

UNLOCKING THE CIRCULAR ECONOMY POTENTIAL TO TACKLE THE SANITATION CHALLENGE

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We serve over 130,000 urban residents with safe sanitation every single day - ©Sanergy

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Most of the African countries are far from reaching the Sustainable Development Goal 6.2 aiming at achieving access to proper sanitation for all by 2030. Diseases related to poor sanitation, such as diarrhoea, cause thousands of preventable deaths, hamper productivity, education, and economic growth.

Sanergy has developed and runs a comprehensive model based on container-based sanitation and circular economy in Nairobi's slums. Sanergy has three main activities: (1) fabrication and installation of toilet units serving more than 130,000 people every day, (2) treatment of urban organic waste – kitchen, agricultural, market and faecal waste (12,000 tons of waste removed in 2019) and (3) commercialization of valuable end-products for the agricultural sector. Cracking the case was a hardship but working hands in hands with the local government and the communities enabled to create mutually beneficial collaborations. Sanergy proved that container-based sanitation (CBS) are adapted to slums. Achieving financial balance will require scaling up the operational model in order to collect enough raw material. This scalability challenge, in addition to the investment required to build strong relationships with local authorities, may explain why CBS solutions are not yet a widespread solution in African slums. The advocacy work carried out by Sanergy and other key players involved in the Container-Based Sanitation Alliance (CBSA) is aiming to accelerate these innovative solutions.

INTRODUCTION

Around the world, 2.3 billion people live without access to basic sanitation services. Almost 900 million of these people practice open defecation¹. Poor sanitation is the cause of multiple diseases (cholera, diarrhoea, dysentery, hepatitis A) as well as a multitude of social issues (anxiety, indignity, risk of sexual assault, loss of time). The problem is responsible for a global loss of \$260 billion annually². Finding solutions could help prevent more than 2 million deaths per year, most of them children³. In African countries, with a fast-growing population and limited government resources, responding to the sanitation urgent need is a vital challenge.

Sanitation has become a priority for the Kenyan government, but the lack of financial resources hinders sewerage projects. In Nairobi, two-thirds of citizens suffer from lack of access to sanitation services, as most of the urban slums are not connected to a sewer⁴. Sanergy is offering an innovative value proposition, built on a container-based toilet network and circular economy, to contribute to solving the sanitation challenge.

1 World Bank, 2015

2 WHO, "Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage", 2012

3 UN, "Clean Water and Sanitation: Why it matters", 2016

4 Cathy Watson, "Thirsty city: after months of water rationing Nairobi may run dry," *The Guardian*, July 24, 2017

THE SANITATION CHALLENGE IN AFRICA

WHY SANITATION MATTERS

Sustainable Development Goal #6.2 aims at achieving access to adequate and equitable sanitation and hygiene for all and put an end to open defecation by 2030. Despite significant progress since 1990 – over 2.2 billion people gained access to improved toilets – almost one on every three people in the world lives without proper access to sanitation⁵. In 2010, significant progress was achieved in Kenya when sanitation became a constitutional right. Article 43 of the Constitution provides that every person has the right “to reasonable standards of sanitation”. The Kenyan government has a strong ambition to eradicate open defecation by 2030 and the KESHP (Kenya Environmental Sanitation and Hygiene Policy), developed by its Ministry of Health department has already made progress in combating unsafe sanitation. Despite this political ambition, investments are not enough to reach the target: the government of Kenya spends only \$3 per person per year for the official sewerage system whereas \$54 would be necessary to serve everyone in the city⁶. Moreover, the population growth rate of Nairobi, almost 4% per year, urges the city to find other solutions, less expensive, more flexible, and faster to be deployed. On top of that, Nairobi is facing very frequent water crises, as the demand for its fast-growing population exceeds the supply capacity of its infrastructure (local dam, transfer canals, tunnels).

The benefits of a transition to safe sanitation for all are multiple. First, sanitation enables major health improvements, through a reduced number of diseases and improved nutrition. Diarrhoea is the 2nd mortality cause for children under 5. When it is not mortal, it causes stunting due to poor nutrition⁷. Second, the lack of sanitation hinders economic growth. Poor sanitation leads to gigantic losses, amounting to the equivalent of 6.4% of GDP in India (2006), 7.2% of GDP in Cambodia (2005) and 2.4% of GDP in Niger (2012)⁸. Premature deaths, health care treatment costs, loss of productivity, and loss of time are the main explanations of this cost. Moreover, improper disposal, and treatment of wastewater and faecal sludge seriously pollute the ecosystems. Human excreta are a burden for most countries, even though it could be turned into a profitable resource (fertilizer, energy, water, etc.).

Almost one out of every three people in the world lives without proper access to sanitation

POOR SOLUTIONS OFFERED TO CITY DWELLERS IN MOST INFORMAL SETTLEMENTS

Sewerage will not be feasible in every city, especially in the short-term. It requires billions of dollars and governments have often other priorities. Geography is also complex in urban slum areas which further hinders the development of these solutions.

When there is no sewerage to ensure individual equipment with safe and private toilets, residents are left with 4 options: (1) pay-per-use community pit latrine, expensive and in poor conditions, (2) plot toilets (shared between 10 to 50 households living in the same compound), pit latrines often in terrible conditions because they require regular maintenance, which is not always easily accessible (3) “flying toilets” (i.e. pooping into a plastic bag and throwing it as far away as possible), which has a detrimental impact on the living environment and (4) open defecation in open areas such as dumping yard, riverbanks, along railways, etc. An estimated 66% of the excreta is unsafely managed in Nairobi⁹, polluting most rivers and canals. These

alternative solutions are risky for users as most of them are unhygienic and have an impact on health and the environment.

THE ROLE OF THE PRIVATE SECTOR IN IMPROVING ALTERNATIVE SOLUTIONS

In this situation, container-based sanitation, which consists of collecting human excreta in removable containers then transported to treatment facilities, appears to be a promising solution adapted to these areas. The KESHP recognized this solution as an equally efficient sanitation alternative in 2016. By doing so they acknowledge the role of the private sector in improving alternative to sewerage and solutions like the one developed by Sanergy.

Still tackling the sanitation challenge is complex. Beyond infrastructure and technologies, governments and the private sector should remember that ensuring a transition to safe sanitation for all also required behaviour change approaches. Many different sociological, economic, and cultural factors influence sanitation-related decisions and must be considered to ensure new sanitation infrastructures are adopted and used daily. If not carefully considered, these factors can deter people from using safe sanitation options, even when they are available.

5 World Bank, 2015

6 Sanergy, internal study, 2018

7 WHO, 2017

8 World Bank, Water and Sanitation Program, 2012

9 APHRC, Sanergy, NCCG, NWSC, Nairobi's Shit Flow Diagram



Sanergy has installed over 3,500 Fresh Life Toilets across 11 informal settlements in Nairobi - ©Sanergy

SANERGY'S SOLUTION: UNLOCKING THE POTENTIAL OF THE CIRCULAR ECONOMY

A SIMPLE STARTING POINT: TURNING S*** INTO GOLD

Sanergy was founded in 2009 by 3 MIT students (David Auerbach, Lindsay Stradley, and Ani Vallabhaneni) with the ambition to tackle the sanitation crisis in the developing world. The original idea was to turn human waste into biogas because energy generation seemed particularly promising for the MIT students and responded to local demand. The company name, Sanergy, was created at that time, as a combination of "sanitation" and "energy". Six months after the launch, the co-founders realized that biogas production was not profitable without an enormous amount of faeces to treat. Given the difficulty in scaling up the collection, they decided to pivot to something with a faster return on investment. Fertilizer seemed to be the most promising product. The transformation process was mainly a well-proven natural process of decomposition, much easier to master than biogas production. Since then, Sanergy has expanded its range of products (insect-based animal feed, biomass briquettes for combustion) and has continuously been working on new product development.

Sanergy has developed a circular economy model in which value is created for different stakeholders at each step of the cycle: the waste of the ones become the resource of the others

A FULL-VALUE CHAIN APPROACH

Sanergy has developed a cyclic model in which the company creates value for different stakeholders at each step of the cycle. The waste and burden of the ones become the resource and opportunity of the others. The large number of stakeholders involved in the cycle represents a strength and a challenge at the same time. Circular sanitation business models evolve in an ecosystem composed of entrepreneurs, waste operators, small and large businesses, municipalities, and foreign donors.

Sanergy's activity can be divided into 3 workstreams: providing access to infrastructure while creating economic opportunities for local communities, safely collecting sanitation waste and finally turning waste into valuable products, especially for farmers.

PROVIDING ACCESS TO SAFE AND AFFORDABLE FACILITIES WHILE BRINGING ECONOMIC OPPORTUNITIES TO SLUM-DWELLERS

The first workstream consists of developing a network of toilets in Nairobi's slums. Today Sanergy has 3,500 active toilets serving more than 130,000 people per day across 11 informal settlements, with a 13% penetration rate in its operating regions. These toilets are low-cost, high-quality container-based latrines branded as Fresh Life Toilets (FLT). Sanergy franchises these toilets to local entrepreneurs (currently working with over 2,000 entrepreneurs), called Fresh Life Operators (FLOs), who charge the users with a small fee.



Sanergy's logistics staff regularly removes waste from the community safely and professionally - ©Sanergy

Sanergy deploys toilets for different types of users: residents (B2C) and residence and community institutions (B2B).

- On the B2B side, Sanergy's residential franchise model represents 76% of the network. They provide toilets to landlords managing residences and community institutions such as schools, clinics, or churches. For landlords, installing an FLT is a way to increase the value of the rental property and to satisfy the tenants. They do not have any upfront investment for the installation of the FLT, and only pay a monthly fee for service of \$8.50 per toilet for all the support services (regular waste collection, maintenance, customer support).
- On the B2C side, Sanergy franchises FLT to community members (FLOs) who run the toilet as pay-per-use toilets in public areas, overseeing the promotion and daily cleaning of the toilets. On the first year of their franchise agreement, the entrepreneurs buy the toilet for \$270 (and have access to a zero interest loan provided by Sanergy) and they pay a franchise annual fee of \$70 for all the support services (regular waste collection, maintenance, customer support) ensured by Sanergy's employees. FLOs are encouraged to follow market price to charge users: usually KSh5 (\$0.05) per use. The revenue generated by FLOs can reach \$1,000 per year. The model is therefore attractive and led to an important rise in the number of franchise demands in neighbourhoods that are highly impacted by unemployment (40% of unemployment in most Kenyan slums¹⁰).

FLOs in both franchise types receive a kit (hand-washing stand, soap, mop and cleaning bucket, safety gloves and boots) and must provide saw dust, tissue, water and soap for users.

ENSURING DECENTRALIZED WASTE COLLECTION WITH WELL-TRAINED COLLECTORS

Sanergy also ensures faecal waste collection from FLT to their Organics Recycling Factory. It is a huge operational challenge: more than three thousand FLT units spread across the tight and tangled streets of Nairobi's slums must be emptied on a very frequent basis. Sanergy has 100 waste collectors trained to carefully clear the waste every day. They use manual handcarts to transport the sealed barrels of waste out of slums and then load them onto trucks for transportation to treatment and processing plant, located in the outskirts of the city.

This is a crucial step. If the emptying and cleaning are not properly done, the users will not use the service anymore, and they will spread the word very quickly. On the contrary, well-maintained toilets will naturally attract more and more users and franchisees.

Unlike the other workers who traditionally empty the slums' latrine pits in dire conditions, Fresh Life's waste collectors are trained and benefit from health insurance, employment contract, full personal protection equipment, and vaccination to protect them against waste-borne diseases.

Most of them are community members who know all too well the existing sanitation challenges in their communities. They are well respected for their contribution of making a difference by cleaning up their communities.

¹⁰ UN Development Programme, "Human Development Report 2016: Human Development for Everyone"



1,000+ farmers use Sanergy's agricultural inputs and have seen a 30% increase in their yields - @Sanergy

DISTRIBUTING AGRICULTURAL END-PRODUCTS MADE FROM SANITATION WASTE

Once delivered in the recycling facilities, the waste is treated and converted into 3 different products: organic fertilizer, protein for animal feed and energy briquettes.

The first product is a nutrient-rich organic fertilizer aiming at improving Kenyan farmers' soil health and boosting their yields. Most of the clients are medium to smallholders' farmers. The fertilizer is made of urban sanitation waste as well as other organic waste. Sanergy processes the faecal waste to eliminate any pathogens. One of the main advantages is to reduce the farmers' dependence on imported chemical fertilizers. Sanergy's product improves soil health by adding organic matter and is proved to ensure better crop yields (30% increase) in the long term, making it a more profitable input. The waste is also turned into protein for animal feed. The process involves rearing Black Soldier fly larvae, an insect that will naturally and very efficiently convert the waste into a safe animal feed. Customers reported a 30% increase in yields because of using the high-protein feed. The product is a sustainable alternative for common fishmeal used for chicken and pig farming, which has led to overfishing and ecosystem destruction in the Lake Victoria region. Sanergy has also developed energy briquettes for industrial use, made from organic and sanitation waste. Produced locally, these briquettes limit Kenya's dependence on fossil fuels.

Many of the industrial processes mentioned above require considerable quantities of waste to be profitable. The challenge is to scale the amount of waste collected – both

sanitation waste from the network of Fresh Life Toilets and from collection of organic waste fast enough to provide enough waste to treat.

KEY SUCCESS FACTORS TO DEVELOP SANITATION SOLUTION IN AFRICAN SLUMS

ENABLING ENVIRONMENT AND RELATIONSHIPS WITH LOCAL AUTHORITIES

Nairobi has been a major entrepreneurial hub in East Africa for more than 10 years. Some social entrepreneurs have already known great success, such as solar energy provider M-Kopa and agriculture NGO One Acre Fund. This enabling environment has created a real dynamic and collaborative environment from which startups, including Sanergy, benefit.

Beyond a dynamic and innovative private sector, the role of the public sector is also essential to develop new solutions in the sanitation sector. Sanergy needs authorizations from public authorities to run its activities and install FLT in informal settlements, collect all the waste generated as well as safety guaranties and authorization to sell agricultural inputs. Sanergy has a dedicated team whose role is to work with local government to adjust policies and regulations, obtain labels and business licenses to operate, and secure land access for FLT and waste processing facilities. This is a key challenge to enter new markets outside Kenya. Sanergy has launched an advisory

service named Citywise. Citywise helps sanitation actors, mainly municipalities, to assess the needs and helps them to develop CBS solutions. They are currently working with Kisumu in Kenya and Bukavu in Democratic Republic of Congo.

BRAND AWARENESS AND REPUTATION

Brand awareness has been key in Sanergy's expansion with the challenge to build a credible brand that communities want to invest in. Right from its early days, Sanergy used a problem-led approach, rather than a solutions-led approach to address the existing sanitation gap. Communities expressed their discontent with unhygienic norms of their sanitation landscape: flying toilets and unsanitary pit latrines which polluted their environment and harmed their health. Out of their desire for a fresh start and an improvement in their life towards hygienic sanitation, Sanergy's brand 'Fresh Life' was borne. Sanergy then put a heavy emphasis on intensive grassroots engagement in the local community to build their brand. Continually shining a spotlight on its customer: the slum residents who generously shared their experiences, needs, and aspirations for building healthy, robust communities in what was a fragmented sanitation ecosystem. At the same time, Sanergy built a marketing team which conducted focus group meetings and planned edutainment events. These events attracted crowds of hundreds of people, with whom Fresh Life engaged in conversations about health education and the priceless benefits of safe sanitation habits, like toilet usage, handwashing, and making sure waste safely leaves the community. They missioned hip-hop songs to play on local radio and broadcast a catchy motto that the children would remember and sing at home. Neighbourhood block parties were organized to celebrate the opening of toilets and introduce the concept of Fresh Life Toilets. Even the toilets themselves were designed to spread brand awareness: bright blue-painted walls featured with a colourful Fresh Life logo contrasting with the drab colours of the slums. Ultimately, Fresh Life gained an understanding of the community context and had the chance to market its initial product and services centered around a franchise model that simultaneously promoted public health and economic empowerment.

BEHAVIOUR CHANGE

Sanergy has put a lot of efforts to trigger behaviour change in the different steps of their activity. A dedicated sales team consisting of community members has been created. They are probably the most convincing voices to generate behaviour change. They use the existing relationships they have within the community to promote Sanergy's products and services. Business development and behaviour change also rely on FLOs and local leaders, who are particularly good ambassadors since they have invested and are involved in the project. WASH training is also dispensed in schools. Children are often excellent champions of behaviour change in their own family.

Peer-to-peer dissemination of information turned out to be the best way to promote behaviour change and to support the adoption of Sanergy's solution. The Fresh Life network had been built from within the community intentionally - from franchisees to the salespeople to the waste collectors: people who grew up in and thus knew the informal settlements. All of these people had a personal connection to Sanergy's mission, and therefore could easily take ownership and convey the value of hygienic sanitation to the rest of the community. To complement their local expertise, Fresh Life provides regular training and ongoing operational support, setting clear expectations to the local entrepreneurs as they have their toilet business up and running. In the last phase of Sanergy's cycle, behaviour change is also key. Farm Star products are radically innovative for many farmers and using agricultural inputs made of human waste can be perceived as risky by potential customers. To capture market shares, Sanergy relies on the influence of lead farmers that have tested and approved Farm Star products. The peer-to-peer recommendation is, here again, essential for behaviour change. It builds trust and reinsures on the performances of the products on the farmers' yields.

CONCLUSION

Full coverage of African urban areas with sewer systems will be difficult to achieve given the pace of urbanization, the cost, and technicity required to install such an infrastructure. In a nutshell, the world cannot wait for sewers. Solutions like the ones developed by Sanergy are effective solutions to answer an urgent need.

CBS solutions are safe, waterwise, and affordable, which sounds promising for the continent. More and more private players are testing such solutions in various geographies: Clean Team in Ghana, Loowatt in Madagascar, x-runner in Peru, SOIL in Haiti, etc. As these solutions bring safe sanitation for slum residents with up to 95% less money than traditional sewerage systems, it can be qualified as a leapfrog innovation. Even if these solutions are market-ready, they lack confident investors and support from public authorities.

To accelerate the adoption and the scale-up of these solutions, a coalition of sanipreneurs named Container-Based Sanitation Alliance (CBSA) promotes knowledge sharing and learning, enhances legitimacy by creating a set of common CBS guidelines and standards. The Toilet Board Coalition, a global business-led partnership also has the ambition to accelerate CBS economy, with research programs, accelerator programs for sanitation entrepreneurs, and by connecting private, public, and non-profit sectors. These coalitions believe there is an opportunity for CBS enterprises to collaborate in an effective way to achieve sector-wide acceptance and endorsement, reach scale, and create sustainable impact.