

SANITATION ECONOMY MARKETS: KENYA

ABOUT THE TOILET BOARD COALITION

Established in 2015, the Toilet Board Coalition (TBC) is a business-led partnership platform with the goal to accelerate the transition to the sanitation economy. Our ambition is to transform sanitation systems from unaffordable public costs into robust marketplaces of sustainable business value.

The TBC is facilitating private sector engagement; large-small company partnerships and public-private collaboration to contribute to the achievement of Sustainable Development Goal 6 – universal access to water and sanitation.

We run accelerator programmes and implement strategic projects dedicated to growing sanitation economy business solutions that are smart, circular and resilient to address the unmet sanitation needs of the world's most vulnerable.

The members of the Toilet Board Coalition believe that accelerating the sanitation economy will deliver significant benefits to business and society.



ACKNOWLEDGMENTS

We would like to thank all those who contributed to the preparation of this report for their valuable inputs and insights. In particular we would like to thank the Toilet Board Coalition team and Saikat Mookherjee who joined us for this work.

The authors are especially grateful to RTI Innovation Advisors who partnered with the Toilet Board Coalition to bring this piece to life. Their expertise and guidance on adapting our methodology from India to new contexts and wealth of knowledge on sanitation in Africa enabled us to bring together a piece that we're proud of.

This work would not have been possible without the support of WSSCC. Their vision for the role this piece can play in the sector, particularly amidst their own internal transition to the Sanitation & Hygiene Fund is moving.

As the Toilet Board Coalition's networks and work in Kenya is yet limited we are particularly grateful to the individuals who offered up their time for interviews and to review and contribute resources and recommendations to the piece: David Auerbach, Kate Bohnert, Andrew Foote, Sheila Kibuthu, and Alex Manyasi.

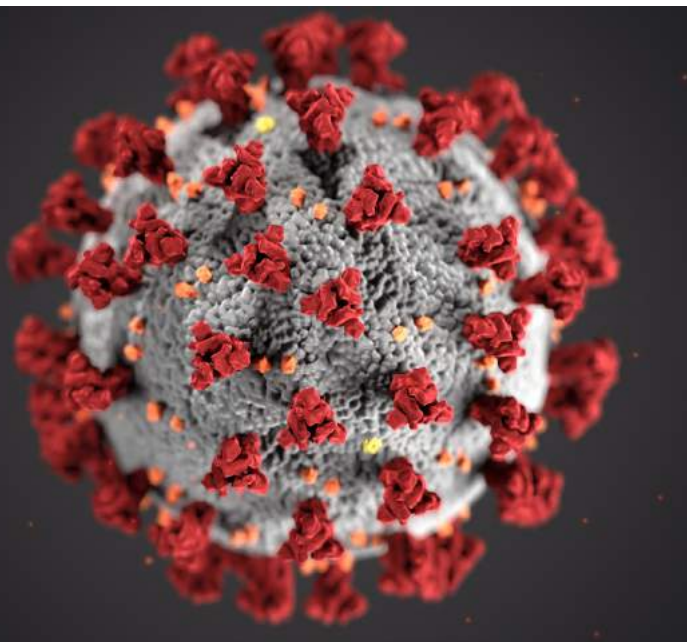
We thank the Toilet Board Coalition members for their contributions and review of the piece and ongoing leadership in the sector.

DISCLAIMER

The contents of this paper provide a synthesis of our discussions and findings from the study. All information has been subject to the interpretation of the authors, the Toilet Board Coalition Secretariat, and does not necessarily represent the views of all Toilet Board Coalition members or those companies and experts who participated in the study.

FOREWORD

AS GLOBAL MARKETS BEND, SHIFT AND LOOK UP TO A REVIVAL UNDER THE WEIGHT OF 2020 AND COVID-19, WE HAVE SEEN INCREDIBLE RESILIENCE THROUGHOUT THE SANITATION ECONOMY AND MOST INNOVATIVE BUSINESSES IN THE SECTOR HAVE THRIVED.



With COVID-19, our world has restored the crucial role of sanitation and hygiene in the context of human health and wellbeing and begun appreciating the interdependence of health and stable ecological and environmental systems. Against this backdrop, we have observed some entrepreneurs finding ways to broaden their impact despite challenging circumstances, growing and developing their businesses with speed to meet heightened demand and new opportunities around improved sanitation services that ensure health. Others have weathered stoutly the quiet of cities shut down and services at a stand-still for a season. A silent revolution is ongoing, the sanitation economy is expanding with sustainable and resilient business models, in spite of and alongside COVID-19. And our work at the Toilet Board Coalition has never felt more relevant.

Over the last five years the Toilet Board Coalition members have driven a shift towards a new framing of sanitation. Replacing outdated perceptions around sanitation as solely a public cost, old

technologies and unrealistic targets, we advocate for the business opportunity of sanitation. The sanitation economy is a holistic, sustainable and economically viable approach to sanitation that capitalizes on innovation, harnesses the power of smart technologies and is fueled by the local and global private sector. To propel this transition and thinking we have developed a market estimate methodology to quantify for stakeholders what a thriving sanitation economy might look like in their geography.

Our first application of the methodology, in 2017 for India, wielded an opening of doors throughout India to this approach. The exercise of attaching a number to the market opportunity of sanitation has brought the potential into perspective for businesses and governments. We have seen greater attention, innovation and engagement across the sector as a response. We have since looked at the market opportunities of the sanitation economy for South Africa and, in 2020, revisited the numbers for India with a first look at the Philippines, Indonesia and now Nigeria and Kenya.

EXECUTIVE SUMMARY

Kenya has been host to remarkable social progress since the signing of a new constitution in 2010, and is currently home to some of the world's most successful sanitation businesses serving low-income populations. And yet, although the constitution asserts access to basic services such as sanitation as a human right, there is still a significant amount of work to be done to make universal access to safely-managed sanitation a reality in Kenya.

According to the World Bank, if Kenya continues at the same rate of progress, it will take over 200 years to achieve universal access ([World Bank](#), 2018). The Kenya Environmental Sanitation and Hygiene Policy 2016–2030 (KESH Policy¹) estimates that Kenya loses 1–2% of its GDP annually due to poor sanitation.

At the latest count through the WHO/UNICEF Joint Monitoring Project (JMP) in 2019, only 30% of Kenya's 50 million citizens have access to safely-managed and basic sanitation and 10% of the population, or 5 million individuals, are still practising open defecation. This isn't just a problem at home, but in schools, hospitals and public spaces. Simultaneously Kenya is seeing record population growth, with expectations that the population could double by 2050 and with 48% of people living in urban areas by 2030. Much of this urbanization is happening in secondary cities, where sewerage access is non-existent.² Currently 10 million Kenyans live in slums without access to basic amenities.³

1. [Republic of Kenya Ministry of Health: KESH Policy 2016–2030](#)

2. [Devex: Africa's Future is in its Secondary Cities October 2016](#)

3. [The Standard: Search for Town Jobs Pushes 10 Million Kenyans to Slum Poverty January 2020](#)

\$3.2 BILLION

**SANITATION ECONOMY
MARKET OPPORTUNITY
IN 2021**

\$6.2 BILLION

**SANITATION ECONOMY
MARKET POTENTIAL
BY 2030**

2030 PROJECTIONS:

\$5,101 MILLION
Toilet Economy

\$350 MILLION
Circular Sanitation Economy

\$747 MILLION
Smart Sanitation Economy

KENYAN POLITICAL WILL

The Kenya Environmental Sanitation and Hygiene strategic framework or KESH Policy¹ notes that, “with sanitation made a guaranteed human right and sanitation services having been devolved to 47 County Governments, a practical shift in the methodology and approach to sanitation and hygiene service delivery must urgently be addressed to accelerate progress”.

In 2018 Kenya created the Ministry of Water & Sanitation, in its strategic plan (2018–2022) it’s stated the following vision and mission:

- Vision: “Universal access to adequate, safe and sustainably-managed water resources and sanitation.”
- Mission: “To ensure good governance in the conservation, protection, harvesting and storage, management and development of water resources and sanitation infrastructure for national socio-economic development.”


To learn more about the regulatory environment of sanitation in Kenya, we recommend [this resource](#).⁴

Kenya, a water-scarce country, also faces stark climate challenges, with uneven distribution of available water, frequent droughts and flooding. Water and waste are intrinsically interlinked and Kenya’s Climate Policy wisely touches on waste management as well. The National Climate Change Action Plan (NCAAP, 2013) calls on stakeholders to achieve targets ‘through adoption of low carbon and efficient transport; and improved waste management (e.g. waste recycling, landfill gas management)’.

The following excerpt from a piece published by the World Bank⁵ illustrates this issue. ‘Sanitation in the urban areas is further compounded by the inter-linkages with other services, including stormwater drainage, solid waste and water supply. For instance, Wajir town has a high groundwater table and shallow water wells, which are the main source of water for domestic and livestock use. This makes the construction of simple pit latrines unfeasible. Instead, about 68% of the 100,000 residents use bucket latrines, a system introduced during the colonial times to protect the groundwater. During the rainy seasons, fecal waste overflow from buckets is swept away by the stormwater, resulting in fecal contamination of the shallow wells. Consequently, Wajir town suffers from frequent outbreaks of waterborne diseases, especially cholera and diarrhea.’

4. [WHO: Sanitation Policy and Planning Framework Case Study](#)

5. [World Bank Blog: Why Kenya’s sanitation challenge requires urgent attention February 2018](#)



The Kenyan government and development partners have invested considerable effort to increase overall spending on water and sanitation; however, USAID reports that donor funding still makes up 64% of the total sector financing. The National Water Master Plan 2030, launched in March 2014, estimates that nearly \$20 billion would need to be invested to reach targets by 2030. This signals a notable need for the acceleration and enabling of private sector contributions to this landscape, continued policy improvement and an embracing of innovative technologies and approaches.

Against this backdrop, the TBC and WSSCC undertook a market sizing exercise to estimate the potential addressable market of the sanitation economy operating at scale in Kenya. Our goal was to shed light on the sizable business opportunity that lies within the sanitation sector, and galvanize discourse and planning about how public and private actors might seize upon this opportunity together. The following pages outline the methodology, give a brief introduction to the sanitation economy approach and then detail the opportunities and estimates for each of the three areas of the sanitation economy. It is important to note that we are estimating the potential addressable market of the sanitation economy operating at scale in a particular geography. These estimates, therefore, do not reflect the current reality. As the sanitation economy scales, the market reality and this work will come into alignment. For instance: if the toilet resources (the TBC's term for human waste) are not collected from sanitation facilities across the

country, the products and market estimations of the circular sanitation economy cannot be realised. Many of the entrepreneurs graduating from the Toilet Board Coalition's business accelerator programme are already addressing portions of this market through their products and services, as are the broader private and development sectors, so the market numbers listed should not be considered wholly untapped opportunities. Indeed it is our relationship with those actively realizing this market potential that provides us with the data to estimate how the market can develop.

We provide first a number for 2021 and then build towards 2025 for medium-term future and 2030 at the close of the UN's Sustainable Development Goals (SDGs), when our collective work should result in universal access to sustainable, safely-managed sanitation systems.

In principal, the market estimations are a formula of population and market value of products and services, with considerations for cultural and national context. The products and services included are not exhaustive to the sanitation economy but, rather, align with the market in consideration. They were selected based on data availability, pertinence to our current entrepreneurial network and relevance. Data sources are from reputable published work by government and trusted sources, combined with on-the-ground knowledge and insights from the Toilet Board Coalition's entrepreneur network.

ABOUT THIS PAPER

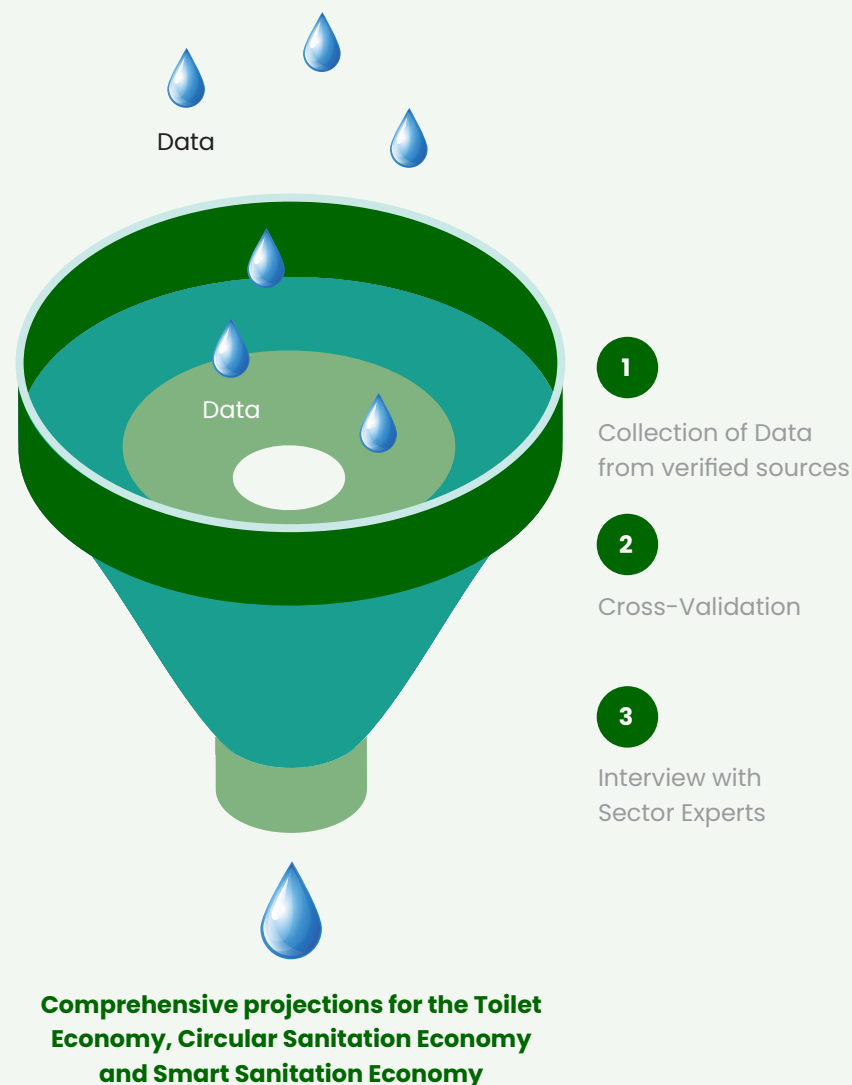
OBJECTIVES OF THE EXERCISE

The objective of the study is to estimate the size of the sanitation economy markets of products and services, renewable resource flows, data and information at a country level for Kenya, deep diving into products and services for the toilet economy, circular sanitation economy and smart sanitation economy.

APPROACH FOLLOWED

The overarching approach followed for the estimations was a modified top-down approach. In this approach, high-level chunks of information at the feature or design level were estimated and were decomposed progressively into smaller chunks or work-packets as information was expanded. For this approach, extensive secondary research to collate verified data from the published government or trusted sources was collated and cross-verified with other indicators. Care was taken to scan each source of information in terms of the following aspects:

- **Validity:** data clearly and adequately represent the intended result
- **Integrity:** data have safeguards to minimize risk of transcription error or data manipulation
- **Precision:** data have sufficient level of detail to permit management decision-making
- **Reliability:** data reflect stable and consistent data collection processes and analysis methods over time
- **Timeliness:** data available at a useful frequency, are current, and timely enough to influence management decision-making





SANITATION ECONOMY

The team referred to leading publications and notifications from government, leading consulting firms, research publications, notifications, press releases and interviews with entrepreneurs. An elaborate depiction of the secondary sources referred to has been provided at the close of the report. Another unique feature of this approach was the fact that it aimed to arrive at the universal figures of numbers of toilets under each sub-component, before using existing market-based assumptions (validated from real stakeholders in the market) and statistics-based growth rates to estimate the future scenario of products and services. The modelling technique also attempts to build up an algorithm, which has several sub-components, that can be updated in line with the real-time price revisions across various geographies.

TOILET ECONOMY

- Household Toilets
- Community Toilets
- Public Toilets
- O&M and high-relevance auxiliary products

CIRCULAR SANITATION ECONOMY

- Biogas
- Electricity
- Biochar
- Agricultural Products
- Animal Feed

SMART SANITATION ECONOMY

- Health Data
- Smart Technologies
- Smart Logistics
- Data Analytics & Applications

REFRESH

THE SANITATION ECONOMY

The sanitation economy is a growing marketplace of products and services, renewable resource flows, data and information that is transforming cities, communities, and businesses and driving progress towards the Sustainable Development Goals.

The Toilet Board Coalition has previously published **14 reports on the Sanitation Economy**, unpacking its value and impact across sectors, supply chains and cities. Our 2019 report, 'Scaling Up The Sanitation Economy' details the **sustainable and scalable business models** we see operating in this space and the **financial scenarios** of the scaling from a government and private sector perspective. Learn more at: <https://www.toiletboard.org/resources>

In this model, all natural and biological resources (energy, nutrients, water), as well as valuable information about human health and behaviours, are used to generate value within three domains: the toilet economy, circular sanitation economy, and smart sanitation economy. Each offers business models with new revenues, while providing economic, environmental and social benefits.

Grounded in collaboration between private and public sectors, the sanitation economy is a place where innovation, entrepreneurship and investment bring new business opportunities to what used to be seen as an unaffordable public cost.

The sanitation economy harnesses one of the population's most consistent and yet overlooked daily activities to provide valuable resources and information to our population. It is a source of energy, nutrients and water that uniquely grows with the population.

The sanitation economy links three distinct areas for business and societal benefit:

THE TOILET ECONOMY: Products and services that provide safe toilet access for all, whether public or private. This spans centralised and decentralised, sewerage and non-sewerage, high and low water tables, low-income to high, rural, urban and peri-urban. Toilet designs apply circular sanitation economy principals to minimise waste and greenhouse gases and capture data to feed the smart sanitation economy.

THE CIRCULAR SANITATION ECONOMY: Toilet resources (The TBC's preferred term for human waste) feed into a system which replaces traditional waste management with a circular economy approach. It connects the biocycle, using multiple forms of biological waste, recovering nutrients and water, creating value-adding products such as renewable energy, organic fertilisers, proteins and more.

THE SMART SANITATION ECONOMY: Digitised sanitation systems that optimise data for operating efficiencies, maintenance, plus consumer use and health information insights. Sanitation is included in smart cities' architecture, monitoring public toilet usage, sewage treatment and health indicators, and detects needs for maintenance and repair throughout the system.

THE SANITATION ECONOMY

MARKETPLACE

PREVENTATIVE HEALTH



HEALTH DATA
Nutrition & health data can inform public officials, the healthcare and pharmaceutical community and individual users

DISTRIBUTION
Relevant data is communicated back to the user through mobile applications and services

SENSORS



IN TOILETS



TOILET ADJACENT



IN BATHROOM



INFRASTRUCTURE

SOFTWARE/DATA PROCESSING & ANALYTICS
Sensor sends molecular characterisation data to cloud based cognitive computing platform where data is analysed and organised

SENSORS & DATA CAPTURE
Sensors in household, business, community and public toilets capture molecular characterisations of waste and transmit data through connected networks and devices

SMART SANITATION ECONOMY

CONSUMER USE DATA
Consumer insights data related to consumer behaviour & product usage, Customer relationship management, marketing, advertising & product decisions



SYSTEM OPERATIONS DATA
Manufacturers, operators, and service companies can access status information to inform the need for maintenance, repair, cleaning, waste collection, etc.

TOILETS & PRODUCTS DESIGNED FOR REUSE OF RESOURCES

CIRCULAR SANITATION ECONOMY

HOMES, BUSINESSES, FARMERS, MANUFACTURERS, CITIES
Upcycled products from Toilet Resources are sold back to businesses, cities and individuals to complete the loop

PROCESSING
Resource recovery plants process and refine the collected waste through various technologies to produce safe valuable products

PRODUCTS



Fuel, electricity, heat
• Biogas for local factories & electricity to the grid
• Bio diesel for transport
• Bio charcoal to replace wood/coal



Water recovery and purification of wastewater

- Local agricultural irrigation
- Water intensive factory processes
- Further treatment to produce drinking water



Compost, organic fertilisers, nutrients such as nitrogen and phosphorus
• Non-food crops: forest free fibre crops, flower crops, etc.
• Food crops



Such as oils and protein meal
• Protein oils for consumer toiletry goods and potentially cosmetics
• Protein "meal" for pet and farm animal feed



Materials for innovative products
• Faecal matter for pharmaceutical (biome) regenerative health products and procedures
• Bio-plastics

Sanitation as a business opportunity instead of an unaffordable cost

Sanitation as a solution provider, offering not only sanitation, but cost savings and environmental improvements to food/agriculture, consumer goods, energy, health, waste, water and other industries



Consumer biological waste
• toilet waste
• kitchen waste
• animal waste
• compostable packaging & other items

Industrial biological waste
• food / market waste,
• agricultural & food waste
• farm waste
• compostable packaging & other items



COLLECTION & TRANSPORT OF BIOLOGICAL WASTE



THE SANITATION ECONOMY AND THE SUSTAINABLE DEVELOPMENT GOALS

The sanitation economy takes sanitation beyond SDG6 and becomes an enabler for water and food security, mitigates climate change and advances human rights. It places sanitation at the centre of a new grid which fundamentally realigns flows of nutrients, water, energy, data and capital.



Climate Action / Affordable and Clean Energy

Contributions to slow climate change by producing renewable energy and reducing carbon and methane emissions, helping businesses meet low carbon targets, while also helping agricultural systems adapt to changing rainfall patterns.



Clean water and Sanitation

Providing water security through new sources of clean water for agricultural and industrial use, reduced contamination of existing water sources, lower water use in sanitation, and reduced need for irrigation.



Zero Hunger

Providing food security by improving soil health, agricultural productivity, climate change resilience, and reducing plantation operating costs through organic fertilisers and soil conditioners.



Good Health and Well-being

Improving the health of workers, both with sanitation's traditional function of preventing disease transmission, and also by providing real-time data for preventative and reactive healthcare for employees.

Sanitation can create new economic value and becomes a solution provider for urgent business and societal issues that address many of the Sustainable Development Goals – from water security, to climate change, food security and human rights.



Industry Innovation and Infrastructure

Enabling innovation, sales, marketing and consumer research opportunities with consumers in developing markets.



Gender Equality

Enabling female empowerment and health benefits.



Responsible Consumption and Production

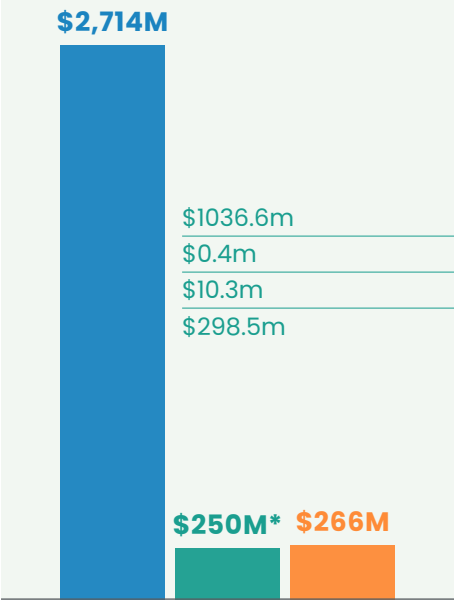
Creating a waste pathway for all forms of compostable (biological) waste, preserving nutrients and energy in the process, and enabling the replacement of plastic items with compostable alternatives.

THE SANITATION ECONOMY QUANTIFIED

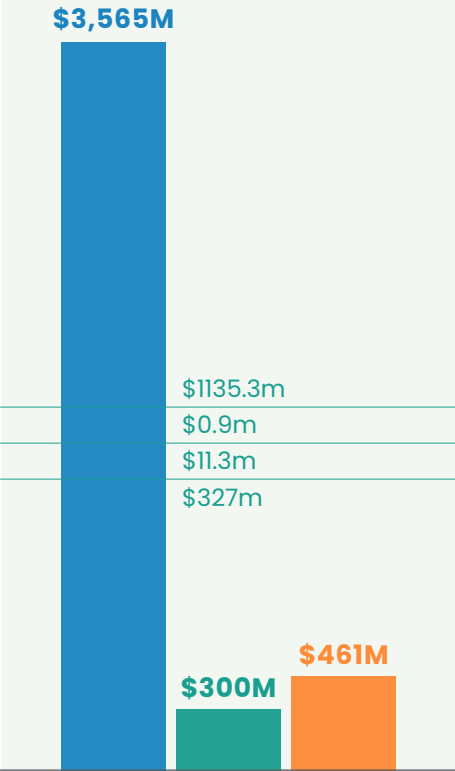
That table below summarises the annual market opportunity for each of the three sanitation economy domains in 2021, 2025 and 2030. All estimates are presented in millions of US dollars. For these calculations we have used a fixed currency conversion rate of: 1 USD = 109 KSH

- Circular Sanitation Economy
- Toilet Economy
- Smart Sanitation Economy

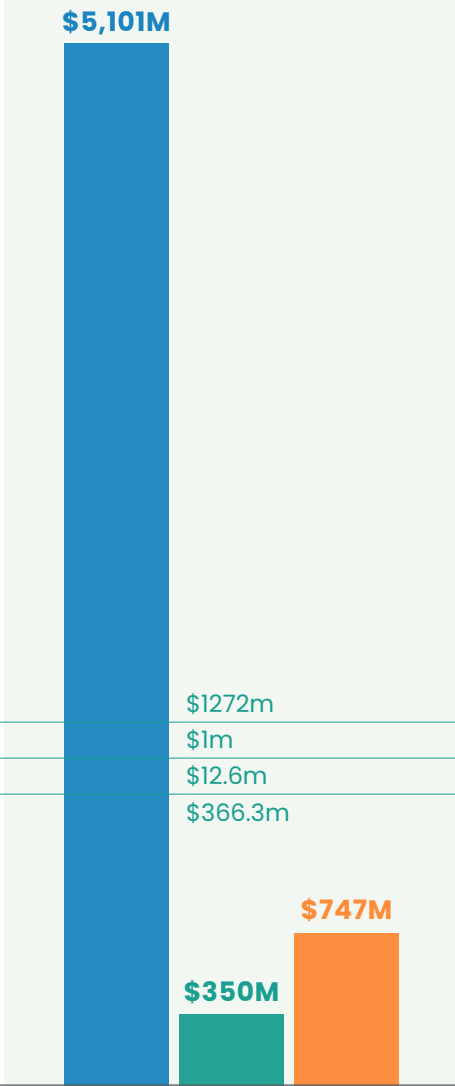
2021 TOTAL: \$3.2B



2025 TOTAL: \$4.3B



2030 TOTAL: \$6.2B



*Because the circular sanitation economy market opportunities are generated from the same quantity of resources, in our methodology there is overlap between these numbers and not all can be simultaneously fully realised. We have therefore identified a sample conservative, indicative number to summarise the opportunity.

THE TOILET ECONOMY



MARKET INSIGHTS

In both urban and rural contexts, sewered sanitation technologies are not feasible to implement due to their exorbitant costs and lengthy installation process. Alternatively, public- and private-sector stakeholders are increasingly advocating for non-sewered solutions that capture the waste and either treat it on-site or collect it frequently and transport it locally for treatment.

Pit latrines have been the go-to technology in both rural and urban contexts. Space constraints in urban low-income environments currently limit the capacity to build new pits but, still, many exist and are often not managed properly.

In rural areas, often pits are incorrectly dug too deep, contaminating the water supply in an effort to delay or minimise emptying.



FOCUS ON HEALTH

Preventing infections is one of the key objectives of the innovations, technologies, products and services that make up the Toilet Economy, eg, handwashing with soap after the use of a toilet is a primary line of defence around infectious diseases and with COVID-19. Similarly, cleaning, sanitisation and O&M of toilets is aimed at addressing filth and malodour; a primary trigger of disgust that can lead to individuals turning to open defecation and other infectious disease-spreading behaviours.

Many parts of Kenya have a very high water table; residents thus adapt the pit latrine concept and build above ground to elevate the toilet to help avoid flooding. These latrines often collapse, however, due to flash flooding and loose soil formation.⁶

In Wajir, the World Bank is financing sanitation improvements of the bucket toilet system to improve the health of the community and the dignity of collectors, whilst also recognising that a container-based system can be effective in water-scarce areas like Wajir.⁷

For rural areas, the KESH Policy advocates safe sanitation facilities with “at least minor improvements to reduce flies, odours, etc. (at least an upgraded pit latrine), VIP latrines or pour-flush latrines connected to a septic tank linked to soak-away pits and/or a collection system.”^{2 8}

Kenya’s work to provide households with basic sanitation in the past has resulted in a substantial market of households with toilets that are interested and need of upgrading.

The challenge will be how to support these upgrades without training thousands of masons; further product R&D will need to happen so that current complicated installation processes can be greatly de-skilled. This will be an important key to engaging more sophisticated private sector stakeholders, nationwide wholesalers and distribution networks.

6. [UNICEF: Situation Analysis of Children and Women in Kenya, 2017 – page 119 \(electronic page 145\), point 461](#)
7. [World Bank IDA Project Appraisal Document April 2017](#)
8. [Republic of Kenya Ministry of Health: Kenya Environmental Sanitation and Hygienic Strategic Framework 2016–2020](#)

THE TOILET ECONOMY



MARKET INSIGHTS

Given rapid urbanization in recent years, many people live in informal settlements for which disaggregated figures are not available. Availability of toilet facilities is reportedly sufficient in four urban informal settlements surveyed in 2015, although not necessarily accessible. Most of the available toilet facilities were shared among households living in the same tenancy blocks. Hygiene in toilets was inadequate, and children could not use them because of the poor conditions. The informal settlements in Nairobi and Mombasa had some sanitation blocks operated by individuals charging user fees of between Ksh 5 and 10, reportedly beyond the reach of most residents. In the absence of toilets, many households confirmed using designated communal defecating areas, such as rubbish tips, riverbanks, ocean shores, open sewer trenches, railway lines, forests, bushes, and roadsides. Disease was most prevalent in the rainy

season. Poor sanitation within the informal settlements leads to a high prevalence of water-borne diseases, such as cholera, typhoid, amoeba infection and diarrhoea.⁹

As urban and peri-urban areas grow rapidly, there is an acknowledgement that innovative sanitation services must play an integral role. For urban areas the KESH Policy, whilst acknowledging a preference for sewer systems, recognises the necessity of quicker, cheaper and easier-to-implement solutions that tackle waste treatment challenges: “Collection, storage, removal and safe disposal and treatment of residential and commercial sludge and wastewaters through individual disposal systems such as septic tanks or Urine Diverting Dry Toilets (UDDTs) shall be given the highest priority in urban environmental sanitation while the sewerage system with proper treatment facilities shall be regarded as a better option”. However, in slums and peri-urban areas, the focus is on non-sewered sanitation and affordable options, stating that “The County Government, in collaboration with stakeholders, shall promote low-cost appropriate technologies, such as twin pit, UDDT or eco-sanitation, in peri-urban and slum areas and in other small-to-medium-sized urban centres.”^{2 8}

Container based sanitation, a relatively new and growing model, is of great relevance in this context.

Menstrual health management remains a limiting factor for women in the workplace.¹⁰

Access to sanitation is reportedly a problem in many schools, with the number of latrines insufficient, given the population of pupils. In 2015 the Ministry of Education reported a ratio of 35 boys per toilet and 29 girls per toilet in schools: this is below the national norms of 30:1 and 25:1 respectively. In some counties, the figures are much poorer: Turkana County had 107 boys per toilet and 75 girls per toilet, while Mandera County had ratios of 76:1 and 54:1. The quality of latrines is also an issue. School principals and county education officials have reported that school budgets are too restricted even to empty latrines at times, let alone set up new structures. As a result, in many areas open defecation remains the only alternative.¹¹

9. [UNICEF: Situation Analysis of Children and Women in Kenya, 2017 – page 119 \(electronic page 145\), point 462](#)

10. [WSUP: Barriers for female decision-makers in Kenya's sanitation sector May 2020](#)

11. [UNICEF: Situation Analysis of Children and Women in Kenya, 2017 – page 119 \(electronic page 145\), point 463](#)

EXAMPLE OF METHODOLOGY BREAKDOWN

Estimated no. of toilets/per establishment were arrived at basis secondary data, which have been provided in course of research. Cost of products for maintenance of toilets and manpower was calculated as per existing norms to arrive at the estimate for current year. For future projections, revision at existing rates were considered. This was basis exhaustive secondary research and interaction with policy makers and entrepreneurs/sector experts working in the domain.

E.g. To arrive at soap usage/ handwash figures for Kenya, the sum of urban and rural household nos. were derived for the year 2021, using Census 2019 figures and applying 2.3% growth rate per annum. The urban and rural household size calculated was also as per 2019 census. As understood from the sources indicated above, an average expenditure per toilet is 6.1 USD/ annum on soaps. All calculations were performed on a USD/ annum, which was then converted to USD Mn.

PRODUCT OR SERVICE	2021	2025	2030
Household or Community			
Rural Toilets (new installations)	\$1.7m	\$1.8m	\$2.3m
Rural Toilets (upgrade products)	\$77m	\$86.2m	\$106.2m
Mid/High Income Urban Toilets	\$108.6m	\$130.8m	\$159.9m
Low Income Urban Toilets	\$18.9m	\$22.7m	\$29m
Portable toilets/container-based sanitation	\$95.7m	\$99.6m	\$104.6m
Public			
Schools/College/Universities	\$26.3m	\$28.9m	\$31.5m
Railway and Bus Stations	\$1m	\$0.2m	\$0.2m
Airports	\$0.01m	\$0.01m	\$0.01m
Malls	\$0.06m	\$0.07m	\$0.07m
Hotels/accommodation Units	\$3.5m	\$3.9m	\$4.0m
Hospitals	\$6.3m	\$6.9m	\$7.1m
Offices	\$0.6m	\$0.6m	\$0.8m
O&M and high-relevance auxiliary products			
O&M (cleaning & emptying) for household	\$813.3m	\$970.9m	\$1205.3
O&M (cleaning & emptying) for public	\$1450m	\$2087.4m	\$3307m
Hand washing using soap	\$52.5m	\$54.7m	\$57.4m
Menstrual health and hygiene products	\$145.9m	\$159.8m	\$179.0m
Total	\$2,714m	\$3,565m	\$5,101m

2021



O&M (Cleaning) for Public
\$1,450M



\$145.9M

Menstrual health & hygiene products



\$52.5M

Hand washing using soap



\$10.2M

Offices

\$3.5M

Hotels/Accommodation Units

\$0.1M

Railway and Bus Stations

\$26.3M

Schools/Colleges/Universities

\$6.3M

Hospitals

\$0.01M
Airports

\$0.06M
Malls



\$1.7M

Rural Toilets (new installations)

\$77M

Rural Toilets (upgrade products)



\$108.6M

Mid/High Income Urban Toilets



\$18.9M

Low Income Urban Toilets



\$813.3M

O&M (cleaning & emptying) for household

CIRCULAR SANITATION ECONOMY



MARKET INSIGHTS



The collection and treatment of toilet resources (the Toilet Board Coalition's preferred term for human waste) is imperative not only from an environmental and public health perspective, but also from a business perspective. It is the addition of these services and the services of the Smart Sanitation Economy that shifts Sanitation Economy business models into profitable territory. To learn more please read '[Scaling the Sanitation Economy](#)'.

Kenya boasts a strong enabling regulatory environment for innovative approaches to waste collection, treatment and the sale of products derived from waste. This is a product of the persistence of entrepreneurs in Kenya, with support from the sanitation sector, in working with the government to develop and champion these approaches.

Kenyan water service providers are being asked by the water service regulatory board to focus on inclusive urban sanitation approaches that combine both sewered and non-sewered sanitation services for a holistic strategy. (WASREB impact report)

In peri-urban and urban areas, solid waste management is a challenge. This results in people dumping other waste into pit latrines – diapers in particular – that can make mechanical emptying more difficult, as machines get clogged.

Where accessible and possible, mechanical emptying can be done but often pits are emptied manually and throughout the night, due to the illegitimate nature of the emptying and disposal of the waste, once collected.

Market challenge: local experts shared that, because human waste must be disposed of, there are many informal services that will collect waste and then dispose of it illegally or sell it on, insufficiently treated, as fertiliser, at a very low price. This distorts the market and poses significant challenges to legitimate businesses who treat properly and certify their processes. To operate sustainably, their product prices must exceed the illegitimate competition's pricing, which makes sales more difficult.

CIRCULAR SANITATION ECONOMY



MARKET INSIGHTS

Similar to other markets, animal manure is also readily available and there is not sufficient customer awareness of the quality and productivity variance between different fertilisers. Buyers may also be squeamish about consciously choosing a product derived from human waste over one derived from animal waste.

To counter the two previous points, for example, sanitation economy business Sanergy has chosen to go through an extensive certification process and marketing campaign to help customers understand the processes of treatment and the certification standards.



FOCUS ON HEALTH

Pit latrines have been the go-to technology for providing access to basic sanitation, however when pits are not properly sealed or evacuated when full, the untreated waste leaks or overflows, contaminating groundwater supply. Application of circular models to recover value is not only lucrative business-wise, it is crucial for preventing infectious disease epidemics.

Kenyan growers find themselves in a challenging scenario, as food safety and security is a national priority but soil infertility results in low farm yields and chemical fertilisers are no longer proving productive.

Kenya enacted a logging ban in 2018 that has motivated citizens to turn to alternative sources of energy.¹² This has elevated the price of charcoal and presents a distinct market opportunity for energy products from toilet resources.

The Rainforest Alliance recognised the issues facing Kenya in 2012 and began working with Kenya's tea sector to reduce the use of firewood in tea factories by switching to biomass briquettes.¹³

Briquettes for cooking are very interesting and widely accepted, as they produce fewer emissions and burn for longer.

Black soldier fly protein for animal feed is a very attractive opportunity for Kenya and boasts a strong enabling regulatory environment as well. The fly larvae need a significant and consistent supply of toilet resources and there is strong customer demand for an affordable, quality-controlled and readily-available source of protein for animal feed.

12. [African Business: Kenya faces timber shortage as demand for wood grows November 2020](#)

13. [Rainforest Alliance: Kenyan Tea Farmers Switch to Renewable Energy May 2018](#)

EXAMPLE OF METHODOLOGY BREAKDOWN

The basis of calculation of the first four components of the circular sanitation economy is the Toilet Resource Calculator coined by the TBC. Taking the same into consideration and extrapolating the same on Kenyan population nos., the amount of toilet resource was calculated in quantity terms per annum. Extensive search for unit cost was conducted and average value was multiplied to the quantity to arrive at estimates for the sub components. It may be noted here that the sub components are mutually exclusive and may not add up to a total figure as it would do for the rest of the economies under consideration.

E.g. To arrive at biogas generated figures for 2021, 2025 and 2030, the TBC calculator for calculation of toilet resources was used. Population figures were derived basis 2019 census and 2.3% growth rate per annum was computed to arrive at figures for 2021, 2025 and 2030 respectively. Since in the TBC calculator the biogas output was assumed at MJ of heat, this was converted to kWh of energy using and existing energy costs were applied to the in order to arrive at final estimates of Bio gas production.

PRODUCT	2021	2025	2030
Biogas	\$536m	\$587.1m	\$657.8m
Electricity	\$227.8m	\$249.5m	\$279.6m
Biochar	\$272.7m	\$298.7m	\$334.6m
Compost	\$.41m	\$.45m	\$.51m
Nitrogen	\$.16m	\$.17m	\$.19m
Phosphate	\$.13m	\$.14m	\$.15m
Potassium	\$.13m	\$.14m	\$.16m
Water	\$10.3m	\$11.3m	\$12.6m
Black Solider Fly Larvae – Animal Feed	\$299m	\$327m	\$366m



Company name: Sanivation

System/Technology: Faecal sludge treatment facility

Location: Naivasha, Kenya

Sector: Sanitation, Energy

Agriculture use: Fuel and Energy

Beneficiaries: Local governments and industries, rural, urban and peri-urban populations

Summary and Impact

Sanivation develops and operates fecal sludge treatment plants in partnership with the government. They treat the waste and transform it into biomass fuel that is sold to local tea and flower farms, among other industries, to use as part of their commercial operations.

Sanivation created a process in 2015 that mixed the toilet resources obtained from its container-based sanitation facilities with industrial waste from surrounding factories, such as sawdust from wood mills. Recognizing the need for city-wide inclusive sanitation in secondary cities, the company is now receiving faecal sludge from pit latrines and septic tanks to their faecal sludge treatment facility. The sludge is heat-treated to inactivate any pathogens, and the sludge and biomass mixture is then put in a system that extrudes non-carbonized briquettes for commercial biomass boilers.

To date, Sanivation has treated 2,250 T of waste; it has served 44,292 people with safely managed sanitation, and it has sold 2'695 T of fuel. Sanivation employs 55 people, and it has an offset of 6,597 T of CO₂-eq from fuel displacing firewood.



Company name: Sanergy

System/Technology: Toilets and nutrient, water and energy recovery

Location: Nairobi, Kenya

Sector: Water, Sanitation, Agriculture and Energy

Agriculture use: Horticulture Farms, Livestock Farms and Energy for General Industry

Beneficiaries: large scale and smallholder farmers in horticulture and livestock, restaurants, agricultural pack houses, low-income, non-sewered urban and peri-urban populations

Summary and Impact

Sanergy currently processes approximately 20,000 tonnes of waste/year (2020), and now has the capacity to process 70,000 tonnes at its organics recycling factory in Nairobi. Sanergy serves over 1,000 farmers with its fertiliser and animal feed products. Its sanitation network serves 140,000 people every day. It currently employs over 400 people through its work. Sanergy hires local people to manufacture and distribute cost-effective toilets for Nairobi's slums. Local residents pay a small fee for a waste collection service.

Sanergy's model consists of four critical steps: (i) building and distribution of high quality, cost-effective container-based sanitation units called Fresh Life; (ii) professional collection and removal of all sorts of organic waste (sanitation waste from the Fresh Life toilets, agricultural waste, and market/kitchen waste from restaurants, market areas and agricultural pack houses); (iii) its safe transportation to their large-scale recycling factory; and (iv) the treatment and repurposing of the waste to agricultural inputs and energy for commercial and smallholder farms.

2021



536M

Biogas



\$227.8M

Electricity



\$272.7M

Biochar



\$0.41M

Compost



\$299M

Black Soldier Fly Larvae –
Animal Feed



\$0.16M

Nitrogen

\$0.13M

Phosphate

\$0.13M

Potassium



\$10.3M

Water



Since 2011, Sanergy has installed 3,145 toilets in Nairobi, which serve more than 100,000 people on a daily basis. The company safely removes 12,000 tonnes of waste annually and has created over 1,000 jobs throughout its full value-chain approach.

SMART SANITATION ECONOMY



MARKET INSIGHTS

Kenya is looking to digital technologies and the markets that come with them, but we have yet to see Kenya advocating smart sanitation approaches. However, we do hope that, as the private sector's engagement grows, this approach will permeate.

Konza Smart City, the Silicon Savannah is a project (set for completion in 2022) to develop a 5,000 acre technopolis between Kenya's two largest urban hubs, Nairobi and Mombasa. Located 60 km southeast of Nairobi, Konza will be a sustainable, world-class technology hub, a major economic driver for the nation and home to a vibrant mix of businesses, workers, residents, and urban amenities. The plan envisions urban densities, walkable neighborhoods, access to parks and

recreation, transit-oriented development, varied retail and restaurant options, and a full spectrum of housing choices. Konza will also host data centers, technology and life science facilities, commercial office space, hotels, convention centers, educational institutions, and community support services. Konza is expected to help Kenya achieve middle-income status by 2030, growing into a community of more than 200,000, attracting 17,000 direct jobs and generating \$1.3 billion in gross regional product. The city will feature smart sanitation from an operational perspective but is not yet scoped to include smart sanitation technologies from a consumer insights or public health perspective.¹⁴

The Ministry of Information, Communication, Technology's Digital Economy Strategy is integral to the Republic of Kenya's long-term socio-economic and ICT development. Crucially, the strategy encourages multiple sectors and stakeholders in Kenya to develop roadmaps geared towards ushering Kenya into the Fourth Industrial Revolution (or 4IR), and provides a blueprint for Kenya's continued immersion in the digital economy. There is not yet a roadmap for the sanitation economy of Kenya but this could be a powerful next step.

Kenya's population of 48 million people is particularly young, with an average age of 19 years. The population is regarded as being particularly innovative, especially with respect to developing and adapting technological solutions to combat specific regional problems. The success of mobile transfer service, M-Pesa, in the region is testament to this.¹⁵

Kenya is a member of the Smart Africa Alliance Initiative and plays a strong role on the approach to the digital economy. As Kenya's use of digital technologies for other essential services grows, we anticipate a willingness to embrace smart sanitation approaches as well.

From a public health perspective, Kenya is grappling with an accelerating challenge of antibiotic resistance. Sanitation and wastewater testing for antibiotic use could prove a valuable data stream to understanding usage in the country.¹⁶

14. [Coffey: Konza Smart City – the New Silicon Savannah 2019](#)

15. [Frost & Sullivan: Digital Market Overview: Kenya 2018](#)

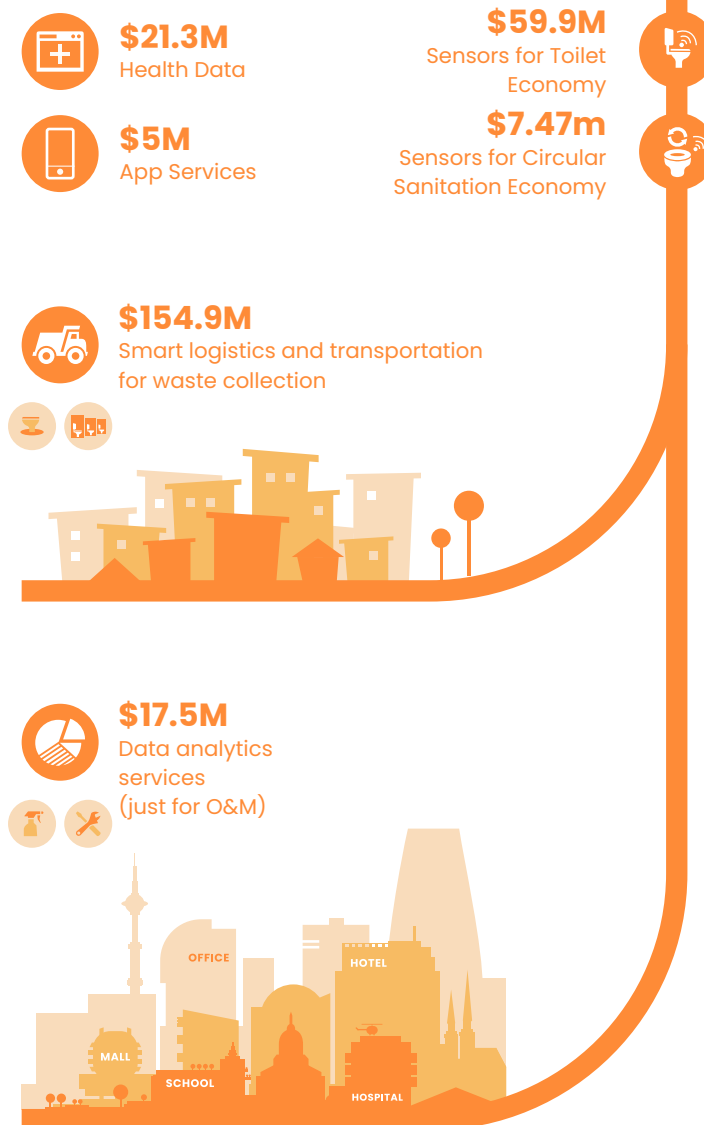
16. [Science Direct: Occurrence of Antibiotics and risk of antibiotic resistance evolution in selected Kenyan wastewaters, surface waters and sediments June 2020](#)

EXAMPLE OF METHODOLOGY BREAKDOWN

Smart Sanitation economy was based on futuristic concepts of monitoring health or ironing out infrastructure bottlenecks based on the emerging digital landscape. In relation to each of the sub components, data from trusted sources were referred to and cross-referenced with other data points. E.g. smart logistics & transportation for waste collection was cross referenced with total community in the urban slums of Kenya. It was assumed for 4 households 1 community toilet facility was available and for emptying the latrines, a cost of 180.6 USD/ annum is being levied. All calculations were performed on a USD/ annum, which was then converted to USD Mn.

E.g. For estimating the sensor fitted toilet technologies, no. of toilets in the public spaces that was calculated in the toilet economy, was used as the starting point. It was assumed that an organic growth in adoption of sensors would occur in those toilets (which was 5% till 2021 - 2023, 10% till 2025 - 2027 and 15% from 2028 -2030). It was also assumed that the sensors would require a replacement in every 4 years. An average cost of a sensor module at existing market rate was considered. All calculations were performed on a USD/ annum, which was then converted to USD Mn.

PRODUCT OR SERVICE	2021	2025	2030
Health data	\$21.3m	\$44.6m	\$112.5m
Sensors for Toilet Economy	\$59.9m	\$179.8m	\$299.6m
Sensors for Circular Sanitation Economy	\$7.47m	\$6.65m	\$7.47m
Smart logistics and transportation for waste collection	\$154.9m	\$169.7m	\$190.1m
Data analytics services (just for O&M)	\$17.5m	\$51.3m	\$123.9m
App services	\$5.0m	\$8.6m	\$13.1m
Total	\$266.1m	\$460.6m	\$746.6m





The members of the Toilet Board Coalition have come together to align and amplify private sector engagement and investment in the sanitation sector. With this work, we hope to catalyse further momentum and attention within Kenya and globally on the opportunities in this beautiful republic. We have asked the team at Sanergy, a TBC Accelerator graduate and now member of the Coalition, to contribute the call to action that follows. We firmly believe in the potential of private sector stakeholders of all sizes to usher in a new era of sanitation.

At the Toilet Board Coalition we see a compelling opportunity in Kenya, from a regulatory and entrepreneurial perspective. As a global community of investors and advocates, we must now put our support behind these local stakeholders and use our strength to accelerate progress. Kenya offers great promise for a scale demonstration of a thriving sanitation economy serving all.



Over 52% of Kenya's urban population lives in the Nairobi metropolitan area. The population of Nairobi is expected to grow from 4 to 6 million (M) by 2030 and seven of its surrounding cities are in Kenya's top 25 fastest-urbanising areas. As this region accounts for 35% of Kenya's GDP and is growing quickly, it is an attractive location for investment. In Nairobi County, approximately 1.6 M people (53%) do not have access to toilets (World Bank. "Republic of Kenya: Kenya Urbanization Review." February 2016).

At the same time, 66% of the human waste generated ends up in the ecosystem untreated, causing environmental pollution and harming public health. In order to accelerate the achievement of SDG 6 on safe sanitation for everyone everywhere, collaboration between the private and public sector is required in the implementation of solutions that are designed to evolve as the population grows and those that can be adopted quickly by its citizens.

Cost-effectiveness is a critical factor of consideration in determining the sanitation solutions to implement. Traditional sanitation solutions, such as sewers, require large financial investments borne by the government and are not feasible to implement in some areas, such as the crowded urban slums. Working with the private sector, which is flexible, to test new sanitation technologies enhances inclusive sanitation delivery that is affordable and can be scaled easily. In addition, adapting solutions that promote the growth of a sanitation economy ensures affordability and sustainability of solutions implemented. In the case of Sanergy's solution, sanitation delivery has been made affordable through revenues acquired throughout the value chain: from the service fee charged to the sale of waste-derived products.

Creating a sustainable enabling environment is also critical for a thriving sanitation economy. Public and private sector engagement is key in developing a regulatory framework that promotes inclusive sanitation delivery and the manufacture and sale of waste-derived products.

The Team at Sanergy

ADDITIONAL SOURCES

SL	REPORT TITLE	PUBLISHED BY	DATE OF PUBLICATION
1	Report on the 2017 Kenya Census of Establishments	Kenya National Bureau of Statistics	2017
2	AFDB Statistics Pocketbook	AFDB	2019
3	2016 Basic Education Statistical Booklet	Ministry of Education Govt. of Kenya	2016
4	Digital Market Overview: Kenya	Frost & Sullivan Report	2018
5	Kenya Environmental Sanitation and Hygiene Strategic Framework (Kessf)	Ministry of Health, Govt. of Kenya	2016
6	Kenya WASH Program Fact Sheet 2019	USAID	2019
7	WASHplus Program in Kenya	Govt. of Kenya USAID FHI 360	2020
8	Sanitation Policy and Planning Framework Case Study for Discussion	Govt. of Kenya	2019
9	Rural Kenya Market Research on sustainable Sanitation products and solutions for Low income Households	SNV – UNICEF	2013
10	Commuting in Urban Kenya: Unpacking Travel Demand in Large and Small Kenyan Cities	MDPI	2019
11	UN – World Water Development Report – Wastewater, the untapped resource	UNESCO	2017
12	Population by County and Sub County	Kenya Population & Housing Census	2019
13	Kenya Onsite Sanitation Market Intelligence	Ministry of Health, WSC, IFC	2013
14	JMP datasets for Kenya	WHO & UNICEF	2020
15	World Bank datasets	The World Bank	2020