

CASE STUDY

**SCALING SANERGY:
GROWING A PROMISING
SANITATION STARTUP**

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No innovation in the past 200 years has done more to save lives and improve health than the sanitation revolution triggered by invention of the toilet. But it did not go far enough. It only reached one-third of the world.

– Sylvia Mathews Burwell, Former U.S. Sec. of Health & Human Services¹

Some poop here and there. Others do it in a special place.

– Taro Gomi, Author of children’s book *Everyone Poops*

In May 2018, at Sanergy’s headquarters in Nairobi, Kenya, president and co-founder David Auerbach stood in front of a satellite map of the city. He surveyed the irregular clusters of grey and brown that characterized Nairobi’s slum communities, noting the highlighted areas indicating the locations of Sanergy’s toilets.

In the seven years since Auerbach and his partners founded Sanergy, they had demonstrated not only the effectiveness of a market-driven approach to sanitation infrastructure, but also a path to profitability which Auerbach called “turning sh** into gold.” This path involved franchising toilets to urban slums in Nairobi, then collecting the raw sanitation waste for conversion into fertilizer and insect-based animal feed.

“The lesson is clear,” Auerbach said. “If we can provide the services they demand, residents of slums will invest in hygienic sanitation.” The potential returns on such investment were enticing. Poor sanitation led to a global loss of \$260 billion annually² and more than 2 million preventable

¹ Sylvia Mathews Burwell, “Reinventing the Toilet,” Bill and Melinda Gates Foundation, speech given on July 19, 2011, <https://www.gatesfoundation.org/media-center/speeches/2011/07/sylvia-mathews-burwell-reinventing-the-toilet> .

² World Health Organization, “Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage,” 2012, http://www.who.int/water_sanitation_health/publications/global_costs/en .

deaths per year,³ most of them children. The World Bank estimated that every \$1 invested in sanitation generated a \$5 return between the prevention of sanitation-related deaths, overall savings on healthcare, and increases in productivity and working hours due to reduced illness.

Kenya's urban slums alone lost \$270 million dollars due to poor sanitation, which was why Auerbach was especially excited about one particular metric: Sanergy could theoretically provide sanitation services to slum residents at a cost to the government of less than \$10 per person per year, as compared to around \$55 per person for the average running-water sewer system.⁴ This theoretical cost was contingent upon Sanergy saturating the market in *all* of Nairobi's slums, in order to leverage economies of scale in both collecting waste and culturing fertilizer.

Auerbach stepped back from his satellite map, feeling overwhelmed by the sheer volume of Nairobi slum-dwellers still lacking toilets. Sanergy was installing 100 new toilets per month, and that rate was increasing fast, but Auerbach's team still had a long way to go before reaching their targeted economies of scale. Moreover, Sanergy's success seemed a mere drop in the bucket considering the *4.5 billion* people worldwide (indeed, 61% of the world's population) who lived without adequate sanitation.⁵ Could Sanergy ever grow enough to seriously cut into that number?

Now that Sanergy's for-profit arm was finally generating revenue, it was time to consider the next steps to grow the company. Sanergy could sell much more fertilizer to farmers, but to reach economies of scale they would have to significantly increase the amount of waste being collected. Increasing waste collection would require installing more toilets, which meant that Auerbach needed additional funds. Was it best for Sanergy to stay focused on growth in Nairobi, where the team knew its local community and had a proven track-record? Or did it make more sense to pursue large government infrastructure projects in other countries, where public funds for sanitation projects might be more readily available?

Behind Auerbach, Sanergy's main office was a bustling open workspace that felt like a modern tech startup despite being a converted warehouse in the heart of Nairobi's slums. On a blue wall in large white letters was a quote from environmental activist and Nobel laureate Wangari Maathai: "No matter who or where we are, or what our capabilities, we are called to do the best we can." How could Auerbach continue to do the best he could while scaling up his company?

³ United Nations, "Clean Water and Sanitation: Why It Matters," 2016,

<http://www.un.org/sustainabledevelopment/wp-content/uploads/2016/08/6-Why-it-Matters-Sanitation-2p.pdf>.

⁴ Sanergy calculated comparison estimates using figures from a cost analysis conducted in Dakar, Senegal (see cost figures in table on page 4): Pierre-Henri Dodane, Mbaye Mbéguéré, Ousmane Sow, and Linda Strande, "Capital and operating costs of full-scale fecal sludge management and wastewater treatment systems in Dakar, Senegal," *Environmental Science & Technology* 46, no. 7, 2012: 3705-3711.

⁵ World Health Organization and the United Nations Children's Fund, "Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines," 2017, <http://www.who.int/mediacentre/news/releases/2017/launch-version-report-jmp-water-sanitation-hygiene.pdf>.

Figure 1. From left to right: co-author Georgina Campbell-Flatter, Ani Vallabhaneni, Lindsay Stradley, David Auerbach, and Megan Mitchell (Legatum Center Program Manager)



Source: Casewriters

Finding a Profitable Pipeline

In 2004, after Auerbach graduated from Yale University in American Studies, he moved to Hunan Province, China to teach English for two years. There, he became acutely aware that much of the world lacked access to toilets and proper sanitation. Auerbach saw the consequences of daily stress, disease, and childhood mortality and began wondering, why were there so many terrible toilets? Isn't this a solvable problem?

He kept these thoughts in mind when he moved back to the United States and settled in New York City (a place that had historically struggled with its own share of sanitation challenges, including dumping raw sewage into the Hudson River as late as the 1980s). Auerbach worked at the Clinton Global Initiative and managed partnerships and outreach at Endeavor, a non-profit that supported for-profit entrepreneurs in emerging markets. Working at Endeavor sparked his interest in using market-based solutions to solve widespread social challenges. He soon realized that he wanted to start his own initiative, though he wasn't entirely sure what that should be.

In 2009, while on the lookout for exciting problems to tackle through market-based solutions, Auerbach began his MBA program at MIT's Sloan School of Management. Before school started, he signed up for a pre-orientation trip in New Hampshire to connect with likeminded first-year

students. He chose hiking over the whitewater rafting option, hoping it would be easier to meet like-minded folks while on a hike rather than screaming his way down the rapids.

This proved a fateful choice. While hiking through New Hampshire's colorful fall foliage, Auerbach bonded with his fellow classmates Lindsay Stradley and Ani Vallabhaneni. Auerbach recalls that they immediately felt they were all "kindred spirits." Stradley was an educator and consultant from Georgia who had developed a charter school, taught in New Orleans after Hurricane Katrina, and later worked at Google. Vallabhaneni was a computer scientist and operations expert from Illinois, who had recently returned from a consulting project in the Philippines to make a chain of clinics self-sufficient. When classes began, the trio decided to take MIT's Development Ventures course together with the explicit intention of cofounding a viable startup that would help the planet.

The three had an interest in systems thinking and systems change, and they saw that the sanitation crisis was in dire need of innovative solutions. Even in well-developed cities, sewage systems had changed little since the Bronze Age; cities continued to use relatively fresh water to flush sewage from buildings and households into massive holding tanks, where toxic and inefficient treatments were not always successful in properly decontaminating the waste. The three co-founders all agreed that sewage collection and treatment in the developing world could only become profitable if they took a systems-level approach; governments in emerging markets were unlikely to be able to afford traditional sewage infrastructure, so they would have to devise a company that could somehow add enough value to the waste to subsidize collection and treatment.

After brainstorming various schemes for sewage conversion in Development Ventures, the team decided to focus on biogas digestion. Turning waste into biogas initially seemed promising, partly because funders and development experts seemed particularly excited about energy generation. Auerbach and his co-founders combined "sanitation" and "energy" to get their company name "Sanergy," and then set about developing their business model.

By the end of the semester, however, it became apparent that biogas was not very profitable without an enormous amount of sanitation waste from the outset. Given the difficulty in scaling up a biogas endeavor, Sanergy's co-founders decided to pivot to something that could give them a faster return on their investment.

Looking over the list of viable products to make out of human waste, the co-founders found fertilizer to be the most promising. For a company that would have to navigate a lot of risk elsewhere, fertilizer seemed like a welcome safe bet. After all, humans had been converting stool and urine into fertilizer since ancient times. This was a well-proven agriculture technology, and conversion was mainly a natural process of decomposition. Agriculture was the backbone of most developing economies, but few countries outside the United States and Europe actually manufactured their own fertilizer, and even fewer used natural rather than chemical options. Thus, Auerbach, Stradley, and Vallabhaneni developed a new business model around fertilizer production. By then, despite their pivot away from energy, the name "Sanergy" had stuck and they decided to keep it.

The team settled on Nairobi as their initial market, viewing it as an entrepreneurial hub of major donors, like-minded businesses, non-profits, consultancies, and impact investors. Social initiatives such as renewable energy provider M-KOPA and the agriculture non-profit One Acre Fund had paved the way for future impact-driven business models in Nairobi. “It’s easy to learn from these guys,” said Auerbach, emphasizing that fellow entrepreneurs often went out of their way to aid likeminded businesses.

For the final part of their Development Ventures class, the Sanergy team travelled to Nairobi together over the month of January to investigate sanitation companies. Their roles as students conducting a research project opened doors for them to meet and interview potential competitors. Instead of being overly guarded and uncooperative for fear of the Sanergy team stealing company secrets or copying their methods, all the waste companies around Nairobi were actually happy to share ideas with students. At the end of the month, Auerbach and his team wrote a white paper on sewage collection in Nairobi, which they then shared with all their contacts. This report revealed considerable fragmentation along the waste-collection supply chain and significant opportunity for Sanergy to add value within slum communities rather than compete with incumbents. In addition to gathering research, Sanergy’s co-founders realized that they especially enjoyed working together in the field, outside of MIT’s air-conditioned classrooms and conference rooms. They resolved to strengthen their commitment to Sanergy.

When Auerbach returned to MIT Sloan for his second semester, he made all of his classroom projects about Sanergy. In his Pricing class, for example, he developed a model for how much people would be willing to pay for sanitation services. His fellow classmates, many of whom were far more experienced in the subject, were excited to help him out. Auerbach also met Kenyan Sloan professor Tavneet Suri, and she put him in touch with several colleagues in Nairobi who helped Sanergy sort out land acquisition and set up its first two toilets.

Sanergy also applied for MIT’s \$100K business plan competition.⁶ Yet with only three co-founders, the beginnings of a business plan, and no actual toilets built, the team did not yet have enough evidence of success. They also didn’t yet have (in Auerbach’s words) that “insanely inspiring story” that could really persuade judges. He admits Sanergy “bombed” the \$100K competition its first time around.

The following year, Auerbach and Vallabhaneni were awarded Legatum Fellowships⁷ through MIT, which covered a significant portion of their tuition and left them with less debt and more freedom upon graduation to pursue their entrepreneurial purpose. Auerbach and his co-founders then resolved to recruit a larger, more robust team and reapply for the MIT \$100K Competition again in 2011. Since his original team was comprised of three MBA students with relatively similar skills and no practical engineering abilities, Auerbach started attending interdisciplinary

⁶ The MIT \$100K is a 29-year-old startup competition in which students and researchers from across MIT and Greater Boston compete in three different contests (Pitch, Accelerate, and Launch) to win financial prizes for their ventures.

⁷ The MIT Legatum Center for Development and Entrepreneurship awards a one-year fellowship to around 20 MIT student-entrepreneurs who are developing enterprises in emerging markets. Fellowships provide tuition, mentorship for project development, and a stipend for travel and other expenses.

networking events across MIT's campus. Sanergy eventually recruited a civil engineer, a chemical engineer, and a mechanical engineer and educator from MIT's Development, Design, and Dissemination Lab (D-Lab). This expanded team was able to prove that Sanergy's two pilot toilets were going strong, and all co-founders were determined to develop their company regardless of whether they won the competition.

In its second attempt, the Sanergy team took first place in the \$100K Competition, then went on to win an additional \$100,000 from MassChallenge.⁸ By the time they graduated in 2011, Auerbach and his team had won a combined \$350,000 in grants and social enterprise fellowships, providing them with a runway of six months in Kenya while they honed their business strategy. The three co-founders, along with several of the most committed people on Sanergy's founding team, all moved to Nairobi.

Auerbach continued fundraising after moving to Nairobi, though he found funders around Kenya to be less interested in taking an unproven risk on sanitation than their counterparts in the United States and Europe. Even so, by leveraging his track record in competitions, Auerbach was able to raise a convertible note round that bought Sanergy an additional year of runway.

Auerbach preferred raising a convertible note round of funding to raising pure equity, since he found this system friendlier toward entrepreneurs. Convertible notes initially get written up as loans, and then convert into equity once a startup raises actual capital. For Sanergy, this equated to a two-page legal document rather than the typical 50-page document (and the requisite lawyers) needed to negotiate a full equity round. Sanergy's convertible note enabled the team to delay major discussions of valuation until later on, when the company would have greater proof of the viability of its business model.

After a year of operations and the initial success of its business model, Sanergy raised its Series A round from several impact investors in April 2013.

A Crappy System Full of Holes (and Plastic Bags)

Across Kenya in 2017, 8 million people lived in dense, informal housing settlements commonly referred to as "urban slums." Very few of these ramshackle slum houses had any form of hygienic sanitation. Auerbach discovered that the government of Kenya paid \$3 per person per year for its official sewage system, but that system served only a small fraction of the population. Even in the bustling metropolis of Nairobi, water constraints further limited the growth of a traditional pipeline sewage system; only 40% of Nairobi residents had reliable access to running water in 2017, and two-thirds of the city's 4 million people had no access to proper sanitation facilities.⁹

⁸ Based in Boston, MassChallenge is an international acceleration and grant program that supports local startups by bringing together corporates, policy-makers, and other stakeholders to provide mentorship and scholarships for qualified entrepreneurs.

⁹ Cathy Watson, "Thirsty city: after months of water rationing Nairobi may run dry," *The Guardian*, July 24, 2017, <https://www.theguardian.com/global-development-professionals-network/2017/jul/24/thirsty-city-after-months-of-water-rationing-nairobi-may-run-dry>.

The few toilets that did exist were mostly holes in the ground, occasionally emptied out by “frogmen” who physically jumped inside to shovel out the waste. They collected and transported the waste in rickety wheelbarrows colloquially referred to as “ambulances” because everyone rushed to get out of the way as the carts sloshed down residential paths.

For residents of urban slums who lacked sewage holes under their houses, there were three options:

1. People could use free public toilets on the outskirts of slums, which were often far away and frequently backed-up. These public toilets were especially dangerous for women who risked assault and even rape when seeking out a distant toilet after dark.
2. One could pay to use the private toilets, which were mostly pit latrines. These did receive regular maintenance, but usually flowed directly into rivers and canals where they caused disease and water pollution.
3. Finally, the infamous “flying toilets” consisted of pooping into a plastic bag and throwing it as far away as possible. This option was often the cheapest and easiest, but also the most detrimental to the local environment. Shopkeepers were especially revolted by this practice, as poop-filled bags tended to stink up the vicinity and drive away customers.

Toilet by toilet, Sanergy began to alter this landscape.

Pivoting Whenever Sh Hit the Fan**

Although Sanergy’s co-founders arrived in Nairobi with a solid business model, they shifted many aspects of their company along the way. For instance, their original plan was to work primarily with teenagers in youth groups as franchisees, rather than professional adults. But these youth proved difficult to work with, Auerbach said, because they were unaccustomed to responsibility. They also tended to band together which made them harder to influence constructively than if they identified more strongly as individuals.

In its early days, Sanergy also struggled to deliver the right message about toilets to potential end users. Initial marketing focused too squarely on the dangers of poor health and other negative motivators. Potential customers occasionally expressed interest in asking about Sanergy’s bright blue outhouses, but no one actually showed up to buy the toilets. Sanergy then hired a local branding team, who suggested crafting a more positive message about the benefits of sanitary toilets and what that meant for a healthy lifestyle. They suggested the brand name “Fresh Life” for Sanergy’s toilets, which were then marketed through neighborhood block parties. Sanergy even commissioned hip-hop songs to play on local radio about the joys of “fresh” toilets.

After operating for a few years, Sanergy began moving their toilets closer together. This facilitated the servicing and guarding of the facilities, allowing the toilets to stay open after dark. It also cut costs considerably.

A major business shift for Sanergy came in 2016 after five years of operation, when the founders realized that they had been limiting their scale by charging franchisees for toilets up front rather than recouping costs over time. Initially, Sanergy would sell toilets to franchisees at either an up-

front price of US\$500, or through interest-free microfinancing schemes in partnership with Kiva Microfunds. Sanergy tried lowering the price to \$350, but even that proved too expensive for many prospective franchise operators, who tended to be self-employed in various informal businesses and had to plan for inconsistent cash-flows.

After carefully reconsidering customer needs and modeling alternative strategies, Sanergy decided to offer its toilets for no cost up front, then compensate by raising its annual waste removal fee by approximately \$30. This equated to a sort of pay-per-service model in which Sanergy effectively still owned all of its toilets, and franchisees paid for regular waste collection rather than for the toilet itself. Just a few months after shifting to this new model, Sanergy tripled its rate of new toilet installations.

Cultivating Success

Sanergy's founders hired executive coaches to help build a company that would attract top talent. In terms of workspace, Sanergy aimed to have its headquarters resemble a hip, friendly startup from Silicon Valley or Boston. The unstructured, open office layout allowed for easy collaboration across different teams. Inspirational quotes emblazoned the walls. To ensure regular Internet and power during Nairobi's often biweekly outages, Sanergy kept its own backup generator on-site. These choices set Sanergy far apart from other Nairobi offices, most of which followed a more traditional, individualistic layout with clusters of cubicles. Auerbach attested that his company's open culture helped with retention and increased productivity.

Sanergy recruited employees primarily through word-of-mouth marketing rather than by soliciting applications from the general public. Only a few of their full-time employees had college degrees, but Sanergy also recruited many fellows from top North American universities (e.g. MIT, Yale, and Stanford) to intern for the summer and sometimes longer. Auerbach said that even three months could provide enough time for interns to develop interesting projects and create value for Sanergy, especially because they were embedded in local teams and managed by Kenyan team leads.

Sanergy had strict moral guidelines for professional behavior, including a zero-tolerance policy for corruption. Once, the company had an open tender for a construction project in which vying companies were supposed to stay blind to each other's bids. Yet a Sanergy employee shared confidential information with a friend, enabling that friend's company to drop their own bid price. Although this employee thought he was doing the right thing—that is, by helping a qualified friend get work and helping Sanergy get a lower price—Auerbach and his fellow executives were compelled to let the employee go in order to set an anti-corruption precedent.

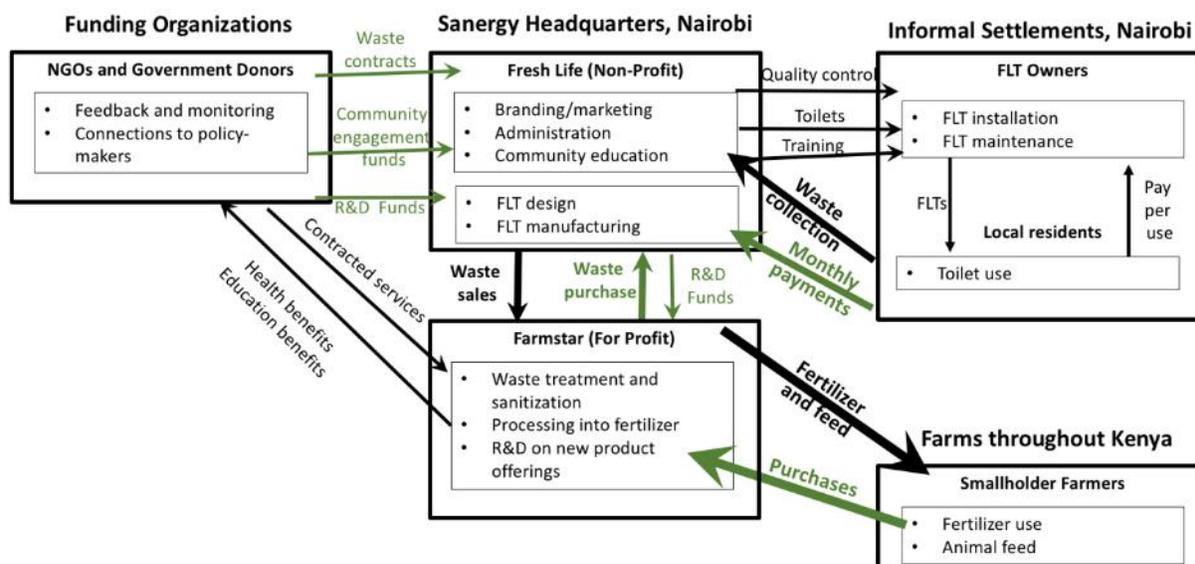
Sanergy's Hybrid Model

To make quality sanitation profitable, Sanergy had to keep adding value everywhere it could. In Auerbach's words: "Sanergy takes a systems-based approach that engages the community at every step and, in doing so, guarantees that residents of slums gain access to the hygienic sanitation services they both need and want."

Sanergy was structured according to this systemic approach. Officially, there were two independent entities— a for-profit and a non-profit. Auerbach was the legal president of the for-profit and a manager of the non-profit, and he only served on the for-profit’s board. Stradley ran the non-profit and Vallabhaneni ran the for-profit. This hybrid business model enabled enhanced participatory financing, so Sanergy could receive both donations and investment. Auerbach noted that transitioning at a later stage from non-profit to for-profit, or vice versa (or even adding on a new hybrid arm to one’s company) could be very challenging. By having two entities from the beginning, Sanergy’s legal structure was fairly straightforward.

Sanergy’s for-profit arm, Farm Star, focused on clearly established market opportunities. It collected waste and processed it into fertilizer and insect-based animal feed which it sold to farmers – an established market. The non-profit arm raised funds mostly from family foundations who sought measureable health, social, and environmental impacts in Nairobi’s slum communities; this arm built the sanitation network and supported franchise operators. The for-profit arm off-took the waste from the non-profit. Thus, both sides of the company were highly incentivized to work together for mutual benefit.

Figure 2. Sanergy’s two-pronged business model



Source: Casewriters

Non-profit: Fresh Life

Fresh Life’s model involved the distributed capture of waste: Fresh Life employees regularly went out and collected the waste from all the Fresh Life toilets (FLT’s), and this waste was then centrally processed by Sanergy’s Farm Star arm. As of May 2018, Sanergy had 1,800 FLT’s in operation. Unlike the informal “frogmen” who cleaned out pit toilets, Fresh Life’s waste collectors were trained professionals with excellent employee benefits. All workers received health insurance, full personal protection equipment, and inoculations to protect against waste-borne disease. They used

handcarts to safely carry covered barrels of waste out of densely populated areas, then loaded them onto specialized trucks for transportation to Farm Star facilities.

Figure 3. “Frogmen” waste collectors on left, as compared to Fresh Life collectors



Source: Sanergy

Sanergy’s engineers designed a robust toilet station which was easy to clean and empty, and eventually decided to build all its outhouse components in-house. These cheerfully painted boxes featured blue concrete walls decorated with the Fresh Life logo, a sturdy concrete base covered in tiles, and a plastic squat-toilet in which urine and feces were separated into their respective buckets. Sanergy constructed its own concrete factory for pouring slabs to make the outhouse walls, which were simple to transport and install. The team started with an off-the-shelf toilet bowl, but eventually developed a more ergonomic design of their own, which was injection-molded in Nairobi to Sanergy’s specifications. Each toilet included hand-washing facilities as well as a mirror, just like the amenities of any modern bathroom.

Figure 4. Private pit latrines on left, as compared to a Fresh Life Toilet



Source: Sanergy

Figure 5. Inside of a Fresh Life toilet



Source: Sanergy

Fresh Life used different outreach and marketing strategies to cater to its diverse stakeholders: FLT franchisees, FLT users, international donor organizations, and local governments.

Fresh Life Toilet Franchisees

Fresh Life provided free toilets up front to its operators, and made up the cost of production, collection, and maintenance by charging these franchisees a regular fee of \$70/year. Fresh Life guaranteed comfortable and hygienic toilets that could reliably serve 50-100 people per day.

Unemployment in Kenya's informal settlements was nearly 40%,¹⁰ so the ability to generate revenue was a primary interest for these stakeholders. A well-placed FLT generated around \$1,000 in profit per toilet per year, with minimum effort on the part of the operator. Operators typically charged customers a few cents per use, and paid a flat monthly fee to Sanergy to cover collection costs.

Fresh Life provided operators with an occupation that was not only profitable but meaningful; franchisees were helping to improve the health of their local neighborhood. Upon installation of a new toilet, Fresh Life Operators (FLO'S) received a kit which included a Fresh Life uniform, a sign, a bucket for washing hands, and soap. Fresh Life employees would perform occasional spot-checks on franchisees to ensure that toilets were well-maintained, water and soap were in ready supply, and the quality of the brand was being protected.

Figure 6. The FLT operator starters' kit



Source: Casewriters

¹⁰ United Nations Development Programme, "Human Development Report 2016: Human Development for Everyone," 2016, <http://hdr.undp.org/en/2016-report> .

In addition to these pay-per-use commercial toilets run by local entrepreneurs, which initially comprised about half of all their franchisees, Fresh Life also provided toilets to residences and community institutions (primarily schools).

Landlords on private plots of land were installing and operating residential FLT's in order to increase the value of their rental properties. These landlords often had no toilet facilities prior to purchasing FLT's. Most of Fresh Life's landlord-customers supervised five to 15 rooms, and each toilet served four to five people. Some landlords who installed FLT's saw their occupancy increase by as much as 60%, and rental plots with FLT's remained consistently at 100% occupancy. Some landlords even reported receiving their rent payments more promptly. Residential toilets grew in popularity, making up about 60% of the FLT network in early 2018.

Schools, churches, clinics, and other community institutions were also operating FLT's, and here too customers saw rapid returns on investment. Given the paucity of decent toilets in local schools, it made sense that schools with FLT's were seeing up to 20% increases in enrollment. This was especially significant for private schools which, as businesses, had to compete for students with other educational institutions. Quality school toilets were particularly vital for female students, who would often opt to stay home during menstruation if their schools lacked safe, hygienic, and private facilities.

Toilet Users

A second key group of stakeholders for Fresh Life were the customers of its commercial franchisees, i.e. the slum residents who used commercial FLT's on a pay-per-use basis. Many residents had initially been unwilling to pay to use FLT's since they had other free (albeit sub-par) options available. However, once enough people heard Fresh Life's songs on the radio or tried out FLT's for free during block parties and other promotional events, they came to appreciate the comfort difference between pit toilets and higher quality facilities. Those who tried FLT's generally preferred to keep using them, and network effects came into play as enthusiastic customers referred their friends and neighbors.

International Organizations

Given the difficulties inherent in working in an emerging market, compounded by the particular challenges of Nairobi's sewage systems, Auerbach found grant funding to be essential. Fresh Life's donors wanted to see metrics around health impacts, such as decreases in diarrhea rates or increases in school attendance. They also wanted to see evidence of Sanergy's potential for profitability and scalability.

Auerbach knew Sanergy couldn't rely upon donated funds in this way forever; it was vital to make his business model viable for governments as soon as possible. Still, he did plan to continue funding Sanergy's ongoing research and development through grants and donations to the Fresh Life arm, in order to help "iron out the inefficiencies" in Sanergy's operations. The Bill and Melinda Gates Foundation, for instance, had been funding a variety of research projects around turning waste into useful end products, and Fresh Life had become a key partner in implementing

these ideas. This partnership had already led to Farm Star’s insect-based animal feed, and Auerbach hoped it would yield other lucrative opportunities in the future.

One challenge for Sanergy’s research and development team had been finding the right balance between exploration and focus. They didn’t want to spread themselves too thin by researching a wide variety of possible products, but they also had to avoid honing in too early on a few promising projects to the exclusion of other opportunities. As Auerbach said, “the notion that one solution will be correct is preposterous, so there’s a constant questioning [within the team].”

Local Governments

Since Sanergy was playing a role that had traditionally been managed by the public sector, it was especially important for the company to have excellent relationships with local governments. “Even if you have a better solution,” said Auerbach, “you are going to anger people in the public sector unless you work with them.” Sanergy had five full-time employees dedicated to government relations. Part of their job was to secure land access for FLT’s and waste processing. “Our approach is to be completely transparent,” Auerbach said, “and to actively engage people.” Thanks to these efforts, Sanergy was encountering very few road blocks from the government, which was uncommon for a private company building any sort of public infrastructure in Nairobi.

For-profit: Farm Star

Farm Star’s primary stakeholders were farmers with 2-50 acres of land who grew crops and/or reared livestock. In 2017, Farm Star was only using solid waste; it poured the urine into established sewers, though the company’s scientists were actively experimenting with processes to convert urine into a nitrogen-rich liquid fertilizer.

Farm Star processed the fecal waste to break down any pathogens, and created an organic,¹¹ nutrient-rich fertilizer called *Evergrow*. Farm Star mixed this with food scraps purchased from local compost companies to further enrich the final fertilizer. The company had recently started a new business that collected other forms of organic waste, and hoped to add in more food-waste streams in the future.

It took 8-10 months to properly convert fecal waste into compost, during which time the microbe-induced temperatures became high enough to kill any dangerous pathogens. This lengthy production period had proven a particular challenge for Sanergy, since the process required considerable quantities of solid waste (hence Sanergy’s economies of scale) as well as swaths of land to culture the product. Land was expensive, but luckily Sanergy’s team had collaborated with the local government to obtain an affordable plot outside of the city for processing. Sanergy anticipated scaling up from five to fifteen acres in 2018.

There were few organic fertilizer manufacturers in Kenya in the local market, and Farm Star quickly became Kenya’s largest producer of organic fertilizer. Even so, chemical fertilizers were

¹¹ The term “organic” here refers to fertilizer made from plant or animal matter rather than from minerals or from an industrial chemical process.

much cheaper, so Farm Star’s marketing efforts had become crucial in convincing farmers to try investing in its brand. Its value proposition was simple: Farm Star fertilizer gave farmers more produce in the short-term and better soil in the long term. Compared to inorganic fertilizers, Evergrow retained more moisture and phosphates, improving overall soil quality over time. It also had favorable amounts of nitrogen and carbon. The result? Farm Star’s trials indicated that Evergrow could increase crop yields by up to 30% in a single growing season.

Like Fresh Life, Farm Star had also struggled to get potential customers to try the product. “Seeing is believing,” admitted Auerbach. To this end, Farm Star offered free trials of Evergrow, and persuaded farmers to run their own pilots and report on the results.

In 2012, the Gates Foundation had proposed that Farm Star should try cultivating Black Soldier Fly larvae to make insect-animal feed—a process that one of the Foundation’s partners had been testing out in the lab. Black soldier flies were one of nature’s most efficient organic waste converters, turning an unprecedented 10% of waste into fat and protein during their larval stage.¹² With support from the Gates Foundation, Farm Star started using its solid waste to raise colonies of soldier fly larvae, which were then boiled, dried, and sold to feed-millers who in turn would make high-protein animal feed for farmers. The same waste used to feed fly larva could subsequently be processed as fertilizer in a closed-loop system. “We’re double-dipping on everything,” said Auerbach proudly.

From 2013-2014, Farm Star developed a new product line, branded *KuzaPro*, which turned out to be a highly profitable market opportunity. The predominant animal feedstock in Kenya was fishmeal, which had variable quality, smelled terrible, and was unreliable given the dwindling numbers of fish in Lake Victoria. In 2016, Farm Star’s team increased its fly production to one metric ton per month, and customers were happily reporting that their chickens and pigs were growing as much as 30% larger thanks to a PureProtein diet.

Farm Star also had a number of other pilot initiatives still in the research and testing phase, including a reexamination of the Sanergy co-founders’ initial idea of turning sanitation waste into biogas.

Scaling up (without Pooping Out)

Standing in front of his Nairobi map, Auerbach traced his finger along the edges of highlighted, toileted clusters where Sanergy was having a serious impact. His eyes lingered in the larger swaths of gray and brown: the communities where Fresh Life had not yet built any toilets and might not for some time. Sanergy’s goal was to revolutionize urban sanitation systems worldwide. To date, the company had collected and converted over nine metric tons of waste, yet there was so much further they could go. Sanergy was playing the long game, and every growth spurt had to be strategic. Now that it had proven its business model and achieved profitability, what was the best next step?

¹² Denis Ruto, “Engineering solutions to optimize Black Soldier Fly production,” Sanergy Blog, August 2016, <http://saner.gy/archives/5755> .

Across its 1,800 active toilets in early 2018 (up from 750 in late 2016) Sanergy was serving 60,000 people per day across 11 informal housing communities, or an average of 10% of all residents in its operating regions. It had 220 full-time employees, and franchised toilets to over 1,000 operators who took home a profit of around \$1,000 per unit per year. This was a substantial supplementary income; in 2016, Kenya's gross national income (GNI) per capita was \$1,380.¹³

Unfortunately, a number of slum residents already had pit toilets and were unlikely to switch over to FLTs unless they could see significant benefits. Perhaps Fresh Life could start a new initiative to retrofit existing pit toilets into something more compatible with Fresh Life's waste collection process.

If Fresh Life could reach the point of collecting the majority of waste across *all* of Nairobi's informal settlements, Sanergy's projected costs would drop by 65%. The company could then provide sanitation services to slum residents at a cost to the government of \$4 per person per year. An additional \$11 per person would be required in participatory financing, which would be covered by Sanergy's fertilizer sales and routine toilet maintenance and collection costs. At present, the overall cost per person per year of Fresh Life Toilet maintenance was \$23 (including the \$11 of participatory funding).

Any new strategy had to include the ability to saturate the market—quickly—so that Farm Star would have enough waste to achieve economies of scale in both waste processing and fertilizer and animal feed production. Farm Star could not expand its operations into a new region without proportional growth from the Fresh Life arm of the company.

While Auerbach still foresaw a long-term reliance upon grant funding for research and development, he was excited about the prospect of transitioning his primary revenue stream from donor grants to sustained government funding. After all, sanitation in well-developed cities was funded through tax dollars rather than for-profit activities or grants. The problem was, the government of Kenya did not have any major sewage projects in the pipeline. In comparison, Zambia and Ghana both had plans to spend \$250 million to increase sewer coverage in urban centers. Ghana's current plans would provide sanitation infrastructure for 200,000 more people—yet Sanergy could theoretically serve the same number of citizens for a mere \$5 million, or 2% of the cost.

Thus, Auerbach faced two strategic dilemmas: should Sanergy focus on saturating its market in Nairobi, or expand internationally into a country with an increased willingness to pay? Furthermore, did it make sense to start diversifying his product on the Fresh Life and/or Farm Star side— or should he stick with his tried and proven products? To complicate matters, Farm Star's scientists had a number of new technologies that they were excited about turning into market pilots, and Auerbach had to decide how to respond.

Despite these daunting choices, Auerbach felt optimistic that his company was well-positioned for future growth. Humans around the world would continue to provide raw materials for

¹³ World Bank, "GNI per capita, Atlas method" for Kenya, 2018, <https://data.worldbank.org/indicator/NY.GNP.PCAP.CD?locations=KE> .

fertilizer, animal feed, and other waste-based products. And Sanergy, by “turning sh** into gold,” had demonstrated the success of its alchemical business model.

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Finally, we’d love your feedback! We may write case updates in the future and we appreciate fellow teachers’ input.

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