Public Disclosure Authorized
Public Disclosure Authorized
Public Disclosure Authorized
Public Disclosure Authorized

Evaluating the Potential of

Container-Based Sanitation

Sanergy in Nairobi, Kenya

WORLD BANK GROUP

GWSP
GLOBAL WATER SECURITY & SANITATION PARTNERSHIP

About the Water Global Practice

Launched in 2014, the World Bank Group's Water Global Practice brings together financing, knowledge, and implementation in one platform. By combining the Bank's global knowledge with country investments, this model generates more firepower for transformational solutions to help countries grow sustainably.

Please visit us at www.worldbank.org/water or follow us on Twitter @WorldBankWater.

About GWSP

This publication received the support of the Global Water Security & Sanitation Partnership (GWSP). GWSP is a multidonor trust fund administered by the World Bank's Water Global Practice and supported by Australia's Department of Foreign Affairs and Trade; the Bill & Melinda Gates Foundation; The Netherlands' Ministry of Foreign Trade and Development Cooperation; Norway's Ministry of Foreign Affairs; the Rockefeller Foundation; the Swedish International Development Cooperation Agency; Switzerland's State Secretariat for Economic Affairs; the Swiss Agency for Development and Cooperation; Irish Aid; and the U.K. Department for International Development.

Please visit us at www.worldbank.org/gwsp or follow us on Twitter #gwsp.

Evaluating the Potential of

Container-Based Sanitation

Sanergy in Nairobi, Kenya

© 2019 International Bank for Reconstruction and Development / The World Bank

1818 H Street NW, Washington, DC 20433

Telephone: 202-473-1000; Internet: www.worldbank.org

This work is a product of the staff of The World Bank with external contributions. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of The World Bank, its Board of Executive Directors, or the governments they represent.

The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Rights and Permissions

The material in this work is subject to copyright. Because The World Bank encourages dissemination of its knowledge, this work may be reproduced, in whole or in part, for non-commercial purposes as long as full attribution to this work is given.

Please cite the work as follows: World Bank. 2019. "Evaluating the Potential of Container-Based Sanitation: Sanergy in Nairobi, Kenya." World Bank, Washington, DC.

Any queries on rights and licenses, including subsidiary rights, should be addressed to World Bank Publications, The World Bank Group, 1818 H Street NW, Washington, DC 20433, USA; fax: 202-522-2625; e-mail: pubrights@worldbank.org.

Cover photo: © Sanergy.

Cover design: Bill Pragluski, Critical Stages, LLC.

CONTENTS

Figures

Maps

Photos

Tables

ACKNOWLEDGMENTS

The report was written by Julian Parker (independent consultant), with support from Sophie Trémolet (Senior Economist, World Bank) and Ruth Kennedy-Walker (Water Supply and Sanitation Specialist, World Bank). Clémentine Stip (Operations Analyst, World Bank) helped finalize the report.

The author would like to thank the Sanergy team for hosting the study and facilitating interviews and field visits. Special thanks go out to David Auerbach and Lindsay Stradley for coordinating various activities; Sanj Sanampudi and Katie Wartman for their work on the financial modeling for the cost analysis; Alex Manyasi for facilitating the governmental meetings; Kennedy Okwany for giving the author a tour of Sanergy's treatment plant at Kinanie; and Florence Mwikali, Peter Khaemba, and Polycarp Sifuna for facilitating the interviews of the Fresh Life Operators, and guiding the author around Sanergy's service area.

Finally, the author appreciates the various people from the Government of Kenya and Nairobi City County Government, the World Bank Kenya office, and various donor foundations, who graciously gave their time to be interviewed for this study.

EVALUATING THE POTENTIAL OF CONTAINER-BASED SANITATION: AN OVERVIEW

The World Bank Water Global Practice (WGP) has developed an approach to urban sanitation based on citywide inclusive sanitation (CWIS) principles, which have been developed in conjunction with sector partners (Bill & Melinda Gates Foundation et al., 2017). This approach aims to shift the paradigm around urban sanitation approaches in World Bank engagements, promoting the following principles:

- ***Everybody benefits*** from adequate sanitation service delivery outcomes.
- Human waste is ***safely managed along the whole sanitation service chain***.
- ***Comprehensive approaches*** to sanitation improvements are deployed, with long-term planning, technical innovation, institutional reforms, and financial mobilization.
- A ***diversity of technical solutions***, which are adaptive, mixed, and incremental, is embraced.
- Effective ***resource recovery and reuse*** is considered.
- Cities demonstrate ***political will*** and technical and managerial ***leadership***, and they identify ***new and creative ways of funding*** sanitation.
- ***Both on-site sanitation and sewerage solutions,*** in either ***centralized or decentralized systems,*** are considered to better respond to realities faced in cities.
- ***Complementary services (including water supply, drainage, greywater, and solid waste)*** are considered.

As part of the implementation of these principles, the WGP is developing a suite of tools and other material to support Bank teams and their clients when engaging in CWIS. One of the aims of this work is to explore innovative approaches to provide safely managed sanitation services along the whole service chain and to support clients in identifying when such options might make sense. The study "Evaluating the Potential for Container-Based Sanitation" aims to answer some of these questions for container-based sanitation (CBS), an emerging sanitation approach.

The objective of this study is to document and assess existing CBS approaches, with a particular focus on evaluating their safety, reliability, affordability, and financial viability. The report also seeks to identify the circumstances in which CBS approaches are most appropriate and whether they could be considered as part of a portfolio of options for CWIS. The study was motivated by growing interest in the emerging CBS experiences and by the fact that many governments, city authorities, and financing entities are often not familiar with the approach.

The study builds on four case studies (Sanergy, Nairobi, Kenya; Sustainable Organic Integrated Livelihoods [SOIL], Cap-Haitien, Haiti; Clean Team, Kumasi, Ghana; and x-runner, Lima, Peru) to provide insights into these questions. The present document is one of these four case studies. The full suite of documents is available at www.worldbank.org/cbs.

Reference

Bill & Melinda Gates Foundation, Emory University, The University of Leeds, WaterAid, Plan International, and World Bank. 2017. *Citywide Inclusive Sanitation: A Call to Action.*

EXECUTIVE SUMMARY

This case study, along with three others, is a component of a wider study by the World Bank of container-based sanitation (CBS) models. CBS consists of an end-to-end service—that is, one provided along the whole sanitation service chain—that collects excreta hygienically from toilets designed with sealable, removable containers and strives to ensure that the excreta is safely treated, disposed of, and reused.[1] Rather than having to build a sanitation facility, households can sign up for the service. The CBS service provider then installs a toilet with sealable excreta receptacles (also referred to as *cartridges*) and commits to emptying them (that is, removing and replacing them with clean ones) on a regular basis.

The objective of this study is to document and assess existing CBS approaches with a particular focus on evaluating their safety, reliability, affordability, and financial viability. The report also seeks to identify the circumstances in which CBS approaches are most appropriate and whether they could be considered as part of a portfolio of options for citywide inclusive sanitation (CWIS).

This case study examines the CBS service provided by Sanergy and how its business model fits overall in Nairobi as well as specifically in informal settlements there. The study took place in May and June 2017 and involved interviews with Sanergy staff, national and local government officials, business partners (franchisees), donors, and customers/users. It also involved visits to Sanergy's service area and treatment site and the collection and analysis of relevant data and reports.

Overview of Sanergy Business Model

Sanergy's basic business concept is to provide safe sanitation to low-income residents of informal settlements in Nairobi and to create a sustainable value chain that converts feces into premium reuse products for agriculture. The structure is based on the concepts that excreta end products can be produced and sold to agricultural markets at a profit and that sanitation services for the urban poor are a public good for which no market solution at scale currently exists. The activities of the for-profit excreta reuse business complement the nonprofit CBS toilet service by ensuring pathogen elimination of the feces, thus creating a full value chain from containment to safe treatment.

Sanergy provides single-cubicle, branded Fresh Life Toilets (FLTs) to franchisees for a fee and collects the excreta from the toilets on a frequent basis (daily or every two or three days). There are three business models for these toilet franchises: "commercial" toilets serve the public as pay-per-use businesses, "school" toilets are used by pupils and teachers, and "residential" toilets are operated by landlords for use in their compounds. In the commercial model, toilet operators pay a US$350 installation fee followed by an annual US$70 renewal fee. Schools pay US$290 for installation and US$60 for renewal. In the residential context, following a successful pilot phase, a new sales model has been implemented across the toilet network since mid-2017, which offers landlords a US$8.50 monthly collection fee and no upfront installation fee. Sanergy is aiming to reach the entire addressable market in its service area by increasing manufacturing capacity for its locally made toilets and converting existing pit latrines to FLTs.

The emptying and collection processes involve swapping out filled plastic containers with fresh ones and transporting the excreta to a treatment site to produce organic fertilizer and animal feed. At the treatment site, feces is composted aerobically to produce high-quality organic fertilizer, which is sold on the open market

under the Evergrow brand. Sanergy has also developed a high-protein animal feed product using black soldier fly larvae (BSFL).

Sanergy's Operating Context in Nairobi

Kenya is the largest economy in East Africa and recently introduced a devolved system of government in which 47 newly created counties were mandated to provide basic services to their populations. Kenya's capital city, Nairobi, has a young and rapidly growing population, with a large number of people living in informal settlements with poor access to basic services and infrastructure. The urban poor purchase water in jerrycans from public kiosks and disproportionately suffer the impacts of climate change and environmental degradation, including periodic water shortages and flooding.

The total population without access to sanitation in the area where Sanergy operates is approximately 500,000. Water supply in Nairobi is insufficient to meet demand, and the residents of informal settlements are the most affected as they purchase water from water vendors and public water kiosks. Pit latrines are the most common alternative to Sanergy's toilets and almost always result in unsafe excreta disposal. Public toilet blocks connected to sewers are available in some commercial areas adjacent to informal settlements.

CBS is now defined in a policy as a specified category of improved sanitation in Kenya (referred to as *cartridge-based sanitation*). The national Kenya Environmental Sanitation and Hygiene Policy (KESHP) 2016–30 includes provisions for increased private sector participation in providing sanitation services, requires local governments to develop annual plans and financing/investment plans for sanitation, and aims to tackle fragmentation of responsibilities in the sector. However, legal and regulatory frameworks at the county level were still evolving at the time of the case study, and Sanergy's excreta collection service was primarily regulated by the National Environment Management Authority (NEMA).

The county and national governments have recognized the need for partners in defining more affordable solutions to help bridge the gap in sanitation for urban areas where sewers and septic tanks are not appropriate solutions. In Nairobi, the Nairobi City Water and Sewerage Company (NCWSC), a parastatal wholly owned by the Nairobi County Government, is responsible for water, sewerage, and wastewater treatment provision. Sewerage coverage for urban areas in Kenya has been on a slow decline since 2010–11, when it was at 19 percent, to 2014–15, when it was at 15 percent, leading the water and sewerage services regulator to recognize that low-cost options need to be explored in order for Kenya to attain its Vision 2030 target of 100 percent sanitation coverage for urban populations (Water Services Regulatory Board [WASREB] 2016).

Assessment of Sanergy's Services

Satisfaction expressed by customers with Sanergy's toilets was high, including Sanergy's excreta collection service, the support received from Sanergy, and, in the case of commercial toilet operators, the income that their toilet businesses provided. User feedback was universally positive, with each interviewee raising cleanliness of the FLTs as a principal attractive feature.

Users of Sanergy's toilets are paying much the same rates as they would for other toilet options. Sanergy allows franchisees to set their charging system and rates. Operators of commercial (public) toilets are mostly pay-per-use with a few giving a monthly flat-rate option. Landlords incorporate charges into the rent and schools into school fees.

Sanergy plans to scale significantly to serve as many as 500,000 people in its existing areas of operation. The only current alternatives that provide a full sanitation service chain solution are public toilets (pour-flush)

connected to sewers or lined pits that hire a licensed exhaustion service. Neither of these provide a completely satisfactory solution for informal settlements. There is insufficient access to construct sewer laterals and service lines, and a safe exhaustion service would require a complete overhaul of current practices (including pricing, equipment, and treatment facilities).

The FLT service had an estimated total annual cost of a little less than US$1.5 million in 2017, with a little less than US$290,000 (19 percent) recovered via fees from operators and from sale of the reuse product. Revenues from the fees charged to the FLOs were a little more than US$160,000 in 2017, amounting to 11 percent of the total costs, and 19 percent of the costs of providing the toilet service. Up to this point, the majority of external funding has been provided by 15 family and corporate foundations (the median contribution being US$93,000). Sanergy has been deploying various approaches to reduce the external funding requirement for the nonprofit, including improving its operating model, gaining efficiency, and growing the operations to generate economies of scale. In order to remain financially viable over the medium term, Sanergy is looking to mobilize domestic subsidy funding in a predictable manner—for example, through results-based financing arrangements.

Key Lessons

Sanergy's FLT operation fills a gap in sanitation provision in the informal settlements where it operates, which results from the unplanned nature of these settlements and severe space constraints. FLTs have a minimal footprint and only require on-foot access. By contrast, water-based sanitation—pour-flush toilets—requires access to a sewer, whereas sewers generally do not penetrate into the heart of the informal settlements. In addition, FLTs have the significant advantage of not requiring water to operate, as the main cover material in use is sawdust, which can increase resilience where water scarcity is a challenge. Pit latrines fill up and have to be emptied, which is an unpleasant manual process, and when this is performed at present, the excreta is often dumped in the nearby environment.

An evolving policy landscape and significant investment by Sanergy and others has radically changed the status of CBS in a short time. When Sanergy began operating, it faced resistance from the Nairobi County Government, which was skeptical of the legality of CBS services. Sanergy introduced a government liaison team that established and maintained a dialogue with policymakers at the city–county level and the national level. Over time, the Nairobi government has come around to seeing CBS as a high-quality solution and an important one for at least the medium term. At national level, the KESHP explicitly recognizes CBS as an accepted technology.

FLTs are generally well-managed and deliver a high standard of user satisfaction. The franchisees that operate the toilets are usually individuals or small partnerships so that management responsibility is concentrated. FLTs that do not keep to minimum standards are shut down (that is, excreta containers removed) and debranded.

Users of Sanergy's toilets are paying much the same rates as they would for other toilet options. Sanergy leaves it to the Fresh Life Operators (FLOs) to set the price per use; hence, market forces prevail, and the estimated annual cost to users of its commercial (public) toilets is about US$18. Residential toilet fees are covered in the rent, though some landlords do not increase the rent after installing a Sanergy toilet as they see it as a way to maximize occupancy levels. School toilet prices are included in the school fees.

The FLT operation shows promise to provide a highly cost-effective sanitation solution at scale. Financial modeling of Sanergy's expansion plan, conducted by Sanergy, shows an increase in cost recovery from the

toilet servicing and fees paid for the feedstock value of the feces from 20 to 70 percent. The expansion is projected to take seven years, with the addition of 2,000 toilets per year to Sanergy's Fresh Life network, during which time the subsidy required (costs not covered by revenues) per person should rapidly reduce—from about US$19 per person in the first year to about US$2 per person per year once expansion is completed.

Sanergy has an ambitious expansion plan that will need to be monitored to verify assumptions, in particular, in terms of the number of users per toilet. Increased dominance of the residential model, should the commercial model market penetration plateau, could lead to the average number of users per toilet falling as most residential compounds are relatively small (eight households or fewer). Sanergy can monitor this after having established the mean mass of excreta per use, and it would be important to follow this metric, adjust the cost model for the expansion, and report this to partners such as donors, regulators, and authorities to inform its planning processes.

Continuous research, development, and piloting of new approaches has been key to Sanergy's progress and success and has been enabled by a strong funding base. Sanergy has been very successful in raising funding from donors and investors. This has allowed it to aggressively pilot new approaches, generating growth via new business models where older ones were appearing to face headwinds or reach limits. However, this raises a risk as its services are highly dependent on receiving a continuous stream of external funding.

Note

1 In this report, the term *excreta* is used instead of *waste* to avoid any potential confusion with solid waste. Tilley et al. (2014) define excreta as "urine and feces that is not mixed with any flushwater." Note that for the four CBS case studies and the main report, feces and urine are separated using urine-diverting toilet technologies. Cases where the CBS service provider collects only feces is referred to accordingly as *feces*. Also note that cover material (for example, sawdust or carbon cover) is added to the excreta in all cases.

References

Tilley, E., C. Lüthi, A. Morel, C. Zurbrügg, and R. Schertenleib. 2014. *Compendium of Sanitation Systems and Technologies.* Dübendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology (Eawag).

WASREB (Water Services Regulatory Board). 2016. *IMPACT Report no. 9: A Performance Review of Kenya's Water Services Sector 2014–15.* Nairobi, Kenya: WASREB.

ABBREVIATIONS

avg.	average (mean)
BMGF	Bill & Melinda Gates Foundation
BSFL	black soldier fly larvae
BOD	biochemical oxygen demand
CBS	container-based sanitation
CFO	chief financial officer
CIDP	County Integrated Development Plan
COD	chemical oxygen demand
CWIS	citywide inclusive sanitation
EIA	environmental impact assessment
FLO	Fresh Life Operator
FLT	Fresh Life Toilet
FSM	fecal sludge management
GDP	gross domestic product
GoK	government of Kenya
KESHP	Kenya Environmental Sanitation and Hygiene Policy
MT	metric tons
NCCG	Nairobi City County Government
NCWSC	Nairobi City Water and Sewerage Company
NEMA	National Environment Management Authority
NESCRA	National Environmental Sanitation Coordination and Regulatory Authority
OSS	on-site sanitation
t	ton
UDDT	urine-diverting dry toilet
USAID	United States Agency for International Development
US$	United States dollar
WASREB	Water Services Regulatory Board
WWT	wastewater treatment

INTRODUCTION

Background

This case study, along with three others, is a component of a wider study by the World Bank of container-based sanitation (CBS) models. CBS models have emerged over the past 10 years as an alternative model to network-based sanitation or on-site sanitation (OSS) services. Sanergy started operating and providing CBS services in the informal settlements of Nairobi, Kenya, in 2010.

CBS consists of an end-to-end service—that is, one provided along the whole sanitation service chain—that collects excreta hygienically from toilets designed with sealable, removable containers and strives to ensure that the excreta is safely treated, disposed of, and reused.[1] Rather than having to build a sanitation facility, households can sign up for the service. The CBS service provider then installs a toilet with sealable excreta receptacles (also referred to as *cartridges*) and commits to emptying them (that is, removing and replacing them with clean ones) on a regular basis. Transport methods can vary (and may involve *tuk tuks,* motorcycles, hand carts, and donkey carts) and adapt to a variety of space and logistical constraints. Some CBS entrepreneurs build and operate resource recovery facilities, taking advantage of the high-nutrient content of the relatively "fresh" and undiluted excreta, to produce biogas, fertilizers, or protein for animal feeds.

Study Objectives

The objectives of the overall study are to document and assess existing CBS approaches with a particular focus on evaluating their safety, reliability, affordability, and financial viability. The study also seeks to identify the circumstances in which CBS solutions are most appropriate. The ultimate objective is to identify whether these solutions could be considered as part of a mix of options for citywide inclusive sanitation (CWIS).

The objective of the case study is to better understand how Sanergy's business model fits in the overall context of the informal settlements in Nairobi in which it operates. Sanergy provides public toilets, school toilets, and shared toilets for residential compounds. The toilets are set up under a franchise system where landlords, private businesses and businesspeople, and cooperatives operate the toilets, and Sanergy provides a regular emptying service for a fee. This is the only example of a service model using a franchise system with shared toilets.

Study Methodology

The case study was carried out in early 2017 based on interviews with key Sanergy staff, covering the range of activities and functions of the organization. Relevant data and documents were collected and analyzed until May 2017, though major developments and updates through May 2018 are reflected. Interviews were held with selected officers from the national and county governments across the health, water and sanitation, and environment sector portfolios in order to better understand their perspective on Sanergy's operations and on CBS in general, as well as the strategic directions of their organizations. A full list of interviewees is included in Appendix A.

Other interviewees included Sanergy funders, franchisees (the direct "customers" from Sanergy's point of view), and users, with interviews taking place over several days of visits to different parts of Sanergy's operational area.

Toilet facility data, including locations, opening dates, and the type of service model was obtained from Sanergy and plotted against a Nairobi road map in QGIS.[2]

Purposive sampling was then used to select toilets with the following characteristics:

- Two "new" commercial toilet operators, operational for fewer than six months
- Two "old" commercial toilet operators, operational for more than 12 months
- Two "new" residential toilet operators, operational for fewer than six months
- Two "old" residential toilet operators, operational for more than 12 months
- One school with Sanergy toilets, operational for fewer than six months
- One school with Sanergy toilets, operational for more than 12 months

For each of the first four categories, one male and one female operator were selected, though interviews were often with the husband, wife, daughter, co-operator, or employee of the registered Fresh Life Operators (FLOs). This way, six of the interviewees were female and two were male. The FLOs were operating between one and three toilets each. The period of time that these FLOs had been operating the toilets did not have any noticeable impact on their level of satisfaction or responses in general.

While visiting an FLO, users leaving the toilets were asked if they were willing to be interviewed. The consultants identified the users, and the FLO would make the request. Many were busy during the workday, and only five were interviewed.

Two schools were selected, and short focus group discussions were conducted at each with a group of five girls and a group of five boys.

Report Structure

Chapter 1 describes the CBS operation's service area and the basic geographic, economic, and demographic characteristics of Nairobi and its low-income areas. Chapter 2 provides an overview of the CBS operation, with a technical description of the different components of the operation as well as the management strategies, systems, and processes behind them. The impact of the policy and regulatory environment is briefly examined. Chapter 3 assesses the performance of the service from the customers' points of view and reviews customer growth. Chapter 4 presents a financial analysis of the operation and briefly discusses the main cost drivers. Chapter 5 summarizes key lessons.

Notes

1 In this report, the term *excreta* is used instead of *waste* to avoid any potential confusion with solid waste. Tilley et al. (2014) define excreta as "urine and feces that is not mixed with any flushwater." Note that for the four CBS case studies prepared for this report, the feces and urine are separated using urine-diverting toilet technologies. In cases where only feces are collected by the CBS service provider, this is referred to accordingly as feces. Also note that cover material (for example, sawdust or carbon cover) is added to the excreta in all cases.

2 Quantum GIS, an open-source geographical information system.

CHAPTER 1 • CBS SERVICE AREA CONTEXT

Location

Kenya is the largest economy in East Africa. A new constitution in 2010 introduced a devolved system of government in which 47 newly created counties were mandated to provide basic services to their populations. Following a major reform of the water sector in 2002, piped water supply and sewerage services are provided by parastatal water service providers with corporate status. With devolution, each water service provider is now wholly owned by the relevant county government.

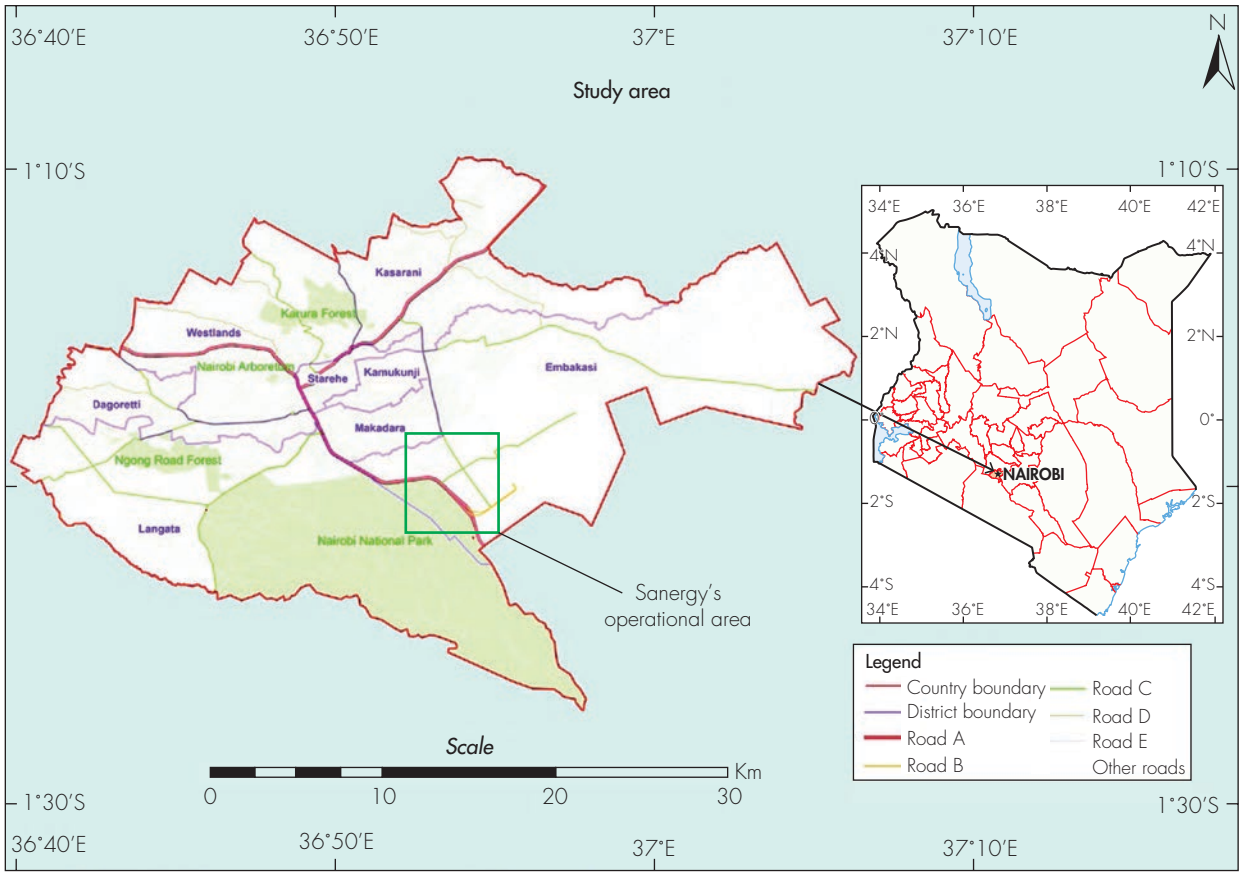
Kenya's capital city, Nairobi, has a young and rapidly growing population, with a large number of people living in informal settlements with poor access to basic services and infrastructure. Nairobi is one of three cities in Kenya that has the distinction of also being a county (it is therefore formally known as a *city county*). Nairobi had a population of approximately 3.1 million in 2009, when the most recent census was taken, but the water and sewerage utilities for Nairobi city had a combined estimated population of 3,994,003 in their service areas in 2014 (Government of Kenya [GoK] 2009; Water Services Regulatory Board [WASREB] 2016).[1] Nairobi has a population growth rate of about 4 percent with a high proportion of people in their twenties due to a net immigration (about 700,000 between 1999 and 2009, according to Japan International Cooperation Agency [JICA] 2014). The gross regional domestic project per capita in 2013 for Nairobi City County was estimated at approximately US$1,081, the eighth-highest of Kenya's 47 counties (Bundervoet et al. 2016). Employment in Nairobi is dominated by the community, social, and personal services sector (52.1 percent), followed by the agriculture and forestry sector (24.1 percent), and the wholesale and retail trade, (7.2 percent), whereas the manufacturing sector accounts for only 3 percent (GoK 2012).

A large percentage of Nairobi's population lives in informal settlements, but the exact number is unknown. The GoK defines an informal settlement as "an urban settlement characterized by at least two of the following: inadequate access to safe water; inadequate access to sanitation and other infrastructure; poor structural quality of housing; overcrowding and insecure residential status" (2012). According to the 2009 census, 36.2 percent (1,124,459) of Nairobi's inhabitants live in informal settlements. Some estimates have the number as high as 60 percent (for example, United Nations International Children's Emergency Fund [UNICEF] 2012).

The impact of climate change exacerbates environmental degradation due to inadequate enforcement of environmental regulations and disproportionately affects the urban poor. Poor drainage infrastructure and urban densification leads to flooding in various parts of the city during heavy rains. The informal settlements where Sanergy operates—on the eastern side of the central business district—are low-lying and adjacent to the Nairobi River system; therefore, they disproportionately suffer from flooding as well as from the high flows of industrial and domestic pollution in the river. Nairobi, which lies within the Athi River Basin, obtains most of its water supply from the Tana River Basin, from reservoirs[2] as far as 50 kilometers away. The Tana River Basin has insufficient water for all of its abstractors during drought periods, which are becoming more frequent. Siltation of reservoirs is also a major concern.

The total population without access to hygienic sanitation in the area where Sanergy operates, as shown in map 1.1, is unknown but is likely to be more than 500,000. This estimate is based on population data taken from a the GoK platform MajiData (WASREB 2018) in 2013.

Map 1.1 • Map of Nairobi, Showing Sanergy's Service Area



Source: JICA 2014.

Table 1.1 sets out the data available and the estimates of people currently not using a safe sanitation facility, as defined by the Joint Monitoring Programme, but allowing shared facilities.

The slums identified in the GoK study data do not correspond exactly to the specific settlements included in Sanergy's service area, which are shown in map 1.2, along with the location of Sanergy's collection centers and transfer station. The estimate ranges between 430,000 and 565,000, depending on whether the pay-per-use facilities that 99 percent of the population of Kiambiu Lower is using are safe sanitation facilities. It is likely that the vast majority is not, and Sanergy's 45 toilets in Kiambiu would serve only about 1,800 people (at an average of 40 users per toilet). Hence a figure of about 560,000 is the best obtainable estimate of people in need of safe sanitation from the available data. Sanergy estimates that it will serve about 520,000 people, including about 50,000 people in Mathare, by 2022.

Water and Sanitation Services in Nairobi

Water supply in Nairobi is insufficient to meet demand, and the residents of informal settlements are the most affected. According to the 2009 census, roughly a quarter of Nairobi's population gets water piped into their homes. Roughly half gets water from piped sources outside their homes, and 16 percent

Table 1.1 • Population Data for Sanergy Target Population

Majidata name	Sanergy area name	Estimated population	Percentage that uses safe sanitation facilities	Estimated number without access to sanitation
Njenga	Mukuru kwa Njenga	311,121	31.38	213,491
Agare	Part of Makadara	2,007	No data	No data
Nyayo	Kabaya	35,913	14.23	30,803
Viwandani	Viwandani	94,272	6.65	88,003
Kiambiu lower[a]	Kamukunji Kiambiu	138,116	No data, but 99 use pay-per-use toilets	136,624[b]
Kiambiu upper[a]	Kamukunji Kiambiu	14,272	33.56	9,482
Tassia	Tassia	18,547	86.81	2,446
Total		**614,248**		Approximately 480,000

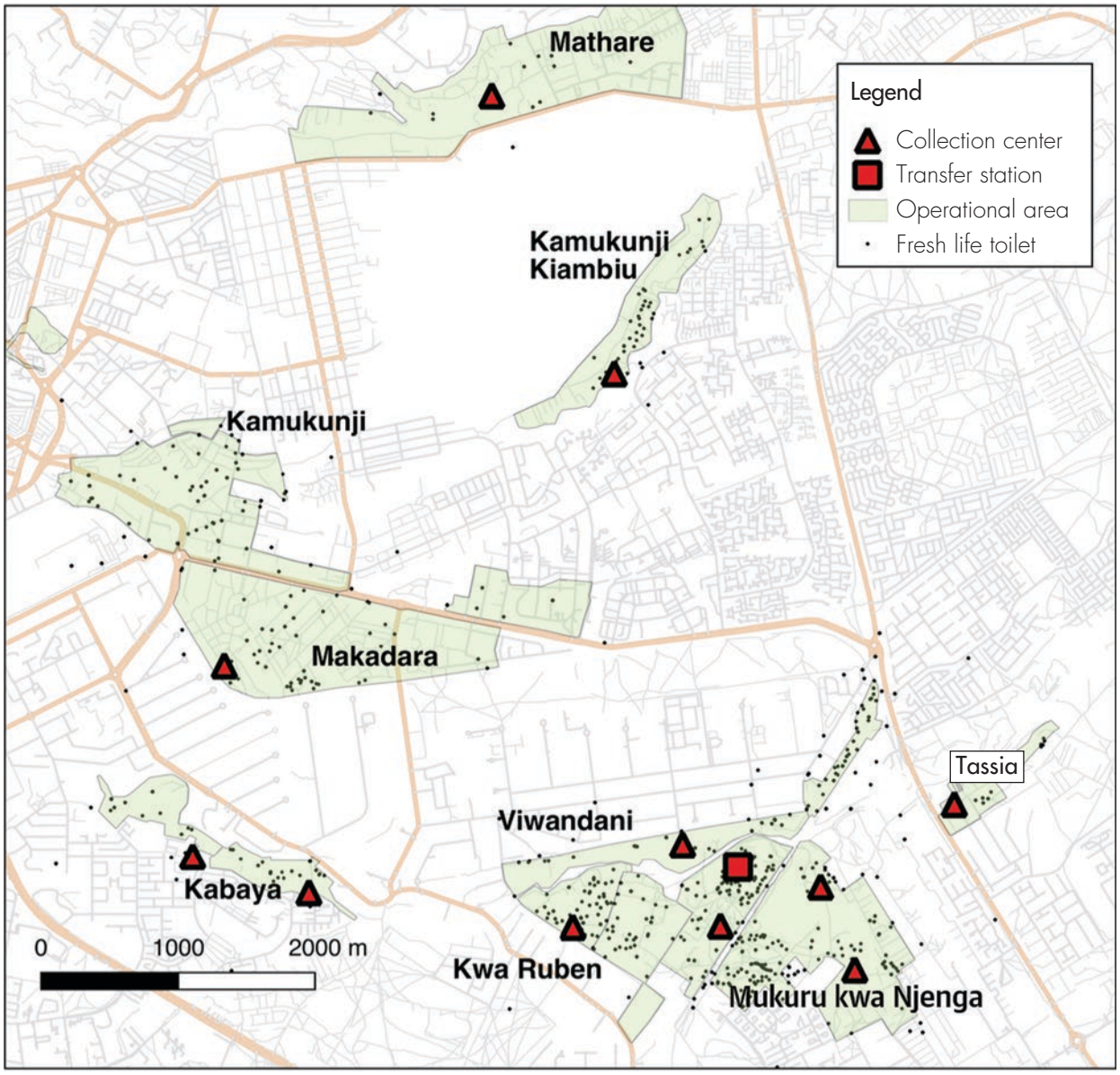
Source: MajiData.
a. Not identified as an informal settlement according to MajiData.
b. Depends on (unknown) state of facilities used.

obtain it from water vendors. The residents of informal settlements mostly obtain their water from water kiosks and water vendors (selling it by the jerrycan), as shown in table 1.2. The census questionnaire did not specify whether water kiosks constituted piped water or water vendors, but given that high frequency of piped water was a response, it is likely that most kiosks were recorded in this category.

As a result, a rationing system is in place, whereby different parts of the network get water on specific days of the week (which buffers the supply with storage tanks at the household- and compound-level, plus private boreholes in some cases). High levels of non-revenue water (38 percent in 2014–15, according to WASREB 2016) exacerbate the water supply deficit. When water shortages strike, the frequency with which different parts of the piped supply network are supplied with water is reduced. In informal settlements, where water availability is already low, this means long waiting times and typically increased prices because water haulers have to travel farther to collect water (for example, from more distant boreholes instead of nearby water kiosks connected to the Nairobi City Water and Sewerage Company [NCWSC] piped network).

Whereas the informal settlements of Nairobi are generally within the service area of the sewer

Map 1.2 • Sanergy's Service Area—Detailed View



Source: Sanergy.

network and have trunk mains running through them (see map 1.3), the majority of residents do not have access to sewered services for a number of reasons:

- The settlements are illegal and, therefore, the legal basis to supply services via fixed infrastructure is too weak for authorities to make the major investment this would involve to extend the sewer network into them.
- Unplanned and dense housing construction prevents access to the existing infrastructure and prevents excavation of the ground and the laying of new sewers.

Table 1.2 • Frequency of Different Water Supply Types in Nairobi

	Spring/well/ borehole	Piped into dwelling	Piped	Rainwater harvesting	Water vendor	Other[a]
Number of households	70,729	230,704	514,943	1,691	162,057	4,892
Number of people	225,350	735,048	1,640,665	5,388	516,331	15,586
Percentage of households	7	23	52	0	16	0

Source: GoK 2009.
a. Pond/dam/lake/stream.

- Water availability is generally low and prone to shortages, and water is expensive; hence, maintaining adequate water flows to prevent sewers blocking can be a challenge.

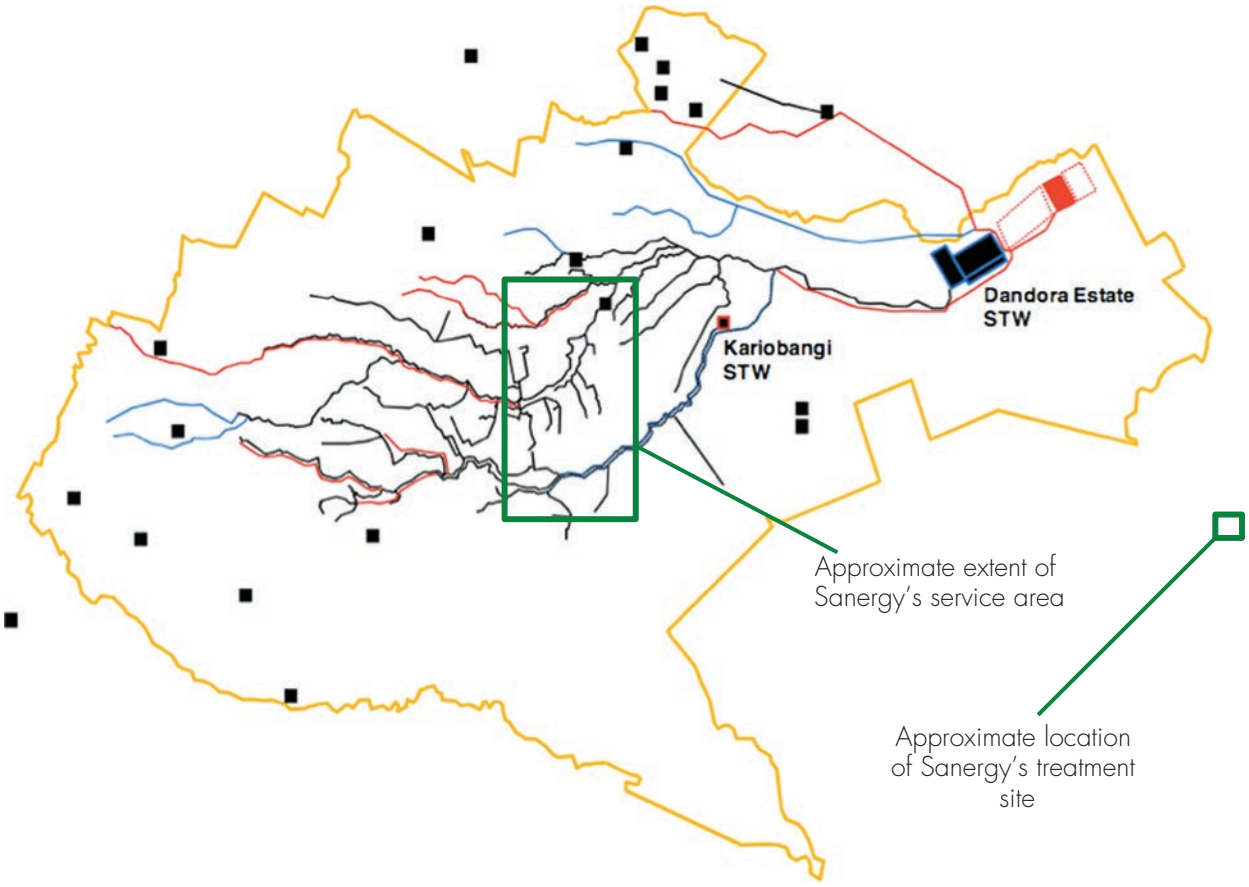
Nevertheless, there are sewer-connected public toilets in some of the areas where Sanergy operates. For example, in Shauri Moyo, public ablution blocks are operated by youth groups providing toilets and shower facilities, including disabled facilities in one relatively well-run facility. Their services, however, were affected by the water shortages in early 2017, resulting in temporary closures or weekly rationing of shower facilities. Sewer blockages can occur but are resolved by local private plumbers. The cleanliness of facilities varies, and some provide a sufficient level of safety, yet only one of the facilities observed (a twin set of pour-flush toilets rented and operated by a private individual) had a level of cleanliness that matched that of the toilets in Sanergy's network. These facilities were originally built and operated by the Nairobi City Council (prior to devolution) but were taken over by youth groups.

A single biocenter (toilet and shower facility where excreta is collected in a biogas reactor) was observed. Biogas was not being produced, and the toilets were in a poor state of repair with broken doors and overflowing toilet pans. Biocenters are more common in the informal settlement of Kibera, which is in a different part of Nairobi. Table 1.3 outlines the frequency of different sanitation solutions in Nairobi.

Public toilet blocks connected to sewers or biogas reactors are a viable sanitation option but generally fall below adequate standards of safety due to poor maintenance. These facilities are generally run by community-based organizations, typically with about 30 members who often take turns operating the facility in return for a share of the revenue. Therefore, the level of motivation and commitment of the individuals is likely to be lower than that of an individual private operator who keeps all the profits.

Pit latrines are the most common alternative to Sanergy's FLTs and almost always result in unsafe excreta disposal. These require emptying, and in most cases, this means manual emptying due to poor accessibility. Manual emptying involves a crew of two or more digging out the excreta, often at night, and transporting it away from the latrine in drums (about 200 liters) mounted on an axle with two vehicle wheels (referred to locally as *ambulances*). There is no incentive to dispose of the excreta safely; hence, excreta is dumped in waste ground, rivers, gullies, and so on, typically within a few hundred meters from the point of emptying.

Map 1.3 • Sewerage Footprint and Expansion Plans for Nairobi



Source: JICA 2014.

Note: Not to scale. WaSSIP = Water and Sanitation Service Improvement Project; NaRSIP = Nairobi Sewerage Improvement Project.

Table 1.3 • Frequency of Different Sanitation Types for Nairobi

	Sewer	Septic tank	Cesspool	VIP latrine	Pit latrine	Bucket	Bush	Other
Number of households	469,800	95,400	10,500	26,500	370,500	5,200	4,000	3,200
Number of people	1,503,360	305,280	33,600	84,800	1,185,600	16,640	12,800	10,240
Percentage of households	48	10	1	3	38	1	0	0

Source: GoK 2009.

Policy and Regulatory Environment for Sanitation Services

Various legal instruments exist to promote the expansion of sanitation services coverage in Kenya. Article 43 of the Constitution of Kenya (2010) states that every person has the right to accessible and adequate housing, and to reasonable standards of sanitation, and that it is the county governments' responsibility to ensure these rights. Kenya's Vision 2030 document prioritizes the rehabilitation, expansion, and development of urban sanitation infrastructure in the satellite towns around several large cities and in various medium-sized towns. Kenya is a signatory of the Ngor declaration on Sanitation and Hygiene, which was adopted by African Ministers responsible for Sanitation and Hygiene and commits its signatories to:

- Focus on the poorest and most marginalized members of society, enabling and engaging private sector innovation;
- Budget at least 0.5 percent of gross domestic product (GDP) for sanitation and hygiene by 2020 (this requirement is pushed down to the county level via the national sanitation policy); and
- Encourage the productive reuse of feces.

Container-based sanitation (CBS) is now defined in policy as a specified category improved form of sanitation. The Ministry of Health has released the Kenya Environmental Sanitation and Hygiene Policy (KESHP), which emphasizes the importance of appropriate and affordable technologies and contains a list of technology options that includes the "cartridge-based toilet." This is defined as "a toilet that eliminates human-fecal contact through safe collection and containment of fecal sludge in sealable cartridges or containers that are easy to remove and transport." Urine-diverting dry toilets (UDDTs) are also included in the list of acceptable technologies (most CBS systems are urine-diverting). The policy also emphasizes resource recovery from excreta and the consideration of decentralized wastewater treatment options. A water bill (which includes sanitation) for the county of Nairobi has been drafted, based on the KESHP, but it has not yet been signed into law.

The policy framework for sanitation was still evolving at the time of the case study. The Water Services Regulatory Board (WASREB) regulates sewerage and wastewater treatment, which are implemented by urban and municipal water service providers. The disposal of excreta was previously regulated by the National Environment Management Authority (NEMA), created under the Environmental Management and

Co-ordination Act, 1999, which needs to be revised to take into account the 2010 constitution that heralded the introduction of devolution. The KESHP includes the creation of a National Environmental Sanitation Coordination and Regulatory Authority (NESCRA), which is mandated to take leadership of, and to be accountable for, the national sanitation portfolio. Its responsibilities, however, are to be implemented in coordination with WASREB and NEMA. Going forward, NESCRA, WASREB, and NEMA also need to coordinate the regulation of fecal waste treatment and disposal with county governments. As noted by senior government officials, it will take a number of years for the establishment of NESCRA and reconfiguration of the regulatory agencies within the framework of devolution and the Ministry of Health's increased role in sanitation. The relationship between the key institutions for the sanitation sector is shown in figure 1.1.

The KESHP states that the government will support private sector participation in sanitation provision by creating clear standards and guidelines and creating legal instruments, such as exemptions. The aim is to promote private sector innovation and the deployment of a greater variety of feasible technology options. The policy allows for flexibility regarding the legal and contractual arrangements and which part(s) of the sanitation chain private sector actors engage in, but services should, where possible, be on a full cost-recovery basis. Private sector participation is directed toward demand creation, product development, and provision and operation of sanitation and fecal waste management services and infrastructure. It is also directed to take consideration of sanitation in non–owner-occupied houses in low-income slum and peri-urban settlements.

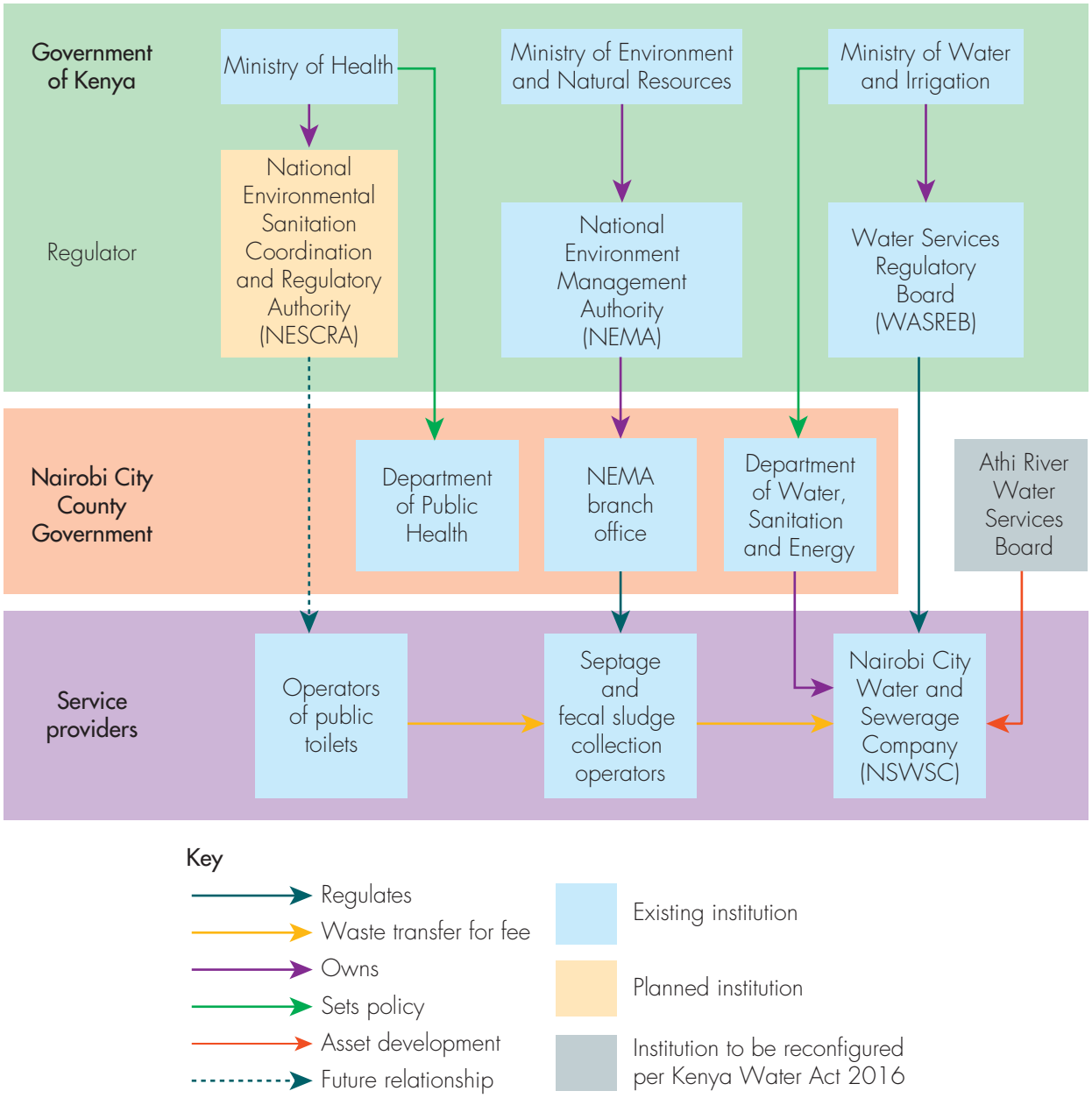
However, the legal instruments to support private sector involvement are not yet in place. The KESHP states that private sector service provision should, where possible, be on a full cost-recovery basis. This is currently possible only where the service is limited to a part of the sanitation chain, such as desludging of containment structures by exhauster trucks. In such cases, cost recovery relies upon subsidies to other parts of the chain. Hence, the tipping fee charged by the water utility does not cover the full life-cycle cost of the treatment of excreta.

The national sanitation policy requires the local government for cities, municipalities, and towns to develop annual plans and financing or investment plans for sanitation.[3] Sanitation services should aim for full direct-cost recovery through user contributions, with shortfalls covered by the county government. County governments are encouraged to mobilize funds from the private sector in addition to development partners (donors) and, for suitable projects, a new national sanitation fund that will pool donations from various sources and distribute them with a pro-poor focus (in a similar manner to the existing Water Sector Trust Fund). Urban authorities will have sanitation steering committees that draw up plans and budgets for sanitation, coordinate the activities of service providers, encourage private sector participation, and conduct research into improved services.

In Nairobi, the NCWSC, a parastatal wholly owned by the Nairobi City County Government (NCCG), is responsible for water, sewerage, and wastewater treatment (WWT) provision. Septage and fecal sludge should be deposited into the sewer systems at a tipping point just upstream of the main WWT plant at Dandora (see map 1.3 for approximate location), operated by NCWSC. NCWSC has two vacuum tankers for desludging septic tanks, whereas about another 60 are privately operated—these tankers pay a monthly tipping fee of US$150 to NCWSC.

Sewerage coverage for urban areas in Kenya has been on a slow decline since 2010–11, when it was at 19 percent, and subsequently went down to 15 percent in 2014–15. The water regulator, WASREB, is recognizing that reaching the entire urban population with

Figure 1.1 • Key Institutional Relationships for Sanitation Services in Nairobi



sewer-based solutions might not be viable given the financial constraints:

"Sewerage coverage currently stands at 15 percent. The trend has been declining from 19 percent in 2010 due to the rapid increase in population, which is not matched by corresponding investment in sewerage. As in the case of water supply, all urban settings will require some form of water borne system to manage wastewater. To attain the sector target of 100 percent coverage for the urban population, the sector requires an average growth in sewer connections of approximately 350,000 which translates to 3.2 million people annually. *It is clearly evident that the resource*

requirements to attain the 2030 target are enormous and the sector should explore other low-cost options if access is to be progressively realized" (WASREB 2016, emphasis added).

Responsibilities for sanitation policy and regulation remain overlapping and fragmented, and they need to be updated to reflect the new devolved dispensation. The environment regulator, NEMA, regulates Sanergy's activities across most of the sanitation service chain, but, as mentioned earlier, the Environmental Management and Co-ordination Act is due for an update. The KESHP attempts to bring improved coordination and accountability to the sanitation sector and introduces a helpful inclusion of CBS as a class of improved sanitation facility. The introduction of a new regulatory agency, while aiming to address institutional fragmentation, introduces additional overlapping of responsibilities and will require careful coordination with WASREB and NEMA. The renaming of the Ministry of Water and Irrigation to the Ministry of Water and Sanitation in January 2018 is an important development for the evolution of urban sanitation in the country. However, in the continued absence of the president's executive order, any expansion of the mandate of the new ministry remains unclear.

Notes

1 The two utilities are Nairobi City Water and Sewerage Company and Runda Water, a small, privately owned utility.

2 Sasumua Dam, Kikuyu Springs, Ruiru Dam, Thika, and Ngethu water works.

3 Urban areas are classified as towns if they have a population of at least 10,000, an integrated development plan, and sufficient financial and service delivery capacity. For classification as a municipality, the minimum population is 250,000 and additional requirements include specific infrastructural assets. Cities must have a population of at least 500,000 (2011 Urban Areas and Cities Act).

References

Bundervoet, T., L. Maiyo, and A. Sanghi. 2015. *Bright Lights, Big Cities: Measuring National and Subnational Economic Growth in Africa from Outer Space, with an Application to Kenya and Rwanda.* Policy research working paper no. WPS 7461. Washington, DC: World Bank Group.

Government of Kenya. 2009. *2009 Population and Housing Census.* Nairobi, Kenya: Kenya National Bureau of Statistics.

Government of Kenya. 2012. *Statistical Abstract 2012.* Nairobi, Kenya: Kenya National Bureau of Statistics.

JICA (Japan International Cooperation Agency). 2014. Nairobi Integrated Urban Master Plan.

UNICEF (United Nations International Children's Emergency Fund). 2012. *The State of the World's Children 2012: Children in an Urban World.*

WASREB (Water Services Regulatory Board). 2016. *IMPACT Report no. 9: A Performance Review of Kenya's Water Services Sector 2014–15.* Nairobi, Kenya: WASREB.

WASREB. 2018. http://majidata.go.ke/maps-data/.

CHAPTER 2 • OVERVIEW OF EXISTING CBS SERVICES

Background: Brief History of Sanergy

The basic business concept of Sanergy is to provide safe sanitation in informal settlements in Nairobi and create value chains that serve agricultural markets. The concept has not changed since the company's creation in 2010. Sanergy's services are provided by two entities—a nonprofit and a for-profit entity—both of which are wholly owned by Sanergy LLC (USA) but are branded independently of each other:

- The nonprofit entity, referred to as Fresh Life Initiative, rolls out a public toilet service by setting up toilet business franchises.
- The for-profit entity, Sanergy, provides excreta management services to the nonprofit arm and produces branded fertilizer and animal feed that incorporate feces as a core feedstock.

The structure of the Sanergy entities is based on the concept that feces end products can be produced and sold for agricultural users at a profit through effective innovation and marketing, whereas sanitation services for the urban poor are a public good for which no market solution at scale currently exists. Sanergy does not consider sanitation facility services in informal settlements to be amenable to private sector investment at this stage. Hence, Sanergy funds the overall costs of the sanitation services through a combination of philanthropic funding for the collection of excreta and proceeds from the sale of treated feces for the back end of the value chain (transport, treatment, and reuse).

The structure of Sanergy and Fresh Life is shown in Appendix B. Sanergy's operation is composed of seven business units run by three directors/co-founders and the chief financial officer (CFO). These units do not map precisely to the organization of the teams in the organogram, as Farm Star is split across two separate teams under the operations director and the CFO, respectively. The business units are summarized in table 2.1.

The for-profit supports the nonprofit container-based sanitation (CBS) toilet service by providing discounted waste collection services. The nonprofit pays a fee to the for-profit for every kilogram of feces removed. This fee is set below the market rate for waste management services in the urban context and is based upon the rate of an exhaustion truck (which provides lower service and does not ensure safe treatment). This has significant implications for the financial flow along the sanitation service chain: The for-profit cannot be used to subsidize the full cost of the sanitation service, as it must return a profit to its shareholders. On the other hand, a supply chain relationship with the for-profit provides the nonprofit with a sustainable, predictable, and quality collection service and gives the feces it collects value.

Sanergy's conceptual presentation of its costs and revenues and the relationships between the nonprofit and for-profit arms of the operation can be summarized as follows:[1]

- Franchisees subscribe to the nonprofit Fresh Life Toilet (FLT) business, paying an installation charge and an annual renewal fee for the excreta collection service in the commercial context or a monthly fee and no installation charge in the residential context. The nonprofit empties the containers and takes them to the perimeter of the slums.
- The for-profit then transports the excreta on behalf of the nonprofit, charging for the service. The toilet service provides reliable quantities of feces to the for-profit.

Table 2.1 • Sanergy Business Units

Unit	Branch	Function
Fresh Life	Nonprofit	Roll out excreta and sanitation services through sales, toilet manufacturing, and installation; management of network logistics and excreta collection within informal settlements; customer onboarding; and ongoing support of franchisees
Future initiatives	Nonprofit	Research products and services that can be added to Sanergy's portfolio in order to increase the amount of excreta that can be safely removed
Farm Star	For-profit	Production and sale of fertilizer and animal feed
Organic waste collection	For-profit	Collects excreta from Fresh Life Consolidation Centers and sources co-feedstock for fertilizer and animal feed products
Sanergy operations	For-profit	Supports companywide operations, including supply chain activities, maintenance (treatment site, equipment, toilet fabrication site, etc.), quality assurance, health, and safety, etc.
Support teams	For-profit	Provide the basic business support infrastructure (information technology, legal, administrative, and finance)

- The for-profit then treats the feces (to eliminate pathogens) at its own cost. The for-profit is scaling up its operation and reconfiguring its process flow in order to achieve profitability.

The full cost of activities along the sanitation service chain is the cost of the toilet service from sales and marketing through transport, plus the cost of approximately two months of composting, which is what is needed to bring the pathogen load to levels that would allow for landfill disposal.

Overview of Services Provided

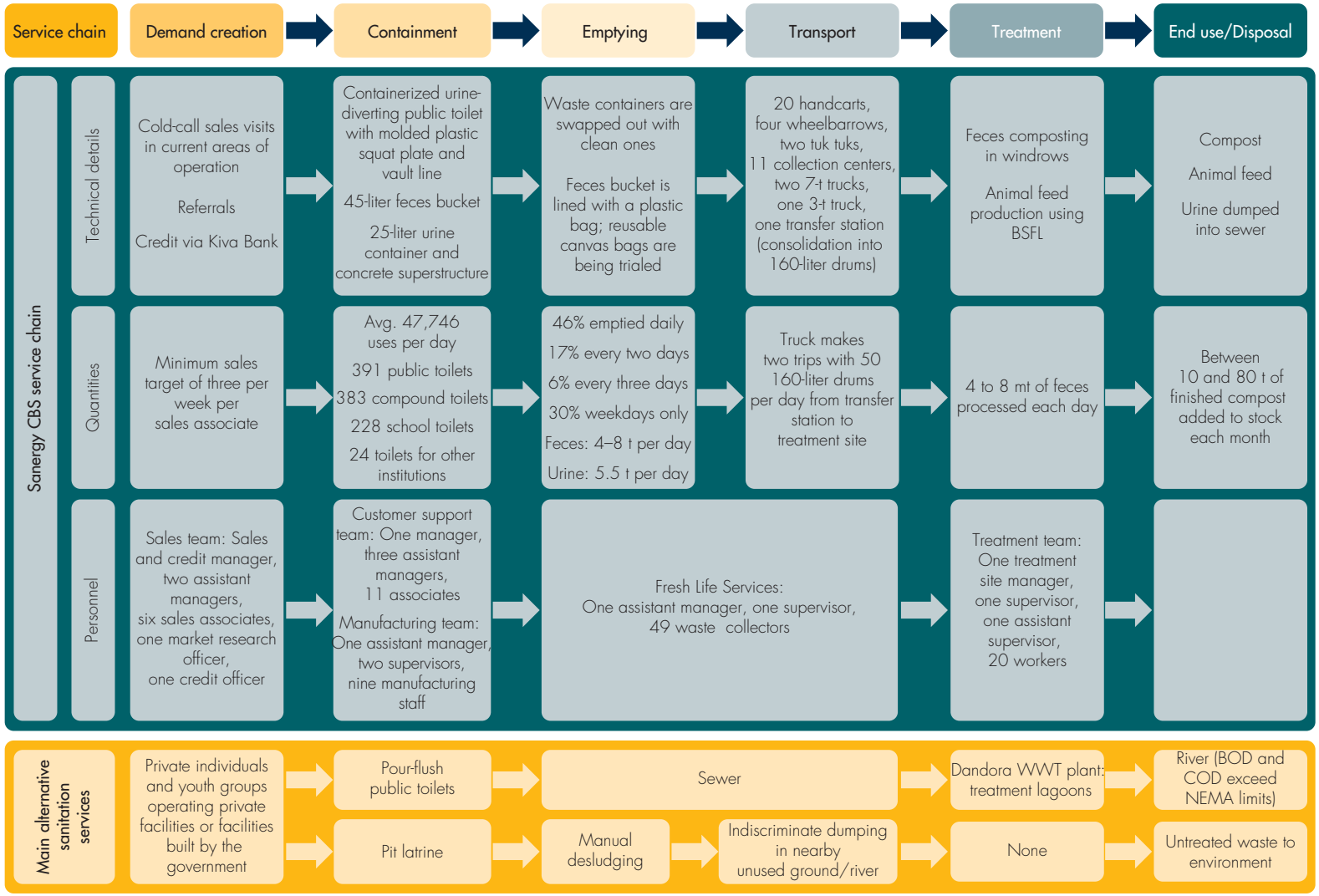
Figure 2.1 illustrates the sanitation service chain for Sanergy and the two prominent alternatives in the same locality—pit latrines (manually desludged) and public pour-flush toilets connected to the sewer system.

Collection: Fresh Life Toilets

FLTs are built entirely from prefabricated components produced in a local plastics factory and Fresh Life/ Sanergy's manufacturing site. (see photo 2.1) The user interface/capture mechanism comprises a custom-designed molded plastic squat plate, a 45-liter feces capture drum, and a 25-liter urine container to hold the drum and jerrycan and isolate them from the soil. The toilet does not use water; instead, sawdust is used as a cover material. The small amounts of greywater generated are disposed of in nearby drainage channels.

The squat plate is currently on its third design iteration and is grouted directly into a ceramic tiled floor. The previous iteration sat on a wooden board, and the first was an off-the-shelf model. A large part of the redesign exercise was aimed at reducing the splashing for women during urination. The superstructure is built

Figure 2.1 • Sanitation Service Chain for Sanitation Options in Mukuru (as of May 2017)



Note: Avg. = average; BOD = biochemical oxygen demand; BSFL = black soldier fly larvae; COD = chemical oxygen demand; mt = metric ton; NEMA = National Environment Management Authority; t = ton; WWT = wastewater treatment.

Photo 2.1 • Fresh Life Toilets

a. Fresh Life Toilet user interface

b. Sanergy employees manufacturing toilet components

Source: Sanergy.

of slim, high-strength reinforced concrete wall panels with a corrugated plastic roof. The current manufacturing capacity is approximately 30 toilets per week based on the number of molds for the various components. Eighty percent of the FLTs have a raised superstructure and require two days to assemble on-site, whereas the remaining "normal" FLTs have a sunken vault and are installed in a single day. Painting the logo requires an additional day.

Sanergy aims to reach the entire addressable market in its service area by increasing manufacturing capacity and converting the existing pit latrines to FLTs. Sanergy intends to invest in a new manufacturing facility in late 2018, increasing its manufacturing capacity to 3,000 per year. Its current manufacturing operation has no idle capacity, which has put a strain on operations. The approximate cost of fabrication and installation of an FLT is US$350. Sanergy has introduced the option of converting a pit latrine to an FLT as the pit latrine is the prevalent form of alternative sanitation. This is roughly double the cost but will allow Sanergy to double its total addressable market from about 250,000 to a little more than 500,000.

Sanergy sells franchise arrangements to businesspeople, cooperatives, landlords, and the management of schools and other institutions, recruiting them as Fresh Life Operators (FLOs). Fresh Life has three different types of toilet service model:

1. **Commercial FLTs** – Open to the public, generally on a pay-per-use basis, though some have introduced monthly subscription schemes. Commercial FLTs are evenly split between those in residential areas (commercial–residential) and those in local commercial or market areas (commercial–open market).
2. **School FLTs** – Operated by the school management for use by the pupils. The price of using the toilets is included in the school fees. In 30 schools, the toilets

might be made available to local residents or the public as well (hybrid–school).

3. **Residential FLTs** – Operated by landlords and made available first and foremost to the tenants within their compound. The price is generally included in the rent. In some cases, the toilets are also made available to the public on either a pay-per-use or subscription basis.

The fees for franchisees are as follows:

- US$350 for the first toilet
- US$300 for subsequent toilets for the same franchisee
- US$70 per year for annual renewal

Alternatively, a leasing model where there is no installation fee but rather a fee of US$8.50 per month (or US$102 per year) was being mainstreamed in late 2017 following a pilot in 2016. This allows the challenge of a franchisee not being able to mobilize the upfront installation costs for new toilets to be overcome. This strategy is discussed in more detail in Current Costs and Financing Sources (chapter 4).

Operating through a franchise network allows Sanergy to delegate some of the menial but important tasks to its franchisees. The franchisees, for example, are responsible for ensuring supply of sawdust. This avoids the complexity of sourcing large quantities (as would be the case if Sanergy supplied the sawdust itself) and the inconvenience (due to lack of storage space) of regularly sourcing small quantities for users of household CBS toilets should they be responsible.

Cover material is more readily available than water for flushing in some areas. Water is relatively expensive in the informal settlements in Nairobi, where homes and institutions are not connected to the reticulation network. Water has to be carried in jerrycans, which takes up time. Sawdust appears to be readily available, and the quantities required are lighter and less bulky, and hence easier to store, than that of water for flushing. In one school visited during the study, significant savings were made when FLTs were installed due to the reduction in water required and the fact that sawdust, a waste material, was provided for free to the school. This resulted in savings of US$60 per month (US$100 during water shortages when prices were elevated).

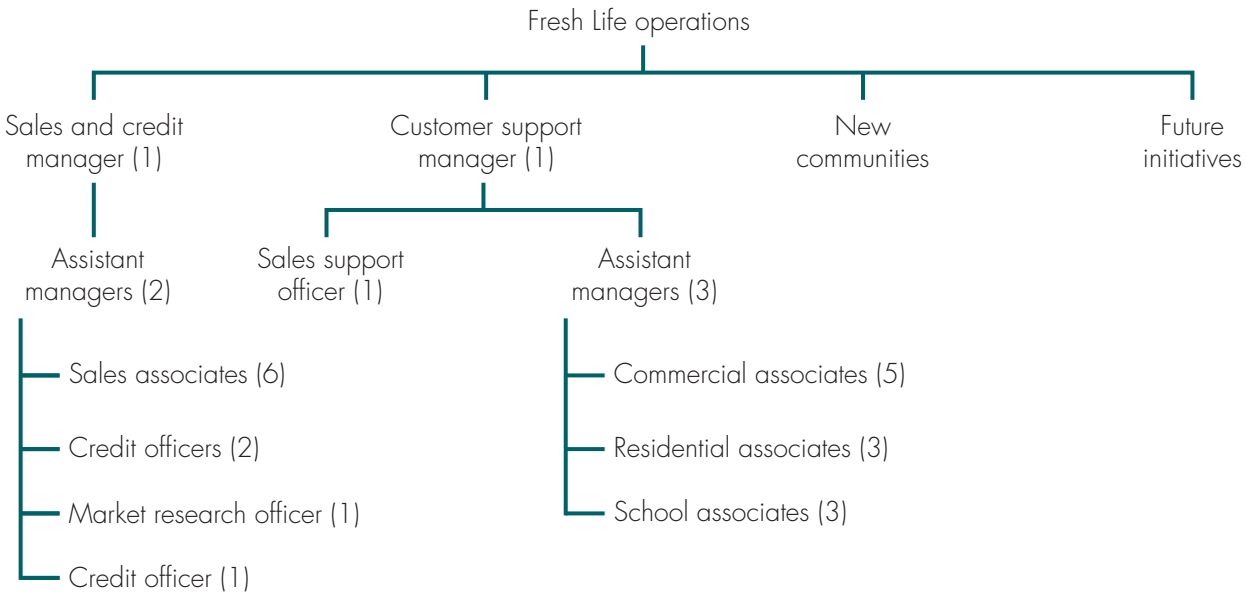
Sales, Onboarding, and Franchisee Support

The process of recruiting and setting up new FLOs is split into functions and across two teams, as illustrated in figure 2.2. The sales and credit team recruits new franchisees and, where credit is requested, convenes a credit committee to evaluate the business case of the applicant. Sanergy's credit officers also visit the proposed toilet location to assess its viability.

Sales activities focus on following up with referrals and making cold calls within Fresh Life's areas of operation. Referrals include people identified by existing franchisees and Fresh Life/Sanergy staff, as well as existing franchisees that wish to add another (second, third, and so on) toilet (that is, self-referrals). In the first quarter of 2017, referrals constituted 50 to 60 percent of new sales. Existing franchisees are incentivized for referrals via one-off payments of US$10 for referring someone who then signs up. They previously enjoyed a reduction in their annual fee from US$90 to US$50 for adding a second toilet, but in 2017, a flat rate of US$70 replaced this system after Fresh Life/Sanergy assessed that commercial toilet operators do not require an incentive to add more toilets and franchisee landlords are limited in adding more residential FLTs due to space constraints.

Cold calls are made in existing areas of operation in pursuit of densification of the Fresh Life network to increase logistical efficiency. This approach is particularly focused on landlords to whom sales associates pitch the problem and cost of not having a sanitation facility in the property. One FLO interviewed mentioned that he needed to install the toilet due to high

Figure 2.2 • Fresh Life Operations Department Structure



competition (that is, availability of empty properties) in his area.

Sales associates are given targets and incentivized with a bonus scheme. They are expected to conduct five conversations per day and have a minimum target of three sales per month each, though one of the sales associates briefly interviewed in passing in the field said he sets himself a personal target of eight per month. The base monthly salary is augmented with bonuses as follows, from which the logic of a self-imposed monthly target of eight sales is clear (a jump from 49 percent of salary bonus for seven sales to 104 percent for eight sales):

- 1 percent of salary for each deposit received, plus:
  - 3 percent of salary per deposit received for one to three sales per month, or
  - 6 percent of salary per deposit received for four to seven sales per month, or
  - 12 percent of salary per deposit received for eight or more sales per month.

Credit is made available through loans from Kiva Bank, an online microlending platform. An informal Sanergy survey of landlords found that access to credit is crucial, and it is a key selling point for potential sales prospects. Although Sanergy has sufficient capital to provide credit itself, partnering with Kiva reduces the risk it has to take. Sanergy also experimented with a partnership with two microfinance institutions (Faulu Microfinance Bank Limited and Kenya Women's Microfinance Bank) but found that the churn of funds was too low—the available capital allowed only a small number of people to borrow money at any one time—and closed down the partnerships after receiving only three sales.

Sanergy is responsible for assessing the creditworthiness of the prospective franchisees and for following up on cases of defaulted repayments. Credit users pay a US$10 finance fee and a US$5 deposit. Higher deposits previously led people to turn to local "loan sharks" at punitive rates of interest, increasing the risk of default on Kiva payments. A Sanergy/Fresh Life credit committee vets applicants, refusing or deferring those with poor business cases, those with poor creditworthiness, or those engaged in (illegal) activities considered incompatible with the Fresh Life values and brand. Prior to the introduction of a

credit manager in early 2015, the appraisal process was weak and a dropout rate of 1 to 2 percent at the time of renewal was experienced. Since the introduction, dropouts have fallen to almost zero. Kiva conducts a borrower verification of the Fresh Life network once a year.

The customer support team takes over once the prospect has paid the required deposit. The onboarding process is coordinated with the government relations department to secure the required government approvals (including from the local chief's office) and to ensure that the land available is sufficient and suitable. If negotiations with other local actors (for example, other toilet operators) are required, the customer support team gets involved, though Fresh Life management believes they are "too involved in the weeds" currently and the commercial toilet model currently entails a high overhead in terms of the time and resources required for these negotiations. Residential toilets are the smoothest to onboard, whereas schools have a medium overhead as some are leasing land for which toilet installation needs to be negotiated.

Prior to commissioning the toilets, each franchisee is trained on Fresh Life's rules and standards, business aspect, and record keeping. They are provided a business-in-a-box startup kit, containing movable equipment (including personal protective equipment) required to operate the toilet, as well as an initial supply of consumables (for example, soap, sawdust, and detergents for handwashing and cleaning).

Once the toilet is operational, support is provided by three teams of support associates, one for each service model (commercial, school, and residential). Commercial FLTs require more support throughout their life cycles from creating awareness to persuading people to use their toilets. Residential FLTs require more support on weekends when tenants/users tend to be at home, are more prone to raise issues, and are available to receive customer support associates.

Customer support operations include the following activities:

- Working with the Sanergy collection team on week-by-week adjustments to the collection schedule (for example, to take into account school holidays)
- Fielding complaints from FLOs (for example, in cases of missed collections)
- Ensuring that customers are reminded prior to their renewal dates and following up on delayed/defaulted payments
- Organizing networking forums for FLOs to share ideas on what is working and what is not (separate quarterly forums for the three service models and a combined annual forum)
- Conducting regular inspections to ensure toilets are being kept clean and equipment and consumables are being provided by the FLO and identifying repair needs, which are reported to the maintenance team

The principal performance metric for the customer support team is the FLO retention rate, as acquiring new customers is an expensive process. Other performance metrics are

- Case resolution—the percentage of cases resolved within the specified timeframe for the type of issue involved—and
- The percentage of collections scheduled that are done.

If the operation of an FLT is terminated for any reason, Sanergy removes the cartridges and squat plate, which remain the property of Sanergy. The superstructure and handwashing station are the property of the FLO but are debranded by being painted white. FLT servicing can be terminated if the FLO decides to terminate the service, Fresh Life/Sanergy deems that adequate standards are not being met, renewal payments are defaulted on, or the structure in demolished (as happened in one case due to new road construction).

Emptying and Collection Operations

The emptying and collection process involves swapping out the plastic containers with fresh ones and transporting the feces to a transfer station for consolidation into large drums for final transport to the treatment site. The feces is hauled away using handcarts, wheelbarrows, and tuk tuks to collection centers, which are composed of rented buildings that are relatively accessible by vehicle. Feces containers are transported from the collection centers[2] to the transfer station by truck or tuk tuk. At the transfer station, the feces in the toilet containers is consolidated into 160-liter drums (approximately one drum per 10 toilets) before being transported on to the treatment side outside Nairobi via two 7-ton trucks and one 3-ton truck. Sawdust is placed at the top of the drums before sealing to minimize smell emanating from the drums as the transfer station is surrounded by domestic lodgings. Urine is collected from the household (in a separate 25-liter sealed cartridge) and disposed of into sewers—it is not reused currently due to the energy costs associated with conversion being too great. The feces is consolidated into intermediate bulk containers at the transfer station and taken away by exhauster trucks.

The network of transport, collection centers, and transfer stations is continually adjusted to maintain optimal efficiency as the FLT network expands. Pairs of collection centers in Mukuru kwa Njenga and Kayaba, respectively, are being replaced by a single transfer station in each, and transfer stations are being planned for other locations. Sanergy had previously developed a mobile transfer station, but it was eventually abandoned as it was too heavy to be hauled around the rough terrain of the operational area.

Initially, collections were on a daily basis for all FLTs, but in 2016, Sanergy adopted a demand-based collection schedule to increase collection efficiency. Toilets that that have lower utilization are collected every other day or, in rare cases, once every three days. School toilets are generally emptied daily as urine accumulation is very high but are on a "special schedule" that allows for no use over weekends. The proportion of FLTs on different schedules as of May 2017 was as follows:

- 46 percent emptied daily
- 17 percent emptied every other day
- 6 percent emptied every three days
- 30 percent on a special schedule (daily, except for weekends)

Feces Processing

Sanergy's feces processing site currently produces organic fertilizer, which is sold on the open market as Evergrow. It is located about 35 kilometers from its operational area, in an area designated for feces processing for the export processing zone near Athi River. It occupies about 5 acres of land leased from the government and is split into four different zones or operations:

1. Pre-processing—Removal of feces from the 160-liter drums and separation from the plastic or canvas lines; shredding of co-waste where necessary
2. Mixing of wastes—Mechanical mixing in a Biomax plant (see photo 2.2) in batches; loading takes about three hours and mixing 30 minutes
3. Aerobic composting in windrows[3]
4. Sieving and packaging—Producing the branded bags of Evergrow organic fertilizer (see photo 2.3)

The Biomax plant can process about 7 tons of waste per batch and, hence, can comfortably process two batches or 14 tons in an eight-hour day. It is currently operated in this manner every two days. The loading process will likely be sped up in the future via purchasing and bin tipper as well as a loading hopper.

Sanergy has trialed 70 different recipes of organic fertilizer to enable it to manage seasonal availability and the resulting variation in prices and transport

Photo 2.2 • Biomax Mixing Machine

Source: Sanergy.

Photo 2.3 • Production of Fertilizer

a. Finished fertilizer product

b. Bag of Evergrow organic fertilizer

Source: Sanergy.

distances and associated costs for the inputs on non-feces waste. To the 4 to 8 tons of feces collected each day, other organic wastes equivalent to between 20 percent and 200 percent of the fecal waste weight are added. On average, 84 percent of the mass of waste is lost during the composting process, resulting in a current average fertilizer production of between 0.8 and 4 tons per day. The shelf life of the fertilizer is 12 months.

Sanergy is currently conducting research and development on the use of black soldier fly larvae (BSFL) to produce a high-protein animal feed, which would radically change the treatment process. The plan is to first process feces (or a mix of feces with a proportion of non-fecal organic waste) through the BSFL and then forward the residue to the organic fertilizer production. Sanergy is in the process of scaling up this process to industrial production levels.

The key inputs for the feces processing are labor (36 percent), water (25 percent), and feedstock (23 percent). Power requirements are minimal, and maintenance comprises 10 percent of the costs. At the end of the first quarter of 2017, revenues were equivalent to 40 percent of the costs of processing, not including sales and marketing and distribution.

The current processing capacity is approximately 30 tons per day. This would require a bin tipper and loading hopper to be purchased for the processing plant. Sanergy plans to add a second 5-acre land parcel to its processing site in order to increase processing capacity to 250 tons of feces input to the composting process. As the BSFL process comes into mainstream production, the theoretical limit to fecal sludge processing capacity will be about 750 tons per day, equivalent to the feces of about 2.5 million people.

As of May 2017, Sanergy had sold around 550 tons of soil fertilizer—350 tons from March to December 2016 and 200 tons in the first quarter of 2017. 550 tons is worth about US$220,000 at the market price of US$400/ton. Of this total, 195.3 tons were sold to seven commercial farms and 358.2 tons to smallholders.

Legal and Policy Environment and Impact on CBS Services

The county government has recognized the need for partners to help bridge the gap in sanitation for areas where sewers and septic tanks are not appropriate solutions. There is no formal partnership between Sanergy and the county government yet, but Sanergy is recognized as a top-tier alternative to conventional services as it is perceived to have achieved and consistently maintained high standards of service. The Nairobi County Integrated Development Plan (CIDP) includes plans to extend sewers into informal settlements in low- and middle-income areas, but it is recognized that informal settlements will be a challenge due to various constraints (legal, space, and resources). Nairobi County, in early 2018, also adopted a plan for regenerating Nairobi River, which is where slums typically are located, in an effort to promote new sanitation initiatives in a more integrated manner.

When Sanergy began operations, concerns about the approach being a regressive "night soil" solution appeared to have been common, and government officials recalled strong concerns. They now acknowledge that FLTs are filling a gap in their service provision and will have a place for the foreseeable future. The success (or failure) of Sanergy's system will have a strong influence on whether CBS is accepted as a long-term solution in Kenya, as one national government official directly stated.

The collection service is primarily regulated by NEMA, the environment regulator. Each truck and tuk tuk is licensed by NEMA, and the license defines what type of waste can be transported. With devolution, NEMA has branch offices at the county level, but Sanergy has obtained its licenses from the national office, as its

treatment facility is in Machakos County and its vehicles, notably the trucks, need to operate across county lines.

The processing site is also licensed by NEMA, which licenses all waste treatment and disposal operations. An environmental impact assessment (EIA) was required for the license to be issued. Currently the hand carts and collection centers are not licensed by NEMA due to frequent turnover of facilities/equipment and the lack of a clear category or regime for their licensing. Sanergy, however, informs them in writing of any changes or new facilities; currently, NEMA is satisfied with this as a transitional arrangement pending the introduction of a suitable regulatory framework.

Notes

1 Appendix C illustrates the financial relationship between the nonprofit and the for-profit.

2 At collection centers, waste is stored for only a few hours and remains in the containers removed from the toilets. At the transfer station, the waste is removed from the toilet containers and packed into large 160-liter drums for more efficient use of space (containers from the toilets are only partially filled).

3 Windrows are long rows of (mixed) wastes piled together to compost aerobically. They are turned periodically to ensure that, over time, all parts of the pile are exposed to the required conditions (aeration and high temperature) for pathogen destruction and breakdown of the waste.

CHAPTER 3 • CBS SERVICE PERFORMANCE

This section examines customer progression, the factors affecting this progression, as well as customer perceptions concerning the service.

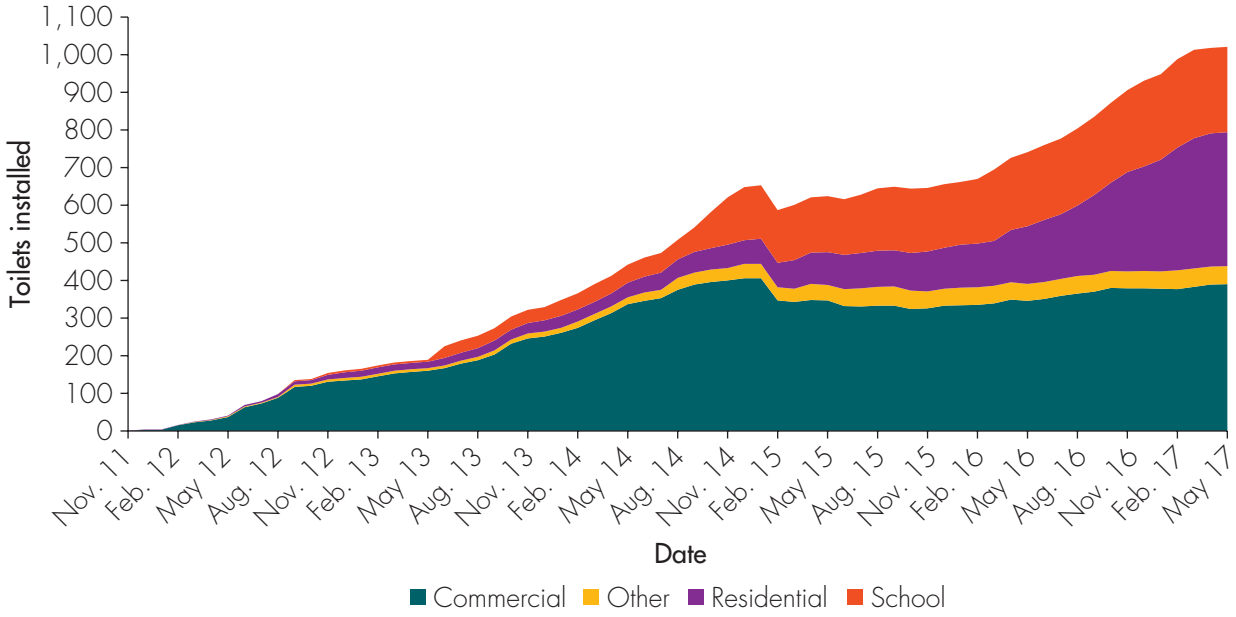
Fresh Life Toilets' Customer Growth

The customer base for Fresh Life Toilets (FLTs) has grown relatively slowly but steadily since the first commercial toilets were opened in November 2011, with the residential model taking over from the commercial model as the main growth driver. Figure 3.1 shows the growth in operational toilets (that is, toilets operational each month, taking into account newly opened toilets and closed toilets), and figure 3.2 shows the toilets added each month by type (commercial, school, and residential).

The first toilets were predominantly commercial toilets, which were used to build up the Fresh Life brand and market penetration. Commercial toilets led the growth curve until August 2014. From September to December 2014, a focus on school toilets led the growth. This focus was funded by an injection of donor funding and provided an opportunity to build the relationship with the government. From February 2015 to April 2015, the growth was led by school toilets and residential toilets. From May 2016 on, the residential model began to lead growth as Fresh Life focused on this market segment.

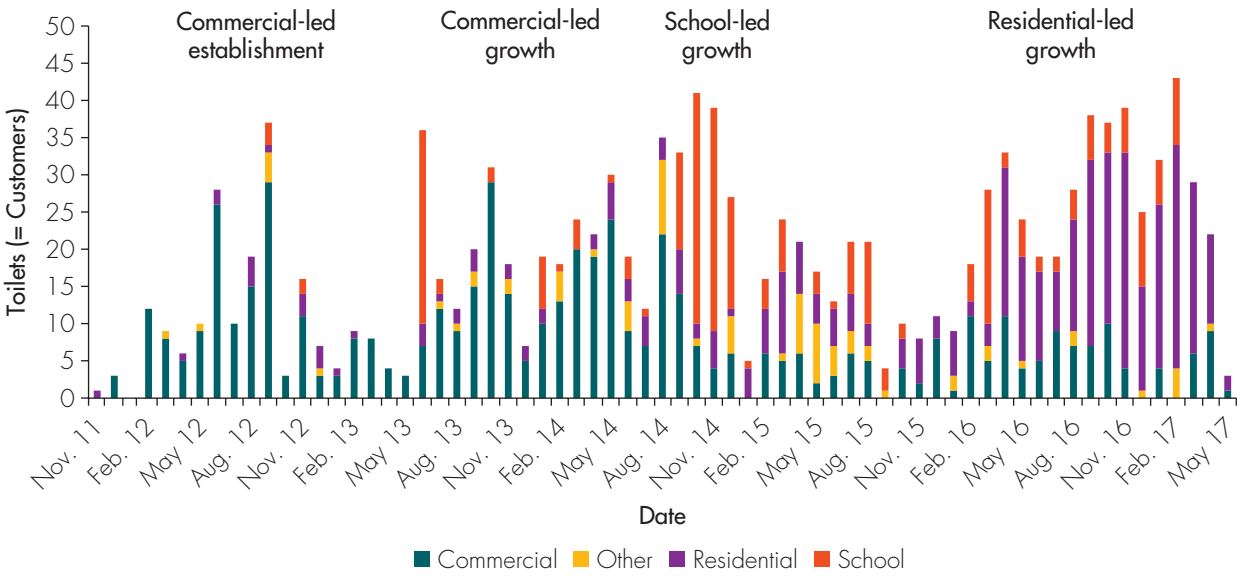
In February 2015, Fresh Life instigated a series of FLT closures following the appointment of a credit manager who cracked down on Fresh Life Operators (FLOs) with overdue payments (loan repayments or

Figure 3.1 • Fresh Life Toilets' Growth over Time, 2011–17



Source: Sanergy.

Figure 3.2 • New Fresh Life Toilet Installations, by Month, 2011–17



Source: Sanergy.

late annual or monthly fees). Some of the closures were temporary; others were permanent.

Sanergy continues to identify and target new customer segments to maintain its FLO network growth and, in turn, the growth in the sanitation service end users. The residential model continued to lead growth into 2017 as Sanergy identified non-resident landlords (that is, landlords not living in the plots where they rent out dwellings) as a new market segment to target, building on the surge in popularity of the residential toilets. This also contributes to the strategy of focusing on densifying market penetration—that is, focusing on the areas where they already operate in for new sales rather than opening up new areas. This involves targeting slower adopters.

Sanergy conducted a successful pilot of a leasing model in Mathare, a separate slum where Sanergy undertakes pilots, with a monthly payment of US$8.50 and no installation fee or annual fee. This pilot has since been implemented as the main sales structure in the residential context across the toilet network. This leasing model removes the need for upfront financing and reduces the sales and marketing overheads. Sanergy installed 11 commercial toilets over the first two years of operation in Mathare, but after introducing the leasing model in one of its subareas of operation, it began installing about 20 per month.

Assessing the Value of the Fresh Life Service to Customers

This analysis shows that container-based sanitation (CBS) services provided by Sanergy offer a sound alternative to other forms of sanitation in areas where difficult access, cramped conditions and restrictions on water availability create challenges for these alternatives.

Quality and Reliability of Services

All of the FLOs interviewed expressed satisfaction with the Fresh Life service, including the emptying service. The only minor complaint was from one FLO whose toilet had an old 35-liter drum for feces collection that was a few inches too low, leaving a gap between the squat plate

drop hole and the feces container. The FLO business-in-a-box kit contains a small stool to set the drums on, but he had not received one. One of the two schools selected for teacher and pupil interviews mentioned that, in 2015, excreta collection was organized for the afternoons—after the school had closed—but it was rescheduled in 2016 for the mornings after the school complained at the inconvenience of the schedule.

Sanergy tracks the collections and provided data for the percentage of missed collections for the first four months of 2017, as shown in table 3.1. The data is insufficient to establish a long-term trend.

Sanergy tracks complaints that are raised and how quickly they are resolved. Each particular category of complaint has a target timeframe for resolution—for example, two days for a broken lock but longer for chamber-based issues. Figure 3.3 shows a steady improvement in the timeliness of case resolution from about 20 percent from July to October 2016 to 80 percent in April 2017. None of the eight FLOs interviewed had a complaint about Fresh Life's responsiveness to maintenance requests—the three that had raised maintenance issues experienced a quick and effective response.

Cost to the Customer or User

Users of Sanergy's toilets are paying much the same rates as they would for other toilet options. Sanergy leaves it to the FLOs to set the price per use; hence, market forces prevail. The price per use is US$0.05 for adults and US$0.02 to US$0.03 for children in most areas. In Shauri Moyo, a highly commercialized area, the price for adults was double this at US$0.1 for both public pour-flush toilets run by cooperatives and FLTs. Taking the most common price of US$0.05 for adults, and assuming one visit per day, produces an estimated annual cost to the user of US$18.25 or a total estimated cost of US$63 per household (based on two adults and three children). The total costs could be much higher, however, depending on the number of visits per household member.

Residential toilet fees are covered in the rent and school toilet prices in the school fees. Some landlords maintain the same rent after installing the toilet, seeing it as an important way of attracting new tenants, whereas others raise the rates, generally by US$1 to US$2 per month (there is no charge per use). Schools are paying US$60 per year per toilet (generally two—one for boys and one for girls), which the pupils use for "free"—the cost to users is included in the school fees.

Customer Satisfaction

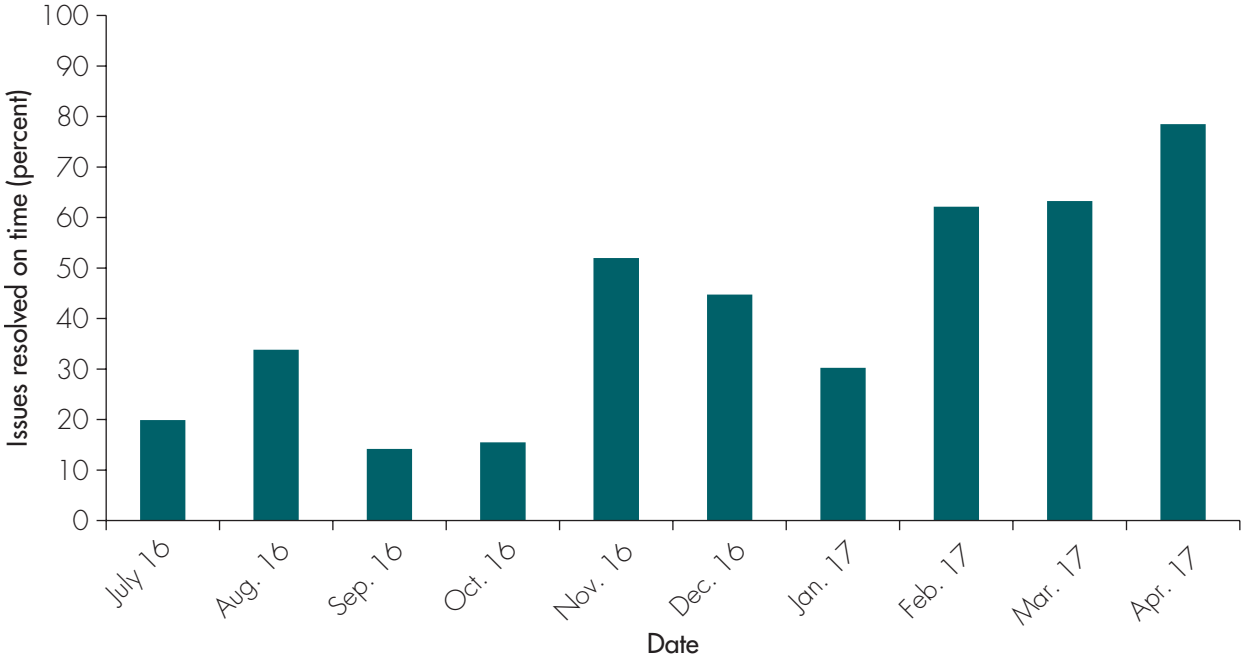
Sanergy's direct customers, unlike other CBS service providers, are the FLOs—franchisees that operate the FLTs for the public, plot residents, and/or school pupils. Interviews were conducted with a small sample of FLOs.

Table 3.1 • Missed Collections in 2017 (January to April)

	January	February	March	April
Planned collections	19,738	20,372	21,438	20,255
Missed collections	566	473	304	366
Percentage missed	2.87	2.32	1.42	1.81

Source: Sanergy.

Figure 3.3 • Percentage of Fresh Life Toilets' Issues Resolved on Time



Source: Sanergy.

Those interviewed were operating between one and three toilets each, and all were very satisfied with the business and the service from Fresh Life/Sanergy. The period of time for which the FLOs had been operating the toilets did not have any noticeable impact on their level of satisfaction or responses in general.

Commercial FLOs were motivated by the revenue and the recognition of a need for safe and clean toilets in the neighborhoods in which they live and work. They were particularly satisfied with the cleanliness of the toilets, Fresh Life/Sanergy's customer service, and the provision of handwashing facilities (for which the FLOs supply the soap). The toilets were also said to provide more safety at night because they are located closer to their users (some alternative public toilets are in large blocks that tend to be located far apart and on the periphery of the informal settlements where there is more space for these large toilet blocks). The FLOs were generally happy with the income, which ranged between US$50 and US$150 per month after deducting expenses (but excluding the annual US$70 fee to Fresh Life). The only negative point raised was the lack of water for Muslim users (for washing themselves after going to the toilet), which was resolved by providing a small jug of water and asking users to clean themselves over the urine collection part of the squat plate.

Residential (plot) FLOs were motivated by the need for a toilet solution for their residents that does not take up too much space, is clean and hygienic, and has a payment schedule that can be matched to the monthly rent payments to protect the operators' cash flows.

User feedback was universally positive, with each interviewee raising cleanliness of the FLTs as an attractive feature. When asked to identify something they did not like, all responded that there was nothing while giving between two and four things that they did like, including security/accessibility, hygiene, the presence of a handwashing station, and convenience.

Users in schools indicated strong satisfaction with the services. The two schools visited installed FLTs after Fresh Life sales calls. In the case of Gate of Hope Academy, the installation of two FLTs in October 2014 followed a cholera outbreak in which two pupils died. The school decommissioned and sealed two pit latrines that were starting to smell. They also built two new pit latrines to complement the FLTs, but the pits filled with subsoil water and are not used.

All but one of 20 pupils interviewed in the four focus groups expressed a preference for FLTs over other toilets. The one exception preferred the flush toilet because it does not have the urine separation mechanism and is therefore easier to use. The cleanliness, lack of smell, and the fact that the toilets do not consume water (a very scarce resource) were the most commonly raised attractive features of the FLTs. Unlike the adults and FLOs interviewed, the pupils raised some negative points. One group from a school where FLTs had been in use for a year raised the issue of a smell during collection and a challenge urinating for girls.

The teachers interviewed at both schools stated that it took a few weeks for pupils, particularly the girls, to get used to the toilets. However, overall, this was not raised as a barrier to usage. Pupils from both schools raised issues with shortages of sawdust, even though one was getting it for free and had a good stock when visited. Two of the four groups—one of boys and one of girls—had no complaints with the FLTs.

The resilience of FLTs to water shortages is a key advantage over water-based public toilet blocks. Two commercial centers within Sanergy's operational area with water-based public toilets were visited. In Shauri Moyo, piped water was unreliable, so public toilet operators had to purchase water in jerrycans several days a week; in Kayaba, a public toilet adjacent to the chief's office had not received piped water for more than a month due to the ongoing water shortage and was closed. The head teacher of pilot school management cited the lack of a need for water as a major advantage of their new FLTs. An ongoing water shortage in May in the area saw the cost of (borehole) water rise from US$0.3 to US$0.5 per 20-liter jerrycan. The pour-flush toilets they relied on prior to installing their FLTs one year prior needed about 10 jerrycans per day for flushing; the cost was about US$60 per month (US$100 with the price at US$0.5). Sawdust, the main input required for FLTs, on the other hand, is provided for free to the school by local carpentry businesses.

Sanergy Services vs. Available Alternatives in the Service Area

The only current alternatives for Sanergy's areas of operation that provides a full sanitation service chain solution are pour-flush toilets connected to sewers or lined pits whose excreta is safely emptied, transported, treated, and disposed. These two alternatives are shared options as virtually no one in the informal settlements in Sanergy's service area has a household toilet due to space restrictions.

Constructing sewer lines in the tightly packed informal settlements would require the removal of properties to lay sewers and access the trunks.[1] Similarly, constructing water-based public toilets on septic tanks would be difficult for the same reason, and they would not be accessible to vacuum tankers for emptying. Existing large public toilet/ablution blocks on sewers are largely limited to the peripheries of the settlements, including commercial centers, where there is space for their construction and sewer lines are available and accessible. Although smaller units of one or several pour-flush toilets connected to sewers do exist within the informal settlements, they are limited in number and are more likely to block frequently due to the lower volumes of water used compared to large ablution blocks that generally include shower facilities and hence produce greywater to help wash the pour-flush along the sewer pipes.

Table 3.2 • Qualitative Comparison of CBS and Alternatives

	Safety of sanitation service chain					Potential reach
	Containment	Emptying	Transport	Treatment	Disposal/reuse	
Sanergy CBS	CBS	In sealed containers		Composting/BSFL		Extensive
Sewer-based	Public pour-flush toilet	Sewer		WWT ponds	River	Limited mostly to periphery
Lined pits + FSM	Lined pit	Manual	Drum on wheels	None	To river/waste ground	Manual

Note on color-coding: Green = safe; yellow = partially safe; red = unsafe; BSFL = black soldier fly larvae; CBS = container-based sanitation; FSM = fecal sludge management; WWT = wastewater treatment.
Note on potential reach: Potential to provide defined sanitation service to all households in specific targeted geographical area.

Pit latrines are mostly manually desludged with the excreta disposed of unsafely in the nearby environment. The manual emptying process is unsafe and unpleasant for the workers. Exhauster trucks (vacuum tankers) cannot access the majority of the pit latrines, and most owners would not be able to afford their rates anyway. Currently, no facilities exist in Nairobi for the treatment of septage and fecal sludge, and exhauster waste (mostly septage) is deposited in the sewer to be treated in wastewater treatment (WWT) ponds at the Dandora plant. Safe disposal of the excreta would therefore require either transport to centralized treatment facilities or the development of decentralized treatment facilities or collection/transfer stations. Sanergy is developing a pilot to incentivize safe pit latrine exhaustion by setting up collection centers and developing a branded certification scheme to professionalize the manual exhausters, but it was at too early a stage to assess at the time of the case study.

Table 3.2 compares the safety of Sanergy's CBS service with the alternatives at each point in the sanitation chain, as well as their potential reach—that is, how well they can penetrate into the informal settlements given the space constraints. Public pour-flush toilets on sewers would mostly be limited to peripheral areas of the settlements, to which they could provide a safe sanitation service if the WWT plant was functioning properly 100 percent of the time (currently it is not). Lined pits with manual emptying do not provide a safe sanitation chain; the emptying is unsafe for the operators and there is insufficient space to construct them in some places (and excavation of pits is not possible in some areas).

Note

1 Some areas of informal settlements have trunk mains passing under them, but laterals and service lines would still need to be constructed.

CHAPTER 4 • FINANCIAL PERFORMANCE

This section reviews the financial performance of Sanergy. The financial analysis was performed using available data and analysis provided by Sanergy.

Current Costs and Financing Sources

The total annual cost for the Sanergy suite of companies was a little less than US$1.5 million based on annualized projections for 2017, with a little less than US$290,000 (19 percent) recovered via fees from Fresh Life Toilet (FLT) operators and from sales of the reuse product. Revenues from the fees charged to the Fresh Life Operators (FLOs) were a little more than US$160,000 in 2017, amounting to 11 percent of the total costs and 19 percent of the costs of providing the toilet service.

The cost (to the for-profit) of collection between January and April 2017 was between US$0.06 to US$0.07 per kilogram of feces, roughly double the amount charged to the nonprofit. In the first quarter of 2017, an average of 13 tons of feces and urine combined was collected per day (approximately equal weights of each), with daily values of feces arriving at the treatment site ranging between 4 and 8 tons. The feces is weighed at the collection center. The resulting charge to Fresh Life was about US$12,000 per month. The cost of feces collection had reduced from US$0.15 in 2014, and Sanergy was targeting US$0.04 by the end of 2017.

Total annual costs are projected to rise to a peak of about US$4.2 million around 2023, when full market penetration is achieved, before dropping and stabilizing at about US$3.4 million thereafter. Annual revenues are projected to rise steadily to a plateau of about US$2.3 million, representing 55 percent cost recovery by 2023 and 69 percent from 2024 onward (due to the lower total cost).

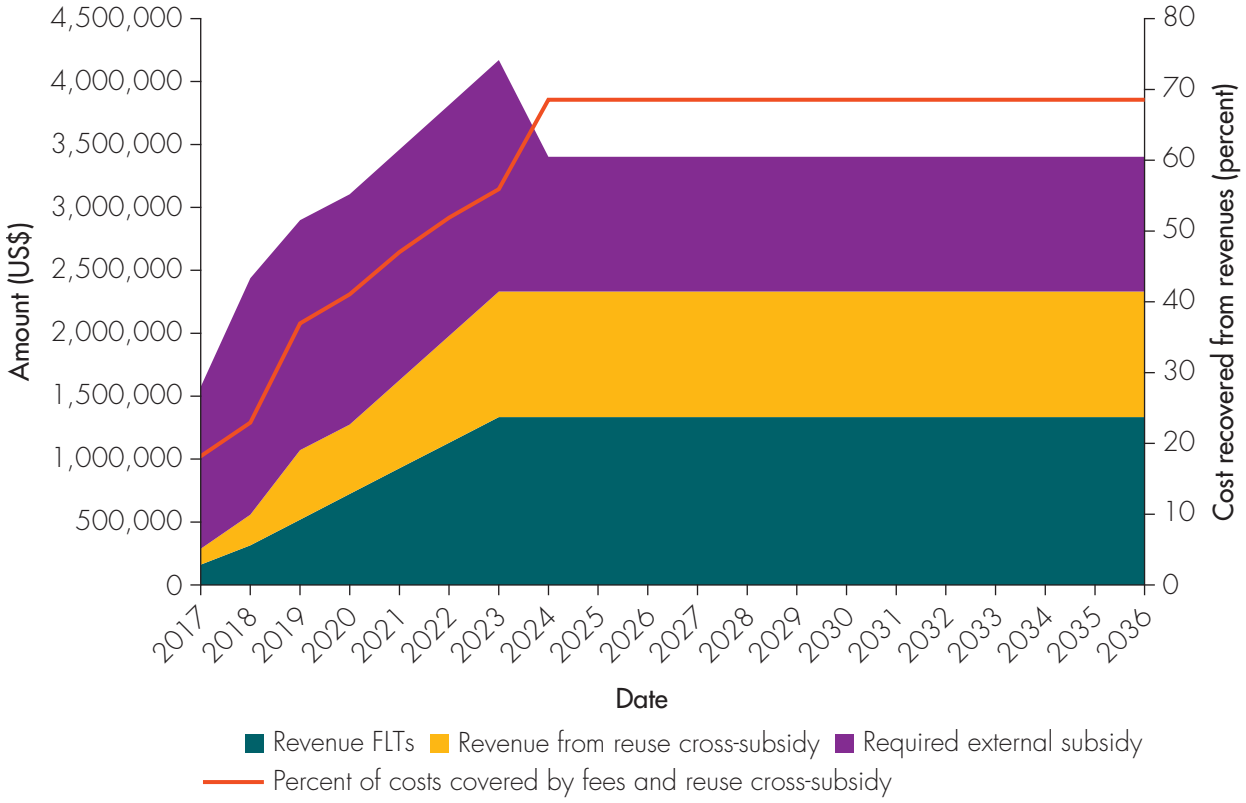
Sanergy projected that the net costs—that is, the annual subsidy requirement—would increase to approximately US$1.9 million in 2018, stay between US$1.8 million and US$1.9 million until 2024, and then drop to a stable level of a little less than US$1.1 million.

These projections rely on assumptions about scaling up production for the reuse product and sales. This is illustrated in figure 4.1.

Until May 2017, the majority of external funding for Fresh Life (the nonprofit) had been provided by 15 family and corporate foundations (the median contribution being US$93,000). About 3 percent of this funding was restricted, specifically funding school programs or research, development, and piloting of an in-home toilet.[1] The remainder of the funding was unrestricted. In May 2017, Sanergy raised US$12.5 million for the for-profit entity: US$5 million in debt, US$5 million in equity from four investors, and US$2.4 million in grants from the Bill & Melinda Gates Foundation (BMGF). It had previously raised US$5 million in equity through two financing rounds and about US$4 million in grants from United States Agency for International Development (USAID) and BMGF.

Sanergy has been deploying various approaches to reduce the external funding requirement for the nonprofit, including by improving its operating model, generating efficiency gains, and growing the operations to generate economies of scale. Some of the strategies to improve financial viability are discussed in more detail in the next section as well as in Overview of Services Provided. Despite these strategies, however, the financial analysis shows that securing reliable flows of external subsidies will be critical in order to ensure the financial viability of the operation.

Figure 4.1 • Projected Costs, Revenues, and Financing Needs for Expansion



Source: Sanergy.
Note: FLTs = Fresh Life Toilets.

Improving the Efficiency of Its Operations

Sanergy maintains a close focus on operational efficiency and the elimination of idle capacity. Sanergy's collection operation has current idle capacity, which continues to be filled as more toilets are leased through the fee-for-service monthly collection charge model. The toilet manufacturing capacity, however, was being fully utilized as of early 2017. Toilet installations will become more expensive in the immediate future due to the addition of pit latrine conversions (which are required to achieve 100 percent coverage of the service area with safe sanitation, utilize the space, and remove competition from unhygienic toilets). Pit latrine conversions will represent half of the new toilets going forward—and cost twice as much as a standard toilet.

As of May 2018, Sanergy was examining the potential trade-offs, in terms of reduced sales costs, of rolling out a leasing model that had been piloted in Mathare across all zones and customers of this area of operation. This model resulted in accelerated uptake in a previously dormant market. Although charging an upfront installation fee to franchisees reduces the capital expenditure that Sanergy has to cover, the extra time and effort to reach a sale is much higher when an installation fee is paid, including that required to organize and administer any necessary credit. In addition to the costs associated with making the sale, a significant amount of customer support consists of following up with franchisee debts, some of which pertain to credit for the installation cost. Thus, the model in which the installation is leased to the operator (rather than the operator having to pay

an upfront fee) was developed, deemed successful, and rolled out as the predominant operating model.

Labor is the predominant cost driver for the emptying and collection, forming 60 percent of the total cost. Hence, efforts to optimize the cost of the emptying and collection service have been focused on maximizing labor productivity. Sanergy did not increase staffing for the approximately 1,000 toilets it serviced in 2017 from its 500 toilets in 2015. Currently, one excreta collector serves, on average, 24 toilets, though for the various collections routes, this figure ranges between 16 and 34 toilets per excreta collector. The configuration of transport means is constantly being adjusted and optimized, with a focus on optimizing the use of labor rather than other transport costs (fuel, maintenance, and so on).

Densification is also a key strategy for improving cost-efficiency and is resulting in a shift toward more reliance on low-tech transport means. At the same time, Sanergy is looking to increase consolidation of excreta closer to the toilets so that excreta collectors, some of whom might complete their collection duties within as little as two hours, can be engaged in excreta consolidation. Hence, they are looking at upgrading collection centers into consolidation facilities. The collection centers might be too far from the excreta collectors' areas of operation to allow this. Sanergy is currently trying to identify suitable sites with the communities and has slowed down expansion into new areas in order to concentrate on developing a "densified" operation from which a replicable financially sustainable model in other communities, cities, or countries can be derived.

Another major cost driver is the management of the plastic bags that line the feces containers. These had to be removed from the feces (as plastic is a contaminant) and incinerated in suitably accredited local incinerators at US$0.35 per kilogram. Due to this cost—and the introduction of a nationwide ban on plastic bags introduced in September 2017—Sanergy piloted the use of reusable canvas bags in 80 toilets. By May 2018, the use of reusable bags (with industrial washing) had been generalized to fully comply with the ban.

Plans to Achieve Economies of Scale through Expansion

Sanergy plans to expand the Fresh Life network to a little more than 13,000 toilets in order to cover the whole of its service area and serve about 520,000 people. As of May 2017, Sanergy's forecast model for expansion was to have 1,582 toilets by the end of 2017, increasing by 1,500 to 3,082 in 2018 as the new factory comes online and then by 2,000 a year until 2023, with a final network of 13,082 toilets, serving 40 people each on average. This expansion rate would be a significant step up from what it has achieved so far—it previously added 1,000 toilets in seven years of operation. However, this relatively slow growth is partly linked to the need for developing the business model and technical processes. After 2023, the factory is assumed to produce 2,000 toilets a year for replacements (a conservative estimate) and would therefore not result in new toilets being added to the network. Sanergy estimates the maximum number of users for a toilet to be 80; hence, the final network of 13,082 toilets could cater for additional users due to natural population growth. The actual number of users will vary considerably; however, residential toilets might have fewer than 40 users, and commercial toilets might have more. Additionally, school toilets will likely be serving children that use other toilets—FLTs or alternatives—when not at school.

In 2017, Sanergy estimated the cost of serving one person—after revenues from franchisees and the market value of the feces are taken into account—was about US$18 (US$23 before revenues are taken into account). It also estimated that the cost could drop to a little less than US$2 per person once the operation reached

a full scale of a little more than 500,000 users. This assumes sales of 2,000 toilets per year and an average of 40 users per toilet. If, as seems likely, the residential model becomes the main driver of growth, the average number of users per toilet could fall below this level.

Note

1 The Fresh Fit Toilet. The pilot involves 60 in-home container-based sanitation (CBS) toilets, of which about one-third were rolled out at the time of the case study. This case study is focused on the Sanergy's shared toilet main business model.

CHAPTER 5 • KEY LESSONS

Sanergy's Fresh Life Toilet (FLT) operation fills a gap in sanitation service provision in the informal settlements where it operates that results from the unplanned nature of these settlements and severe space constraints. FLTs have a minimal footprint and only require on-foot access. By contrast, water-based sanitation—pour-flush toilets—requires access to a sewer, whereas sewers generally do not penetrate into the heart of the informal settlements. In addition, FLTs have the significant advantage of not requiring water to operate, as the main cover material in use is sawdust, which can increase resilience where water scarcity is a challenge. Pit latrines fill up and have to be emptied, which is an unpleasant manual process, and when this is performed at present, the excreta is often dumped in the nearby environment.

An evolving policy landscape and significant investment by Sanergy and others has radically changed the status of container-based sanitation (CBS) in a short time. When Sanergy began operating, it faced resistance from the Nairobi City County Government (NCCG), which was skeptical of the legality of CBS services. Sanergy introduced a government liaison team that established and maintained a dialogue with policymakers at city–county level and the national level. Over time, the Nairobi government has come around to seeing CBS as a high-quality solution and an important one for at least the medium term. At national level, the Kenya Environmental Sanitation and Health Policy (KESHP) 2016–30 explicitly recognized CBS as an accepted technology.

FLTs are generally well managed and deliver a high standard of service, leading to high user satisfaction. The franchisees that operate the toilets are usually individuals or small partnerships so that management responsibility is concentrated. FLTs that do not keep to minimum standards are shut down (excreta containers removed) and debranded.

Users of Sanergy's toilets are paying much the same rates as they would for other toilet options. Sanergy leaves it to the Fresh Life Operators (FLOs) to set the price per use; hence, market forces prevail, and the estimated annual cost to users of its commercial (public) toilets is about US$18. Residential toilet fees are covered in the rent, though some landlords do not increase the rent after installing a Sanergy toilet as they see it as a way to maximize occupancy levels. School toilet prices are included in the school fees.

The FLT operation shows promise to provide a highly cost-effective sanitation solution at scale. Financial modeling of Sanergy's expansion plan, conducted by Sanergy, shows an increase in cost recovery from the toilet servicing and fees paid for the feedstock value of the feces from 20 to 70 percent. The expansion is projected to take seven years, with the addition of 2,000 toilets per year to Sanergy's Fresh Life network, during which time the subsidy required (costs not covered by revenues) per person should rapidly reduce—from about US$19 per person in the first year to about US$2 per person per year once expansion is completed.

Sanergy has an ambitious expansion plan that will need to be monitored to verify assumptions, in particular, in terms of the number of users per toilet. Increased dominance of the residential model, should the commercial model market penetration plateau, could lead to the average number of users per toilet falling as most residential compounds are relatively small (eight households or fewer). Sanergy can monitor this after having established the mean mass of excreta per use, and it would be important to follow this metric, adjust the cost model for the expansion, and report this to partners such as donors, regulators, and authorities to inform its planning processes.

Continuous research, development, and piloting of new approaches has been key to Sanergy's progress and success and has been enabled by a strong funding base. Sanergy has been very successful in raising funding from donors and investors. This has allowed it to aggressively pilot new approaches, generating growth via new business models where older ones were appearing to face headwinds or reach limits. However, this raises a risk as its services are highly dependent on receiving a continuous stream of external funding.

References

Ernst & Young. 2014. *Feasibility Study on Charging Sewerage Services Levy to Cover Part of the Collection, Treatment, and Disposal Cost in Kenya's Urban Centers.* WASREB (Water Services Regulatory Board).

JICA (Japan International Cooperation Agency) and the Government of Kenya. 2013. "Final Report Volume IV, Sectoral Report 1/3 Section D: Sanitation." In *The Project on the Development of the National Water Master Plan 2030 in the Republic of Kenya.* A report by Nippon Koei Co., Ltd. for JICA; the Ministry of Environment, Natural Resources and Water; and the Water Resources Management Authority.

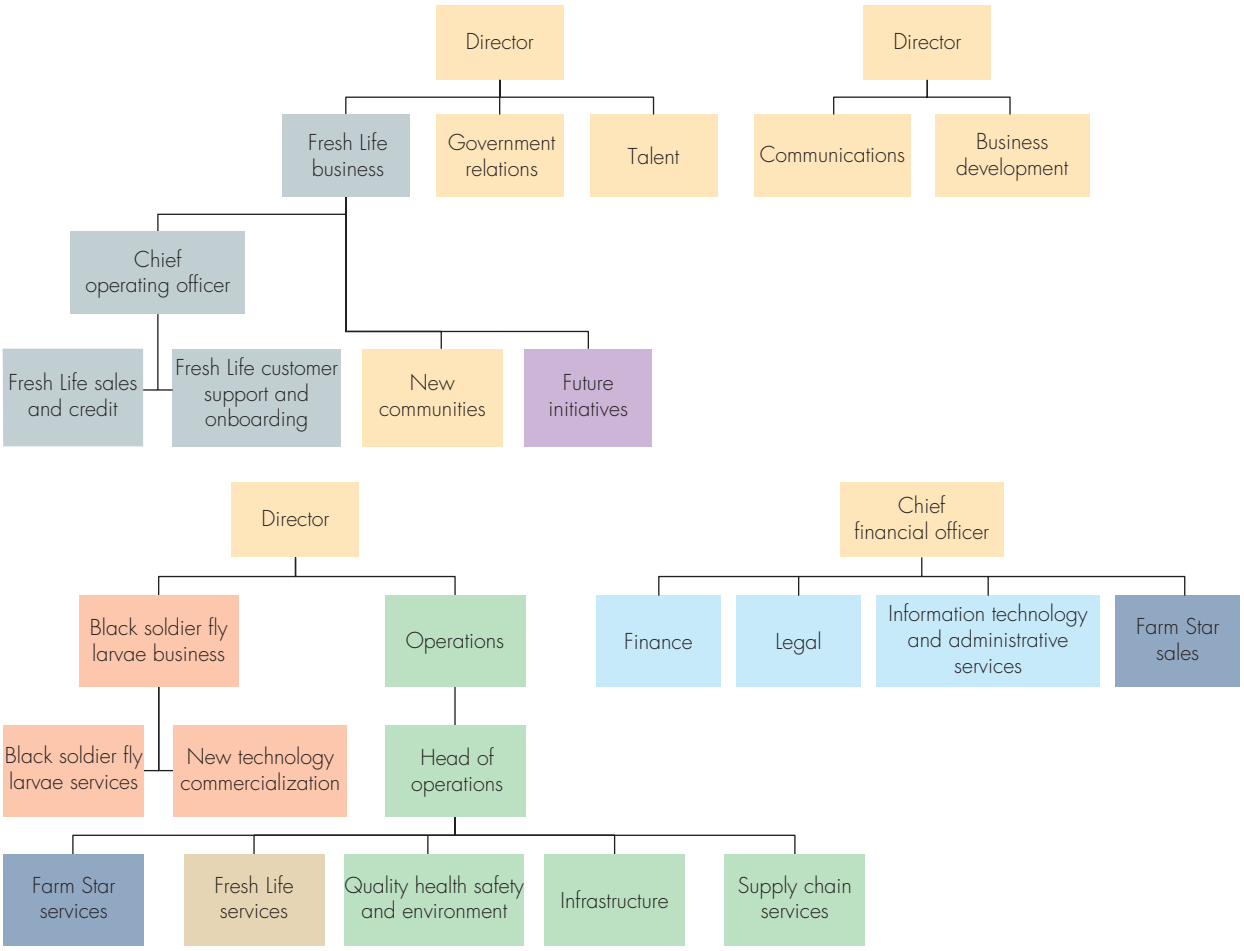
APPENDIX A • PEOPLE INTERVIEWED

Organization	Position	Name
Sanergy	Co-founder/director	David Auerbach
Sanergy	Co-founder/director	Lindsay Stradley
Sanergy	Co-founder/director	Ani Vallabhaneni
Sanergy	Chief financial officer	Sanj Sanampudi
Sanergy	Customer support manager	Joseph Githinji
Sanergy	Fresh Life chief operating officer	Titus Kuria
Sanergy	Fresh Life services manager	Eric Machango
Sanergy	Government relations manager	Alex Manyasi
Sanergy	Head of operations	Michael Lwoyelo
Sanergy	Residential customer support assistant manager	Florence Mwikali
Sanergy	Commercial customer support assistant manager	Peter Khaemba
Sanergy	Schools customer support assistant manager	Polycarp Sifuna
Sanergy	Treatment site manager	Kennedy Okwany
Nairobi City County	Public Health deputy director	Jairus Musumba
Nairobi City County	Water and Sanitation director	Kainga Mario
Ministry of Health	Public Health director	Kepha Ombacho
Ministry of Water and Irrigation	Sanitation director	Rose Ngure
National Environment Management Authority	Compliance and enforcement officer	Maurine Njeri
Imara Daima location	Assistant chief	Mark Nyasera
Mukuru kwa Njenga location	Senior chief	Jonathan Musila
Shauri Moyo location	Assistant chief	Hezekiah Obongita

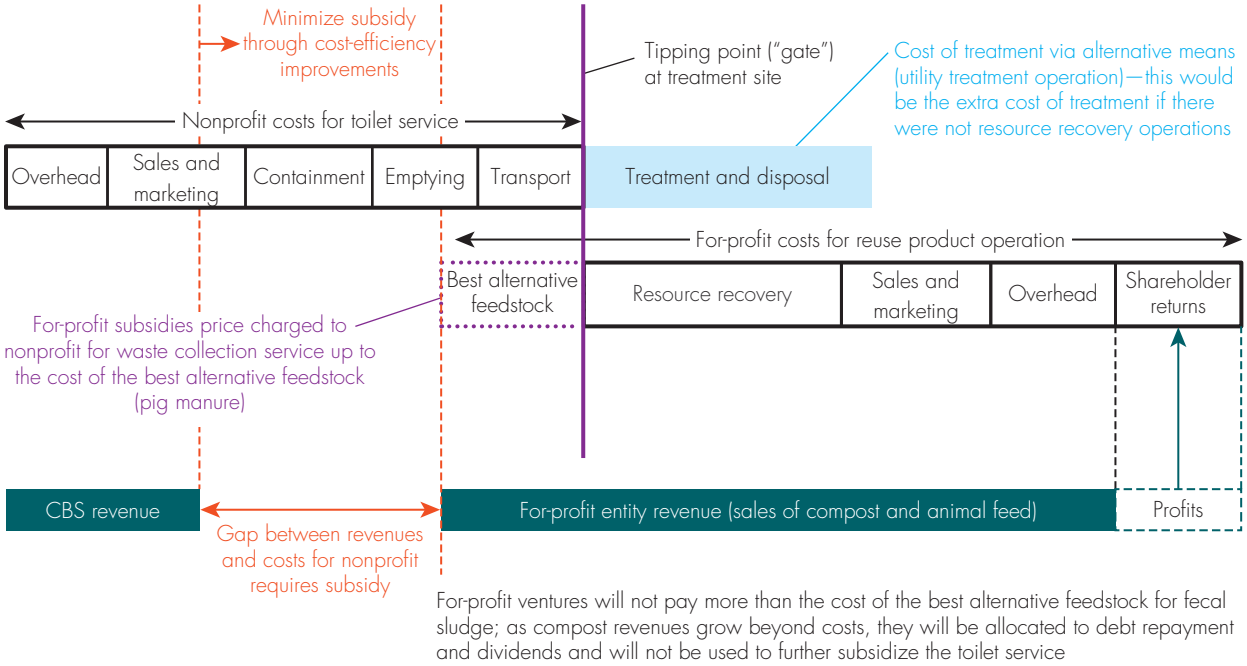
table continues next page

Organization	Position	Name
Shauri Moyo location	Chief	Florence Mbwika
Land Mawe (Kayaba) location	Chief	Solomon Muragori
Goeta School, Mukuru	Teacher	James Mutonga
Goeta School, Mukuru	Boys' focus group (five, from classes 4–7)	Anonymous
Goeta School, Mukuru	Girls' focus group (five, from classes 4–7)	Anonymous
Pilot School, Mathare	Head teacher	Aloyss Oyoma
Pilot School, Mathare	Boys' focus group (five, from classes 6–8)	Anonymous
Pilot School, Mathare	Girls' focus group (five, from classes 6–8)	Anonymous
Fresh Life Operators (FLOs)	FLOs (eight: three residential, three commercial, two hybrid)	Anonymous
Community	Fresh Life users (five) and non-users (one)	Anonymous
Bill & Melinda Gates Foundation	Demand-Led Sanitation senior program officer	Jan Willem Rosenboom
World Bank Kenya Office	Senior Water and Sanitation Specialist	Chris Heymans
World Bank Kenya Office	Operations Analyst	Lewnida Sara
Osprey Foundation	Managing director	Louis Boorstin
Vitol Foundation	Head of Water, Sanitation, and Hygiene	Regis Garandeau
Vitol Foundation	Board member	Richard Carter

APPENDIX B • SANERGY ORGANOGRAM



APPENDIX C • COSTS, REVENUES, AND CROSS-SUBSIDIES WITHIN SANERGY



Note: CBS = container-based sanitation.

GWSP
GLOBAL WATER
SECURITY & SANITATION
PARTNERSHIP

WORLD BANK GROUP

W18042