufficient knowledge of the UDT and in some instances, the refusal by users to comply. In other settlements where flush waterborne facilities were provided, non-compliance was attributed to users' pursuit for individual waterborne toilets as prescribed in the sanitation policy which for municipal officials was politically motivated. This infers that the non-compliance with the use requirements does not depend solely on the sanitation technology or use patterns, but also other factors including individual attitudes and perception of the supplied facilities.

The magnitude of non-compliance was not the same across the study settlements. In settlements where the caretaker was available at the facility, the level of compliance was much higher. Contrary to Winter *et al.* (2018) who determined an association between the level of compliance and age and gender, this study shows that compliance with the use requirements was instilled by (i) the management arrangements, when a facility was monitored and (ii) users' perceptions and attitudes towards a given sanitation technology and type of facility. Since most residents hope for individual waterborne facilities, this might explain their attitudes towards any alternative that is different from their preference. This infers that the "speculative" knowledge of the sanitation technology does not necessarily result in compliance with the use and operational requirements. Users are more inclined to individual waterborne facilities than communal ones, which for many are policy compliant.

5.2.2.3 Impacts of sanitation service provision on access

Access to sanitation remains a challenge for many residents. While previous studies (Bartlett, 2003; Hutton, 2013; StatsSA, 2016) have associated the availability of sanitation with access and health and environmental benefits, this was not totally the case in the five informal settlements under study. The accurate number of people accessing the facilities was difficult to quantify because of the lack of access control measures, suggesting that the availability of a sanitation facility does not imply access, and does not automatically result in the reduction of health risks and environmental degradation. This underscores the need to develop measures that could be used to assess the impact of the deployment of sanitation to a given informal settlement. Such measures should be based on visual facts including free open defecation and bucket free

settlement. These measures can inform the decision-making process regarding the selection, deployment or management of facilities, and be used to ascertain universal access to sanitation.

5.2.2.4 Technical challenges associated with the deployment and use of facilities

In South Africa, informal settlements are entitled to at least basic sanitation services which are deployed after certain stage of settlement development. While partially in line with previous studies (Makheta *et al.*, 1998; Mara & Alabaster, 2008; Argawal *et al.*, 2012), this study demonstrates that technical challenges associated with both waterborne and non-waterborne sanitation facilities have some level of ramifications of social and institutional nature. The socio-technical challenges associated with the deployment and use of sanitation facilities may be explained by the fact of the sanitation facility as the interface between the user and excreta. As an example, the increasing number of users is associated with the number of facilities deployed. This may be explained by the free nature of access, and the search for access to dignified facilities, that offer a certain degree of privacy and comfort. The increase in number of users has been previously identified as a hindrance to access, contributing to the deterioration of facility quality (in terms of cleanliness) (Tumwebaze *et al.*, 2013). In this study, it is associated with frequent breakdown, misuse, and vandalism. Since many female users are reluctant to share the facilities with males (Winter *et al.*, 2018) for several reasons discussed later in this thesis, the use pattern became an issue. In other instances, challenges were associated with the design of some of the facilities.

The appropriateness of sanitation technologies of facilities in terms of their design was either unaccommodating for some categories of users or lacking in essential features. The choice of sanitation technologies that were perceived as inappropriate has been attributed to the power vested in municipalities to decide on the technology of their choice. This has led municipalities to select and deploy facilities without engaging other stakeholders. Unlike McGranahan (2015) who cited political interference as an accelerator of service provision, this study, like several others (Mulenga, 2003; Robins, 2014; McFarlane & Silver, 2017), sees it as a barrier and perpetuator of the entitlement mentality and as an enflaming factor for residents to refuse any alternative that is not individual waterborne. For instance, promises by political leaders to supply high level of service (e.g. individual waterborne toilets) without considering technical aspects delayed the provision of facilities (Phakati & Ensor, 2013; McFarlane & Silver, 2017), weakening the already fragile relationship between informal settlement residents and municipal officials.

The difficult conditions of the settlements and land tenure are challenges for service provision in informal settlements. While many studies (e.g., Agunbiande *et al.*, 2015; Parikh *et al.*, 2015) have claimed that land tenure is a pre-requisite for improving the conditions of informal settlements (e.g. provision of sanitation facilities), this may not be the case in South Africa. The legal status or ownership of the land seems a constraining factor for deploying certain sanitation technologies when the settlements are developed on lands that belong to a private individual or institutions (Taing *et al.*, 2014). The policy provides guidance for the provision of sanitation services for privately owned land. In such a case, tenure security must be ensured prior to the deployment of appropriate facilities. Rugged conditions (e.g., steep slope, high water table) have also impacted the position or location of the facility which for many users can be problematic. Similar to findings of Lagardien *et al.* (2012a) and Tumwebaze *et al.* (2014), the position of the facility was informed by conditions of the settlement in terms of space, ground condition and topography. Like Okurut *et al.* (2015b), this study argues that without understanding the technical challenges associated with the selection and deployment of sanitation facilities and an agreement of their nature and extent, it will be complicated to achieve the provision of sanitation facilities.

5.2.2.5 Management arrangements

The cleaning and maintenance of facilities were undertaken by the municipal services or their appointed contractors. While stipulated in the sanitation policy that the daily care of the facility is the responsibility of the household (Mjoli *et al.*, 2009), informal settlement residents were rarely involved in the management of their facilities. Their non-involvement may be justified by (i) the interpretation of the term *household* and (ii) their understanding of "free access to the facilities for all". The term *household* may not be applicable to informal settlements (from a town planning point of view) given their setup. Free access does not allow the involvement of a household (if any) to take care of the facility as no individual has control over another. Therefore, the sharing use of communal facilities calls for practical and sustainable management arrangements.

While the cleaning and maintenance were undertaken by municipal services or appointed contractors, the management arrangements varied from one facility to another. In some settlements, janitors or cleaners were officially assigned to clean facilities and report technical issues. In other settlements, the caretakers oversaw cleaning and general management, including access control and monitoring as well as awareness and reporting technical issues. Some municipalities preferred janitorial services paid through the expanded public works programme (EPWP) while other preferred private contractors. In some instances, where the cleaning service was not available, users resorted to assuming responsibility for cleaning and keeping the facility for their own use. In terms of technology, some technologies (e.g. UDT) require regular awareness especially when access is free. The difference in management arrangements may be justified by easiness of use and operational requirements, and to a large extent, the financial status of a municipality. For instance, the UDTs are often labelled unaccommodating technology because of their stringent use and operational requirements (Duncker *et al.*, 2006; Mkhize *et al.*, 2017) thus requiring a certain level of compliance. Preference for private contractor cleaners may be justified by the trust and level of accountability compared to municipal janitors who are public servants. This suggests that the nature of a sanitation technology and facility, and the context of deployment define the use and management arrangements. Such arrangements may require cooperation between users and service providers to ensure coordination of actions in terms of access and use patterns.

5.2.3 ***Social aspects of sanitation***

Many informal settlements emerging outside formal urban planning and social aspects of sanitation discussed in this section of thesis are related to the emergence of informal settlements, challenges experienced by residents and municipal officials with regards to the lack of or deployment and use of sanitation facilities, and impact of these challenges and mitigating actions.

5.2.3.1 Emergence of informal settlements and municipal response

Informal settlements are common features of urbanisation in developing countries, with their emergence (development and growth) attributed to several factors. Similar to previous studies (Makhetha *et al.*, 1998; Reintges, 2001; Horn *et al.*, 2001; Huchzermeyer & Karam, 2006; Moloi & Harrison, 2011; Letema *et al.*, 2014; Turok, 2017), the five informal settlements were an emanation of apartheid spatial planning, expansion of the city and rural exodus due to deteriorating opportunities in rural areas. Most residents originated from other provinces and neighbouring countries, seeking renewed opportunities. The developmental stages were similar to those reported in the literature (Wegelin-Schuringa & Kodo, 1996; Malinga, 2000) with land evasion the most common means of securing shelter. Regardless of the way these settlements come into existence, UN-Habitat (2015) asserts that informal settlements provide shelters for

many urban poor, thereby justifying the large number of residents observed across the five study areas.

Municipal response to the emergence of informal settlement is not the same. While the approach to address the emergence of informal settlements includes eviction and demolition (Tibaijuka, 2005), upgrading and relocation (Werlin, 2010; Weksea *et al.*, 2011; Minnery *et al.*, 2013; Simiyu, 2016), in South Africa, the response to development of informal settlements varies from one municipality to another and depends on the developmental stage of the settlement. In many instances, both eviction and relocation have been applied. The commonality of these municipal responses is the tacit acknowledgement of the settlements, which in many cases result in the provision of rudimentary services including water and sanitation. The diverging ways of addressing the emergence of informal settlements can be partly attributed to the failure of the spatial development and housing strategies, suggesting that contextual factors determine the municipal responses to the emergence of informal settlements.

5.2.3.2 Challenges associated with lack, deployment, access and use of facilities

In this study, the primary challenges associated with the emergence of informal settlements included the lack of basic services, insecure land tenure and overcrowding. The lack of sanitation facilities has been widely documented in the literature (Phaswana-Mafuya, 2006; Mjoli *et al.*, 2009; Mels *et al.*, 2009; Verhagen *et al.*, 2010; Tumwebaze *et al.*, 2013). Informal settlements did not have any facilities during the early stages of development. Unlike many other developing countries, South African policies allow municipalities to provide basic service services in informal settlements only after a certain period of occupation, regardless of the legal tenure of the land occupied.

The provision of inadequate or emergency facilities (e.g. chemical toilets) was followed by that of basic services (e.g. communal toilets) when informal settlements attained the maturation and consolidation stages. Despite the provision of these facilities, their appropriateness was questioned, and access remained a challenge for several reasons: the high number of users and safety concerns that are discussed later in this thesis. These challenges were further exacerbated when the settlements reached a saturation stage, at which point the lack of facilities was acutely problematic because of the high number of users and availability of space. Both the lack of sanitation facilities (at the initial stage) and the provision of facilities (at the consolidation and maturation stages) have many ramifications extending to other challenges including the poor condition, safety concerns and unhygienic practices as people resort to alternative means to fulfil their defecation needs. Other challenges were related to the deployment of the facility, which for some respondents has been made without following due procedures (section 5.2.1). Access and use of the facilities emerged as a challenge for reasons discussed later in section 5.3.2. These challenges were mainly related to the ratio of users vs. facilities, poor hygiene, and fragile safety. Social challenges were not necessarily about the lack of facilities or their conditions; safety concerns to access of facilities emerged as the prevalent issue.

The causes of social challenges, often associated with the cultures and beliefs of people, are viewed from various viewpoints. For some they are driven by the lack of education and awareness (Taing *et al.*, 2014; COHRE, 2007; Elledges *et al.*, 2002) and for others, the failure of the policy to address people's needs (Mjoli *et al.*, 2009) and the way informal settlements are regarded (Makheta *et al.*, 1998) as well as a lack of social cohesion (Malinga, 2000) and diverging user and service provider expectations (Taing *et al.*, 2014). While concurring with these previous studies, our own findings reveal that social challenges are informed by individuals' attitudes and circumstances surrounding living environments, municipal officials' attitudes towards informal settlements and their residents, political interference, social cohesion, poverty, and challenging

conditions within the settlements. The extent of these challenges varies from one developmental stage to another depending on the municipal response.

5.2.3.3 Impacts of social challenges on facilities and sanitation service provision

Studies that unravel the provision and access sanitation have scarcely addressed the impacts of social challenges associated with either the provision or access to sanitation facilities, specifically in the policy context of FBSan. In this study, several impacts including the reduction in number of facilities, high number of dysfunctional facilities, uneasy access, high maintenance cost and delays of service provision were identified. The reduction of number of facilities is one of the consequences of the non-compliance with the operational and use requirements and has ramification with the number of dysfunctional facilities. When the facilities are not used as intended or when users are not familiar with a technology, and or misuse the facility for some reasons, this will impact on the functioning of facilities., thus reducing their number. In such a case, facilities are often abandoned which often trigger the spat of vandalism and theft of parts and other components. In response, municipalities are obliged (as per their Constitutional mandate) to undertake either maintenance, repairs, or replacement.

The cost of maintenance, repairs or replacement (as result of non-compliance with operational and use requirements) may in some cases stretch beyond the planned budget, prompting municipalities to reduce their maintenance interventions. Consequently, the number of facilities is reduced significantly, thus impacting access. In such a case, access becomes uneasy for many residents who have no choice other than reverting to certain sanitation practices (e.g. use of bucket). Another impact is the reversion to sanitation backlogs as previously serviced areas are again lacking functional facilities. The funds allocated for servicing other settlements is instead used for repairs and maintenance, causing delay in the municipality plan to service other informal settlements. This suggests that the impact of social sanitation challenges on both the sanitation facilities and the provision of sanitation services as a whole are a reflection of the gaps in the sanitation service provision approach and shortfalls of the sanitation policy. The top-down and supply-driven sanitation provision approaches do not cater for dialogue; the policy has shown its limit in terms of the applicability to informal settlements. This underscores the need to understand the social challenges prior to developing any mitigation actions to deal with the impact.

5.2.4 ***Summary***

From the discussion above, it is understood that institutional, technical, and social aspects of sanitation provision are key elements guiding the provision of sanitation services in the policy context of the FBSan. In South Africa, informal settlement residents do not generally pay for sanitation services, as these are provided as part of a Free Basic Services package. However, achieving adequate sanitation service provision in informal settlements requires an understanding of several aspects including institutional (process and management), technical (appropriateness of sanitation technology), social (behaviour and practices).

The provision of sanitation services in informal settlements currently faces three interrelated challenges. These are (i) institutional from the formulation and implementation of the sanitation policy; (ii) technical from the different interpretation of the sanitation policy in terms of the level of service; and (iii) social from users' behaviours and attitudes towards municipal supplied services. The institutional, technical, and social aspects of sanitation service provision inform the way sanitation stakeholders are organised, how sanitation technologies are selected, deployed and managed and adopted by residents. Stakeholders involved in sanitation service provision play different roles and work in isolation. The decision-making process has been short-circuited

due to the emergency nature of informal settlements and the escalating demand for sanitation services. Municipalities use the power vested in them by the policy to adopt supply-driven and infrastructure-driven approaches to deploy sanitation facilities without prior consultation with other stakeholders. Focusing only on the technical aspects by selecting and deploying facilities (as currently done) and not paying much necessary attention to the institutional and social aspects has undermined sanitation provision imperatives. Our view is that while a "self-decided" service provision will not necessarily have the effect of eradicating the sanitation backlogs, it will result in an unacceptably high level of dysfunctional facilities and subsequently, a high cost of maintenance. The increasing lack of sanitation services in some informal settlements should be understood from various perspectives: (i) failure of the sanitation policy; (ii) deliberate move to discourage the proliferation of informal settlements; (iiI) unplanned nature of the settlements; (iv) inappropriate management; and (v) inappropriate approaches for sanitation service provision. These perspectives call for clarification of the sanitation policy, and for municipalities to revisit their approaches to service provision.

These findings divulge the complexity of providing sanitation services in the policy context of the FBSan. It is understood that the provision of sanitation services entails a combination of problems and successes that are dependent on the knowledge of the institutional, technical and social aspects governing its provision. These three aspects have been previously addressed in isolation without considering their potential unified impact on sanitation service provision. Any potential response to sanitation challenges experienced in informal settlements needs to address these three aspects of sanitation together. The precedence of one aspect over another may deter the commitment to achieve universal access to sanitation for all residing in informal settlements. The next section discusses user sanitation practices and their related impact on access, functioning of facilities and long-term sustainability of sanitation services.

5.3 Sanitation practices (behaviours and attitudes) and related impacts on access and functioning of facilities and sustainability of sanitation services

5.3.1 *Introduction*

Sanitation practices are personal. They involve private issues that can be difficult to discuss or evaluate. In this study, care has been taken to ensure that the privacy of respondents was respected. Sanitation practices are often framed as health and hygiene issues (e.g., handwashing and use of soap, for example). In this study, the focus in on the way informal settlement residents manage their excreta in the presence or absence of facilities.

5.3.2 *Access and use of sanitation facilities and associated challenges*

5.3.2.1 Access and use of the facilities

While previous studies (Mels *et al.*, 2009; Foppen & Kansiime, 2009; Govender *et al.*, 2011; Crous, 2014) have characterised informal settlements by the lack of infrastructure including sanitation, this may not be the case in South Africa. The five study informal settlements were provided with various sanitation infrastructure; toilets emerged as the most used facilities. Access to and use of these facilities (e.g. toilets) were unrestricted for everyone. For some, access to the facility was for defecating while other for disposing their buckets. However, some residents were unable to access and use facilities for a number of reasons. The lack of access and use of the facilities (regardless of the reasons) confirms the existence of alternative facilities or other means of excreta management. These alternatives included the use of night pails, plastic bags, open defecation, or own toilets. As already mentioned above, studies that have debated access to sanitation in informal settlements attribute the limited access to the cleanliness (Tumwebaze,

2014a), safety concerns (Caruso *et al.*, 2017; Muanda *et al.*, 2020), distance between house and facility (Tumwebaze *et al.*, 2014b; Muanda *et al.*, 2020), management arrangements (Simiyu *et al.*, 2019), socio-cultural values and beliefs (Jewitt, 2011). Access is also informed by individual choice, attitudes and feeling, the time of day during which an individual needs the facility and the purpose (either defecating or disposal of night pails).

Access to a sanitation facility is often understood in terms of coverage, which in practice is a reflection of the number of people accessing the facility. Free access implies that users have a choice to use the facility without constraint. Such choice may be informed by attitude, feeling or perception towards the facility. Non access to facilities means that an individual has other defecation methods which in this study is considered as a sanitation practice. The use or non-use of the facility has various dimensions including gender, age, physical conditions, and time of the day as well as religious beliefs and personal feelings. The demographic dynamics exclude certain groups (especially pregnant women, children, and physically challenged persons) from accessing sanitation facilities. In terms of gender, women were more reluctant to use the facilities for a number of reasons including safety concerns, privacy and the genderless use patterns, thus making reverting them into non-users. In terms of age, parents did not allow their children to use the facility, mainly for safety concerns. Physical conditions (e.g., disability, pregnancy) prevented many users from accessing the facilities mainly because of the unaccommodating design, location, and poor conditions of the facility. The frequency of access varies from one individual to another – depending on sanitary needs. Access was also temporal and fluctuating, characterised by the peak and off-peak periods. The peak period was characterised by long queues during which many users attempted to access to the facilities. Access further classified as day and night depending on the time during which an individual uses the facility. These findings show that the split between day and night use is guided by factors such as safety concerns, while the peak and off-peak are related to the ratio of users vs. facilities, and the condition and the number of functioning facilities.

When choices are made, the options may be limited, and the only available facility at a given time may not be the most desired. User decisions are, therefore, in a constant situational flux between convenience, comfort, safety, accessibility and health. The intended and extent of use of a sanitation facility is determined by the intention and perception of an individual about the nature and availability of the facility, use patterns and conditions (cleanliness and comfort), position and the environment (e.g., accessibility, privacy, and safety) surrounding the facility. This infers that the reality of communal facilities in informal settlements has three implications: it means that users will (i) access the facility for use (to defecate); (ii) access the facility to discharge night pails; or (iii) not access the facility at all. Accessing a facility for intended use (defecation) or for the disposal of the night pail is still recognised as use of the facilities.

5.3.2.2 Challenges and risks associated with access and use of facilities

Across the globe, access and use of communal sanitation facilities are associated with a number of challenges and risks, context dependent. While concurring with previous studies that have attributed these challenges and risks to various factors including the number users and high rate of dysfunctional facilities (Lagardien *et al.*, 2012), the length of queues and waiting time (Mazeau *et al.*, 2014), users–facility ratio (Taing, 2015; Pan, 2016), conditions of the facility (Schouten & Mathenge, 2010; Tumwebaze *et al.*, 2014a; Foggit *et al.*, 2019) and management (Simiyu, 2017), this study found more relation to the free access nature of the facility provided through the FBSan policy context. Despite unrestricted access to facilities, many users found access challenging for a number of reasons, some of which were social, technical or institutional in nature. Free access does not mean *actual* access to sanitation but has rather instigated several interrelated challenges

that have deterred countless residents from accessing the supplied facilities and subsequently, prompted unhygienic sanitation practices.

Access and use of the communal sanitation facilities have been associated with the prevalence of waterborne diseases (WHO, 2009; Cameron *et al.*, 2013; Anderson & Rosemarin, 2016; Freeman *et al.*, 2017; Caruso, 2017), pollution of water resources and the general environment (Hammer *et al.*, 2006; Abraham, 2011; Okurut *et al.*, 2015a). While in agreement with these previous studies, our findings demonstrate that risks associated with the use of communal sanitation facilities were related to the perceived fear of contamination and sickness while associated problems were mainly related to safety concerns, loss of dignity and privacy (discussed in section 5.3.3). The actual impacts such as diarrhoea, typhoid fever and pollution of water resources and natural flora were less apparent across the case study settlements despite their general poor condition suggesting that users view risks associated with the use of sanitation from a personal point of view. Users are more interested in their personal conditions (e.g., health, safety) than the general environment. As an individual becomes overwhelmed by particular challenges of access to a sanitation facility at the time of need, the likelihood of considering an alternative is higher. Some of the sanitation challenges and risks experienced by users have, to a large extent, informed their practices. The relation between these challenges and user sanitation practices are discussed in the next the section.

5.3.3 *Sanitation practices - causes and extents across case study settlements*

While sanitation technologies and facilities are available in each of the five informal settlements, this study shows that they barely address user needs or settlement conditions, are not context appropriate and are generally poorly maintained. Previous studies (Jenkins & Scott, 2007; Simiyu, 2015; Winter *et al.*, 2018) have discussed factors associated with women's ability and willingness to access and utilise different sanitation alternatives. Some of the challenges outlined in the section above are compounded by the (un)availability of sanitation, conditions of facilities and lack of knowledge of way use can perpetuate certain malpractices. Some of these practices (e.g. open defecation) are often related to education level and religion (Sara & Graham, 2014), lack of cleanliness, perception of safety, feeling of comfort, privacy and personal habits (Winter *et al.*, 2018), fear of being exposed to sexual harassment, assault or embarrassment (UN-Habitat, 2007). The vulnerability of informal settlement residents combined with a wide range of social concerns around poverty and unemployment, high levels of crime and health conditions aggravated by the lack of access to sanitation highlight the need for further in-depth research, particularly within the context of FBSan.

Sanitation practices have been informed by various interrelated factors associated with challenges and risks experienced by users. Specific factors that inform sanitation practices are context specific and dependent on local circumstances and conditions surrounding each informal settlement. For instance, safety concerns, understood as fear of being robbed, raped or even killed, emerge as the most common factor associated with the adoption of alternative and often undesirable sanitation practices. While often associated with the night use of sanitation facilities (Taing, 2015), in this study, safety concerns were a threat for use both day and night. Safety concerns inform user practices most specifically in South Africa where there are high levels of poverty, unemployment and crime (Stats SA, 2019), and to some extent have a gender connotation (Kwiringira *et al.*, 2014b). Due to the structure of their body, women are more susceptible to attacks or harassments, and thus prefer practices that are believed safer. Consequently, women have no choice but to wait until there are fewer safety risks (Tilley *et al.*, 2013) or use alternatives such as porta-potties or a pail to fulfil their defecation needs. While

most users may have their preferred or particular excreta management, many base their choice on opportunity rather than preference.

The poor condition of facilities has been one of the biggest challenges affecting access and use of sanitation facilities in informal settlements. Previous studies have attributed the poor condition of sanitation facilities to various factors including the number of users sharing (Schouten & Mathenge, 2010; Tumwebaze *et al.*, 2014a), the cleaning responsibilities, lack of cooperation amongst users (Isunju *et al.*, 2011), high number of users - which in some cases are more than ten families sharing one toilet as observed in South Africa (Seymour, 2013) and Uganda (Tumwebaze *et al.*, 2014a). In this study, the poor condition of facilities was most prevalent in informal settlements where several residents share a limited number of toilets. This has resulted primarily in non-compliance with the use requirements, inadequate cleaning and maintenance of the facilities, lack of facility management, inadequate sharing ratio as well as the heterogenic nature of residents and fear of contamination that prevented many users from proper use of toilets. This may be explained by the free nature of the facility which guarantees the right of access for everyone, and with no right to exclude another. As a result, over-exploitation and misuse take precedence while the condition of the facility deteriorates. Similar to previous studies that showed that filthy, locked and inaccessible facilities can deter user access (Tumwebaze, 2014a), weaken the quality of cleanliness (Roma *et al.*, 2010) and trigger unhygienic sanitation practices (Jenkins & Scott, 2007; Kwiringira *et al.*, 2014a; Pfadenhauer & Rehfuess, 2014), communal sanitation facilities were more likely to be filthy because of the combination of free access and an uncontrolled number of users.

Unavailability of facilities at the time of need has, due to the number of dysfunctional facilities, created shortages as many users fail to access the facilities when needed the most. This lack of choice or alternative at the time of need can lead an individual to accept what is available, regardless of its conditions. The lack of facilities for alternative use such as urination and disposal of night pails has contributed to the poor condition of facilities. Access to these facilities (e.g., urinals and night pail disposal hub) has not been thoroughly discussed in the literature. Those who access the facilities with the sole purpose of emptying their pails are unlikely to clean the toilets. Some municipalities have provided porta-potties as an alternative, but this is perceived as socially unacceptable, corroborating previous studies (Duncker, 2014; Pan *et al.*, 2016; Mkhize *et al.*, 2017) and confirming user preference for certain sanitation technologies.

While some studies (Tumwebaze, 2013; Taing, 2015; Garn *et al.*, 2016) have claimed that the sustainable use of a sanitation facility is determined by its cleanliness, this was not the case in this present study. For instance, in some informal settlements, facilities were cleaned and pleasing to use, but residents nonetheless preferred alternatives such as open defecation or night pails. This implies that the condition of a facility is more than its cleanliness; cleanliness is just an aesthetic side of a facility. Cleanliness should not be considered a defining factor for access but a desirable factor that can promote access. As the WHO (2009) shows, unhygienic sanitation practices lead to disease. This is a vicious cycle as not using the facilities results in unhygienic practices which are triggered by perceptions of users, in particular by the fear of contamination when accessing a filthy toilet. However, adopting unhygienic practices because of perceived fear of contamination can lead to disease (Curtis & Cairncross, 2003; WHO, 2009; Bartram & Cairncross, 2010; Cameron *et al.*, 2013; Kwiringira *et al.*, 2014b; Freeman *et al.*, 2017).

Despite the prevalence of facilities in each of the five settlements, many of these were dysfunctional and unusable, resulting in long queues, especially as some residents (mainly females) were not comfortable using the facilities. For instance, the number of facilities was

commensurate to that of users across the five settlements. However, the uncontrolled nature of informal settlements and the free access mode of use often result in long wait queues and waiting time to access the facilities. Although municipalities were maintaining the facilities, the number of dysfunctional facilities was alarmingly high. These findings partially concur with Crous (2014) by attributing the drop-in number of facilities to inadequate cleaning, lack of O&M, inappropriate use of the facilities or lack of compliance with the use requirements. The sustained functioning of a sanitation facility is subject to regular maintenance and appropriate use.

The issues of walking distances and inappropriate location of the facilities have barely been addressed in the literature and yet these have consequences for the acceptance and use of the facility. The few studies that have addressed this issue have asserted that walking long distances to access a sanitation facility may cause discomfort amongst users (Kwiringira *et al.*, 2014b; Pan *et al.*, 2016; Winter *et al.*, 2018) due to perceived fears of being robbed (Crous, 2012; Taing, 2015) or people's age and physical conditions (Jenkins & Sugden, 2006; Tumwebaze *et al.*, 2012). In this study, long walking distances and position or location of the facility emerged as deterrents for various reasons including dignity and safety concerns. Although facilities were not far in the sense of distance, they were not located within the eyesight of users. What made the distance unfavourable was the long walk through dark, sinuous, and congested shacks, which for many, led to feelings of insecurity. The inappropriateness and failure of the technologies, unfamiliarity with the technology, uncleanliness, or lack of awareness, meant that many users did not comply with the use requirements of the facilities. Some technologies (e.g. UDT) have specific use requirements which many users found demanding. Failure of the technology emerged when the technology did not match users' practices (e.g. anal cleansing methods). Similar findings by Joshi *et al.* (2011) reveal that privacy and comfort are desirable – and often determining – factors associated with the use of a sanitation facility. Since many facilities lacked essential features (e.g., locks or doors) and there were long waiting queues mainly composed of males, some users including elderly people and females did not feel safe. These findings concur with Taing (2015) who asserted that the entitlement mentality and user attitudes towards existing facilities can lead to non-compliance. Dysfunctional facilities are often abandoned, urn triggering behaviour that leads to vandalism and theft of parts. This perpetuates vicious cycles in terms of access due to vandalism, theft and abuse of facilities previously serviced now experiencing sanitation backlogs.

There is also the issue of the heterogenic nature of informal settlements where people of various cultures and beliefs cohabitate, sharing the same facilities. For some, sharing a facility with individuals not belonging to their inner circle or culture is intolerable. Previous studies (Jenkins & Scott, 2007; Jewitt, 2011; Duncker, 2014) have shown that attitudes, perceptions, expectations, aspirations, and beliefs are key factors for the acceptance and sustained use of a sanitation facility. This study confirms that cultural values and beliefs influence the perceptions people have for sharing sanitation facilities, which in turn perpetuates unhygienic practices. Users are ready to embrace practices that are simple and correspond to their culture or beliefs. In this case, personal choice, preference, feelings, or beliefs can be a hindrance to access and a trigger for unhygienic sanitation practices, an indication that hygiene awareness is an important factor to ensure appropriate use and sanitary conditions of the facilities. This infers that the provision of facilities without awareness about their use and compliance with use and operational requirements can trigger misuse and the adoption of unhygienic practices.

Institutional or management arrangements have also been pointed out as a deterrent because of the lack of access control and closing time. As illustrated in a previous study by Simiyu (2017), inadequate management of the facilities can lead to uncleanliness. In the FBSan context, the appointment of a caretaker (as in informal settlement A) can make a difference in terms of both

cleanliness and compliance with the use requirements. Like previous studies (Schouten & Mathenge, 2010; Heijnen *et al.*, 2015), the closing of facilities at night or padlocking restricts access to users. In these instances, many residents resort to other practices such as using buckets, open defecation or flying toilets.

The FBSan policy has created expectations so that residents of informal settlements in South Africa expect nothing less than their own full flush waterborne toilet (Duncker, 2014). The different interpretation of the sanitation policy has enticed users to feel that they are entitled to individual waterborne toilets, thereby not accepting communal facilities. The challenge is the difficulty of convincing users that the supplied facilities are indeed within the requirements of the policy and suitable to the conditions of informal settlements. Such aspirations and expectations have generated negative attitudes towards any other alternative sanitation technology (Roma *et al.*, 2010; Lagardien *et al.*, 2012; Pan *et al.*, 2016; Mkhize *et al.*, 2017) and municipalities in terms of their capabilities to provide appropriate services. This study adds that the non-acceptance of the supplied facilities because of user expectations and their understanding of certain clauses of the sanitation policy related to the sanitation technologies and type of sanitation facilities. This behaviour is seen as a way to force municipalities to provide their preferred facilities. The FBSan policy has been the key guiding framework for the provision of basic services (DWAF, 2008). While focusing on the provision of facilities, it has, however, overlooked the complex set of social issues existing in informal settlements in general. The current rate of alternative sanitation practices across the study settlements confirms findings from previous studies (Hogrewe *et al.*, 1993; Makhetha *et al.*, 1998; Lagardien & Muanda, 2014; Pan *et al.*, 2018) suggesting that service providers have little or no knowledge of the existing sanitation practices of the communities for whom they have responsibilities.

Although all these factors have informed residents' sanitation practices, our data as well as data from previous studies shows the way in which safety concerns (Tumwebaze *et al.*, 2013; Simiyu, 2017), high numbers of users (Lagardien & Muanda 2014) and lack of cleanliness (McFarlane, 2008) as well as non-compliance with the use requirements with the increasing number of dysfunctional facilities (Muanda *et al.*, 2020) are interconnected. For instance, the high number of users and long waiting queues (related to the high number of blocked toilets and unavailability of facilities at the time of need) are typical characteristics of sanitation in a FBSan context. Non-compliance, recurrent in the FBSan policy context, is evident when users do not comply with the use requirements by either discarding their buckets or using inadequate anal cleansing materials. In such a case, the likelihood of breakdown of the facility is high. When a facility is broken down, access difficulty is heightened as users revert to the remaining functioning facilities, thus increasing the number of users for those facilities. Previous studies have shown that user sanitation practices are embedded in their cultural values and behaviours (Seymour, 2013) and that behavioural, social, and psychological determinants inform the adoption of a given technology (Dreibelbis *et al.*, 2013). In this study, we note that users' sanitation practices are strongly influenced by perceptions and attitudes toward a specific sanitation technology. The variance in sanitation practices suggests that different individuals hold a variety of considerations and motives based on local conditions, surrounding situations and culture. These considerations and motives can inform their perceptions of the supplied facilities and subsequent use. These findings are supported by Taing (2015) who experienced similar situations in other informal settlements. Nevertheless, the diversity of sanitation practices identified in the five informal settlements reflects residents' desperate needs to relieve themselves in a manner that is safe and convenient. In order to eradicate sanitation backlogs, it is critical to consider social factors that drive behaviour and use (or abuse) of sanitation provided under the FBSan in informal settlements.

5.3.4 *Impacts of sanitation practices on access, functioning and sustainability of the services*

The impact of poor sanitation on human and environment health has been widely documented. Unhygienic sanitation practices are estimated as causes of diarrheal diseases and unsafe living conditions characterised by pollution (WHO, 2016). It is evident that users retain certain perceptions about their reported sanitation practices. The impact of sanitation practices is often seen from human and environmental health perspectives (Caruso, 2017; Andersson & Rosemarin, 2016; Okurut *et al.*, 2015a). The consequences of the poor sanitation practices are not only the abandonment, vandalism, and misuse of provided facilities but reversion to unhygienic practices, such as open defecation, that have dire consequences for humans and the general environment. In terms of affecting human health and the general environment, some practices such as open defecation, use of plastic bags or night pails and their subsequent discharge in open spaces, bushes or outside the dedicated areas have caused numerous health and environmental problems. This corroborates previous studies (Malinga, 2000; Kudva, 2009; Saga, 2012) that demonstrated the pollution and associated environmental problems caused by the lack of sanitation in informal settlements. Since the sanitation service provision is intended to ensure access to sanitation for all, and some of these practices are persisting, the sustainability of the services will be impacted. Damage due to misuse, vandalism and non-compliance with operational requirements has a huge bearing on the maintenance costs of the services. Data shows that one of the consequences of these sanitation practices is frequent reactive maintenance to fix faulty facilities or replacement of parts, which in many cases is expensive. The money spent on repairs or refurbishment of vandalised or misused facilities could have been used for the provision of similar facilities to residents in un-serviced areas or improve facilities. Repetitive and expensive maintenance may not be sustainable for the roll-out of services to other settlements in need. In such a case, it will deplete fund that would have been used for deploying facilities in other areas, thereby delaying the provision of services.

5.3.5 *Mitigation actions to address sanitation practices*

Although respondents acknowledged the prevalence of inappropriate sanitation practices and their impacts, they did, however, suggest different mitigating actions to address these impacts. Key actions suggested by users include an increase in the number of facilities, access control, monitoring the conditions of facilities and awareness, and provision of individual facilities while municipalities, for instance, suggested different actions by either introducing janitorial services or switching to new sanitation technologies. In addressing user sanitation practices, scholars acknowledged the difficulty in coordinating actions and monitoring individual use and implementing rules (Lagardien *et al.*, 2012). Since communal facilities are a common property of every resident, the implementation of rules governing access has not been achieved in practice. As sanitation practices are user-specific, sanitation interventions are challenged by the need to incorporate user preferences. Actions to address sanitation practices are formulated differently by sanitation stakeholders. For instance, actions that have been suggested include ensuring privacy and convenience of users (Kwiringira *et al.*, 2014b), adequate facility management, cooperation between stakeholders, collective decision making, and social norms (Simiyu, 2017). While concurring with these studies, our findings explain the complexity of addressing sanitation practices. The different municipal approaches highlighted in this study are justified by the extent of the sanitation practices, financial capabilities of municipalities and efficacy of the institutional arrangements. Since sanitation practices are a consequence of the institutional, technical, and social aspects of sanitation, mitigating actions should be proportional to the extent of their impact. This suggests that addressing sanitation practices requires adequate knowledge of its causes that are linked with the institutional, technical, and social aspects of sanitation.

5.3.6 *Summary*

Despite the availability of sanitation facilities, access remains inequitable amongst residents across informal settlements in South Africa. The data reflect on the various sanitation practices of residents including the use of buckets, porta-potties, plastic bags, and existing facilities within and outside their settlements for either defecating or discharging bucket content and for open defecation. Several interrelated factors – including safety concerns, cleanliness, and location of the facility, walking distance, high number of users, lack of privacy and comfort, fear of contamination and lack of choice – have informed the adoption of compromised sanitation practices. All these factors derive from or are associated with the social, physical, and institutional environment surrounding informal settlements and their residents. These factors are site-specific which means that 'one size' does not fit all. Several of the sanitation practices adopted by residents have severely hampered the provision of sanitation services and thus exacerbated sanitation backlogs. This has, in some instances, sparked violent service delivery protests. The next section discusses the applicability of sanitation technologies and facilities provided to informal settlements.

5.4 Applicability of sanitation technologies and facilities provided to informal settlements, institutional arrangements, and impacts

5.4.1 *Introduction*

Informal settlements are widely known for their evident sanitation challenges (discussed in the previous section). In addressing these challenges, municipalities in South Africa have taken effort to ensure that each informal settlement has at least basic sanitation facilities. While this initiative has been applauded, the quality of these supplied sanitation technologies and facilities are subject of contention between users and service providers, as revealed by our findings. This section of the study discusses findings related to the applicability of sanitation technologies provided to informal settlements and their implication on access and sustainability of sanitation services.

5.4.2 *Applicability sanitation technologies and facilities*

Similar to Jenkins *et al.* (2014), this study has shown that the type of sanitation technology and facility are important considerations associated with sanitation service provision. However, measuring their applicability can be subjective, often dependent on feelings and circumstances surrounding an individual. Various technology assessment frameworks serve only as guidance documents as they are not context specific. In this study, the applicability of sanitation technology and facilities was measured using pre-defined criteria suggested by respondents based on their understanding of the applicability and the context of deployment[31] of sanitation services.

While sanitation technologies are developed to solve excreta management and disposal problems, their applicability is often informed by various interrelated factors including socio-cultural concerns (Murphy *et al.*, 2009) which can influence their type (e.g., waterborne, or non-waterborne). In this study, the applicability of sanitation technologies (water and non-waterborne) was assessed in terms of seven user-defined criteria including operational requirements, ease of use, compliance with policy, meeting users need and aspirations, relevance to informal settlement conditions, easiness of O&M and management. For instance, users view applicability of a technology in terms of prestige offered while municipal officials view the maintenance and cost and other technical aspects. Like the technology, sanitation facilities

[31] Context of deployment is referred to as the way facilities are deployed; facilities can be provided by the property owner, or an individual, municipality, NGO, CSO, CBO etc. In this study, the way facilities are deployed was found to inform or define the context of use and management arrangements.

provided to informal settlements were not applicable as they did not meet the needs and aspirations of users. The overall assessment shows that only waterborne sanitation technology was applicable in terms of all criteria except for easiness of the O&M and management. The reported non-applicability of non-waterborne sanitation technology and both water and non-waterborne facilities provides an indication of the complex nature of sanitation service provision under the FBSan policy context. User understanding of the applicability is different from that of the service provider. The City of Cape Town, for instance, relies on factors such as land type, availability of bulk infrastructure and space to determine the level of service. These factors are different from those suggested by respondents and those suggested by DWAF (2007) guidelines. The decision to determine the appropriateness of a sanitation technology is often based on pre-determined sanitation technologies (selected using the decision-based criteria) rather than the general attributes of a sanitation technology; for instance, the MobiSan, a UDT considered appropriate by sanitation practitioners (Drangert, 2004; Matsebe & Duncker, 2005; Roma *et al.*, 2013), was not socially applicable for the context of the informal settlement where it was deployed. The non-applicability of non-waterborne and perceived applicability of waterborne technologies demonstrate the lack of understanding of various aspects of a sanitation provision and the confusion created by different legislations (e.g. DWAF, 2003).

In terms of facilities, communal facilities did not meet all six user-defined applicability criteria simply because they are not individual facilities. Users' preference for individual waterborne toilets emanates from their interpretation of the definition of Free Basic Services (DWAF, 2001) which is understood as the provision of individual sanitation for each household, and DWAF (2003) that recommends the provision of waterborne sanitation as the most appropriate option in urban areas. The FBSan policy did not specify the context in which a household is entitled to an individual sanitation facility. The interpretation of these legislations (DWAF, 2001 and DWAF, 2003) may justify users' preference for individual waterborne sanitation facilities. While the prescripts of the FBSan policy and legislative frameworks tend to be sided with formal areas, no clarity was provided regarding their application to informal settlements. For instance, municipal officials' view is that the notion of *household* does not translate well to informal settlements where houses do not respond to the norms and lack of legal tenure. In such cases, suggesting individual sanitation facilities may not be achievable. Unlike Schouten and Mathenge (2010), in this study, like previous others (Mulenga, 2004; Mjoli *et al.*, 2009; Roma *et al.*, 2010; Matsebe & Osman, 2012; Lagardien *et al.*, 2012; Duncker, 2014; Taing, 2015; Mkhize *et al.*, 2017; Pan *et al.*, 2018), users view anything that is less than individual waterborne facility as inferior, offensive and discriminatory. Like Mara (2016), but opposed to Schouten and Mathenge (2010), the deployment of communal sanitation facilities is perceived by users as regressive and not applicable to informal settlements, thus increasing user demands for individual facilities. In terms of compliance with policy, the deployment of non-waterborne technologies was in breach of the sanitation policy that regards waterborne technology as most appropriate technical solution.

Similar to Matsebe and Osman (2012), this study confirms that both non-waterborne and waterborne facilities equipped with mobile or permanent superstructures were regarded by users as non-compliant with policy because of not being an individual facility. Mobile sanitation technologies and facilities symbolised a precarity, which for many reflected the status of informal settlements. The unrestrictive access and sharing use pattern have rendered the communal sanitation facilities inapplicable as per JMP definition of an improved facility (WHO & UNICEF, 2008; 2012a). However, classifying communal sanitation facilities as unimproved based on the sharing use pattern without assessing the challenges of providing individual facilities in densely populated settlements can be misleading. The compliance with operational requirements

depends on the design of the facility, easiness of use, level of awareness and management arrangements. The applicability of a communal facility in terms of the operational requirements rests on the type of use pattern (selective or unselective), the level of awareness and management arrangements. Contrary to Simiyu (2017) that reported that the management arrangements of sanitation facilities should be agreed upon collectively, in the FBSan context, sanitation stakeholders make different decisions, and at different levels based on their interests. Users have little or no control over the management of the supplied facilities.

Respondents felt that sanitation facilities deployed to informal settlements are not applicable to the conditions of their settlements. Municipal officials (as service providers) decide about the deployment and management of the facility, and users (as recipients of the services) decide on the acceptance and use of the deployed facility. One way to determine the applicability of a sanitation technology or facility is to understand the context of its deployment. The perception of the applicability of a sanitation technology and facility comes from the environment surrounding an individual, behaviour, and practices, which in the FBSan policy context are compounded by their interpretation of the sanitation policy and equity rather than technical attributes. Individuals tend to conceptualise sanitation technologies and facilities in terms of their desires, needs, aesthetic and equity without considering other aspects including the condition of deployment and the cost associated with their preferred technology. As municipal officials are to determine the appropriateness of a sanitation technology, a clear consideration must be given to users' needs, practices and settlement conditions. Ultimately, the choice of sanitation facilities must occur with users' needs and practices in mind, and the deployment must allow users to interact with the technology without hinderances.

These findings are supported by previous studies (Mjoli *et al.*, 2009; Duncker, 2014; Mkhize *et al.*, 2017), inferring that users and service providers view sanitation technologies and facilities from different perspectives and with different understandings. These opposing views are informed by the lack of viable guidance in the sanitation policy regarding the appropriate sanitation technology and facility. While the determination of an adequate level of sanitation service to informal settlements is often contested (Taing, 2015), such contestation can open the opportunity for communication and collaboration between various sanitation stakeholders (Bradlow, 2013). However, the entitlement mentality, understanding of the meaning of sanitation and political interference have led to the radicalisation of views, further stirring user preference for individual waterborne facilities. Previous studies (Ignacio *et al.*, 2018; Nawab *et al.*, 2006; Roma *et al.*, 2010; Lagardien *et al.*, 2012; Tumwebaze *et al.*, 2013; Matsebe & Osman, 2012; Jenkins & Curtis, 2005; WSP, 2004; Jenkins & Scott, 2007) have determined that perceptions towards a given sanitation technology is guided by various interrelated factors. In the FBSan policy context, the way an individual views the applicability of a sanitation technology and facility is shaped by their interpretation of the sanitation policy, which for users allow for self-determination of the facility that responds to their aspirations and for municipal officials to select what is most appropriate. Users view sanitation as a facility intended for defecation rather than a behaviour. They often fail to understand the link between sanitation and health, and this may justify the poor environmental health observed in informal settlements. This difference of views confirms Murphy *et al.* (2009)'s study that claimed that standards that determine the appropriateness of a sanitation technology are context based, sometimes contradictory, frequently impossible to achieve in practice, and have a number of implications on both access and sustainability of sanitation services. It underscores the need to amend or develop alternative institutional arrangements adapted to the context in which sanitation technologies and facilities are to be deployed. This is similar to Paterson *et al.* (2007), whose study asserts that regardless of the context of deployment, a

sanitation technology must be technically-feasible, economically-appropriate and socio-culturally-acceptable.
This study understands that the non-applicability of sanitation technologies and facilities can be derived from the confluence of various perspectives: (i) the poor interpretation of the principle of access to basic sanitation as a human right. For instance, on one hand, the prescription of the White Paper on Basic Household Sanitation of 2001 (DWAF, 2001) to provide a toilet for each household has been applied by residents to claim their right to individual waterborne toilet; (ii) the vagueness of the FBSan Implementation Strategy of 2009 in providing guidance on the approach to be used by municipalities in the provision of service added to the tally; (iii) users' limited or utter lack of knowledge on the type of sanitation technology to be deployed to their settlements, the choice of the location, use patterns and management arrangements; (iv) municipalities' reluctance to provide a higher level of services that is perceived as an encouragement to unlawful land occupation. This suggests that without considering the institutional (process), technical (fit for purpose and use technology) and social (practices and behaviours) aspects of sanitation, communal sanitation facilities may not have any value in the actual context of their deployment.

In the FBSan policy context, the way an individual views the applicability of a sanitation technology and facility is shaped by their interpretation of the sanitation policy and understanding of the notion of sanitation which for users allow for self-determination of the facility, and for municipal officials to select what is most appropriate. For each type of sanitation technology and facility, users value one or more criteria that suit their aspirations and expectations. In general, when looking at how stakeholders value sanitation technologies and facilities provided to informal settlements, findings reveal three essential determinants: (i) safety concerns, (ii) cleanliness and (iii) comfort/privacy. Users place most emphasis of social attributes that are associated with their needs and living conditions while considering other determinants, including institutional and technical, to be of secondary importance.

5.4.3 *Implications of institutional arrangements on access and sustainability of sanitation services*

Although the deployment of sanitation facilities (regardless of the type of technologies) has improved the living conditions of residents, the institutional arrangements emerged as a hindrance to access and sustainability of sanitation services as a whole. While the White Paper on Basic Household Sanitation (DWAF, 2001) has devolved decision making power to municipalities regarding the selection and deployment of sanitation technology and facilities, communities would agree with municipalities on the technology to be provided and should participate in the decision-making process about what should be done, how and when. Although institutional arrangements were in place (on paper) at institution and facility levels, stakeholders other than municipal officials demonstrated little or no understanding of the ways these have been developed and implemented. This lack of understanding is partly attributed to their exclusion from the sanitation service provision programme, lack of communication and restricted information sharing. These reasons resonate with other studies (Phaswana-Mafuya, 2006; Mjoli, 2015; SAHRC, 2018) that identify the exclusion of users a main cause of the failure the sanitation provision programme. Data confirms that throughout the five study settlements, users were not adequately involved in the decision-making process around the selection, deployment, and management of sanitation facilities.

The decision to deploy facilities seems to be made on ad hoc basis; management arrangements are made without prior public consultation. It is evident that the lack of transparency around the

way sanitation provision is planned and implemented, and the subsequent management of facilities have severe implications on access and sustainability of the services. In such instances, when users are not associated in the sanitation service provision programme, they found themselves far less concerned and excluded from decisions. This likely explains why the provided facilities are not used as intended, and the high occurrence of vandalism that has contributed to the high number of dysfunctional facilities, thus limiting resident access and delaying delivery of services to other areas.

5.4.4 *Summary*

Deciding on the suitability of a sanitation technology is an important step towards achieving universal access to sanitation for all. The selection and deployment of sanitation facilities in an informal settlement through the FBSan policy context is complex. The overall assessment of sanitation facilities took cognisance of observed indicators highlighted in Appendix D (some of which were previously used by Sonego & Mosler, 2014). There is a definite divergence of views between municipal officials and users regarding the applicability of sanitation technologies and facilities provided to informal settlements. Sanitation technologies (water and non-waterborne) were not applicable in informal settlements they did not fulfil users' pre-defined applicability criteria or other criteria including access, relevance, preference, use, management, and sustainability, as outlined in this section. While users and municipal officials tend to have adequate knowledge of the types and nature of sanitation facilities provided, they lack a common understanding on why some types of facilities (e.g. mobile toilets) are provided suggesting that users and service providers view sanitation technologies and facilities from different perspectives, often contrasting. Providing sanitation facilities without adequate understanding of the context in which they are deployed will not yield expected outcomes. Therefore, the understanding of the relationship between the institutional arrangements, sanitation technology and users' practices is necessary to inform the selection, deployment, and management of sanitation facilities to informal settlements.

5.5 Linking sanitation practices, technologies, and institutional arrangements

It is widely reported that sanitation facilities constitute the interface between users and their excreta (Tilley *et al.*, 2008). These facilities are either provided and managed by individuals (e.g. landlords, owners or users), private (e.g. donors or NGOs/CSOs or CBOs) or by the service providers (e.g. municipality) (Mjoli, 2010; Makhetha *et al.*, 1998). The provision and management in this case constitute institutional arrangements which define the way services are deployed, used and managed. A sanitation technology is defined as specific infrastructural services designed specifically to contain, transform or transport waste to another process, point of use or disposal (Tilley *et al.*, 2008). In this study, *sanitation practice* is referred to as the way individuals manage their excreta. Drawing from the discussion of the institutional, technical, and social aspects of sanitation, sanitation practices and applicability of sanitation technologies and facilities, it is evident that understanding the institutional, technical and social aspects of sanitation must inform the sanitation service provision.

The relationship between technologies and institutional arrangements has been evidenced by a few studies (e.g. Mjoli *et al.*, 2015) while the relationship between sanitation practices and technologies has been evidenced by others (e.g. Lagardien & Muanda, 2014). The relationship between the institutional arrangements and technology is evidenced by the choice of technology, deployment and management of facilities that are decided through the institutional arrangements by considering certain factors discussed in this thesis. The relationship between technology and practices is evident in the technology as the interface between users (through

their sanitation practices) and excreta (that is disposed into the facility). While these relationships are evident, no study (at the best of knowledge) has unpacked the relationship between users' practices, technology, and institutional arrangements in the policy context of Free Basic Sanitation. This section of the study highlights the complexity of sanitation service provision in informal settlements by unpacking the relationship between the institutional, technical, and social aspects of sanitation.

Throughout this study, it was demonstrated that by law, South African municipalities are mandated to provide sanitation services and related facilities of different technologies to informal settlements, regardless of their status. These informal settlements are characterised by residents of different backgrounds, cultures and religion beliefs, and different sanitation practices. To ensure adequate access to facilities and long-term sustainability of the services in informal settlements, municipalities (as service providers) should have certain knowledge of users' practices that allow for the appropriate selection of sanitation technologies (that respond to users' needs and practices) and implementation of institutional and management arrangements that correspond to the type of sanitation technology and facility. Institutional arrangements, sanitation technology and user practices cannot be separated. The relationship between these three pillars (viz. institutional arrangements, technology and user practices) must be maintained if access to sanitation and backlog eradication are to be a reality in informal settlements of South Africa.

Figure 5.1 illustrates this relationship based on the findings of this study, showing how institutional arrangements (as institutional aspect) are linked to user practices (as social aspect) and sanitation technology (as a technical aspect). There is a two-way relationship between institutional arrangements – sanitation technology – and user practices.

In terms of institutional arrangements, the relationship exists by virtue of roles and responsibilities of sanitation stakeholders, management arrangements and accountability measures that guide the selection, deployment, and management of sanitation facilities. In order to ensure users acceptance and appropriate use, these institutional arrangements must be adapted to user sanitation practices, settlement conditions and perceptions, and should be commensurate to user expectations and satisfaction. These arrangements should be further adapted to the selected sanitation technology, appropriate technology adapted and compliant with the decision to deploy facilities and the use patterns. This relationship enables sanitation stakeholders to understand institutional arrangements for a given sanitation technology and human relationships that enable the implementation of the technology.

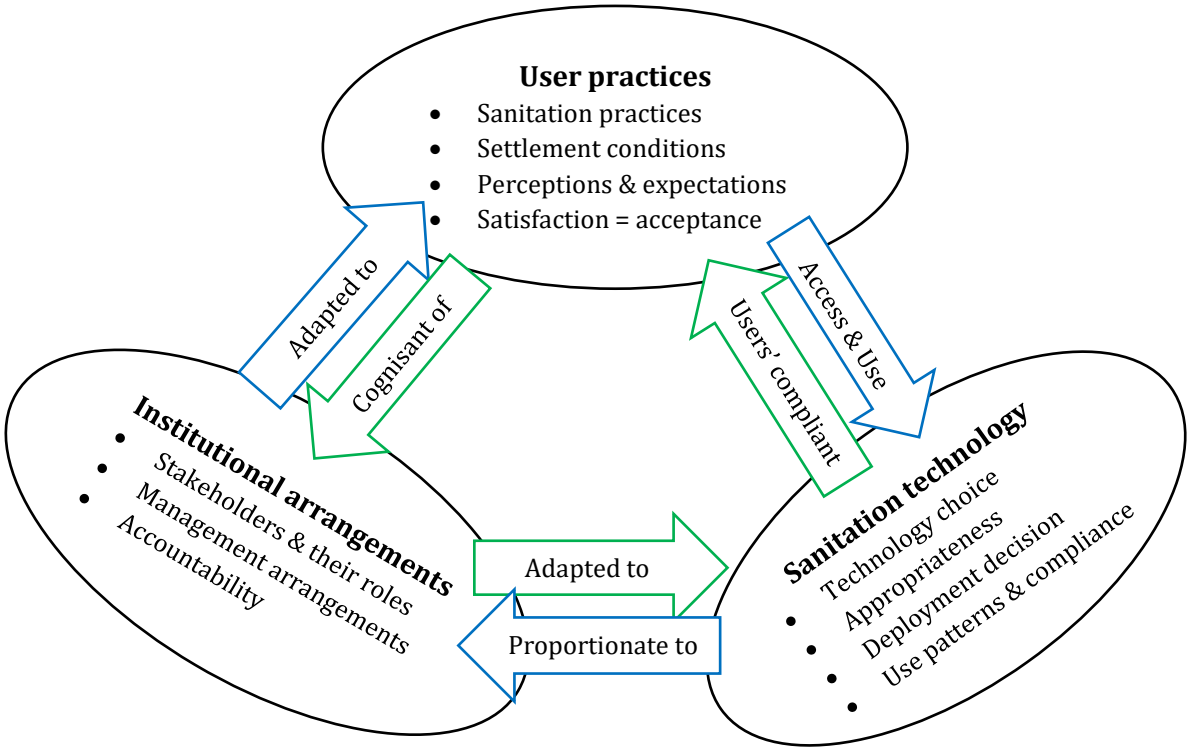

Figure 5-1: Interface between technology, institutional arrangements and users

In terms of technical aspects, the relationship exists by virtue of the sanitation technology as the interface between users and the excreta (Tilley *et al.*, 2014), which needs to be selected through institutional arrangements by stakeholders who have certain knowledge (of users' practices and settlement conditions), needs to be managed in accordance with the local settlement conditions, proportionate to the accountability measures in place to ensure adequate functioning and management. Similar to Bijker *et al.* (2012), this study identifies technology and users as a unified web as the technology is constructed and interpreted by users. Since sanitation technologies are designed with the intention to prevent human and environmental risks, users are required to interact with sanitation technologies based upon operational and use requirements, and the technology is expected to respond in accordance with its purpose. Proper user interaction with sanitation technology is essential for it to operate at its anticipated capacity or for the duration of its lifetime. Therefore, the sanitation technology and related facilities should be compliant with user practices, settlement conditions, user perceptions and expectations and user satisfaction which, by virtue, symbolise the acceptance of the technology.

In terms of social aspects (related to user sanitation practices) the relationship exists by virtue of users' right to access and use of sanitation facilities that are appropriate in terms of technology, deployed in a consensual manner and compliant with the policy, and for which the use patterns provide dignity and comfort. In the same line, users are expected to be cognisant of sanitation stakeholders and their roles, management arrangements of their facilities and accountability measures to ensure adequate implementation and sustainability of the facilities provided to their settlements. This relationship infers that user practices and condition of the settlements should be defining criteria for the selection and deployment of sanitation facilities in informal settlements. The choice of the technology and facilities to be deployed should be made by

stakeholders who have knowledge of settlement conditions and resident sanitation practices, done in accordance with certain principles and based on pre-defined and agreed criteria as discussed in this thesis. This clearly demonstrates the relationship between technology and user practices in a sense that a choice sanitation technology should take cognisance of user practices so as to ensure their buy-in as related to appropriate use and increase in access. In this context, institutional arrangements entail the identification of stakeholders who should take part in the decision-making process pertaining to the initiation of sanitation service provision, selection of the technology, deployment, and management of the facilities. Following the choice and deployment of the facility, findings suggest a continuing link between technology and institutional arrangements in terms of management of the facility.

This relationship suggests (in the context of free basic sanitation service in South Africa) that institutions are indeed not only responsible for the deployment of service by selecting technologies and facilities but the overall management. The management arrangements, including cleaning, O&M and monitoring, are important for ensuring long-term sustainability of services. This association means that even though institutions (municipalities) are responsible for the selection and deployment of sanitation facilities, (i) institutional arrangements should be adapted to the nature of sanitation technology and type of facility, user practices and settlement conditions and commensurate with user expectations. It further infers that (ii) user values (practices, settlement conditions, perceptions, and expectations) inform the sanitation technology (in terms of choice, appropriateness, decision to deploy and location, use patterns and compliance with the operational requirements) and institutional arrangements are understood by users. Lastly, (iii) selected sanitation technology should be user compliant (in terms of addressing their practices, settlement conditions, perceptions, and expectations) while commensurate with the institutional arrangements.

This study offers a view on sanitation service provision as a complex problem shaped by institutional (multi-stakeholders), technical (technology choice) and social (needs, practices, and behaviours) aspects. This contrasts with the prevalent technocratic supply and infrastructure driven approaches that have focused on infrastructure supply, but which consequently have resulted in the provision of inappropriate and failed sanitation solutions in informal settlements.

5.6 Alternative institutional arrangements for sustainable sanitation services in informal settlements

5.6.1 *Introduction*

The provision of sanitation facilities in South Africa is guided by the sanitation policy and an array of institutional frameworks (Tissington, 2011). At the heart of these legal documents are the institutional, technical, and social aspects of sanitation that have been used to frame the sanitation service provision. The intention of these documents is primarily to ensure the smooth provision of sanitation services and their sustainability. However, as demonstrated in this study, this intention has not been adequately translated in practice for various reasons. Therefore, suggestions have been offered for how the institutional, technical, and social aspects of sanitation can be addressed or improved to respond to the ongoing challenges related to the access and sustainability of sanitation services in informal settlements.

The institutional aspects of sanitation are concerned with the way sanitation service provision is organised. They are referred to as the formal and informal institutional contexts that inform the successful delivery of the day-to-day activity operational responsibilities (Ross *et al.*, 2014). In

this research, institutional arrangements relate to the systems and processes municipalities employ to plan, organise, deliver, and manage sanitation as well as share or delegate power and coordinate all stakeholders and actions related to the provision of sanitation services. They entail the way sanitation stakeholders were selected and the decision-making processes for the selection, deployment, and management of sanitation facilities. Like previous studies (Ekane *et al.*, 2013; Elledges *et al.*, 2002), this study shows that the institutional arrangements exist at both municipal and settlement (facility) levels. However, data across the five case studies corroborate Mulenga (2003) to demonstrate that current institutional arrangements are fragmented; implementation differs from one municipality to another and is not enforced as intended.

Stakeholders involved in the sanitation service provision play vital roles in ensuring that the whole sanitation chain is adequately managed and sustainable. In this study, data show that stakeholders involved are from different government departments, have different backgrounds and knowledge, and different understandings of sanitation. The suggested criteria that determine the profile of sanitation stakeholders reveal discrepancies in understanding of the institutional process of sanitation service provision. This difference, attributable to the background and interest of each stakeholder, delays the sanitation service provision if not addressed in advance. Despite their disagreement, there was general consensus that sanitation stakeholders should be those individuals actively involved in the sanitation related issues, and not limited to only municipal officials and support services. This suggestion corroborates previous studies (COHRE, 2008; Lüthi *et al.*, 2011; Mjoli, 2015) and the sanitation policy (DWS, 2016) that suggested the involvement of stakeholders other than municipal officials in the decision provision.

While the roles and responsibilities of stakeholders are stipulated in the sanitation policy, these are not inclusive and not adequately implemented in practices. The roles and responsibilities suggested in this study show that stakeholders are assigned specific roles at each phase of the sanitation service provision in associated with their level of involvement. The roles and responsibilities of stakeholders involved in the sanitation service provided should be commensurate to their level of involvement and not necessarily pre-defined as it is currently stipulated in the sanitation policy. In terms of power relations, our findings are supported by Pan *et al.* (2016) to show that the municipal officials have an imbalance of decision power as compared to other stakeholders. Therefore, the "equal to equal" power relation is the only way to ensure that all stakeholders are accountable to their assigned roles and responsibilities, and fairness is maintained. Since the provision of sanitation service is vested in municipalities, they are therefore the only stakeholder accountable for their actions to the national and provincial governments. On this basis, this study suggests that regardless of their level of involvement, municipalities should be assigned coordination roles. However, in line with other studies (Mjoli, 2015; Pan *et al.*, 2016), this study cautions that the coordination roles assigned to the municipalities can be achieved only through good sanitation governance where the principles of equity, efficiency, participation, decentralisation, integration, transparency, fairness, and accountability are observed.

Although municipal officials are accountable for service provision, suggestions emanating from respondents indicate that the decision-making process should follow a certain pathway where transparency and accountability are maintained. Such a decision-making process should adhere to the four phases of the sanitation service provision (viz. initiation, planning, implementation, and post-implementation). The proposed decision-making process evolves around the four phases of the sanitation provision. To each of these phases, a number of factors that inform the decision are suggested, and the type of decision to be made and expected outcomes are suggested. While all stakeholders are expected to be involved in the decision-making process (Parigi *et al.*,

2004), our study found that their level of involvement is different. Contrary to Simiyu *et al.* (2019) who suggest that the involvement of stakeholders should start of the definition of their responsibilities, level of jurisdiction and ways of collaboration, this study suggests a slightly different approach. The involvement in this study starts with the definition of roles and responsibilities, level of involvement, and pre-defined expectations of their involvement. The difference of approach can be attributed partly to the context in which the facilities are provided, which in this case is the FBSan policy. The level of involvement in this study is classified as follows: (i) decision makers in reference to those making decisions; (ii) advisor (an individual who provides guidance or inputs that can inform a decision but without any power of decision); (iii) recipient of the decision (as individual who is not involved but benefits from the decision and whose right it is to be informed); or (iv) not involved at all (any individual who is not involved in any decision). This classification of stakeholders according to their level of involvement is intended to ensure their level of participation and ensure the inclusivity of decisions made. Central to this relationship is the requirement to sustain open communication and regular feedback which will demonstrate a certain level of accountability, building trust and reducing tension amongst stakeholders.

Drawing from this discussion, it can be seen clearly that the institutional aspects of sanitation are elucidated. This means that stakeholders to be involved are known and the criteria for their involvement are established. Their roles and responsibilities are also established, the power relation, decision-making process, and their level of involvement in the sanitation service provision defined. This illustrates the way institutional arrangements should be considered. Having addressed the institutional aspect, now sanitation stakeholders can address the technical aspects of sanitation.

5.6.2 *Alternative institutional arrangements*

The roles and responsibilities amongst multiple stakeholders involved in the provision of sanitation services suggests the extent of centralisation or decentralisation in the implementation and management of sanitation services in informal settlements (Taing, 2015). Since the existing arrangements are labelled one-sided with the municipalities playing the predominant role, improvements or alternative arrangements were required. Alternative institutional arrangements are required to comply with the FBSan policy by ensuring that all (qualified) stakeholders are involved at various levels and phases of the decision-making process. The analysis of the value propositions from respondents has informed the development of the alternative institutional arrangements.

The proposed arrangements evolve around the four phases of the sanitation service provision where roles and responsibilities of stakeholders at both municipal and facility levels as well as coordination are outlined. Contrary to the previous arrangements, the proposed institutional arrangements should be conjunction with the proposed decision-making process. In these arrangements, stakeholders have been assigned specific roles and responsibilities at both municipality and facility levels as well the coordination of stakeholders' actions at each of the four phases of the sanitation service provision. This shows that the proposed alternative institutional arrangements as an emanation of the social compromises should be embedded into social norms and conventions that govern the provision of sanitation services. The proposed institutional arrangements are indeed intended to ensure that decisions at the municipal level are transparent and inclusive and are implemented and enforced at the facility level. These alternative arrangements provide clear guidance on the way sanitation stakeholders should be working, in terms of their roles and responsibilities in the sanitation service provision. They further provide guidance on the way stakeholders should be identified and selected, outlining their roles and

responsibilities and the extent of their involvement in the decision-making process as well as the types of decisions to be made and expected outcomes and accountability mechanisms. The proposed institutional arrangements enable interaction, coordination, cooperation, and information sharing amongst stakeholders. While these arrangements are specific to informal settlements of South Africa and the policy context of the FBSan, the key concept of the influence of the institutional, technical, and social aspects and their related factors should be considered in every type of sanitation service provision.

5.6.3 *Extent of application and limitations of alternative institutional arrangements*

The proposed institutional arrangements, intended to provide clarity for service providers in their quest to ensure a timeous service provision, might not be considered as prescriptive. The anticipated challenges these proposed institutional arrangements may pose are related to the difficulty of coordinating a large group of people and limited (intellectual, technical, legal, and managerial) capacity of stakeholders as well as the lack of a guidance document for the implementation of accountability measures. Similar to Pan *et al.* (2016), the lack of cooperation and willingness by the municipalities to relinquish their power, and the emergency nature of informal settlements and demands of sanitation services, limit the application of these proposed institutional arrangements.

5.6.4 *Summary*

Institutional arrangements are necessary to ensure the efficient provision of sanitation services. These arrangements evolve around the way sanitation stakeholders are organised and the way sanitation facilities are selected, deployed and managed. Since the existing arrangements were one-sided and exclusive, respondents suggested inputs for the improvement or development of new arrangements. The suggested inputs show the extent of inconsistencies that have weakened previous arrangements. The analysis of these suggestions infers that municipal officials should ensure that efforts are not only directed at increasing access by increasing the number of facilities but also at ensuring that communal facilities are transparently selected and deployed and adequately managed. This can be achieved only through the involvement of stakeholders who have play significant roles (as recommended by the policies) while weighing other aspects including technical and institutional. South African informal settlement sanitation policy design and implementation can be improved by revising the sanitation policy and the institutional arrangement process to reflect both lived and practical realities. As this study suggests, communal sanitation facilities can be elevated to an acceptable form of sanitation facilities in informal settlements if adequately managed. Therefore, for policy development, the focus should be not only on the deployment of facilities to make the number, but on institutional, technical, and social aspects of sanitation.

5.7 Overall summary

The aim of this study was to understand the relationship between institutional, technical, and social aspects of sanitation and their impact on access and long-term sustainability of sanitation services. The intention was primarily to inform the development of alternative institutional arrangements intended to inform the provision and management of sanitation facilities in informal settlements in the policy context of the FBSan. The overall discussion covered the institutional, technical, and social aspects of sanitation, the applicability of sanitation technologies and facilities, sanitation practices and their impact, and lastly, alternative institutional arrangements for the provision of sanitation services in informal settlements. Following the discussion of results in this chapter, several general conclusions are derived.

- Knowledge and understanding of the institutional, technical, and social aspects of sanitation are important for the sustainability of sanitation service provision in informal settlements.
- The applicability of sanitation technologies and facilities lies on the understanding of user needs, settlement conditions and appropriate management of the facilities.
- Sanitation practices are informed by factors that derive from or are associated with the social, physical, and institutional environment surrounding informal settlements and their residents. To eradicate sanitation backlogs, it is critical to consider social factors that drive behaviour and use, or abuse of sanitation provided under the FBSan in informal settlements.
- Alternative institutional arrangements show that the provision of sanitation services should not be limited to the municipality level. The roles and responsibilities of stakeholders should be considered at both municipality and facility levels.

The subsequent chapter presents the conclusions of the study and recommendations for further research.

Chapter 6 CHAPTER SIX: SUMMARY AND CONCLUSION

6.1 Introduction

Access to improved sanitation is one of the burning social issues affecting, and continuing to affect, human wellbeing in developing countries. In South Africa, access to sanitation services is a human right enshrined in the Constitution. It has been translated into sanitation policy that mandates municipalities to provide Free Basic Services (FBS) including water and sanitation (DWAF, 2001) to all South Africans including those living in informal settlements. Through the FBS policy, the Government of South Africa has provided sanitation facilities to various areas including informal settlements since 1994. Despite the dedication of municipalities and the availability of funds, however, many people, especially those living in informal settlements, are still lacking access to improved sanitation services.

Informal settlements are an integral part of the urban landscape. Their lack of infrastructure is of great concern, attributed to a multitude of inter-related factors that are being addressed using different approaches but with varying degrees of success. Often, institutional arrangements are decided by people who have little or no experience of sanitation issues (Tsinda *et al.*, 2013), and decisions concerning resident access to sanitation have been taken without any form of engagement or consultation with the recipients of the services (Mjoli *et al.*, 2009). This mix of issues has exacerbated the already inadequate access to sanitation and has contributed to the lengthy sanitation backlog. Addressing these challenges requires a holistic approach that ensures that residents are provided with appropriate infrastructure.

Although, the government has been striving to accelerate sanitation service provision to ensure universal access to all citizens, many people (especially those living in informal settlements) are still lacking access to improved or adequate sanitation services. The implementation of sanitation services in South Africa is complex for various reasons including the nature of the settlement, the high number of role-players involved and the misinterpretation of sanitation policy (Mjoli & Bhagwan, 2008). Although the institutional framework for sanitation in South Africa has been acclaimed worldwide as progressive, in practice the implementation has been alarmingly deficient (Mjoli *et al.*, 2009). The deficiencies observed are mainly related to the overlap of roles and responsibilities of various role-players (especially those directly responsible for the provision and maintenance of sanitation facilities) and poor coordination of their activities. This overlap has created institutional fragmentation which in many cases has resulted in chaotic service provision (Mjoli, 2015). The choice of sanitation technology and the level of service to be provided are decided by experts (service providers) who have little or no knowledge of the social implications of a particular sanitation choice nor do they have an adequate understanding of the nature of the settlements where a particular technology is deployed (Mjoli *et al.*, 2009; Lagardien & Muanda, 2014). Furthermore, sanitation technologies are often selected by considering cost and availability factors (Crous, 2014) while the sanitation practices (attitudes and behaviour) of recipients and settlement conditions are overlooked (Lagardien *et al.*, 2012). Users, as recipients of the service, do not take part in the decision-making processes and thus reject, misuse, disregard and even vandalise the facilities.

The aim of this study was to examine the institutional, technical and social aspects of sanitation and the extent by which this informs (supports or hinders) the provision of sanitation services, access and long-term sustainability. The study describes how considerations of institutional, technical, and social aspects of sanitation must be used to improve sanitation service delivery in

South African informal settlements. This chapter draws together the main findings from the study as related to the four objectives including:

- explore institutional, technical and social aspects of sanitation service provision with specific focus on informal settlements;
- document, investigate and analyse sanitation user practices (behaviours and attitudes) and values, and establish their impact on access, functioning and sustainability of sanitation services in informal settlements;
- Document, investigate and analyse the practical application of specific sanitation technology, institutional arrangements of existing sanitation provision and their impact and implications generated on access and long-term sustainability to improve sanitation services in informal settlements; and
- design and recommend alternative institutional arrangements based on formal and informal service provider-user co-production practices and collaboration (institutionalised co-production - ICO) to improve access and produce sustainable sanitation services in informal settlements.

These objectives establish a basis for determining the key lessons learnt and recommendations for ensuring adequate sanitation service provision in informal settlements through the Free Basic Sanitation Policy context. They were achieved through a case study approach using both qualitative and quantitative methods. Data collection tools included both primary and secondary sources using various tools: a survey, semi-structured interviews, focus group discussions (FGDs), participant observation, transect walks and literature review. The quantitative survey was critical to collect information on demographic characteristics of the settlements, types of sanitation currently in use by households, sanitation practices and the reasons for their adoption.

The IAD framework and co-production theoretical framework inform this study. The concept of co-production in informal urban sanitation is premised on the argument that the participation of stakeholders other than municipal officials can improve the implementation of sanitation services in informal settlements. In the context of this study, understanding the way institutional, technical, and social aspects of sanitation inform access and long-term sustainability of sanitation services through the lens of the IAD framework and co-production aided in comprehending the extent by which sanitation service provision has been implemented. It also offered an opportunity to interrogate the existing institutional arrangements and develop alternative ones. The IAD framework provided a platform for the study respondents to discuss the institutional, technical, and social aspects of sanitation service provision in the action area using the findings of this study as resources. The outcomes of discussion were later used to co-produce suggestions that were later used to develop alternative institutional arrangements. This final chapter of the thesis summarises the findings, contributions of the study, recommendations and conclusions of the study based on the objectives spelled out in Chapter 1.

6.2 Summary

The provision of sanitation is in South Africa involves various institutions and a multitude of stakeholders. This study found no agreement surrounding the types of stakeholders to be involved in the sanitation service provision, nor their roles and responsibilities. The level of involvement of stakeholders was determined by their roles and responsibilities and their knowledge of informal settlements or contribution towards sanitation service provision. However, despite these arrangements, stakeholders other than municipal officials were not acknowledged as part of the sanitation service provision. The decision power is vested in the municipalities which assume the leading role in service provision, management, and coordination. Top-down and supply-driven approaches were employed to provide facilities

without prior consultation with key stakeholders. These approaches have led to the deployment of facilities that were not fit for use. The decision to deploy facilities was guided by a municipality's pre-determined factors (e.g. land tenure) and criteria that were unknown by other stakeholders. The management arrangements which entail the care of the facility (cleaning, monitoring and maintenance) were different from one settlement to another, dependent on funds available to the municipality. In many cases, facilities were cleaned by the caretaker, contracted cleaners or janitors. These arrangements were decided by municipal officials without user involvement. These findings suggest that a blunt one-size-fits-all institutional set up is neither effective nor applicable in the complex setting of informal settlements. More flexible arrangements that are adapted to the specific conditions of informal settlements are imperative.

The technical aspects of sanitation service provision are concerned with the appropriateness and functioning of the sanitation facilities in relation to the context of their deployment. Both water and non-waterborne sanitation facilities, equipped with either mobile or permanent superstructures, were deployed. Despite their availability, several technical challenges related to access and use were identified: high numbers of users, poor conditions of facilities, unaccommodating design, users with unrealistic expectations and lastly, the facility ratio. These challenges affected both users (in terms of access) and municipalities (in terms of maintenance and cost). In terms of the social aspects of sanitation, the five informal settlements studied have all existed for more than two decades as a conglomeration of people migrating from rural areas. Each of these settlements moved through certain developmental phases where the lack of facilities progressed to a gradual service provision ranging from rudimentary to basic sanitation facilities. Regardless of the way municipalities responded to the emergence of informal settlements, several inter-related sanitation challenges were evident. Some were institutional (e.g. lack of sanitation facilities – as municipalities did not fulfil their institutional mandate), technical (e.g. inappropriateness or unaccommodating nature of facilities) and social (e.g. large number of users, poor hygiene, safety concerns). These challenges were attributed to various issues including negligence by municipal officials to address the needs of residents, lack of user education, poverty and the condition of the settlements, attitudes, and behaviour of residents as well as poor communication and a lack of social cohesion. These challenges severely impacted on sanitation service provision as they have led to an increasing number of dysfunctional facilities, prompting many residents to seek alternative means to meet their defecation needs.

The use of existing facilities was combined with a variety of alternative (sanitation) practices including open defecation, use of plastic bags (or flying toilets), night pails, porta-potties and use of personal self-made facilities such as pit latrines and flush toilets illegally connected to stormwater drains. Thought sanitation practices varied across the sites, they were distinguished as either day or night practices, adopted by almost every resident including children, adults, elderly and physically challenged people. Sanitation practices have been informed by a range of context-dependent factors: safety concerns, cleanliness of the facilities, demand of facilities that exceeded supply, large numbers of dysfunctional facilities, personal feelings or attitudes of individuals, religious and cultural beliefs, unaccommodating design and location of facilities, lack of choice, perceived fear of contamination, local conditions, availability of the facility at time of immediate need, the context in which the resident lives, unfamiliarity with the technology, as well as lack of facilities for alternative use.

The extent of these practices varied from one settlement to another and were dependent on the time of the day, the availability of facilities and their conditions. These practices have several impacts, including the limitation of access and delay or interruption of the FBSan provision, increasing cost of maintenance, further lack of access to facilities and deterioration of living

conditions of residents, human health, and the environment. These impacts have led to an accelerated number of people lacking access to sanitation facilities, sparking, in certain cases, violent service delivery protests as many informal settlement residents believe that municipalities have failed in their duty to provide the much-needed FBSan. The factors that have informed sanitation practices derive from or are associated with the social, physical, and institutional environment surrounding informal settlements and their residents. Users adopt practices that are relevant to their needs and conditions or that offer some level of comfort, privacy, and security at the very least. To eradicate sanitation backlogs, it is critical to consider social factors that drive behaviour and the use of abuse of sanitation provided under the FBSan in informal settlements.

While considered by a municipality as technically sound in the context of informal settlements, the sanitation technologies and facilities provided were regarded by users as socially inappropriate. The applicability of sanitation technologies and facilities was understood from various points of view. In the FBSan policy context, municipalities are responsible for the selection and deployment of sanitation facilities. Consequently, the following holds true: (i) institutional arrangements should be adapted to the nature of sanitation technology and type of facility, user practices, settlement conditions and commensurate to user expectations. It further infers that (ii) user values (practices, settlement conditions, perceptions, and expectations) inform the sanitation technology (in terms of choice, appropriateness, decision to deploy and location, use patterns and compliance with the operational requirements) and institutional arrangements should be adapted to the type of facility and understood by users. Lastly (iii) the selected sanitation technology should be user compliant (in terms of addressing their practices, settlement conditions, perceptions, and expectations) while commensurate to the institutional arrangements (e.g., cleaning and monitoring).

6.3 Contributions of the study

This study is the first attempt in the field of sanitation to examine the institutional, technical, and social aspects of sanitation within the policy context of the FBSan. Through the combined application of the IAD framework and the co-production approach, the study has demonstrated the interrelation between the institutional, technical, and social aspects of sanitation and the extent by which they mutually inform access, functioning and long-term sustainability of sanitation services in informal settlements. It added to the body of knowledge relating to sanitation service provision in informal settlements, with alternative institutional arrangements that are more likely to change the way sanitation service provision is understood and implemented in informal settlements. It also entered the ongoing debate about the extent to which the FBSan Policy has contributed, or should contribute, towards universal access in international targets, particularly SDG 6.2. Overall, this study provides information on sanitation in informal settlements of the Western Cape, thereby contributing to the paucity of data on the institutional, technical, and social aspects of sanitation in these settlements.

6.3.1 *Methodological contributions*

The study has contributed to the literature on the co-production and IAD framework by applying a context specific case study to these theories. The study has shown that the IAD framework and co-production (which considers inputs from all stakeholders in addressing issues of social, technical, and institutional importance) can be used to co-produce knowledge that can improve the wellbeing of community (in this case access and long-term sustainability of sanitation services). The principle is that the application of co-production can aid in developing tailor-made institutional arrangements (as illustrated in this study) while fostering a mutual understanding

between sanitation users and municipal officials, increasing access to adequate sanitation while ensuring long-term sustainability of sanitation services.

The study has led to an elaborate illustration on how sanitation stakeholders should be selected, how their roles and responsibilities should be assigned and how the decision to deploy sanitation facilities should be made within a complex and challenging policy context of the FBSan.

This study makes an original contribution by providing sanitation sector stakeholders with an improved understanding of issues related to the provision of sanitation services in the policy context of the FBSan. This understanding is intended to address issues concurrently related to institutional arrangements, technology choice sanitation and user practices frequently neglected in the literature. The understanding of these issues is also intended to ensure that tailor-made institutional arrangements are available and understood by both service providers and users, to ensure adequate deployment and access to sanitation in informal settlements, and to ensure long-term sustainability of the service. The proposed alternative institutional arrangements that include the institutional, technical, and social aspects of sanitation clarify a number of contentious clauses of the sanitation policy and legislative frameworks. They provide guidance on the profile of sanitation stakeholders, their roles and responsibilities and level of involvement in the sanitation service provision decision-making process as well as management arrangements. In terms of technical aspects of sanitation, the alternative arrangements suggest additional factors that must be evaluated in the choice of sanitation technologies and facilities and further suggest how social challenges related to access to sanitation should be addressed.

The contribution emanating from this study includes the following:

- understanding of the institutional, technical and social aspects of sanitation service provision, and the extent by which they inform access and long-term sustainability of sanitation services;
- understanding of user sanitation practices and their impact on the sanitation service provision, access and long-term sustainability of sanitation services;
- making explicit the relationship between social (user practices), technical (technology choice and appropriateness) and institutional (institutional arrangements) of the sanitation service provision, and the extent by which they inform (hinder or support) access to sanitation and sustainability thereof;
- incorporating the concept of co-production in the formulation of alternative institutional arrangements, and sanitation technology choice that incorporate user opinions; and
- finding alternative tailor-made institutional arrangements, sanitation technology choice models and a methodical framework applied to the decision-making process.

Findings of this study are aligned with the National Development Goals intended to ensure universal access to sanitation for every citizen of South Africa regardless of their social status. The findings also inform the development of the long-term infrastructure development plan. Although this study is limited to five informal settlements confined in the Western Cape Province of South Africa, it has provided invaluable insights into how the institutional, technical, and social aspects of sanitation service provision inform access and long-term sustainability of sanitation services in the context of informal settlements. It further provides insights into how the relationship between these three pillars can inform sanitation service provision (which includes technology choice and related institutional arrangements). Findings of this study can be used to design an even more comprehensive study on the provision of sanitation services in a

predominantly supply-driven context. The findings offer useful lessons to many developing countries whose settings are similar.

6.4 Recommendations

6.4.1 *General considerations*

Although South Africa has managed to ensure access to sanitation to a large fringe of the population, up to 1.2 million people living in informal settlements are still lacking access to improved sanitation. Given the persisting challenges to ensure access to sanitation in informal settlements through the FBSan policy as discussed in this study, the following issues should be considered when planning the provision of sanitation services in informal settlements:

- Due to the fact that municipal officials are the only accountable sanitation stakeholders with decisional power, it is critical to ensure that other stakeholders are involved and decisions made are consensual and compliant with policy and other statutory requirements.
- The sanitation technologies should be selected by incorporating user needs, practices and conditions of their settlements amongst other selection criteria.
- Social issues that have led to users' unhygienic sanitation practices should be examined, with appropriate measures taken to ensure that they are addressed.
- Access to sanitation should not be determined in terms of the number of facilities provided, but rather the number of residents who *actually* use the facilities.
- There should be capacity building at both municipal and facility levels to ensure adequate management of the facilities.

Even though access to sanitation has been recognised as a human right, the number of informal settlements residents lacking access to sanitation reflects a discrepancy between the policy statement and its implementation in practice. The sanitation service provision has been hindered by the lack of consideration of the institutional, technical, and social aspects of sanitation. Given the importance of these aspects of sanitation on the provision of sanitation services, the findings of the study have several implications for policy:

- Interventions and policies related to sanitation service provision should consider the multiple and varied needs of residents, practices (and related factors) and conditions of their settlements *prior* to the selection and deployment of facilities to informal settlements in South Africa.
- Since the power vested in municipalities has led to unilateral authoritarian decisions compounded by a lack of accountability, measures must be established to ensure transparency and accountability for all services deployed to informal settlements.
- Clauses of the sanitation policy pertaining to sanitation stakeholders and their roles, level of service and management of facilities must be revisited and clarified to avoid the current confusion and interpretation observed during the course of this study.
- An addendum to the current sanitation policy which contain regulations for the provision of sanitation services to informal settlements should be developed and disseminated.
- A compendium of sanitation technologies and facilities with advantages and disadvantages of each technology and facility, the context of application and the limitations of each should be developed and disseminated to empower informal settlement residents with technical knowledge.

6.4.2 *Further research*

The following are suggestions for further research:

- Findings of this study outline several challenges hindering the FBSan provision. Further research to understand the barriers for achieving Free Basic Sanitation provision in informal settlements of South Africa is important as it may assist decision-makers to better understand issues and further change their service provision approaches.
- Social aspects emerged as one of the consequences of the delay observed in the provision of sanitation services, explicitly the large number of dysfunctional facilities. It is imperative to undertake further research pertaining to the correlation between social aspects of sanitation and challenges to achieve universal access to sanitation services in informal settlements.
- The management of sanitation facilities was one issue hindering access and proper functioning of sanitation facilities in informal settlements. Further study should investigate various management approaches and arrangements for sustainable access and use of sanitation facilities provided in informal settlements.
- Another issue was the power vested in municipalities to select and deploy facilities to informal settlements. This led municipalities to develop authoritarian attitudes and arbitrary measures in their choice and deployment of facilities. Further study is required to develop accountability measures that measure the actions of municipalities in the provision of sanitation services in informal settlements.
- The impact of institutional arrangements for sanitation service provision in the policy context of FBSan should be investigated. The research should focus on the assessment of the existing institutional and management arrangements and the context of their application for various sanitation technologies and facilities deployed in informal settlements.

6.5 Limitations

Aspects not related to the themes highlighted above – including sanitation policy, technology assessment, design, health and hygiene, financial aspects, removal of household solid waste, wastewater, and grey water disposal – are beyond the scope of this study. The findings should not be generalised to other informal settlements of developing countries as the service provision approaches and methods might not be the same. However, the process and findings of this study can offer insight within a developing country context, if applied to settlements under similar policy context.

6.6 Conclusion

Achieving universal access to sanitation services in developing countries will require long-term planning that addresses institutional, technical and social aspects of sanitation. In South Africa, access to sanitation services is a human right enshrined in the Constitution. It has been translated into sanitation policy that mandates municipalities to provide Free Basic Services (FBS) including water and sanitation to indigent households including those living in informal settlements. However, despite the dedication of public officials and the availability of funds, the situation remains unchanged: many people, especially those living in informal settlements, are still lacking access to improved sanitation services. This situation has prompted the need to understand why access to sanitation remains a challenge despite the enactment and implementation of the FBSan policy. Through the case study approach using mixed methods and combining the IAD framework and ideas of co-production, this study has identified various aspects – institutional, technical and

social – that inform the sanitation service provision. It has also developed alternative institutional arrangements that could improve the sanitation service provision in informal settlements.

Since access to adequate to sanitation is an issue embedded in everyday lives, affected people should be involved in any decision to select, deploy, and manage the facilities. A generalised service provision as currently designed and implemented is not a viable nor sustainable strategy to eradicate the sanitation backlogs due to the lack of appropriate and fit-to-purpose approaches by municipalities and user attitudes and expectations. Continuing the provision of sanitation in its current set up without refining the policy will bring unnecessary deployment. An approach that includes the institutional, technical, and social aspects of the service provision strategy beyond the current service provision approach must be designed to ensure that deployed facilities are appropriate and sustainable. Users' sanitation practices are informed by a range of context-dependent factors which derive from or are associated with the social, physical, and institutional environment surrounding informal settlements and their residents. The applicability of the selected sanitation technologies (water or non-waterborne) and facilities (individual or communal) is evident only if commensurate to user practices, needs and conditions of their settlements.

The institutional, technical, and social aspects are key elements of the sanitation service provision in the policy context of the FBSan. The relationship between the institutional arrangements and technology is evidenced on the fact that the choice of technology, deployment and management of facilities are decided through the institutional arrangements by considering some factors. The relationship between technology and practices is evident because of the technology as the interface between users (through their sanitation practices) and excreta (that is disposed into the facility). Through the combination of the IAD framework and co-production, alternative institutional arrangements and decision-making processes that encompass the types of stakeholders involved and their roles and responsibilities at each phase of the sanitation provision, the level of involvement, decisions and expected outcomes have been developed. The suggested institutional arrangements provide a framework for determining what stakeholders should be involved in the sanitation service provision, what sanitation technology to implement and which implementation and management arrangements will best suit the intended users.

The hypotheses, presented at the beginning of the research, stated that "Understanding the relationship between sanitation practices, technology and institutional arrangements can positively contribute to access to improved sanitation in informal settlements while ensuring long term sustainability of the services" and "Access and long term sustainability of sanitation services in informal settlements is informed by coordinated institutional arrangements and consensual technology choice which will in turn result in adequate sanitation practices". The overall findings of this study suggest that the success of the sanitation service provision in informal settlements through the FBSan policy context will remain unresolved unless the factors that inform its implementation are thoroughly identified, analysed, and addressed. The main aspects identified in this study include institutional, technical, and social, which have different levels of impact on the service provision as whole. Sanitation service provision as currently formulated and implemented is not feasible nor sustainable for the conditions pertaining to informal settlements and their residents' needs, aspirations, and sanitation practices. This is verified with evidence such as the number of people still lacking access to sanitation facilities, the high number of dysfunctional and abandoned facilities, the extent of unhygienic sanitation practices and the poor environmental conditions of informal settlements. Without proper measures to address institutional, technical, and social aspects of sanitation, the 2030 target for

achieving access to adequate and equitable sanitation and hygiene for all and ending open defecation may not be realised.

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APPENDIX

Appendix A. Interview questionnaires

Appendix A1: Institutional, technical and social aspects of sanitation service provision in informal settlements

Appendix A.1.1: Institutional aspects of sanitation service provision in informal settlements

A.1 Stakeholders involved and their roles

1. What guides the provision of sanitation services in informal settlement?

1	2	3	4	5
Policy	By-laws	Constitution	Mayoral decision	Don't know

1.1 If other, please specify

2. Who are other stakeholders involved in the decision-making process?

2.1 If other, please specify

1	2	3	4	5	6	7
MO	ISR	DWS	DHS	NGOs/CBOs	PGD	Don't know

3. According to your knowledge, what roles are they (stakeholders) playing? Circle all that apply

1	2	3	4	5	6	7	8
Advocacy	Activism	Service provision	Recipient	M&E	O&M	Contractor	Don't know

3.1 If other, please specify

4. At what level/stage of the decision-making process are they (stakeholders) involved? Circle all that apply

4.1 Please specify

1	2	3	4	5	6	7
Advocacy	Public participation	Technology choice	Deployment	O&M	M&E	Other - specify

5. Who is coordinating actions of all stakeholders involved in sanitation provision?

1	2	3	4	5	6	7	8
MO	ISR	DWS	DHS	NGOs/CBOs	PGD	Nobody	Don't know

5.1 If other please specify

A.2 Stakeholder power relation

1. Who are the main stakeholders involved in the decision-making process concerning the provision of sanitation services in informal settlements? Please rank them according to their level of influence/power. Circle the most important

1	2	3	4	5	6	7
MO	ISR	DWS	DHS	NGOs/CBOs	PGD	Don't know

1.1 If other, please specify

2. Can you explain how the stakeholder position/power/level of influence impacts the decision-making process?

3. Are power relations influencing the decision-making process?

1	2	3
Yes	No	Don't know

3.1 Specify

4. What factors determine the access or not of different stakeholder in the decision-making process?

1	2	3	4	5
Involvement	Activism	Legal obligation	Rights	Don't know

4.1 If other, please specify

A.3 Decision making process

1. Who regulates informal settlement services?

1	2	3	4	5	6	7
MO	ISR	DWS	DHS	NGOs/CBOs	PGD	Other - specify

1.1 Specify?

2. Who is in charge of initiating the decision-making process regarding the deployment of sanitation services in informal settlement?

1	2	3	4	5	6	7	7
MO	ISR	DWS	DHS	NGOs/CBOs	PGD	Nobody	Other – specify

2.1 Why do you say this?

3. Who is making decisions about the deployment of sanitation services in informal settlement?

1	2	3	4	5	6	7
MO	ISR	DWS	DHS	NGOs/CBOs	PGD	Don't know

3.1 If other, please specify

4. How are decisions making regarding the deployment of sanitation services in informal settlement being made?

1	2	3	4	5	6	7
Using policy	Ad hoc basis	Politically	Technicality	Social issues	Users demand or needs	Don't know

4.1 If other, please specify

5. At what level are decision-making processes taking place?

1	2	3	4	5	6
Community	Municipality	Province	National	NGOs/CBOs	Don't know

5.1 If other, please specify?

6. Does the level of decision-making influence the selection and deployment of sanitation?

1	2	3
Yes	No	Don't know

6.1 Specify

7. What is the officially and socially acknowledged level of decision-making power of the stakeholders involved in sanitation service provision?

1	2	3	4	5	6
Community	Municipality	Province	National	NGOs/CBOs	Don't know

7.1 Please specify

8. To what extent are they (decision making power of stakeholders) capable of influencing sanitation service provision in order to select and deploy sustainable sanitation technologies in informal settlements?

9. What type information is used for decision-making? Circle all that apply

1	2	3	4	5	6	7
Availability of Funds	Availability of technology	Settlement condition	Settlement type	Policies	Public protest	Don't know

9.1 If other, please specify

A.4 Basis for decision making

1. What enables informal settlement residents and service providers to make informed decision about the sanitation services to be deployed? Circle all that apply

1	2	3	4	5	6	7
Policy	Guidelines	Inst. framework	Personal feeling	Constitution	None	Other - specify

2. To what extent have these enabling factors contributed in making informed decision regarding the selection and deployment of sanitation? Please explain

1	2	3	4	5	6	7
Appropriate technology choice	Timeously deployment of facility	Decrease sanitation backlogs	Acceptable technology for users	Understanding between MO and users	Nothing significant	Other - specify

3. What factors have driven/are driving the choice of sanitation technology in informal settlements? Circle all that apply

1	2	3	4	5	6	7	8
Fund	Cost	Aesthetic	Ease of use	Ease of O&M	Preference	Policies	Other - specify

4. Are these factors adequate enough to form a basis for decision-making?

1	2	3
Yes	No	Don't know

2.1 Why do you say this?

Appendix A.1.2: Technical aspects of sanitation service provision in informal settlements

1. What sanitation technology and facilities are provided to this informal settlement? (Circle all that apply)

1	2	3	4	5	7
Communal waterborne	Communal non-waterborne	Individual waterborne	Individual non-waterborne	No facilities	Don't know

1.1 If other please specify

2. Are this technology and facility type responding to users' needs and settlement condition?

1	2	3
Yes	No	Don't know

2.1 Please explain your answer

3. Are the operational requirements of the technology manageable given the context in which it is implemented?

1	2	3
Yes	No	Don't know

10
11
12

4. What challenge(s) have emerged through the implementation and use of the facility? (Circle all that apply)

1	2	3	4	5
Increased number of users	Lack of access	Untidiness	Misuse & vandalism	Don't know

4.1 If other, please specify

5. Are these challenges hindering access to sanitation?

1	2	3
Yes	No	Don't know

5.1 Specify

6. Are these sanitation challenges affecting you as resident/service provider?

1	2	3
Yes	No	Don't know

6.1 Specify

7. Does the provision of sanitation facilities impact on or contribute to access to sanitation services?

13 7.1 Specify

1	2	3
Yes	No	Don't know

8. What technology and type of facility are best suited to users and settlement condition?

1	2	3	4	5	7
Communal waterborne	Communal non-waterborne	Individual waterborne	Individual non-waterborne	None	Don't know

8.1 If other please specify

9. Why do you prefer this type of technology and facility?

1	2	3	4	5	7
Comfort	Privacy/dignity	Pleasing	Right to have facility of choice	Match users' needs	Not sure

10. Who is taking care of the cleaning of the sanitation facilities?

1	2	3	4	5	6	7
Janitors	Contractors	Local residents	NGOs/CBOs	Nobody	Don't know	Other –specify

10.1 Please specify

11. How often are they cleaned?

1	2	3	4	5	6	7
Once a day	Twice a day	Every 2 days	Thrice a week	Weekdays	Don't know	Other –specify

12. How are the sanitation facilities cleaned?

1	2	3	4	5	6	7
Sweeping	Cleaning bowl	Cleaning wall	Unblocking	Disinfecting	Don't know	Other –specify

12.1 Please specify

13. Who is taking care of maintenance of the sanitation facilities?

1	2	3	4	5	6	7
Janitors	Contractors	Local residents	NGOs/CBOs	Nobody	Don't know	Other –specify

14. How regularly are they maintained?

1	2	3	4	5	6	7
When problem is reported	Randomly	Daily	Weekly	Monthly	Don't know	Other –specify

Appendix A.1.3: Social aspects of sanitation service provision in informal settlements

Question

1. How many years ago was this settlement formed

< 1 year	1- 5 years	6 - 10 years	11– 15 years	16– 25 years	> 25 years

2. How did authorities respond to the existence of this informal settlement?

1	2	3	4	5	7
Provided services	Nothing	Eviction threats	Assist us to build	Can't remember	Other - specify

3. What social challenges/issues related to sanitation have emerged in this settlement? Circle all that apply

1	2	3	4	6	5	7
Lack of facilities	Safety	Poor condition of facilities	Few facilities vs. large number of users	Poor hygiene	None	Other - specify

3.1 Specify

4. Are these sanitation challenges affecting you as resident/ISR?

1	2	3
Yes	No	Don't know

4.1 Specify

5. What (according to you) are the drivers for these sanitation challenges? (Circle all that apply)

1	2	3	4	5	7
Negligence by Municipal Officials	Lack of education	Poverty	Settlement conditions	Don't know	Other - specify

6. Are these challenges hindering access to sanitation?

1	2	3
Yes	No	Don't know

6.1 Please explain

7. What are the resulting effects of lack of sanitation on human health and the environment? (Circle all that apply)

1	2	3	4	5	7
Poor living conditions	Poor hygiene	Diseases	Poverty	Don't know	Other - specify

7.1 Specify

8. How have these challenges been addressed? (Circle all that apply)

1	2	3	4	5	7
Providing services	Monitoring services	Addressing needs	Educating users	Don't remember	Other - specify

8.1 Please specify

9. By whom were they addressed (Circle all that apply)

1	2	3	4	5	6	9
MO	ISR	DWS	DHS	NGOs/CBOs	PGD	Other - specify

Appendix A2: Sanitation practices (behaviours and attitudes) and related impacts on access and functioning of facilities and sustainability of sanitation services

Appendix A.2.1: Sanitation infrastructure used by residents

1. What sanitation infrastructure do you have or are available in the informal settlement?

1	2	3	4	5
Toilets	Solid waste bins	Grey water disposal	Don't know	Other - specify

2. What sanitation infrastructure do you actually use?

1	2	3	4	5
Toilets	Solid waste disposal	Greywater disposal	None	Other - specify

2.1 If none – please specify

3. What toilet facility are residents use precisely?

1	2	3	4	5	6	7	8	9
MobiSan	Communal toilet	Kayaloo	Chemical/container	Porta-potties	Bucket	Pit	Unspecified	None

4. For what purpose the toilet is being used

1	2	3	4	5	6	7
Defecating	Bathing	Disposal of night pail	Defecating & disposal	Urinating only	None	Other-specify

5. How often do you use the facility?

1	2	3	4	5	6
Once a day	Twice a day	Thrice a day	Everyday	Weekly	Don't use

6. What are the conditions of the sanitation infrastructure?

1	2	3	4	5	6
Very clean	Clean & usable	Dirty but usable	Dirty and unusable	Very dirty	Don't know

7. What distance (in m) between your house and the facility?

1	2	3	4	5	6
< 50	50 < 200	200 < 500	500 < 750	>750	Don't know

8. Are you affected by the distance?

1	2	3
Yes	No	Unsure

8.1 If yes, in what way are you affected you?

1	2	3	4	5	6	7
Disability	Safety	Dignity /pride	Privacy	Cultural or religion belief	Don't know	Other –specify

8.2 If other please specify

9. Is the access easy and safe?

1	2	3
Yes	No	Unsure

10. What risks evolve from the use of the facility?

1	2	3	5	6	7
Contamination	Safety	Loss of dignity/privacy	Sickness	Don't know	Other –specify

10.1 Please specify

11. What problems occur from the use of the facility?

1	2	3	4	5	6	7
Long waiting	Contamination	Diseases	Blockages	Lack of privacy	Don't know	Other –specify

11.1 Please specify

12. To whom do you report these problems?

1	2	3	4	5	6
Community leader	Municipal call centre	NGOs/ CBOs	Nothing	Don't know	Other –specify

12.1 Please specify

Appendix A.2.2: Sanitation practices and causes

1. What are the residents' sanitation practices in this informal settlement?

1	2	3	4	5	6	7
Use of provided facilities	Use of bucket	Use of plastic bag	Use of porta potties	Use of facilities outside the settlement	Open defecation	Other - specify

1.1 Please specify

2. Are these sanitation practices informed by sanitation challenges faced by residents?

1	2	3
Yes	No	Unsure

2.1 Specify

3. What is the extent of these sanitation practices? (scale of 1 to 5 with 5 = Acute, 5 = average 1 = low

1	2	3	4	5
Low	Medium	Acute	Don't know	Other –specify

4. Who in the community have adopted these practices?

1	2	3	4	5	6	7	8
Children <12	Girls <18	Boys <18	Adult males	Adult females	Elderly (M&F)	Don't know	Other – specify

5. Why have they adopted these practices or why these practices are taking place? (circle the most important one)

1	2	3	4	5	6	7	8
Lack of facilities	Poor condition	Safety	Privacy/ dignity	Religion /culture	Personal reasons	Don't know	Other – specify

5.1 Please specify

6. Can we consider that these practices are the direct result of sanitation challenges?

1	2	3
Yes	No	Unsure

6.1 Please explain

7. Can we consider that sanitation practices are results of inadequate sanitation technology choice?

1	2	3
Yes	No	Unsure

7.1 Please explain

8. How do informal settlement residents feel about their sanitation practices?

1	2	4	5	6	7	8
Neglected	Undignified	Discomfort	Desperate	Nothing	Proud	Other –specify

9. What impacts do these practices have on human health?

9.1 Please specify

1	2	3	4	5	6	7
Sickness	Contamination	Poor health	Death	Nothing	Don't know	Other – specify

10. What impacts do these practices have on the health of the environment?

1	2	3	4	5	6
Pollution	Contamination	Destruction of flora	Nothing	Don't know	Other –specify

11. What do informal settlement residents intend to do to address problems around sanitation practices?

1	2	3	4	5	6	7	8
Report faulty facilities	Awareness	Use of provided facilities	Cleaning facilities	Monitoring	Nothing	Don't know	Other – specify

11.1 Please specify

12. How local authorities (institutions) have responded to or have addressed informal settlement sanitation practices?

1	2	3	4	5	6
Awareness	O&M of facilities	M&E of facility condition	Increase number of facilities	Control access	Don't know

12.1 Please specify

Appendix A.2.3: Impacts of sanitation practices on access, functioning of facilities and long-term sustainability of services

1. What are the impacts (if any) of residents' sanitation practices on access and sustainability of sanitation services?

1	2	3	4	5	6	7
Reduced access	Dysfunctional facilities	Frequent maintenance	High maintenance cost	Increasing backlog	Don't know	Other – specify

2. Do these impacts support/hinder access and sustainability of sanitation services?

1	2	3
Yes	No	Unsure

3.1 Specify

3. What is the extent of these impacts on the sanitation service provision?[32]

1	2	3	4	5	6
Very high	High	Medium	Low	Very low	Don't know

4. How can these impacts be mitigated so that access and sustainability of sanitation services are ensured?

1	2	3	4	5	6
Awareness	O&M of facilities	M&E of facility condition	Increase number of facilities	Control access	Don't know

4.1 Please specify

[32] **Very high** = affect the provision of service by increasing the backlog exponentially; **high** = affect the provision of service; impact on service provision after a short period (<6 months); **low** = impact on service provision after a short period (6 to 24 months); **very low** = affect the service provision after a longer period (>24 months).

Appendix A3: Applicability of sanitation technologies provided to informal settlements, institutional arrangements and impacts on access

Appendix A.3.1: Users' perspectives on access to sanitation facilities

1. Is the access to the facility easy?

1	2	3
Yes	No	Unsure

1.1 Specify

2. What is the user ratio per toilet facility?

1	2	3	4	5	6	7
1:1	1:5	1: 10	1:20	1: 30	>1:30	Other -

3. Is it safe to use the facility?

1	2	3
Yes	No	Unsure

3.1 If not why?

4. Given the number of users, how long does it take you to access the facility?

1	2	3	4	5	6
<5 min	5 to 10 min	11 to 30 min	31 to 60 min	>60 min	Don't know

5. What time of the day would you say that access is the most difficult?

1	2	3	4	5	6
4 to 5h	5 to 7h	8 to 11h	18 to 19h	19 to 21h	Don't know

6. What are the causes of uneasy access?

1	2	3	4	5	6
Number of users	Number of facilities	Condition of facilities	Safety concerns	Location of the facility	Don't know

Appendix A.3.2: User perspectives on relevance of sanitation facilities

1. What make a sanitation technology or facility relevant to the context of an informal settlement?

1	2	3	4	5	6	7
Accessibility	Features	Low O&M	Easy to maintain	Low cost	Don't know	Othe

1.1 Please specify

2. What is the most important criterion that should be considered to determine the relevance of a sanitation technology in the context of informal settlement?

2.1 Please specify

1	2	3	4	5	6	7	8	9	10
Accessibility	Features	Low O&M	Easy to maintain	Low cost	Matching users 'practices	Policy compliant	Suitable to local condition	Don't know	Other – specify

3. Are users' needs and settlement conditions incorporated or being considered into these criteria?
3.1 Specify

1	2	3
Yes	No	Unsure

4. Are current sanitation technologies provided to informal settlement fulfilling these relevance criteria?
4.1 Specify

1	2	3
Yes	No	Unsure

Appendix A.3.3: Users' preference of sanitation technologies and facilities

1. What sanitation technology do users/you prefer and/ or would you like to be provided to the informal settlement as a whole?

1	2	3	4	5	6	7
Communal waterborne	Communal non-waterborne	Individual waterborne	Individual non-waterborne	Any type	None	Other - specify

1.1 Why do you say this? Please explain

2. What are the reasons for your choice or preference?

1	2	3	4	5	6
Features	Comfort	Dignity	Safety	Cleanliness	Other - specify

3. What criteria did you /would you use to make your choice?

1	2	3	4	5	6	7
Personal feelings	Comfort	Dignity	Safety	Cleanliness	Features	Other - specify

3.1 Please explain.

4. Are current sanitation technologies provided to your informal settlement fulfilling these criteria?

1	2	3
Yes	No	Unsure

4.1 Please explain

5. Are these sanitation facilities addressing your needs/needs of informal settlement's residents?

1	2	3
Yes	No	Unsure

5.1 Please explain

6. Are the existing sanitation facilities responding to the settlement conditions?

1	2	3
Yes	No	Unsure

6.1 Please explain

Appendix A.3.4: Overall valuation of sanitation facilities provided to informal settlements

1. How do you value sanitation services provided to informal settlements?

1	2	3	4	5	6	7
Excellent	Substantial	Good	Satisfactory	Pathetic	Worst	Other - specify

2. What perspectives (users or service provider) is predominant and should be considered as far as access and sustainability of services is concerned?

1	2	3	4	5	6	7
Preference	Relevance	Appropriateness	Reliability	Safety	Don't know	Other - specify

2.1 Explain please

3. What impacts these perspectives may have on access and sustainability of sanitation services?

1	2	3	4	5	6	7
Acceptance	Appropriate use	Rejection	Reduction of backlogs	Increasing backlogs	Don't know	Other - specify

Appendix A4: Alternative institutional arrangements for sustainable sanitation services in informal settlements

Question
A. Value propositions for improving institutional arrangements for the provision of sanitation services in informal settlements
Stakeholders involved, criteria for their selection and their roles
1. Who are the suitable stakeholders who should be involved in the provision of sanitation services in informal settlements?
2. How should these stakeholders be involved?
3. What criteria should be applied to involve individuals or organisations to become sanitation provision stakeholders?
4. What should be their respective roles and responsibilities in the provision of sanitation services?
5. What capacity should stakeholders have to deal with the challenges for delivering sanitation services in informal settlements?
6. How should information and knowledge be shared amongst these stakeholders?
Stakeholders power relation and coordination of their actions
7. What types of relationship should exist between different stakeholders involved in sanitation service provision?
8. How should these different stakeholders interact and coordinate their actions towards attaining sanitation provision?
9. What contributions stakeholders' interactions and coordination made towards sanitation provision in informal settlements should be?
10. How the power relations between and within these stakeholders should be structured?
11. What relationship should exist between these stakeholders and the informal settlement residents?
Suggestions for improvements
12. How can current institutional arrangements observed in informal settlements be improved/strengthened to improve access and long-term sustainability of sanitation services?
13. What do this improvement should entail?
14. How could these institutional arrangements function in practice?
15. How these arrangements are should be better monitored and enforced to avoid fragmentation?
16. How could the functions, roles and responsibilities of all the sanitation role-players and stakeholders be better defined?
17. What should be the roles of governments be in relation to the regulation of sanitation services in informal settlements?
18. What forums, structures or bodies should be put in place (at all spheres) in order to better address the coordination and reporting of sanitation service provision?

Appendix B. Responses from respondents (quantitative)

Appendix B1: Institutional, technical and social aspects of sanitation service provision in informal settlements

Appendix B.1.1: Institutional aspects of sanitation service provision in informal settlements

	Informal settlement					Total n (%)
Stakeholders involved and their roles	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	
What guides the provision of sanitation services in informal settlement?						
Policy	11	8	13	10	9	51 (13.3)
Municipal by-laws	2	2	4	3	1	12 (3.1)
Constitution	6	4	10	11	5	36 (9.4)
Mayoral decision	43	46	41	37	34	201 (52.5)
Don't know	9	10	8	21	35	83 (21.7)
Who are other stakeholders involved in the decision-making process?						
Municipal officials	58	62	62	69	71	322 (84.1)
Informal settlement residents	2	1	4	3	2	12 (3.1)
Department of Water and Sanitation	3	3	2	1	1	10 (2.6)
Department of Human Settlement	4	2	3	4	6	19 (5.0)
NGOs/CBOs or CSOs	3	1	2	3	1	10 (2.6)
Provincial government departments (specify)	0	0	1	1	1	3 (0.8)
Don't know	1	1	2	1	2	7 (1.8)
According to your knowledge, what roles are they (stakeholders) playing? Circle all that apply						
Advocacy	1	1	2	1	0	5 (1.3)
Activism	2	3	4	1	0	10 (2.6)
Service provision	59	64	62	78	79	342 (89.3)
Recipient of the services	1	0	1	0	2	4 (1.0)
M&E	0	0	0	1	0	1 (0.3)
O&M	1	3	2	2	8	17 (4.4)
Contractor	0	0	0	1	0	1 (0.3)
Don't know /Unsure	0	0	1	0	2	3 (0.8)
At what level/stage of the decision-making process are all stakeholders involved? Circle all that apply						
Advocacy	2	3	2	4	1	12 (3.2)
Public participation	1	2	1	2	1	7 (1.8)
Technology choice	9	5	7	4	8	33 (8.6)
Deployment	3	9	5	8	6	31 (8.1)
O&M	2	4	7	7	5	25 (6.5)
M&E	8	9	11	13	6	47 (12.3)
Other - specify	45	43	54	41	45	228 (59.5)

Who is coordinating actions of all stakeholders involved in sanitation provision?						
Municipal officials	18	12	21	23	6	80 (20.9)
Informal settlement residents	0	2	3	1	0	6 (1.6)
Department of Water and Sanitation	8	10	18	13	16	65 (17.0)
Department of Human Settlement	6	8	7	15	19	55 (14.4)
NGOs/CBOs	0	0	3	3	3	9 (2.3)
CSOs	0	0	0	1	6	7 (1.8)
Provincial government departments (specify)	2	3	4	6	3	18 (4.7)
Nobody	31	27	8	13	23	102 (26.6)
Don't know /Unsure	6	8	12	7	8	41 (10.7)

	Informal settlement					Total
Stakeholder power relation	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
Who are the main stakeholders involved in the decision-making process concerning the provision of sanitation services in informal settlements? Please rank them according to their level of influence/power. Circle the most important						
Municipal officials	51	52	57	76	78	343 (89.7)
Informal settlement residents	0	0	2	2	0	9 (2.3)
Department of Water and Sanitation	1	1	1	0	0	7 (1.8)
Department of Human Settlement	2	0	1	3	4	10 (2.6)
NGOs/CBOs/CSOs	2	0	0	2	0	4 (1.0)
Provincial government departments (specify)	0	0	0	1	1	2 (0.5)
Don't know	1	1	2	1	3	8 (2.1)
Can you explain how the stakeholder position/power/level of influence impacts the decision-making process?						
Are power relations influencing the decision-making process?						
Yes	57	54	61	72	77	321 (83.8)
No	6	11	8	4	3	33 (8.6)
Don't know	8	5	7	5	4	29 (7.6)
What factors determine the access or not of different stakeholder in the decision-making process?						
Involvement	26	39	32	20	24	141 (36.8)
Activism	15	10	12	19	26	82 (21.4)
Legal obligation	6	9	17	11	5	48 (12.6)
Rights to know	21	10	11	25	23	90 (23.5)
Don't know	3	2	4	7	6	22 (5.7)

Basis for decision making	Informal settlement					Total n (%)
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	
What enables informal settlement residents and service providers to make informed decision about the sanitation services to be deployed? Circle all that apply						
Policy	4	3	5	6	1	19 (4.9)
Guidelines	0	0	0	0	0	0 (0.0)
Institutional f/work	0	0	0	0	0	0 (0.0)
Personal feeling	44	47	53	44	46	234 (61.2)
Constitution	0	0	0	0	0	0 (0.0)
None of the above	0	0	0	0	0	0 (0.0)
Other - specify	23	20	18	32	37	130 (33.9)
To what extent have these enabling factors (outlined in previous question) contributed in making informed decision regarding the selection and deployment of sanitation? Please explain						
Appropriate technology choice	0	0	0	0	0	0 (0.0)
Timeously deployment of facility	0	0	0	0	0	0 (0.0)
Decrease sanitation backlogs	11	9	14	17	5	56 (14.6)
Acceptable technology for users	0	0	0	0	0	0 (0.0)
Understanding between MO and users	0	0	0	0	0	0 (0.0)
Nothing significant	46	51	47	59	63	266 (69.5)
Other - specify	14	10	15	6	16	61 (15.9)
What factors have driven/are driving the choice of sanitation technology in informal settlements? Circle all that apply						
Availability of funds	0	0	0	0	0	0 (0.0)
Costs of the facility	6	8	10	9	3	36 (9.4)
Aesthetic	0	0	0	0	0	0 (0.0)
Ease of use	0	0	0	0	0	0 (0.0)
Ease of O&M	2	1	2	3	0	8 (2.1)
Preference of users	0	0	0	0	0	0 (0.0)
Policies	3	5	5	4	2	19 (4.9)
Other - specify	60	56	59	66	79	320 (83.6)
Are these factors adequate enough to form a basis for decision-making?						
Yes	2	1	1	2	4	10 (2.7)
No	66	68	73	75	76	358 (93.4)
Don't know	3	1	2	5	4	15 (3.9)

Decision making process	Informal settlement					Total
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
Who regulates informal settlement services?						
Municipal officials	45	64	66	74	68	317 (82.8)
Informal settlement residents	2	0	2	3	1	8 (2.1)
Department of Water and Sanitation	0	0	0	0	2	2 (0.5)
Department of Human Settlement	0	0	0	0	3	3 (0.8)
NGOs/CBOs/CSOs	16	0	2	0	0	18 (4.7)
Provincial government departments (specify)	0	0	0	0	0	0 (0.0)
Don't know	8	6	6	5	10	35 (9.1)
Who is in charge of initiating the decision-making process regarding the deployment of sanitation services in informal settlement?						
Municipal officials	58	62	66	71	69	326 (85.1)
Informal settlement residents	2	3	4	3	3	15 (3.9)
Department of Water and Sanitation	0	0	0	0	0	0 (0.0)
Department of Human Settlement	0	0	0	0	3	3 (0.8)
NGOs/CBOs/CSOs	4	0	0	3	0	7 (1.8)
Provincial government departments (specify)	0	0	0	0	0	0 (0.0)
Nobody	4	2	4	3	5	18 (4.7)
Don't know /Other - specify	3	3	2	2	4	14 (3.7)
Who is taking decisions about the deployment of sanitation services in informal settlement?						
Municipal officials	64	66	70	77	78	355 (92.7)
Informal settlement residents	2	1	1	0	0	4 (1.0)
Department of Water and Sanitation	0	0	0	0	2	2 (0.5)
Department of Human Settlement	0	0	0	0	3	3 (0.8)
NGOs/CBOs/CSOs	0	0	0	0	0	0 (0.0)
Provincial government departments (specify)	0	0	0	0	0	0 (0.0)
Don't know	5	3	5	5	1	19 (5.0)
How are decisions regarding the deployment of sanitation services in informal settlement being made?						
Considering policy and municipal guides	12	3	11	14	3	43 (11.2)
Ad hoc basis	35	41	37	46	50	209 (54.6)
Considering political influence	18	20	24	19	21	102 (26.6)
Considering technical feasibility	2	1	1	1	1	6 (1.6)
Considering social issues	0	0	0	0	0	0 (0.0)
Considering users demand or needs	0	0	0	0	0	0 (0.0)
Don't know	4	5	3	2	9	23 (6.0)

Decision making process	Informal settlement					Total n (%)
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	
At what level are decision-making processes taking place?						
Community	8	3	5	2	1	19 (5.0)
Municipality	56	62	67	74	79	338 (88.2)
Province	0	0	0	0	0	0 (0.0)
National	0	0	0	0	0	0 (0.0)
NGOs/CSOs/CBOs	3	0	0	4	0	7 (1.8)
Don't know	4	5	4	2	4	19 (5.0)
Does the level of decision-making influence the selection and deployment of sanitation?						
Yes	45	42	49	58	66	260 (67.9)
No	15	12	14	10	7	58 (15.1)
Don't know	11	16	13	14	11	65 (17.0)
What is the officially and socially acknowledged level of decision-making power of the stakeholders involved in sanitation service provision?						
Community	0	0	0	0	0	0 (0.0)
Municipality	23	19	28	35	27	132 (34.5)
Province	0	0	0	0	0	0 (0.0)
National	0	0	0	0	0	0 (0.0)
NGOs/CSOs/CBOs	5	0	0	3	0	8 (2.1)
Don't know	43	51	48	44	57	243 (63.4)
To what extent is the decision-making power of stakeholders capable of influencing sanitation service provision in order to select and deploy sustainable sanitation technologies in informal settlements?						
What type information is used for decision-making? Circle all that apply						
Availability of funds	2	7	3	6	9	28 (7.3)
Availability of technology	0	3	1	2	2	8 (2.1)
Settlement condition	0	1	1	2	0	4 (1.0)
Settlement type and status	1	1	1	1	0	4 (1.0)
Policies	21	22	27	24	4	98 (25.6)
Public protest	42	31	36	42	60	210 (54.8)
Other - specify	2	4	2	3	5	16 (4.2)
Don't know / Unsure	3	1	5	2	4	15 (4.0)

Appendix B.1.2: Technical aspects of sanitation service provision in informal settlements

	Informal settlement					Total
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
What sanitation technology and facilities are provided to this informal settlement? (Circle all that apply)						
Communal waterborne	3	68	71	79	72	293 (76.5)
Communal non-waterborne	55	0	0	0	0	55 (14.4)
Individual waterborne	0	0	0	0	0	0 (0.0)
Individual non-waterborne	0	0	0	0	0	0 (0.0)
Porta-potties	4	0	0	0	0	4 (1.0)
No facilities	0	0	0	0	0	0 (0.0)
Don't know	9	2	5	3	12	31 (8.1)
Are this technology and facility type responding to users' needs and settlement condition?						
Yes	2	3	1	1	2	9 (2.3)
No	66	65	73	78	81	363 (94.8)
Don't know	3	2	2	3	1	11 (2.9)
Are the operational requirements of the sanitation technology and facility manageable given the context in which it is implemented?						
Yes	2	3	1	5	2	13 (3.4)
No	42	39	58	73	79	291 (76.0)
Don't know	27	28	17	4	3	79 (20.6)
What challenge(s) have emerged through the deployment and use of the facility? (Circle all that apply)						
Increased number of users	42	41	44	40	43	210 (54.8)
Lack of access	2	6	5	12	16	41 (10.7)
Untidiness	9	11	14	20	11	65 (17.0)
Misuse and vandalism	11	9	11	8	13	52 (13.6)
None	4	1	1	1	0	7 (1.8)
Don't know / Unsure	3	2	1	1	1	8 (2.1)
Are these challenges impeding access to sanitation?						
Yes	58	55	67	72	75	327 (85.4)
No	11	12	7	4	5	39 (10.2)
Don't know	2	3	2	6	4	17 (4.4)

	Informal settlement					Total n (%)
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	
Are these sanitation challenges affecting you as resident/service provider?						
Yes	55	53	62	69	71	310 (80.9)
No	12	9	11	6	8	46 (12.0)
Don't know	4	8	3	7	5	27 (7.1)
Does the provision of sanitation services contribute to access to sanitation facilities?						
Yes	37	39	41	44	24	185 (48.3)
No	22	29	25	31	56	163 (42.6)
Don't know /Unsure	12	2	10	7	4	35 (9.1)
What sanitation technology and type of facility are best suited to users and settlement condition?						
Communal waterborne	2	1	1	0	0	4 (1.0)
Communal non-waterborne	0	0	0	0	0	0 (0.0)
Individual waterborne	62	64	74	79	78	357 (93.0)
Individual non-waterborne	0	0	0	0	0	0 (0.0)
None	0	0	0	0	0	0 (0.0)
Don't know /Unsure	7	5	1	3	6	22 (6.0)
Why do you prefer this type of technology and facility?						
Comfort	9	4	7	6	8	34 (8.9)
Privacy/dignity	6	4	4	2	4	20 (5.2)
Pleasing	5	2	2	8	2	19 (5.0)
Right to have facility of choice	12	14	19	17	15	77 (20.1)
Respond to users' needs	34	44	42	46	52	218 (56.9)
Unsure	5	2	2	3	3	15 (3.9)
Who is taking care of the cleaning of the sanitation facilities?						
Janitors	48	59	61	10	7	185 (48.3)
Contractors	12	8	4	49	6	79 (20.6)
Local residents	6	2	6	11	18	43 (11.2)
NGOs/CBOs	2	0	1	4	6	13 (3.4)
Nobody	1	1	2	3	37	44 (11.5)
Don't know / Other –specify	2	0	2	5	10	19 (5.0)

	Informal settlement					Total n (%)
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	
How often are they cleaned?						
Once a day	4	8	10	9	2	33 (8.6)
Twice a day	44	6	3	7	2	62 (16.2)
Every 2 days	2	9	4	2	5	22 (5.7)
Thrice a week	2	3	5	1	4	15 (4.0)
Weekdays only	10	26	32	48	5	121 (31.6)
Don't know /Other –specify	9	18	22	15	66	130 (33.9)
How are the sanitation facilities cleaned?						
Sweeping	6	8	12	14	3	43 (11.2)
Cleaning bowl	47	36	34	46	8	171 (44.6)
Cleaning wall	3	4	9	6	7	29 (7.6)
Unblocking	4	1	8	9	2	39 (10.2)
Disinfecting	2	3	6	2	2	15 (4.0)
Don't know / Other –specify	9	3	7	5	62	86 (22.4)
Who is taking care of maintenance of the sanitation facilities?						
Janitors /caretakers/ municipal service	48	10	39	12	4	113 (29.5)
Contractors	12	43	14	46	12	127 (33.1)
Local residents	6	4	8	5	18	41 (10.7)
NGOs/CSOs/CBOs	2	3	1	3	6	15 (4.0)
Nobody	1	2	4	4	32	43 (11.2)
Don't know	2	8	10	12	12	44 (11.5)
How regularly are they maintained?						
When problem is reported	9	32	41	49	11	142 (37.1)
Randomly	6	10	13	17	39	85 (22.2)
Daily	3	2	1	2	0	8 (2.1)
Weekly	14	7	4	7	3	35 (9.1)
Monthly	16	4	12	3	9	44 (11.5)
Don't know /Other –specify	23	15	5	4	22	69 (18.0)

Appendix B.1.3: Social aspects of sanitation service provision in informal settlements

	Informal settlement					Total
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
How many years ago was this settlement formed?						
< 1 year	1	1	0	0	2	4 (1.0)
1- 5 years	3	4	2	1	2	12 (3.2)
6 - 10 years	9	7	3	5	11	35 (9.1)
11– 15 years	16	11	15	13	14	69 (18.1)
16– 25 years	24	32	36	37	29	158 (41.2)
> 25 years	18	15	20	26	26	105 (27.4)
How did authorities respond to the existence of this informal settlement?						
Provided services	10	9	6	3	1	29 (7.6)
Nothing	9	3	2	16	14	44 (11.5)
Threatened with eviction	46	52	64	61	68	291 (76.0)
Assist us to build our shelters	3	2	2	0	0	7 (1.8)
Can't remember	3	4	2	2	1	12 (3.1)
Other - specify	0	0	0	0	0	0 (0.0)
What social challenges/issues related to sanitation have emerged in this settlement? Circle all that apply – Respondents required to select more than one that is applicable						
Lack of facilities	46	48	54	68	74	290 (58.0)
Safety	41	51	64	61	56	273 (71.3)
Poor condition of facilities	23	59	50	42	79	253 (66.1)
Few facilities vs. large number of users	19	62	44	32	76	233 (60.8)
Poor hygiene	12	36	46	36	71	201 (52.5)
None	2	4	3	2	0	11 (2.9)
Other - specify	0	0	0	0	0	0 (0.0)
Are these sanitation challenges affecting informal settlement's residents?						
Yes	58	62	66	69	75	330 (81.2)
No	12	6	8	10	7	43 (11.2)
Don't know	1	2	2	3	2	10 (2.6)
What (according to you) are the drivers for these sanitation challenges? (Circle all that apply)						
Negligence by Municipal Officials	41	36	39	22	47	185 (48.3)
Lack of education	42	48	54	43	35	222 (58.0)
Poverty	5	6	3	7	9	30 (7.8)
Settlement conditions	3	4	2	2	1	12 (3.1)
Don't know /Unsure	2	1	2	1	1	7 (1.8)
Other - specify	0	0	0	0	0	0 (0.0)

Are these challenges hindering access to sanitation?						
Yes	58	61	67	75	78	339 (88.5)
No	10	5	7	6	4	32 (8.4)
Don't know	3	4	2	1	2	12 (3.1)
What are the resulting effects of lack of sanitation on human health and the environment? (Circle all that apply)						
Poor living conditions	5	7	8	10	11	41 (10.7)
Poor hygiene	21	20	22	21	17	101 (26.4)
Diseases	42	39	42	49	52	224 (58.4)
Poverty	2	3	2	1	3	11 (2.9)
Don't know	1	1	2	1	1	6 (1.6)
Other - specify	0	0	0	0	0	0 (0.0)
How have these challenges been addressed? (Circle all that apply)						
Providing services	44	46	57	65	33	245 (64.0)
Monitoring services	3	5	7	2	4	21 (5.5)
Addressing needs	2	1	1	2	1	7 (1.8)
Educating users	2	3	5	3	3	16 (4.2)
Nothing	16	9	3	5	38	71 (18.5)
Don't remember	5	6	3	5	4	23 (6.0)
Other - specify	0	0	0	0	0	0 (0.0)
By whom were they addressed (Circle all that apply)						
Municipal officials	59	61	64	67	19	270 (70.5)
Informal settlement residents	5	9	12	10	47	83 (21.7)
Department of Water and Sanitation	0	0	0	0	0	0 (0.0)
Department of Human Settlement	0	0	0	0	18	18 (4.7)
NGOs/CBOs/CSOs	7	0	0	5	0	12 (3.1)
Provincial government departments (specify)	0	0	0	0	0	0 (0.0)
Don't know – Other - specify	0	0	0	0	0	0 (0.0)

Appendix B2: Sanitation practices (behaviours and attitudes) and related impacts on access and functioning of facilities and sustainability of sanitation services

Appendix B.2.1: Sanitation infrastructure and their use

	Informal settlement					Total n (%)
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	
Sanitation infrastructure						
Sanitation infrastructure used						
Toilets	46	56	58	65	52	277 (72.3)
Solid waste	49	46	32	48	15	190 (49.6)
Greywater disposal	54	48	38	59	0	199 (52.0)
None	12	3	19	8	59	101 (20.4)
Other (specify)	0	0	0	0	0	0 (0.0)
What type(s) of toilet facility are residents use precisely? Select the one most used						
MobiSan	46	0	0	0	0	46 (12.0)
Communal flush toilet	0	56	58	0	30	144 (37.6)
Kayaloo	0	0	0	65	22	87 (22.7)
Chemical /container toilet	0	0	0	0	0	0 (0.0)
Porta-potties	12	0	2	0	0	14 (3.7)
Bucket toilets	6	5	7	6	12	36 (9.4)
Pit latrine	0	0	3	1	4	8 (2.1)
Unspecified	1	4	2	6	4	17 (4.4)
None	6	5	4	4	12	31 (8.1)
For what purpose the toilet facility is being used?						
Defecating only	10	7	14	7	12	50 (13.1)
Bathing	0	0	0	0	0	0 (0.0)
Disposal of night pail only	12	15	13	16	31	87 (22.7)
Defecating and disposal of night pail	41	45	47	55	32	220 (57.4)
Urinating only	0	0	0	0	0	0 (0.0)
None of the above	8	3	2	4	9	26 (6.8)
Other – specify	0	0	0	0	0	0 (0.0)
Frequency of use						
Once a day	13	6	9	13	9	50 (13.1)
Twice a day	10	14	14	5	6	49 (12.8)
Thrice a day	9	2	4	3	2	20 (5.2)
Everyday	32	40	37	46	14	169 (44.1)
Weekly	2	2	4	3	9	20 (5.2)
Don't use	5	6	8	12	44	75 (19.6)

Condition of the sanitation facility						
Very clean	12	6	4	14	2	38 (9.9)
Clean and usable	37	11	13	12	7	80 (20.9)
Dirty but usable	10	26	18	18	11	83 (21.7)
Dirty and unusable	6	9	10	18	23	66 (17.2)
Very dirty	4	15	29	16	40	104 (27.2)
Don't know	2	3	2	4	1	12 (3.1)
Walking distance to the facility						
< 50 m	12	10	13	16	4	55 (14.4)
50 < 200 m	36	18	26	19	8	107 (27.9)
200 < 500 m	10	14	12	21	29	86 (22.5)
500 < 750 m	4	3	7	10	20	44 (11.4)
>750 m	3	9	3	4	13	32 (8.4)
Don't know	6	16	15	12	10	59 (15.4)
Are you affected by the distance?						
Yes	56	42	44	50	61	253 (66.0)
No	13	25	30	26	20	114 (29.8)
Unsure	2	3	2	6	3	16 (4.2)
How the distance affect users?						
Disability	6	12	13	25	17	73 (19.1)
Safety	39	32	46	59	69	245 (64.0)
Dignity /pride/privacy	4	3	9	4	7	27 (7.0)
Cultural and/or religious belief	2	3	1	2	0	8 (2.1)
Weather condition	4	5	5	7	9	30 (7.8)
Don't know	0	0	0	0	0	0 (0.0)
Other –specify	0	0	0	0	0	0 (0.0)
Is access easy?						
Yes	27	26	32	28	6	119 {31.1)
No	38	32	41	49	64	224 (58.5)
Unsure	6	12	3	5	14	40 (10.4)

	Informal settlement					Total
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
What risks evolve from the use of the facility?						
Contamination	19	12	22	26	29	108 (28.2)
Safety	21	17	23	19	14	94 (24.5)
Loss of dignity/privacy	10	11	14	16	7	58 (15.1)
Sickness	20	22	16	19	31	108 (28.2)
Don't know	1	8	1	2	3	15 (4.0)
Other –specify	0	0	0	0	0	0 (0.0)
What problems occur from the use of the facility?						
Long waiting	20	24	26	33	43	146 (38.1)
Contamination	22	9	2	3	3	39 (10.2)
Diseases	13	4	3	2	1	23 (6.9)
Blockages	2	19	29	32	28	110 (28.7)
Lack of privacy	12	10	14	10	8	54 (14.1)
Don't know	2	4	2	2	1	11 (2.9)
Other –specify	0	0	0	0	0	0 (0.0)
To whom do you report these problems?						
Community leader	38	12	17	9	15	91 (23.8)
Municipal call centre	16	24	26	38	31	135 (35.2)
NGOs/ CSOs/CBOs	0	4	6	3	12	25 (6.5)
Nothing	6	21	19	18	22	86 (22.5)
Don't know	11	9	8	14	4	46 (12.0)
Other –specify	0	0	0	0	0	0 (0.0)

Appendix B.2.2: Informal settlements' residents' sanitation practices

	Informal settlement					Total
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
What are the residents' sanitation practices in this informal settlement?						
Use of provided facilities	46	56	58	65	52	277(72.3)
Use of bucket or night pails	6	5	7	6	12	36 (9.4)
Use of porta potties	12	0	2	0	0	14 (3.6)
Use of facilities outside the settlement	1	4	5	7	8	25 (6.6)
Open defecation	4	3	2	2	7	18 (4.7)
Use of plastic bag	1	1	1	1	3	7 (1.8)
Unknown	1	1	1	1	2	6 (1.6)
Other – specify	0	0	0	0	0	0 (0.0)
Are these sanitation practices informed by sanitation challenges faced by residents?						
Yes	62	67	71	79	81	360 (94.0)
No	3	2	4	1	2	12 (3.1)
Unsure	6	1	1	2	1	11 (2.9)
What is the extent of these sanitation practices? (scale of 1 to 5 with 4 - 5 = Acute, 2 - 3 = average and 0 - 1 = low						
Low	16	19	24	21	10	90 (23.5)
Medium	22	24	14	18	9	87 (22.7)
Acute	31	23	35	38	63	190 (49.6)
Don't know/ Unsure	2	4	3	5	2	16 (4.2)
Who in the community have adopted these practices?						
Children <12	21	14	11	14	17	77 (20.1)
Girls <18	9	11	14	16	12	62 (16.2)
Boys <18	3	4	2	5	2	16 (4.2)
Adult males	6	8	10	6	14	44 (11.5)
Adult females	20	21	25	30	26	122 (31.9)
Elderly and physically challenged (M&F)	3	4	3	5	4	19 (4.9)
Everyone	4	6	5	3	7	25 (6.5)
Don't know	5	2	6	3	2	18 (4.7)
Other –specify	0	0	0	0	0	0 (0.0)

Appendix B.2.3: Reasons for the adoption of sanitation practices

	Informal settlement					Total
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
Why have residents adopted these practices or why these practices are taking place? (circle the most important one)						
Safety concerns	30	22	23	26	24	125 (32.6)
Poor condition of facilities	0	14	12	10	13	49 (12.8)
High number of users and long waiting queues	0	9	10	8	11	38 (9.9)
Lack of privacy and comfort	0	6	8	9	8	31 (8.1)
Long walking distance to the facility	9	3	0	12	5	29 (7.6)
High number of blocked toilets	0	6	12	0	8	26 (6.8)
Fear of contamination	11	3	0	0	7	21 (5.5)
Unavailability of facility at time of need	0	4	4	6	2	16 (4.2)
Lack of choice/ alternative	7	2	0	0	5	14 (3.7)
Position/location of the facility	6	0	0	7	0	13 (3.4)
Lack of dedicated facilities for other use	0	1	7	4	1	13 (3.4)
Personal feelings, religion and beliefs	8	0	0	0	0	8 (2.0)
Don't know	0	0	0	0	0	0 (0.0)
Other –specify	0	0	0	0	0	0 (0.0)
Can we consider that residents' sanitation practices are the direct result of sanitation challenges?						
Yes	45	47	62	58	77	289 (75.5)
No	24	20	9	21	5	79 (20.6)
Unsure	2	3	5	3	2	15 (3.9)
Can we consider that sanitation practices are results of inadequate sanitation technology choice?						
Yes	43	39	53	61	66	262 (68.4)
No	25	21	12	14	11	83 (21.7)
Unsure	3	10	11	7	7	38 (9.9)
How do informal settlement residents feel about their sanitation practices?						
Neglected by municipal officials	11	17	20	30	13	91 (23.8)
Shame /Undignified	28	27	21	16	29	121 (31.6)
Discomfort	12	11	18	21	15	77 (20.1)
Desperate	18	15	17	12	27	89 (23.2)
Nothing	2	0	0	3	0	5 (1.3)
Proud	0	0	0	0	0	0 (0.0)
Other –specify	0	0	0	0	0	0 (0.0)

Appendix B.2.4: Impacts of sanitation practices on human health and environment

	Informal settlement					Total
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
What impacts do these practices have on human health?						
Sickness	37	41	48	44	59	229 (59.8)
Contamination	32	28	25	33	19	137 (35.8)
Poor health	2	1	2	4	4	13 (3.4)
Death	0	0	1	1	2	4 (1.0)
Nothing	0	0	0	0	0	0 (0.0)
Don't know	0	0	0	0	0	0 (0.0)
Other –specify	0	0	0	0	0	0 (0.0)
What impacts do these practices have on the health of the environment?						
Pollution	42	48	47	49	61	247 (64.5)
Contamination	15	10	16	15	12	68 (17.8)
Destruction of flora	12	11	10	14	9	56 (14.6)
Nothing	2	1	3	4	2	12 (3.1)
Don't know	0	0	0	0	0	0 (0.0)
Other –specify	0	0	0	0	0	0 (0.0)
What do informal settlement residents intend to do to address problems around sanitation practices?						
Report faulty facilities	8	7	6	9	4	34 (8.9)
Awareness	20	18	23	25	33	119 (31.1)
Use of provided facilities	11	14	17	18	6	66 (17.2)
Cleaning facilities	9	15	10	9	13	56 (14.6)
Monitoring use	17	11	14	13	16	71 (18.5)
Nothing	0	0	0	0	0	0 (0.0)
Don't know	0	0	0	0	0	0 (0.0)
Other –specify	6	5	6	8	12	37 (9.7)
How local authorities (institutions) have responded to or have addressed informal settlement sanitation practices?						
Awareness	36	10	12	9	3	70 (18.3)
O&M of facilities	4	9	8	11	3	35 (9.1)
M&E of facility condition	18	20	20	21	10	89 (23.2)
Increase number of facilities	0	26	30	38	29	123 (32.1)
Nothing	2	5	6	3	39	55 (14.4)
Control access	11	0	0	0	0	11 (2.9)
Don't know /Unsure	0	0	0	0	0	0 (0.0)

Appendix B.2.5: Impacts of sanitation practices on access and sustainability of services

	Informal settlement					Total
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
What are the impacts (if any) of residents' sanitation practices on access and sustainability of sanitation services?						
Reduced access	10	7	11	9	12	49 (12.8)
Dysfunctional facilities	30	24	25	32	31	142 (37.1)
Frequent maintenance	6	8	5	7	3	29 (7.6)
High maintenance cost	9	11	13	14	7	54 (14.1)
Increasing backlog	14	17	21	18	29	99 (25.8)
Don't know /Unsure	2	3	1	2	1	10 (2.6)
Other –specify	0	0	0	0	0	0 (0.0)
Do these impacts hinder access and sustainability of sanitation services?						
Yes	57	55	64	74	72	322 (84.1)
No	3	5	4	2	3	17 (4.4)
Unsure	11	10	8	6	9	44 (11.5)
What is the extent of these impacts on the sanitation service provision*?						
Very high	21	19	21	17	18	96 (25.1)
High	36	31	40	38	47	192 (50.1)
Medium	10	17	11	24	13	75 (19.6)
Low	2	2	3	1	3	11 (2.9)
Very low	2	1	1	2	3	9 (2.3)
How can these impacts be mitigated so that access and sustainability of sanitation services are ensured?						
Awareness	13	11	9	12	9	54 (14.1)
O&M of facilities	7	11	14	7	8	47 (12.3)
M&E of facility condition	4	3	5	3	1	16 (4.2)
Increase number of facilities	21	32	37	43	54	187 (48.8)
Control access	26	13	11	17	12	79 (20.6)
Don't know /Unsure						
Note: ***Very high** = affect the provision of service by increasing the backlog exponentially; **high** = affect the provision of service; impact on service provision after a short period (<6 months); **low** = impact on service provision after a short period (6 to 24 months); **very low** = affect the service provision after a longer period (>24 months).						

Appendix B3: Applicability of sanitation technologies provided to informal settlements, institutional arrangements and impacts on access

Appendix B.3.1: Users' perspectives on relevance of sanitation technologies and facilities

	Informal settlement					Total
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
What make a sanitation technology or facility relevant to the context of an informal settlement?						
Accessibility	5	6	8	4	8	31 (8.1)
Features	32	31	37	40	42	182 (47.5)
Low O&M	2	1	1	2	2	8 (2.1)
Easy to maintain	1	1	0	1	0	3 (0.8)
Low cost	2	0	0	4	0	6 (1.6)
Don't know	2	1	2	1	4	10 (2.6)
Other – specify	27	30	28	30	27	143 (37.3)
What is the most important criterion that should be considered to determine the relevance of a sanitation technology in the context of informal settlement?						
Accessibility (easiness of access)	20	12	19	18	11	80 (20.9)
Features	26	32	31	37	43	169 (44.1)
Low O&M	2	3	3	4	2	14 (3.7)
Easy to maintain	2	2	3	2	3	12 (3.1)
Low cost	1	1	2	1	1	6 (1.6)
Matching users 'practices	14	16	13	17	16	76 (19.8)
Policy compliant	0	0	0	0	0	0 (0.0)
Suitable to local condition	6	4	5	3	8	26 (6.8)
Don't know	0	0	0	0	0	0 (0.0)
Other –specify	0	0	0	0	0	0 (0.0)
Are users' needs and settlement conditions incorporated or being considered into these criteria?						
Yes	49	55	62	61	74	301 (78.6)
No	19	13	10	16	7	65 (17.0)
Unsure	3	2	4	5	3	17 (4.4)
Are current sanitation technologies provided to informal settlement fulfilling these relevance criteria?						
Yes	2	6	3	1	2	14 (3.7)
No	68	62	70	78	81	359 (93.7)
Unsure	1	2	3	3	1	10 (2.6)

Appendix B.3.2: Users' perspectives on access to sanitation facilities

	Informal settlement					Total
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
Is the access to the facility easy?						
Yes	27	26	32	28	6	119 {31.1)
No	38	32	41	49	64	224 (58.5)
Unsure	6	12	3	5	14	40 (10.4)
What is the user ratio per toilet facility						
1:1	0	0	0	0	0	0 (0.0)
1:5	1	0	0	1	0	2 (0.5)
1: 10	4	3	6	2	3	18 (4.7)
1:20	15	11	7	9	13	55 (14.4)
1: 30	46	54	59	64	9	232 (60.6)
>1:30	5	2	4	6	59	76 (19.8)
Is it safe to use the facility?						
Yes	28	24	30	36	6	124 (32.4)
No	40	43	42	44	76	245 (64.0)
Unsure	3	3	4	2	2	14 (3.6)
Given the number of users, how long does it take you to access the facility?						
<5 min	10	4	6	3	0	23 (6.0)
5 to 10 min	30	38	46	29	6	149 (38.9)
11 to 30 min	28	22	21	35	26	132 (34.5)
31 to 60 min	2	3	3	12	46	66 (17.2)
>60 min	1	3	0	3	6	13 (3.4)
Don't know	0	0	0	0	0	0 (0.0)
What time of the day would you say that access is the most difficult?						
4 to 7h	39	41	50	54	56	240 (62.7)
8 to 11h	15	9	8	11	6	49 (12.8)
18 to 19h	13	17	13	14	15	72 (18.8)
19 to 21h	4	3	5	3	7	22 (5.7)
What are the causes of uneasy access? (circle all applicable)						
Number of users	29	41	64	72	71	277 (72.3)
Number of facilities	21	44	58	67	74	264 (68.9)
Condition of facilities	12	51	49	29	68	209 (54.6)
Safety concerns	38	48	55	64	66	271 (70.8)
Location of the facility	22	19	21	28	32	122 (31.9)

Appendix B.3.3: Users' preference of sanitation technologies and facilities

	Informal settlement					Total
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
What sanitation technology do users/you prefer and/ or would you like to be provided to the informal settlement as a whole?						
Communal waterborne	2	3	5	3	4	17 (4.4)
Communal non-waterborne	0	0	0	0	0	0 (0.0)
Individual waterborne	69	67	71	79	80	366 (95.6)
Individual non-waterborne	0	0	0	0	0	0 (0.0)
Any type	0	0	0	0	0	0 (0.0)
None	0	0	0	0	0	0 (0.0)
What are the reasons for your choice or preference?						
Features	14	11	18	14	12	69 (18.0)
Comfort	26	23	27	38	32	146 (38.1)
Dignity	18	20	21	18	24	101 (26.4)
Safety	10	9	6	10	13	48 (12.5)
Cleanliness	3	7	4	2	3	19 (5.0)
Other - specify	0	0	0	0	0	0 (0.0)
What criteria did you /would you use to make your choice?						
Personal feelings	3	2	4	5	3	17 (4.4)
Comfort	28	29	33	37	42	169 (44.1)
Dignity	2	1	3	4	1	11 (2.9)
Safety	7	9	8	6	4	34 (8.9)
Cleanliness	2	1	1	1	2	7 (1.8)
Features	29	28	27	29	32	145 (37.9)
Other - specify	0	0	0	0	0	0 (0.0)
Are current sanitation facilities provided to your informal settlement fulfilling these criteria?						
Yes	3	4	1	2	3	13 (3.4)
No	66	64	72	76	79	357 (93.2)
Unsure	2	2	3	4	2	13 (3.4)
Are these sanitation facilities addressing the needs of informal settlement's residents?						
Yes	2	1	1	1	0	5 (1.3)
No	66	68	72	77	82	365 (95.3)
Unsure	3	1	3	4	2	13 (3.4)
Are the existing sanitation facilities responding to the settlement conditions?						
Yes	5	2	4	3	2	16 (4.2)
No	64	64	69	77	80	354 (92.4)
Unsure	2	4	3	2	2	13 (3.4)

Appendix B.3.4: Overall valuation of sanitation facilities provided to informal settlements

	Informal settlement					Total
	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n (%)
Is access to the provided sanitation facilities easy for all residents?						
Yes	27	26	32	28	6	119 {31.1)
No	38	32	41	49	64	224 (58.5)
Don't know /Unsure	6	12	3	5	14	40 (10.4)
Are the provided facilities relevant in terms of residents needs and settlements' conditions?						
Yes	2	6	3	1	2	14 (3.7)
No	68	62	70	78	81	359 (93.7)
Don't know /Unsure	1	2	3	3	1	10 (2.6)
Is the provided sanitation technology and facility your preferred choice?						
Yes	0	2	0	0	0	2 (0.5)
No	67	65	75	80	81	368 (96.1)
Don't know /Unsure	4	3	1	2	3	13 (3.4)
Are the use and operational requirements of the facility practicable and conducive to access?						
Yes	14	47	39	51	59	210 (54.8)
No	52	19	29	19	18	137 (35.8)
Don't know /Unsure	5	4	8	12	7	36 (9.4)
Are the management arrangements of the facility conducive to adequate access and use?						
Yes	31	26	31	34	11	133 (34.7)
No	36	42	44	46	72	240 (62.7)
Don't know /Unsure	4	2	1	2	1	10 (2.6)
Is the provided sanitation facility sustainable for the conditions pertaining to the settlements?						
Yes	2	10	12	9	6	39 (10.2)
No	67	56	62	70	77	332 (86.7)
Don't know /Unsure	2	4	2	3	1	12 (3.1)
Drawing from the above, how do you value sanitation facilities provided to informal settlements?						
Excellent	1	2	1	2	0	6 (1.6)
Good	3	2	1	1	0	7 (1.8)
Satisfactory	9	3	2	4	0	18 (4.7)
Bad	17	14	11	39	5	86 (22.5)
Worst	41	49	61	36	79	266 (69.4)
Other - specify	0	0	0	0	0	0 (0.0)
What perspectives (users or service provider) is predominant and should be considered as far as access and sustainability of services is concerned?						
Preference	48	59	64	67	74	312 (81.5)

Relevance	2	1	3	2	1	9 (2.3)
Reliability	1	2	1	1	0	5 (1.3)
Safety	19	8	8	11	9	55 (14.4)
Don't know	1	0	0	1	0	2 (0.5)
Other - specify	0	0	0	0	0	0 (0.0)
What impacts these perspectives may have on access and sustainability of sanitation services?						
Acceptance	44	52	56	64	69	285 (74.4)
Appropriate use	10	8	13	7	5	43 (11.2)
Rejection	0	0	0	0	0	0 (0.0)
Reduction of backlogs	16	9	6	10	8	49 (12.8)
Increasing backlogs	0	0	0	0	0	0 (0.0)
Don't know	1	1	1	1	2	6 (1.6)
Other - specify	0	0	0	0	0	0 (0.0)

Appendix B4: Alternative institutional arrangements for sustainable sanitation services in informal settlements

Appendix B.4.1: Values propositions

	Informal settlement					Total
Values proposition for strengthening institutional arrangements and addressing sanitation challenges	A (n = 71)	B (n = 70)	C (n = 76)	D (n = 82)	E (n = 84)	n %)
In your opinion what can be done to address institutional challenges related to the provision of sanitation services in informal settlements?						
What information should be incorporated when developing a decision support tool for sanitation technology selection in informal settlements?						
List stakeholders that should be involved in the decision-making process? (Circle all that apply)						
Municipal officials	69	68	75	81	84	377 (98.4)
Informal settlement residents	71	70	76	82	84	383 (100)
Department of Water and Sanitation	22	23	29	24	75	173 (45.2)
Department of Human Settlement	19	11	17	14	64	125 (32.6)
NGOs/CBOs/CSOs	39	49	71	79	32	270 (70.5)
Provincial government departments (specify) – (e.g. DoE, DoH)	9	11	8	10	7	45 (11.7)
Don't know	0	0	0	0	0	0 (0.0)
At what level of the decision-making process each of these stakeholders should be involved? (Circle all that apply)						
Planning	41	48	52	63	67	271 (70.8)
Public participation	69	67	70	78	79	363 (94.8)
Advocacy	21	28	21	19	32	121 (31.6)
Technology choice	67	69	71	79	81	367 (95.8)
Provision of services	12	11	9	14	21	67 (17.5)
Don't know	0	0	0	0	0	0 (0.0)
What should we expect from each of these stakeholders in terms of contributions towards improving the sanitation services in informal settlements? (Circle all that apply)						
Advocacy	24	29	31	33	42	159 (41.5)
Public participation	68	69	72	79	82	370 (96.6)
Technology choice	69	67	72	80	81	369 (96.3)
Proper use	21	12	18	13	16	80 (20.9)
H&H education	29	34	37	36	41	177 (46.2)
Don't know	0	0	0	0	0	0 (0.0)
What roles can different stakeholders play to improve the decision-making process? (Circle all that apply)						
Advocacy	39	22	27	19	41	148 (38.6)
Public participation	35	49	56	66	69	275 (71.8)
Technology choice	59	67	72	78	79	355 (92.7)

Activism	24	11	17	10	37	99 (25.8)
Health & Hygiene education	47	52	44	36	31	210 (54.8)
None	0	2	1	4	2	7 (1.8}
Don't know	0	0	0	0	0	0 (0.0)
How can sanitation challenges faced by residents be better addressed? (Circle all that apply)						
Providing services that are relevant to their needs and aspirations	49	51	59	46	72	277 (72.3)
Monitoring services	14	10	9	19	7	59 (15.4)
Educating users	46	44	51	55	47	243 (63.4)
Upgrading the settlement	56	58	62	69	78	323 (84.3)
Don't know	4	2	1	1	2	10 (2.6)
Other - specify	2	1	3	4	1	11 (2.9)
How can these roles be strengthened to address sanitation challenges in informal settlements? (Circle all that apply)						
Communication	26	21	29	20	23	119 (31.1)
Meetings	19	31	24	29	27	130 (33.9)
Dialogue	9	11	10	8	19	57 (14.9)
Public participation	29	34	47	40	28	178 (46.5)
Accountability	41	52	56	67	71	287 (74.9)
Don't know	3	2	4	2	4	15 (3.9)
What factors should be used to determine informal settlement's residents and service provider choice of sanitation technology? (Circle all that apply)						
Fund availability	2	4	3	4	2	15 (3.9)
Costs of the facility and subsequent maintenance	3	5	2	4	3	17 (4.4)
Aesthetic	4	2	3	3	2	14 (3.7)
Ease of use	18	14	21	23	29	105 (27.4)
Ease of O&M	6	3	4	5	2	20 (5.2)
Preference	44	51	59	69	72	295 (77.0)
Policies	12	9	11	9	6	47 (12.3)
Other - specify	0	0	0	0	0	0 (0.0)
How can these roles be implemented in practices to ensure better organisation of sanitation services (with reference to coordination of actions and decision-making process)? (Circle all that apply)						
Steering committee	12	9	6	7	4	38 (9.9)
M&E	9	7	11	14	3	44 (11.5)
Organisational structure	46	38	27	39	40	190 (49.6)
Roles & Responsibilities	23	14	19	28	21	105 (27.4)
Performance appraisal	11	9	7	11	9	47 (12.3)
Don't know	6	2	3	2	4	17 (4.4)
Other - specify	26	19	32	15	27	119 (31.1)

Appendix B.4.2: Level of involvement of stakeholders in the decision-making process

Phase	Type of decision	Stakeholder involved and their level of involvement					
		Municipality	Sanitation Entrepreneur	Community leader	Users	CBOs	NGOs/CSOs
Initiation	Identification and assessment of needs	1	4	1	1	1	2
	Assessment of settlement conditions & users' practices	1	4	1	1	1	2
Planning	Identification and evaluation of available sanitation technologies	1	2	2	4	2	2
	Selection of sanitation technologies relevant to users' needs and settlement conditions	1	2	2	4	2	2
	Selection of an appropriate sanitation technology for settlement	1	2	4	4	4	4
	Final choice of the sanitation technology and type of facility to be deployed	1	4	4	4	4	4
	Development and implementation of institutional arrangements	1	2	1	3	2	2
Implementation	Deployment of facilities (timing, location)	1	2	2	3	4	4
Post-implementation	Facility management, O&M, repairs and replacement – monitoring & evaluation	1	2	2	3	2	2

Level of involvement:
1: Decision making - **2**: Provision of inputs or guidance (but have no power of decision) - **3**: No involvement but right to be informed about decision made (but no power of decision) - **4**: No involvement

Appendix B.4.3: Alternative institutional and management arrangements

	Roles and responsibilities at institutional level				**Roles and responsibilities at facility level**		**Oversight or coordination**
Project phase	Users or their representatives	Municipal officials	Entrepreneurs	CBOs/NGOs/CSOs	Roles & responsibility	Stakeholders involved	Stakeholders involved
Initiation	Provision of support to the service providers Facilitate access and engagement with residents Provide information related to needs and aspiration of users	Project initiation Need assessment Liaison with residents Oversight & coordination	Technology cataloguing	Project facilitation Social facilitation Legal advice to residents Provision of legal advice Community awareness	Identification of possible position/location of the facility within the settlement	Municipal officials (engineering services) Community leaders	Municipal officials (human settlement)
Planning: Preliminary investigation and decision-making process	Facilitate information gatherings (status quo & users' sanitation practices) Facilitate liaison between residents & service providers Provide information required for the selection of technology Contribute towards the selection of sanitation technology Provide guidance to determine appropriate location of the facility	Project planning Investigation Preliminary information Design of facility Technology selection Site information Community interaction Oversight & coordination	Technical advice Technology selection Deployment strategies Maintenance training	Social facilitation Knowledge dissemination Community advisory Community awareness Technology promotion	Identification of training needs Identification of potential trainees Develop training technical schedules Develop social & awareness training schedules	Municipal officials (assisted by sanitation entrepreneurs) Users group & their representatives, assisted by CBOs Sanitation entrepreneurs NGOs/CSOs and CBOs assisted by sanitation entrepreneurs or municipal services	Municipal officials (engineering & environmental heal) Users & CBOs representatives Municipal officials (engineering services) Municipal officials (environmental health)
Implementation: Deployment of facilities or construction of facilities	Assistance to identify local labour force Assistance in the deployment or construction of facilities Assistance to conduct awareness or education (if any planned)	Deployment of facilities Monitoring Oversight & coordination	Technical advices Facility implementation	Social facilitation Legal support /guidance Community awareness	Conduct technical training Develop social & awareness training schedules	Sanitation entrepreneurs NGOs/CSOs and CBOs assisted by sanitation entrepreneurs or municipal services	Municipal officials Municipal officials (environmental health)
Post-implementation (monitoring)	Monitoring access and functioning of the facility Reporting issues related to the operation of facility Provide assistance in maintenance	Maintenance scheduling Monitoring Health & Hygiene Oversight & coordination Reporting	Technical advices Maintenance of facilities Reporting	Community awareness Legal support /guidance Monitoring	Develop schedule and conduct cleaning & routine maintenance Develop schedule and conduct awareness campaigns	Sanitation entrepreneurs (contractors or janitors) NGOs/CSOs and CBOs assisted by community leaders	Municipal officials (engineering services) Municipal officials (environmental health)

Appendix C. Responses from respondents (qualitative data – excerpts from the interviews and FGDs)

Appendix C1: Institutional, technical and social aspects of sanitation service provision in informal settlements

Appendix C.1.1: Institutional aspects of sanitation service provision in informal settlements

Respondent	Theme				
	Stakeholders involved	Roles of stakeholders	Stages of involvement	Basis for decision making	Influence of decision-making power on selection of services
Resident	"We are not directly involved in the process but community leaders are representing our voice"	"The municipality is constitutionally obliged to provide us with the toilets we want and maintain them when they are not working. We are poor and cannot afford to pay for it".		"The way sanitation technologies are chosen and deployed is not clear... these people do things according to their mood and feelings"	"The only language officials understood is protests and violent mass actions...once this happens, services are provided within a short time"
Community leader	"During the sitting, only municipal officials, their advisors and community leaders are involved in the discussion."	"We are mandated to represent our communities at various levels with regard to various issues including service provision. We are the voice of our community and act on their behalf based on the mandate given to us"			"We don't have any clue or knowledge with regard to the technology to be deployed, type of facilities and timeframe for such deployment...very often things happen by surprise"
NGOs			"Although the policy is clear about the roles of municipality in the provision of sanitation services, these (roles) are found to be limited to the provision of facilities, to some extent reactive maintenance while awareness and education are left out"		
CSOs			"Indeed, the roles of the national or provincial governments as stipulated are not manifested into practices… very often, we observe that some decisions are made at provincial or national level instead of local level… and such decisions are motivated by political agenda"		
Municipal official	"We are working with various groups of people including users, their leaders and some NGOs or CBOs. There are other stakeholders who are only providing services on behalf of municipality but not involved in any decision-making process"	"Our roles are defined in the sanitation policy and only limited to the provision of services, operation and maintenance"	"The involvement of other stakeholders is subject of many factors which are considered on a case to case basis. In case of emergency services are provided with prior consultation, and in normal situation, only users or their representatives are involved"	"Users often want individual waterborne sanitation facility even when the conditions (e.g. land status, space, availability of bulk services like sewer etc.) are not permitting. So we have no alternative than provide services that respond	"If other stakeholders are involved, their lack of knowledge may create unnecessary delays to the provision of services"

				to available fund, settlement conditions and cost-effective"	

Appendix C.1.2: Social aspects of sanitation service provision in informal settlements

Respondent	Theme		
	Emergence of informal settlements	**Challenges associated with lack, deployment, access and use of facilities**	**Impacts of social challenges**
Resident			When the facility is lacking a door, how do you expect somebody to use it?" "Facilities are being vandalised daily, and access becomes more and more uneasy...so the only option is to use the bucket or the bush"
Community leader	"At the beginning it was not easy because of eviction threats we received daily. Only after few years, they provided us with chemical toilets, and then container toilets that were not maintained regularly. These toilets were frequently vandalised until the MobiSan was installed"		
Municipal official	"We are not responsible for the eviction of illegal land occupiers. Our services are limited to the provision of services in accordance with the municipal guidelines when other institutions have cleared all legal issues"	"Informal settlement residents have their own range of issues, access to services such as water and sanitation has nothing to of these and should not be used as alibi for their misfortune and misbehaviour as it is the case currently" "It is important to note that social challenges are result of poor or lack of education, legacy of apartheid and populism by some politicians" "Because of the lack of education and awareness, many users perceive that baby nappies, sanitary pads and other materials can be dumped into the toilet, and any other sanitation facilities that is not full flush waterborne is substandard"	

Appendix C2: Sanitation practices (behaviours & attitudes) and related impacts on access, functioning of facilities and sustainability of sanitation services

Respondent	Sanitation services in informal settlements: access and use, challenges and risks evolving from the use		
	Facilities and access	**Challenges related to access & use**	**Risks evolving from the use**
Resident	"The facility is often dirty even after being cleaned because many residents dispose their buckets without flushing. Sometimes the content of the bucket can spill over, thus restricting the next user to adequately use the facility"		"Every time I use these toilets my private parts become itching"
Community leader	"The untidiness of these facilities is due to the lack of attention by officials who don't provide sufficient maintenance and cleaning services"		
NGOs		"Access is difficult for many residents due to large number of users, limited number of functioning facilities"	
CSOs		"In practice this is not true because of the large number of facilities that are not functioning"	
Municipal official	"The unhygienic condition of the facilities is a result of misuse, vandalism and theft by the same users - because they consider that these facilities belong to the municipality and do not have any responsibility"	"Given the dynamic nature of informal settlements and urgent need for services, it is difficult to plan and service. We can only address urgent needs which in this case are access to water and sanitation. Where these needs are addressed, residents often do not consider them as theirs; this attitude is conducive to misuse, theft and vandalism, which become problematic for both residents and officials" "Informal settlement residents become resistant and aggressive when informed that the land they occupy cannot be upgraded, hence proper infrastructure may not be provided. The only solution to address their sanitation needs is to relocate them to other settlements that offer opportunity for upgrading"	

Respondent	Sanitation practices and reasons for their adoption				
	Sanitation practices	Reasons for their adoption			
		Safety	**Condition of facilities**	**Number of functioning facilities**	**Long waiting time to access**
Resident		Thugs are waiting in the dark to rob people… what is the point of going somewhere where you know that you will be a victim?" "After the sunset, I prefer to revert to my bucket as walking down to the toilet may subject me to violence"	"Some of the facilities are locked or closed in the evening, and we are left without any other option than using anything at our disposal" "Most of toilets are not working…where they are working, there is a long queue which make access very difficult" "I always use facilities at my workplace because they are cleaned... when I'm at home, I prefer to use bucket than those dirty toilets"	"Because of the large number of users and long waiting, using my bucket is more safe because of the unhygienic conditions of the toilet after being used by many people" "Look for yourself, these toilets are standing there but cannot be used…they are still counting that our settlement has toilets…" "Some of the facilities are locked or closed in the evening, and we are left without any other option than using anything at our disposal" "All toilets have been vandalised and municipal workers have removed everything…only empty blocks are left…where should we go then?"	"Even when you have access, there are people there watching and waiting for you to finish, hence I feel shy and feel that my privacy is not respected" "It is hard to wait for such a long period or walking a long distance to access toilet. People may prefer an alternative in order to relieve themselves" "Because of the large number of users, long waiting and using my bucket is more safe because of the unhygienic conditions after being used by many people" "It is easy to use a bucket at home and discharge here rather than waiting"
Community leader	"Open defecation is practiced by almost everyone especially children, drunk people and some adults (males and females). It takes place in open spaces, bushes, and in-between and behind shacks"				

Respondent	Reasons for their adoption			
	Lack of privacy and comfort	**Walking distance**	**High number of blocked toilets**	**Hygiene and health constraints**
Resident	" Can you comfortably use this toilet where everyone in looking at you? There is not even a lock, what can happen if somebody just opens that door?"	"Walking over 500 m just for a toilet does not make sense to me; what happens if I have a running stomach? I rather use a bucket than walking such a long distance" "Do you expect somebody to walk through faeces and then sit on a toilet bowl full of faeces"? I'd rather use the bush than a filthy toilet to avoid contamination"		"Every time I use this toilet my private parts start itching and after visiting the clinic, I will be informed that I contracted an infection. I decided to defecate in the bush just behind my house"
Community leader		"It is hard for many residents (mainly elderly) to walk a long distance to access toilet. People may prefer an alternative in order to relieve themselves"	"Many residents have opted for open defecation because of the lack of maintenance of the facilities, vandalism and theft by residents and outsiders"	

Respondent	Reasons for their adoption			
	Closure of the facility	**Location of the facility**	**Unavailability of facilities for other use**	**Personal feeling, culture, beliefs**
Resident	"Some of the facilities are locked or closed in the evening, and we are left without any other option than using anything at our disposal" "Most of toilets are not working…where they are working, there is a long queue which make access very difficult" "I always use facilities at my workplace because they are cleaned... when I'm at home, I prefer to use bucket than those dirty toilets"	"There so many bad people that side of the toilet … every day I could hear people screaming after being robbed, even stabbed"	"Since everyone is using bucket or plastic at night, I think there should provide facilities this purpose … and long waiting queue and misuse may be reduced significantly"	"My culture forbids me to share same toilet with males who are not members of my close family, so bucket is preferable than these toilets" "I personally feel uncomfortable to share a toilet with other people who are not close family or friends"

Respondent	Reasons for their adoption		
	Appropriateness of the technology	**Lack of understanding or compliance with use requirements**	**Lack of hygiene education and awareness, and compliance**
Resident	"As Muslim practitioner, I have to perform ablution after visit the toilet … now I'm being told that this toilet does not require water. This toilet is not comfort to our religious obligations" "These toilets cannot be used by a disabled person because there is no ramp, and the toilet cannot accommodate a wheelchair"	"I cannot use something that I am unfamiliar with, instead I will go to the one that will make me feel comfortable"	
Community leader		"Some residents accessing toilets use newspaper for anal cleansing and leave the facility without flushing ...in such cases, blockage is likely to occur and damage the whole system"	Since most of the toilets are either malfunctioning or being privatise by certain users, those who do not have access use buckets or plastic bags" "It is difficult for male users to sit or lift the toilet lid when urinating ... They prefer the standing position which often results in missing the target and ends up messing the toilet seat"
Municipal official	"We cannot provide facilities based on individual profile and status…this may not be possible for various reasons including space, cost and management"		"Many users have little or no knowledge of certain technologies (e.g. Urine Diversion Toilet). Without an education campaign, the use of these technologies may become a cause of concern, hence leading people to adopt other practices such as the bucket system or plastic bags..." "Sanitation practices are intentionally adopted by some residents as a way to pressurise municipalities to provide individual facilities or speed up the settlement upgrading process"

Respondent	**Perceived impacts of sanitation practices**	**Actions to address sanitation practices**
Resident		"The only way unhygienic sanitation practices can be eradicated is to ensure that toilets are cleaned daily and all defects fixed" "The facility must be fenced and access controlled by a security day and night" The only way to address our current practices is to ensure that individual facilities are provided to each and every resident within the settlement"
Community leader		"Even many of us pretend to know how to use the facility, regular awareness campaign would assist. Janitors or cleaners should be allowed to educate users every time they come at the facility"
Sanitation entrepreneurs	"Using newspaper for anal cleansing is a common practice in informal settlements. This practice can lead to severe problems including blockage of the sewer system, hence depriving access to sanitation to a large number of users" "The number of facilities is diminishing day after day, and people have to wait for sometimes in order to access the facility. Many of them who cannot wait resort by using bucket, plastics which are discarded at water stand post or solid waste dump"	
Municipal official	"Practices such as use of unconventional anal cleansing materials are the main causes of frequent breakdown of the sewer... We cannot continue fixing these facilities every two days and this is not sustainable at all" "The cost incurred to fix blockages and replace parts is almost a third of the actual cost of the sanitation technology. We spend more than expected to fix and run the services"	

Appendix C3: Applicability of sanitation technologies provided to informal settlements, institutional arrangements and impacts on access

Respondent	Sanitation technologies and facilities				
	MobiSan	Communal waterborne toilets	Kayaloo	Communal ablution blocks	Porta-potties
Resident	"This facility is better for me because it is kept clean and no faeces is hanging as seen in many other toilets we have used before" "This toilet is bad because of smell, uncomfortable to use because wind blowing under the vault, and does not cater for our elderly and disabled"	"It's the duty of the municipality to ensure that our toilets are clean and safe to use, and they must fix them when broken…I don't care to know how they are maintained"	"These toilets are not good because they are lacking essential features such as shower and lights" "Security is a concern here…these toilets don't have lights, and are surrounded by shacks where thieves are hiding…there should be fence around to ensure safety of users"		"This toilet is not different from the bucket" "I can't use this toilet because it does not dignify my person"
CSOs				"As long officials are not thinking of providing individual facilities to the residents, these features may not deter users to vandalise or misuse the facilities"	
CBOs		"Many residents are coming from rural areas and not used to waterborne facilities. So, municipal officials should not take things for granted by ignoring awareness and educational campaign"		"The inclusion of necessary features as it is the case for the new CAB is a step in a good direction…It shows that municipal officials are now listening to the concerns of the users"	
Vendor			"Since most of residents are afraid to access the facility at night for safety reasons, buckets are used at night, and discharged into toilets, making them dirtier. There should be a dedicated disposal facility for night pails" "Many people accessing this facility will just do their business and then leave without flushing…when confronted, they blame a faulty flushing mechanism" "Some users dare even to squat instead of sitting, hence ending by breaking the toilet sit…some other use wrong anal cleansing materials such as newspaper, while other dispose nappies and sanitary pads, hence causing blockages"		
Municipal official		"Operational requirements are being ignored by residents to force municipality to provide individual facilities"	"Poverty is an issue but not a reason for not abiding to the basic operational requirements"		

Respondent	Perspectives on sanitation facilities		
	Relevance	Preference	Institutional arrangements
Resident	"I think if there is a shower and light, people can easily access and use the facility"	"Government must provide us with sanitation facilities of same standard as those living in formal areas…and I want nothing else than my own full flush waterborne toilet" "We are now a democratic country and everyone has a right to better living…communal toilets are poor, dangerous to use and unsafe. The government must provide us with own waterborne toilet" "If I have my own toilet, I will feel comfortable and dignified as nobody will see me getting in and out of toilet or walking distance to relieve myself" "Having own toilet will make myself and family feel safe and my privacy will be maintained" ""When one toilet is shared by so many people, it will become dirty even if cleaned…if I have my own, cleanliness will be maintained, hence sparing my loved ones from contamination"	
Community leader		"Residents want nothing else than individual full flush toilet as stipulated in the policy... nothing else will not be accepted."	
CBOs		"These toilets are shared by so many people indiscriminately, and they are often blocked, filthy and unsafe to use during winter and at night"	
NGOs			"We are being marginalised because of our insistence for the upgrading of the settlement and provision of sustainable services that respond to the aspirations of residents
Municipal official	"As long residents aspire for individual facilities; the incorporation of the proposed features may not be a long-term solution"		"The provision of the facilities in these areas was done without prior consultation due to the emergency of the situation…now these settlements are being partially upgraded, and soon proper facilities will be implemented

Respondent	Theme		
	Knowledge and views on institutional and management arrangements	Implications of institutional arrangements on access and sustainability	Implications of users-service providers views on access and sustainability of sanitation services
Resident		"We are not concerned in whatsoever way in everything they are doing…they services are due to fail as long we are being excluded from the entire process... " "The high number of dysfunctional facilities is a result of some individual taking decision on behalf of us, without even knowing or consider our needs and aspirations"	
Community leader	"If these arrangements were adequate enough, we should not experience such high number of dysfunctional facilities"		"We are aware that our views may be considered as refusal to accept what has been offered but it should be noted that users are not going to accept anything that is not compliant with their needs and their living conditions"
CBOs	"Since these facilities are communal, there should be at least permanent staff including caretaker, security and cleaners at the facility…their presence is believed to reassure users"		
NGOs	"There is no coordination and information sharing between the informal settlement services and other services such as solid waste, road and stormwater, environmental health etc. Each of these services work in isolation"		
CSOs	"The current institutional arrangements are unconstitutional because of being not inclusive as stipulated in the sanitation policy and other legal frameworks"	"Being set aside is a sign of desperation to cover up their wrongdoing…they fear our presence to avoid being exposed to the public"	
Manufacturer	"These arrangements are not adequately framed due to fact that users are left out and not given any responsibility…such arrangements promote entitlement mentality whereby everyone want to be served without making any contribution"		
Municipal official	"Due to the unpredictable nature of informal settlements, involving users in the institutional process may promote further land evasions and proliferation of informal settlements"	"Institutional arrangements as currently formulated are deemed for an emergency situation, and should be understood from this viewpoint..."	"It is sad that users' perspectives create an entitlement mentality which lead to the refusal of services being provided, which in fact reverse many into sanitation backlog"

Respondent	Users and service providers' valuation of sanitation facilities				
	Relevance	Preference	Use patterns and requirements	Institutional arrangements	Sustainability
Resident	"Deploying mobile sanitation facilities create an insecure feeling as many people believe that they can be evicted anytime"	"As long individual full flush waterborne toilets are not provided, these things (communal toilets) are unsafe to use during day or night"	"There is no access control and many users have limited or no knowledge of how to use these toilets…because there is no awareness campaign"		"There is huge smell coming from these toilets, and large volume of sewage flowing through every day" "There are only a small number of people being appointed to work as cleaners…this number is not representative of the situation as many people are being jobless"
CBOs	"Mobile sanitation facilities will not be accepted because of being a symbol of the temporary nature of the settlement and its residents"		"The weekly collection, transport, disposal and cleaning of porta potties is expensive compared to the provision of individual waterborne sanitation to residents"		
Municipal official		"Residents needs are to have individual waterborne sanitation facilities, which are not possible given the context and nature of area they are living"		"Due to unexpected ways informal settlements come into existence, required interventions do not need the involvement of many stakeholders"	

Appendix C4: Alternative institutional arrangements for sustainable sanitation services in informal settlements

Respondent	Value proposition to address institutional, technical and social aspects of sanitation – institutional aspects			
	Selection of stakeholders	Roles and responsibilities of sanitation stakeholders	Power relation amongst stakeholders involved in sanitation service provision	Extent and level of involvement in the decision-making process
Resident		"Since the service to be provided is intended for our use, we shall be afforded opportunity to be involved at all stages of the sanitation provision process, so as to assist the service provider in making informed decision, that consider our aspirations" "As recipient of the service, participating at all levels of the service provision process will assist the service providers with valuable information that can guide informed decision regarding the service to be provided" "We are well informed to guide the service provided to take informed decision regarding the services…because of being residents of the settlement"	"Being often considered as passive recipients is one of the causes of the sanitation crisis across informal settlements as many of us don't believe being concerned with regard to the level of service and types of facilities deployed to our areas" "I believe that we should be treated as equal because of our knowledge of the area where we are living…such knowledge can provide insightful information that may assist the service providers to make informed decision with regard to the sanitation service provision"	"As the recipient of the service, we believe that our involvement should be at all level of the service provision so as to provide necessary inputs that will inform the decision-making process"
CBOs	"A sanitation stakeholder should at least be knowledgeable of the social, technical and legal issues surrounding the provision of sanitation services"	"Social, technical and legal facilitation, awareness and promotion should be the core roles and responsibilities of any sanitation stakeholder…Such knowledge is believed to provide a platform for better relationship between residents and service provider which will reduce tension while building a relationship of trust"		
NGOs			"Our roles are to provide assistance so as to ensure that there is a balance between the needs and aspirations of the residents, and the capabilities of the service provide to deploy service in a sustainable manner"	"We are well placed to provide better guidance to both users and municipal officials from various perspectives because of our expertise…our involvement should therefore start from the beginning to the end of the project and beyond"
Municipal official		"Our roles and responsibilities are clear and well-articulated in such a way that there is no need for amendments" "Each and every regulation can be subjected to amendments… however, our roles as currently drafted need enforcement so the actions of other stakeholders are visible"	"They are being involved at certain stages of the service provision but not at the final decision stage due to their intransigencies and failure to understand municipal processes related to the provision of services" "The policy suggests the incorporation of stakeholders other than service providers or government departments in the decision-making	"The planning stage is crucial for the success of any project, involving people who have lack or no knowledge of the matter being discussed may jeopardise the entire process. Hence, it is preferable to undertake all technical and financial tasks prior to think about their involvement"

			process…therefore we shall abide to these regulations by ensuring that those involved are truly representing the interests of users" "The involvement of these organisations is always a cause of concerns especially when funded by international donors, as they tend to create friction between residents and municipal officials by suggesting solutions that are not feasible or sustainable"	"They (NGOs/CSOs/CBOs) play a major role mainly at the inception and post-implementation where they assist in the facilitation and monitoring processes…in between they may not be as useful as intended" "Users may not have technical knowledge related to the level of services, technology and types of facilities and their context of application, therefore their involvement in certain phases of service provision (e.g. decision-making process) should be limited to the provision of information related to users' practices and social dynamic of their settlements"

Respondent	**Value proposition to address institutional, technical and social aspects of sanitation**		
	Technical aspects		
	Relevance of technology & facility	Use and operational requirements	Sustainability
Municipal official	"Users view their preference and features as pre-requisite for a sanitation technology to be relevant. This may not be the case because relevance should be seen from technical perspectives first and then social perspectives"	"The awareness campaign is believed to reduce the level of misuse and vandalism experienced at the facilities"	"Preference should be viewed in terms of a technology that respond to people culture, practices or belief and not individual choice"
Social aspects			
	Social challenges		
CSOs	"Municipality alone cannot address social challenges... there should be concerted efforts by all concerned parties to identify and agree on types of challenges, examine and group them according to their nature, source and assign responsibility to each concerned stakeholder to develop mitigation measures that can be implemented, and whose outcomes are evaluated by all concerned parties"		

Appendix D. Observation checklist

For the purpose of this study, five observable features related to the sanitation practices and technologies were observed.

Observation cluster	Observed issues	Informal settlement				
		A	B	C	D	E
Infrastructure availability	Water supply	Yes	Yes	Yes	Yes	Yes
	Sanitation (toilets)	Yes	Yes	Yes	Yes	Yes
	Greywater disposal	Yes	Yes	Yes	Yes	No
	Solid waste disposal	Yes	Yes	Yes	Yes	Yes
	Stormwater drainage	No	No	No	No	No
Sanitation facility	Existence /availability	Yes	Yes	Yes	Yes	Yes
	Type	Non-waterborne	Waterborne	Waterborne	Waterborne	Waterborne
	Location	Back	Across	Across	Across	Across
	Number	1	8	12	18	6
	Conditions	Good	Adequate	Adequate	Adequate	Worst
	Hand wash facility	Yes	No	No	No	No
	Door with lock	Yes	No	Yes	No	No
	Facility offers privacy and security	Yes	No	No	No	No
	Smell from the facility	Yes	No	Yes	No	Yes
Use of facility	Hours of operation (in hours)	16	24	24	24	24
	Timing (peak/off peak)	6 – 9am	6 – 8 am	6 – 8 am	6 – 8 am	6 – 11 am
	Toilet paper provided	Yes	No	No	No	No
	Hand wash after use	Yes	No	No	No	No
	Mixed or separate use (gender/age)	Separate	Mixed	Mixed	Mixed	Mixed
	Children (<10)	No	No	No	No	No
	Predominant user group	Female	Female	Male & female	Male & female	Male
	Use ratio (number per toilet block)	1:20	1:10	1:10	1:15	1: 60
	Night use	No	Yes, but rare	Yes, bust rare	Yes, but rare	Infrequent
Maintenance of facility (structure and cleanness)	Who maintain? (Janitor/caretaker)	Municipality	Municipality	Municipality	Municipality	Municipality
	How it is maintained?	Daily check	Fixing issues	Fixing issues	Fixing issues	Fixing issues
	How often cleaned?	Mopping	Sweeping	Sweeping	Sweeping	Sweeping
	Facility management	Caretaker	Janitor	Janitor	Contractor cleaner	Nobody
Sanitation practices	Use of toilet provided	Yes	Yes	Yes	Yes	Infrequent
	Use of alternative facilities or none	Yes	Yes	Yes	Yes	Yes
	Disposal of night pails	Yes	Yes	Yes	Yes	Yes
	Disposal of solid waste & greywater	No	No	Yes	No	Yes
	Where people perform body wash?	Houses	Houses	Houses	Houses	Houses
	Disposal of children faeces	Yes	Yes	Yes	Yes	Yes
Total number of inspected facilities (having over 8 toilet blocks)		1	12	16	10	6

Appendix E. Document review and informal interviews

Appendix E.1: Institutional and management arrangements of sanitation facilities

Institutional arrangements as currently formulated entail an administrative set up where the organisational structure of various stakeholders involved in the provision and management of sanitation services is outlined. In this study, a documentary review was undertaken and respondents' views were sought to understand how the institutional set up is conducive to the provision and management of sanitation facilities across the three study municipalities with regard to the provision of sanitation services in general and management of sanitation facilities in particular.

a) Institutional arrangements at municipal level

- *City of Cape Town*

Study informal settlements A, B and C which fall under the City of Cape Town jurisdiction are provided with different sanitation technologies. A communal mobile non-waterborne urine diversion facility has been deployed in informal settlement A, while communal waterborne full flush facilities equipped with mobile and permanent structures have been provided to informal settlement B, and communal waterborne full flush toilets with permanent structures to informal settlement C. The provision of these sanitation facilities was reported to be decided by several municipal departments[33], each playing a specific role that is in theory different from those of other. However, in terms of the provision of facilities, the Water and Sanitation Department has a water and sanitation informal settlement unit that is responsible for the selection, deployment and post-deployment duties. These duties (including daily O&M, monitoring and evaluation and oversight) are either directly or indirectly performed through janitorial services, contractor cleaners or caretakers. The Human Settlements Department that comprises an informal settlements and urbanisation implementation unit is responsible for planning of settlement upgrading and implementation for housing projects. The Solid Waste Department deals with the collection of solid waste, the Environmental Health Department is responsible for monitoring the potential health risks at various water and sanitation facilities while Road and Stormwater Department is responsible for urban drainage. In all these arrangements, it was observed that other stakeholders including users, community leaders, NGOs/CSOs and CBOs have been marginalised as their involvement and roles are limited to report issues related to the functioning of the facilities or incidents. This group of stakeholders reported,

> *We are being marginalised because of our insistence for the upgrading of the settlement and provision of sustainable services that respond to the aspirations of residents.* (NGO representative C)

In contrast, municipal official indicated,

> *The provision of the facilities in these areas was done without prior consultation due to the emergency of the situation…now these settlements are being partially upgraded, and soon proper facilities will be implemented. (Municipal official D)*

Throughout our interaction with the aforementioned departments and units, several issues of coordination were observed despite an apparent pretence of professional collaboration. For instance, each department or unit was observed as operating in isolation without prior consultation with either residents or other entities; there was no evidence of collaboration or information sharing among various municipal services. Depending on the municipal setup, the

[33] Water and Sanitation, Human Settlements, Solid Waste, Road and Stormwater as well as Environmental Health.

provision and management of sanitation facilities (toilets) was solely vested in the municipal Water and Sanitation Department through the informal settlement unit.

- *Stellenbosch municipality*

The responsibility for the initiation, planning, implementation, and post-implementation of sanitation programmes rests exclusively with Stellenbosch municipality. Institutional arrangements in this regard suggest that the municipality (through the Human Settlements and Engineering Services) initiates the programme based on a user need assessment, after which the decision to select a given sanitation technology and deploy facilities rests on the municipal officials. Users are not directly associated in such decisions (officially) due to their lack of understanding of the municipal process and operational requirements of various sanitation technologies. Through the Engineering Services Informal Settlement unit, the municipality is also responsible for the deployment of the facilities as well as the post-implementation tasks (directly or through external service providers). The Informal Settlement unit plays monitoring and evaluation roles while the Engineering Services play an oversight role. Users, community leaders and NGOs/CSOs and CBOs were not directly involved at the institutional level. This group of respondents reported having no knowledge regarding the ways deployment of facilities is initiated, implemented and managed.

- *Theewaterskloof municipality*

Like the City of Cape Town and Stellenbosch municipality, Theewaterskloof municipality is responsible for the initiation of the project (based on a needs assessment), planning, implementation and (officially) post-implementation through its Engineering Services. The Human Settlements service is responsible for the planning and upgrading of informal settlements and has nothing to do with the provision of emergency services (e.g. sanitation facilities). It has been, however, reported by users, CBO and NGO/CSO representatives that the municipality role in the post-implementation is limited to the partial maintenance and repairs of the facilities. The daily operation (cleaning), monitoring and reporting are undertaken by users without any support from the municipality. The roles of users, NGOs/CSOs and CBOs are not officially acknowledged and are regarded as recipients of the services and pressure or lobby groups respectively. The relationship between these groups and the municipality was observed to be tense as they trade accusations of being politically motivated or driven by a political vendetta. Our observations found that the provision of sanitation facilities in this municipality has high political connotation and interference, leading to the confrontation between municipal officials and residents and contributing to the high rate of dysfunctional facilities. There is no municipal guide that describes the process for initiating, deploying and managing sanitation facilities provided to informal settlements.

b) Institutional arrangements at the facility level

Informal settlements are provided with communal sanitation facilities that are either waterborne or non-waterborne, equipped with a mobile or permanent structure. The commonality is that all these facilities are selected and deployed by municipalities, with operation and maintenance undertaken by the municipal services or their appointed contractors.

In the City of Cape Town, facilities deployed in informal settlements include the MobiSan, communal flush toilets and, more recently, the CAB. While these three types of facilities are provided to informal settlements located within the same jurisdiction, the management arrangements pertaining to the daily operation were reported and observed being different. Management arrangements at the facility level diverge according to the type and nature of the sanitation technology. The management of the MobiSan is undertaken by the caretaker who is

responsible for cleaning and monitoring the use, conducting awareness at the facility, issuing toilet paper, the daily operation of the facility (e.g. adding wood chips to speed up the drying process of faeces) and reporting issues related to the functioning of the facility. In contrast, the communal flush toilets are under the direct management of the informal settlement services department through the janitorial services (daily cleaning, sweeping, and reporting of defective facilities). The overall maintenance works are undertaken by the engineering services (e.g., faecal sludge removal and disposal, fixing leaks and unblocking sewers). The management arrangements of the porta-potty toilets have been assigned to private contractors while the informal settlement department plays the oversights roles. The main tasks include the collection, transport, disposal, cleaning, and re-distribution of the porta-potties to users.

Although having similar arrangements as the City of Cape Town (at municipal level), the Stellenbosch municipality has consigned all operations and basic maintenance works including cleaning and general works to contractors. They are compelled to employ only local residents (or users) as part of the contractual arrangements. The monitoring work is consigned to users whose tasks are to report faulty facility to the contractor or directly to the municipality through a toll-free number. The Informal Settlement unit oversees monitoring and evaluation, and the Engineering Services play an oversight role. Other stakeholders, including NGOs/CSOs and CBOs and community leaders, are only involved in the monitoring process where their roles are limited to advocacy and monitoring, and informally enforcing accountability of municipal officials through court actions. Users and community leaders reported having no knowledge regarding the way the deployment of facilities is initiated, implemented, and managed.

Similar to the City of Cape Town and Stellenbosch municipalities, the overall management of the sanitation facilities was reported as the responsibility of the Engineering Services of the Theewaterskloof municipality. The Engineering Services are responsible for the maintenance and monitoring of the facilities across the municipal jurisdiction. Users, NGOs/CSOs and CBOs and community leaders are not directly involved in the management of facilities. The cleaning of the facilities was reported and observed to be undertaken by municipal workers on an ad hoc basis. However, most of the time, users were responsible for the cleaning of their facilities, which has resulted in a widespread padlocking and privatisation of toilet blocks by some user groups for private use. The failure by the municipality to adequately manage the facilities has led to their expulsion from the settlements and surge of self-allocation of toilet blocks by users.

Appendix E.2: Sanitation technologies and facilities provided to informal settlements

A wide range of sanitation technologies have been implemented in various informal settlements across South Africa. Across the study informal settlements, sanitation facilities were available and varied in terms of technology and design. A summary of each technology is outlined as follows:

a) The MobiSan

The MobiSan (meaning mobile sanitation – Figure E.2.1) is a mobile communal urine diversion and dehydration type of sanitation technology provided to informal settlement A. It is a first world and largest communal mobile sanitation urine diversion toilet (UDT) that was developed by a Dutch consortium (consisting of Lettinga Associates Foundation (LeAF), Landustrie Sneek and Vitens-Evides International) in 2009 and piloted in Cape Town.

Figure E.1: The MobiSan facility

A MobiSan consists of a communal sanitation unit built in a shipping container, designed to serve about 500 people. It is equipped with 13 demarcated toilet blocks (three for males, seven for females and three for children), a night pail disposal hub, two handwash basins and 12 waterless male urinals. The facility is elevated to accommodate the collection and containment of dry faeces and does not have a ramp for physically challenged individuals or the elderly; there is lighting for night use. In terms of operational requirements, the MobiSan does not require water for flushing after use. Instead, the addition of wood chips into the faeces container vault is required to accelerate the drying process, aeration of the vault and monitoring of the entire process (mainly the use and disposal of night pails) to ensure that water or urine are not mixed with faeces. Knowledge and understanding of the operational requirements of the MobiSan were one the issues that divided respondents.

b) Communal flush toilet (with permanent structure)

The communal flush toilet (also referred to as ablution block or communal toilet) is a communal waterborne sanitation facility commonly used in informal settlements across South Africa. This type of facility has a permanent structure comprising between eight and 12 toilet units and connected to a sewer (Figure E.2.2).

Figure E.2: Communal flush toilet blocks

Despite being widely deployed by officials, users, NGOs/CSOs, CBOs representatives and community leaders reported that these facilities are lacking several basic features including toilet paper holders, sanitary bins, handwash basins, lighting, male urinals, dedicated washing blocks, night pails disposal hubs and access for disabled and physically challenged individuals. These claims were confirmed through observations and acknowledged by municipal officials who attributed the lack of these features to the temporary nature of the facility which does not allow for the provision of all required features.

c) Kayaloo (waterborne full flush toilet with mobile superstructure)

Kayaloo (meaning 'toilet for our home') is a name given to a special type of mobile (structure) full flush waterborne sanitation facility (Figure E.2.3) mostly used in many informal settlements in the Stellenbosch municipality (informal settlement D), and now in Theewaterskloof municipality (informal settlement E). A typical Kayaloo facility comprises between five and 10 toilet blocks positioned back-to-back. It is made of an assemblage of galvanised steel tubes and sheeting panels and equipped with plastic toilet bolted to the steel floor, has a toilet paper holder and a flushing mechanism securely protected behind a metal screen panel separating two back-to-back toilets, a door and inside lock. Other additional features included a handwash basin, laundry point and water collection tap and a gulley for disposal of greywater. In terms of functioning and operational requirements, Kayaloo is similar to the communal full flush toilet except from the top structure.

Figure E.3: Kayaloo mobile toilet

d) Mobile communal ablution block

Communal ablution blocks (CAB) (Figure E.2.4) have been previously implemented in various informal settlements across the eThekwini municipality. It is currently being deployed to informal settlement B, but not yet operational due to ongoing construction works. CAB is a containerised waterborne full flush facility comprising a range of toilet cubicles equipped with toilet paper holders, lightings, and ventilation. The facility has other features including a shower, handwash basin and laundry facilities.

Figure E.4: Communal Ablution Blocks (CABs)

e) Porta–potties - portable toilet

Porta-potties (Figure E.2.5) are individual portable, self-containing non-waterborne facilities (not connected to a sewer) that have been provided to several informal settlements across the Western Cape Province to cater for lack of conventional facilities such as Kayaloo and communal full flush toilets.

Figure E.5: A porta-potty inside a house

They are also being deployed in a number of settlements to cater for children, physically challenged individuals, those who cannot access existing facilities because of their disability, age,

sickness or personal reasons and those who object to use communal facilities as well as night use because of security concerns or facility inaccessibility.

A typical porta-potty toilet comprises a seat and cover, water cap and locking latch, pour-out spout and cap as well as lip seal. Inside the holding tank are chemicals that break down solid waste, kill germs, destroy smells, and reduce toilet paper into sludge.

The porta-potty toilet flushes either by using water that comes from a hidden water tank inside the toilet or using the toilet chemicals from the holding tank. Users of the porta-potty were aware of the operational requirements which include placing the facility on a flat gradient, opening the lid, ensuring that there is water in the container, pressing the flush mechanism and closing the lid. The porta-potty has been deployed in informal settlements A, B and C but its use has been contested by users and civic organisations.

f) Other infrastructure and facilities

Throughout the five study settlements, respondents acknowledged the availability of other facilities including the use of a gulley for the disposal of greywater, container or drop off facilities for disposal of solid waste. Despite the availability of officially acknowledged facilities, pit latrines and full flush toilets connected to a stormwater drain or connected to a pit, buckets or night pails and plastic bags were in use across the five informal settlements.

Although informal settlements may have other sanitation infrastructures, the most used was the toilet while others (greywater disposal and solid waste) were not used as intended. Greywater and solid waste were disposed behind or between shacks and any open space despite the availability of disposal infrastructure. Night pails and plastics containing human excreta were being disposed at greywater or solid waste disposal facilities. Most users (94.8% n = 363) dislike their toilets because they feel that these facilities do not correspond with their personal needs or with the conditions of their settlements.

Appendix F. Ethical approval

Cape Peninsula
University of Technology

CERTIFICATE OF ETHICS CLEARANCE

STAFF MEMBER

P.O. Box 1906 • Bellville 7535 South Africa •Tel: +27 21 959 6666 • Fax +27 21 595 6641
Symphony Road Bellville 7535

ENGINEERING FACULTY

On the 19 September 2017, the Engineering Ethics Committee of the Cape Peninsula University granted ethics approval to **Mr C Muanda,** for his research activities related to at the Cape Peninsula University of Technology.

Title of Research Project:	The relationship between user's practices, technology and institutional arrangements – A case study of sanitation service provision in informal settlements in South Africa.

Comments:
No data collection is required

Signed: Faculty Coordinator – Research and Innovation	Date:

Appendix G. Site visit clearance

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

INFORMAL SETTLEMENTS, WATER AND WASTE SERVICES
INFORMAL SETTLEMENTS AND BACKYARDERS

Nashietah Leukes
Informal Settlements Basic Services

T 0214446850 M 0832270829
nashietah.leukes@capetown.gov.za

MEMORANDUM

DATE: 29 September 2017
TO: Mr. Christophe Muanda

Wallacedene informal settlement data collection for research

Our discussion on 28 September 2017, regarding data collection for research purpose in Wallacedene informal settlement, has reference.

I hereby confirm that authorization to collect data is not required from our office. Data collection may be accomplished at your own risk.

I hereby wish you well in your research.

Kind regards

Nashietah Leukes
Monitoring and Evaluation

STELLENBOSCH

STELLENBOSCH • PNIEL • FRANSCHHOEK

MUNISIPALITEIT • UMASIPALA • MUNICIPALITY

To whom it may Concern

This serves to confirm that permission has been granted for Mr Christopher Muanda (PHD student at CPUT) to visit the informal settlement of Enkanini and conduct interviews with the residents for his case study. Mr Mcako from (Human Settlement Department: Area Coordinator in Kayamandi) is willing to assist Mr Christopher Muanda with relevant information pertaining his research.

I have provided my office contact details for your convenience should you wish to contact me for further information.

Yours faithfully

.....
Mr Cameron Mcako
Area Coordinator Kayamandi
021 808 8015

OFFICE OF THE EXECUTIVE DEPUTY MAYOR
STELLENBOSCH MUNICIPALITY

2 7 MAR 2018

Appendix H. Consent forms

Christophe Muanda

Dept. of Civil Engineering & Surveying

Concern: permission to access the study site

Dear Community leader

You are hereby invited to assist us in a research study conducted by Mr Christophe Muanda from Cape Peninsula University of Technology, Bellville campus. The research project is entitled **"The relationship between users' practices, technology and institutional arrangements – a case study of sanitation service provision in informal settlements of South Africa".** The aim of this research is to at understanding the extent by which the relationship between users' practices, technology and institutional arrangements impact on or inform the provision of sanitation technology, access and long term sustainability. You are being selected as respondent because of your knowledge and familiarity with one or more aspects of the project. The main approach to be used in this research project include **interview, focus group discussion and participant observation**.

The request assistance is to allow our research team to observe the use of sanitation facilities, users' practices and inspect facilities to ascertain their conditions. Your identity will not be disclosed without your permission, and your participation is voluntary and you may decide to withdraw or refuse to answer questions at any stage of the project. There will be no compensation for your participation. Your privacy will be respected and all information provided will be kept and handled confidentially and, used solely for the purpose of this research.

By signing this document, you are declare having understood the content of this document and your questions have been answered to your satisfaction, and that you have been given a copy of this form. *Please tick applicable box.*

❒ I agree to participate in the study. ❒ I do not agree to participate.

Community leader Name / Signature:

_____

Cape Peninsula
University of Technology

Informed consent

Telephonic interview

Respondent name: .....

My name is Christophe Muanda, a PhD fellow from Cape Peninsula University of Technology located in Bellville South, Western Cape. My research is about the provision of sanitation services in informal settlements in South Africa. I'm looking for people who can share with me their daily experience about issues related to the provision of sanitation services including institutional, technical and social. This research will be conducted in five informal settlements in the Western Cape Province between 30 September 2017 and 25 February 2018.

Please note that:

- Your participation is voluntary: you have the right to participate or withdraw from this research;
- There is no payment or compensation involved for your participation. Refreshment may be offered for people participating in a workshop (for over 3 hours).
- Responses provided will be confidential and merely used for research purpose. Your name, identify or profile will not be disclosed.
- Picture or other descriptive of yourself will be taken without your consent.

I'm very grateful to you for your time and willingness to assist with information.
If you want to know more about this research, you can contact my supervisors:

- Prof. Rainer Haldenwang: 021412 3512
- Prof. Jacqueline Goldin: 0844380203

Best regards

Christophe Muanda

(0728574051)

Cape Peninsula
University of Technology

Face to face interview

Dear respondent
You have been selected as knowledgeable individual to participate and assist us in collecting information for a research study conducted by Mr. Christophe Muanda, a Research fellow from the Cape Peninsula University of Technology, Department of Civil Engineering and Surveying. This research is about the provision of sanitation services in informal settlements of South Africa, where the main focus is on institutional, technical and social aspects of the service provision.

Methods employed in this research include the following:

- **Interview** where you will be asked some questions related to the topic being studied;
- **Participant observation** where Mr Muanda will be observing various sanitation stakeholders daily in order to get insights on their activities and understanding of how they operate, use facilities and what issues emerge from their interactions.
- **Survey:** to assess the condition of the facilities in informal settlements
- **Focus group discussion:** to gain knowledge of sanitation issues from various stakeholders

As a valuable respondent, you are being asked to take part in this research because of your knowledge of the area, issues being discussed and involvement on sanitation provision, operation and maintenance, use or any other aspect.
If you are willing to participate, we would like to inform you that:

- Your participation is voluntary: you have the right to participate or withdraw from this research at any time when not comfortable;
- There is no payment or compensation involved for your participation. Refreshment may be offered for people participating in a workshop (for over 3 hours).
- Responses provided will be confidential and merely used for research purpose. Your name, identify or profile will not be disclosed. The report will be made available to all respondents for comments prior to finalisation and publication.
- Picture or other descriptive of yourself will be taken without your consent.
- Your privacy will be maintained at all time – your name, position and department will not be disclosed. Permission will be requested from you to use your name, position or title in any publication where direct quote may be required.
- Audio or video record of individual or group interview will be conducted only if permission is granted by interviewee(s).

Read carefully the information above and ask question(s) (if any) about anything you do not understand before deciding to participate in the study and signing this consent. Please note that by signing this document, you agree to have been given a copy of the document, read and understood the content.

To confirm your participation, please tick (√) the appropriate box:

Consent	Interview	Interview Recording	Observation	Focus group	Identity disclosure (Name, dept.)
Agree/permission					
Disagree/decline					

Participant Name/Signature: _____Contact details: _____