



**STeP**

Sanitation Technology  
Platform

# MARKET INSIGHTS FOR THE REINVENTED TOILET

Findings from urban Kenya and Nigeria

SEPTEMBER 2017

**Dalberg**

DESIGN  
IMPACT  
GROUP



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The background image shows the interior of a makeshift toilet facility. It is a circular concrete pit with a yellow plastic lid. On top of the lid, there is a small wooden structure with a metal rod protruding from it. The walls of the structure are made of heavy, dark-colored tarps. The floor is made of cracked, light-colored concrete. The lighting is bright, suggesting an outdoor or semi-outdoor setting.

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# MARKET INSIGHTS FOR THE REINVENTED TOILET

Executive summary

**Dalberg**

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# Summary: For the selected segments, Kenya may be an easier market to work in but Nigeria offers a larger opportunity for the RT

Sanitation access	<ul style="list-style-type: none"><li>• <b>Nigeria has a greater need for improved sanitation than Kenya.</b> Nigeria has more households accessing unimproved sanitation than Kenya. Lagos alone has 165,000 households that do not have access to any kind of sanitation solution. That said, significant variation persists across different cities in each country</li></ul>
Value proposition for the buyer/user	<ul style="list-style-type: none"><li>• <b>For existing residential construction</b>, the by-product value proposition of the RT is greater than the waste treatment / sanitation access value proposition for households in the target segments in both countries. Electricity and bio-gas by-products are the two most value by-products in both countries</li><li>• <b>For new construction</b>, developers in both countries (particularly those building in peri-urban areas) are looking for cost-effective sanitation solutions and, as such, are interested in the RT, providing it gives them flexibility in the choice of interface, is compliant with local building regulations, and is reliable</li><li>• <b>For institutional segments</b>, the value proposition is strong in both countries for public toilet operators who seek to reduce operating costs and have value for the electricity and water by-product</li></ul>
Addressable market	<ul style="list-style-type: none"><li>• <b>For existing residential construction</b>, the addressable market size for target segments in Nigeria is larger than Kenya, owing to large differences in population size</li><li>• <b>For new construction</b>, the market size is comparable in the short run, given the ongoing recession in Nigeria. However, in the long-run, far more construction is likely to take place in Nigeria than Kenya</li></ul>
Ease of going to market	<ul style="list-style-type: none"><li>• <b>The government has shown great commitment to improving sanitation in Kenya</b> and is heavily prioritizing sewer expansion in cities (although implementation is uneven and constrained). This may or may not limit their interest in the RT</li><li>• In Nigeria, while there are challenges in working with the government, <b>the Lagos State government is looking for decentralized sanitation solutions</b> and has no plans to build a centralized sewer system</li><li>• <b>Many non-profit/private sanitation players are active in Kenya</b> (with a small collective footprint). They are heavily subsidised and none have achieved scale. <b>Few-to-none such actors exist in Nigeria</b></li></ul>
Path to market-entry	<ul style="list-style-type: none"><li>• <b>In both countries and across all segments, it is essential to create demonstration projects that can prove the value proposition.</b> Such demonstration projects should be used as a way to generate buy-in and facilitate product uptake among other buyers/users. <b>In both countries, we recommend entering the market through an institutional segment such a public toilets or schools and then scaling to residential segments</b></li></ul>

## EXECUTIVE SUMMARY: CONTENTS

1. **Project overview**
2. Kenya and Nigeria's sanitation landscape: stakeholders, challenges and opportunities
3. Residential market: priority segments and go-to-market approach in Kenya and Nigeria
4. Institutional market: priority segments and go-to-market approach in Kenya and Nigeria
5. Conclusion: recommended paths to market-entry

# STeP and BMGF seek to accelerate and de-risk testing for sanitation technologies, in part by understanding the market for the RT

## Project context

- In 2011, the Bill and Melinda Gates Foundation (BMGF) launched the Reinvent the Toilet Challenge—an effort to bring sustainable sanitation solutions to the 2.5 billion people worldwide that lack adequate sanitation access
- The prototypes of the Reinvented Toilet (RT) target the challenge of properly treating waste on-site and extracting value from it, e.g., via combustion, water recycling and transformation into agricultural inputs
- The Sanitation Technology Platform (STeP) is supporting BMGF accelerate and de-risk translation and commercialization of transformative sanitation technologies such as the RT. BMGF and STeP seek insights into the Nigerian and Kenyan urban markets to understand if and how the RT could help address extant sanitation challenges in those countries

## Project objectives

- Develop a complete understanding of urban sanitation needs by residential and commercial/public building structures, including decision-makers and influencers (not just users) within the ecosystem
- Identify promising segments for the Single User Reinvented Toilet (SURT) and the Multiple User Reinvented Toilet (MURT), analyze market size and propose a value proposition for those markets
- Describe a purchase pathway and points of leverage for each segment
- Develop insights to support technical design and refine product features of the RT
- Build out go-to-market implications, including design and business model considerations to encourage large-scale product adoption

# We conducted ~500 interviews with sanitation players in each country to understand the sanitation landscape, opportunities, and preferences

## Interview subjects (*per country totals*)



### Sanitation institutions / experts

- 10–20 NGOs
- 4–6 government officials
- 5–8 academic experts
- 2–5 development partners



### Suppliers

- 15 distributors / wholesalers



### Contractors / developers

- 5–10 developers
- 20 contractors



### Purchasers / users

- 110 homeowners
- 170 tenants
- 10 public toilet users
- 50 landlords



### Service providers

- 30 plumbers and waste collectors
- 15 NGOs / social enterprises (in Kenya)

~175 Qualitative interviews in each country

~25 Human centered design interviews in each country

~300 Quantitative surveys in each country

- Mapped the sanitation ecosystem in each country and identified challenges and opportunities
- Understood the common sanitation needs, preferences and characteristics across selected user segments
- Assessed expressed interest of priority segments in SURTs and MURTs
- Identified specific design characteristics that respond best to customer needs and behavioral patterns
- Identified go to market considerations in each country

# We selected priority residential and institutional segments in Kenya and Nigeria and explored the market opportunity for the RT in each

## *Short-listed segments*

### **Residential market**

1. Poor and lower-middle-income existing tenements
2. Poor and lower-middle-income existing informal dwellings using pit latrines
3. All formal new construction (for all income groups)
4. Formal apartment buildings
5. Formal standalone houses

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### **Commercial / institutional market**

1. State-sponsored housing (SURT/MURT)
2. Educational institutions (MURT)
3. Commercial retail (MURT)
4. Public toilets in markets and transport hubs (MURT)
5. Religious institutions
6. Health care institutions

## *Selected priority segments*

### **Residential – Existing construction**

Low and lower-middle income existing informal dwellings and tenements (SURT / MURT) in Kenya and Nigeria

### **Residential – Formal new construction**

New structures being built for all incomes in Nairobi and Lagos (SURT / MURT)

### **Commercial / institutional**

- State-sponsored housing in Nigeria (SURT / MURT)
- Educational institutions in Kenya (MURT)
- Public toilets in market places in Kenya and Nigeria (MURT)

## *Understanding the market*

- For each of the priority segments, we understood consumer/buyer preferences and identified market opportunities
- We developed a go-to-market approach for reaching that priority segments. No single go-to-market approach will suit all segments. Each segment will require a different approach - business to consumer (B2C), business to business (B2B), or a business to government (B2G) approach, or all three
- **The findings presented in this report pertain to these segments in particular. There are likely opportunities with other segments\***



\*The scope of the research limited the chosen segments to a total of five segments across the two countries



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# Kenya has better access to sanitation than Nigeria and the Kenyan government has shown commitment to expanding sewer access

	 Kenya	 Nigeria
<b>Key questions</b>		
<i>What is current state of sanitation access across the value chain?</i>	<ul style="list-style-type: none"><li>• 13% of dwellers in Mombasa and Nairobi, collectively, access unimproved sanitation solutions – as uncovered pit latrines, buckets or open spaces</li><li>• <b>43% of households in these cities are connected to the sewer line</b>, and Nairobi’s share of such households (51%) exceeds Mombasa’s (16%)</li></ul>	<ul style="list-style-type: none"><li>• 10% of residents of Lagos and 40% of Abuja, access no or unimproved sanitation solutions</li><li>• <b>32% of households in these cities are connected to the sewer line</b>, and Lagos’ share of such households (35%) exceeds Abuja’s (21%)</li><li>• <b>Lagos does not have a centralized sewer system</b></li></ul>
<i>What are the key challenges and opportunities across the landscape?</i>	<ul style="list-style-type: none"><li>• <b>No single institution is accountable for sanitation</b>, leaving an administrative vacuum</li><li>• <b>Many non-profit/private sanitation players are active in Kenya</b>. They are heavily subsidized and none have achieved scale. This also means that Kenyans have some degree of exposure to waste-to-value as a concept</li></ul>	<ul style="list-style-type: none"><li>• <b>The national sanitation policy ecosystem is fragmented</b>. Sanitation is the shared responsibility of several ministries, with no clear line of sight and persistent under-investment</li><li>• <b>There are very few non-profit/private sanitation players in Nigeria</b> and alternative models have not yet been tested widely</li></ul>
<i>What policy trends may impact the sanitation space in the future?</i>	<ul style="list-style-type: none"><li>• The recent National Environmental and Health Sanitation Policy (2016-2030) promotes planning for and financing of sanitation access</li><li>• <b>Kenya’s government is committed to advancing sewer development but recognizes that its goals are ambitious</b>. There are efforts to promote alternative solutions in parallel, but sewers remain the main a policy priority</li></ul>	<ul style="list-style-type: none"><li>• <b>Lagos State government encourages decentralized waste treatment</b> due to the high cost of building and maintaining sewer system</li><li>• <b>There is a long-term plan to phase out truck conveyance of waste to treatment plants in Lagos</b>; biogas generation from human waste is a sector of interest to the government</li></ul>

**Nigeria has a greater need for the RT and state governments seeks to support decentralized sanitation solutions. While Kenya’s national priority is to expand sewer lines, implementation at the county level is likely to be uneven, and county governments may find value in the RT**

# Given the current challenges and policy priorities, different actors within the ecosystem may find value in the RT

Institution	Kenya	Nigeria
Donors and NGOs	<ul style="list-style-type: none"> <li>● NGOs may find value in promoting the RT, as they typically test a variety of sanitation solutions; many such players in Kenya are currently involved in facilitating improved sanitation access</li> </ul>	<ul style="list-style-type: none"> <li>● The RT as a sanitation solution and water/energy generator addresses a range of development problems in the purview of NGOs' work</li> </ul>
Government	<ul style="list-style-type: none"> <li>● The government has recognized non-sewered solutions as a pathway to its sanitation goals but nevertheless prioritizes sewers</li> </ul>	<ul style="list-style-type: none"> <li>● State government in Lagos has no plans to install centralized sewage system and encourages decentralized treatment</li> </ul>
Alternative sanitation providers	<ul style="list-style-type: none"> <li>● Typically, these are social or small enterprises. The most innovative are looking into the waste-to-value chain. The RT would cut off supply for a key resource, unless it is integrated into their business</li> </ul>	<ul style="list-style-type: none"> <li>● There are not many such players in the market and the RT could be direct competition for their product. Some may embrace the opportunity to stock RT and install it for customers</li> </ul>
Waste municipalities	<ul style="list-style-type: none"> <li>● Sanitation services are managed by parastatal Water Services Boards. On-site solutions are not fully aligned with their core business, as their revenue streams are largely linked to sewers</li> </ul>	<ul style="list-style-type: none"> <li>● It is unclear whether the waste municipality will appreciate the cost-saving from the RT or whether they will suffer revenue losses</li> </ul>
Plumbers	<ul style="list-style-type: none"> <li>● Plumbers may still find value if they are involved in the RT value chain - to provide repair and maintenance services, with training where necessary</li> </ul>	<ul style="list-style-type: none"> <li>● Plumbers may still find value if they are involved in the RT value chain - to provide repair and maintenance services, with training where necessary</li> </ul>
Waste extractors	<ul style="list-style-type: none"> <li>● Nairobi and Mombasa each have 12-15 companies offering fecal sludge extraction and numerous "frogmen" who manually extract latrines. The RT will likely compete with their business</li> </ul>	<ul style="list-style-type: none"> <li>● Companies and individuals that currently provide extraction services are unlikely to find value in a purely on-site solution that requires no extraction – thereby competing with their core business</li> </ul>

**The RT's current value proposition is stronger for the Nigerian government, which is looking for decentralized sanitation solutions. Although the Kenyan government is prioritizing sewer expansion, they could be convinced of RT's value proposition in certain areas**



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# Of the many residential segments in each city, we studied two priority segments in detail to identify the value proposition of the RT for each

## RT value proposition to the priority segment user

### Priority residential segments



### Kenya



### Nigeria

1

### Existing construction - Informal building and tenement dwellers

- **Sanitation / waste treatment:** Despite lacking access, households in these segments do not prioritize making improvements to their existing sanitation solution
- **By-products:** Certain fuel sources (e.g., cooking gas) is costly. The RT with biogas could prove to be a valued and cheaper alternative. Electricity access is reliable and controlled by cartels in Nairobi but not Mombasa. RT could prove to be a valued alternative to existing energy sources

- **Sanitation / waste treatment:** Despite lacking access, households in these segments do not prioritize making improvements to their existing sanitation solution
- **By-products:** Electricity access is unreliable and the RT could prove to be a valued alternative to existing sources in both Abuja and Lagos

2

### New formal residential construction

#### *Current value proposition:*

- **Cost-savings on capex** needed to construct a septic tank/extend the sewer line. There is considerable ongoing use of bio-digesters in Kenya, indicating a market for the RT
- **Cost-savings in opex** in instances where developers build units to rent and are responsible for maintenance

#### *Avenues to improve the value proposition:*

- **Provide flexibility** in the choice of RT's interface fixtures/fittings so that developers can install high-end toilet interfaces, if needed
- **Ensure legal compliance of the RT** - ensure that the local planning authority pre-approves the technology so that developers do not have to apply for this compliance themselves

**The value proposition is similar across segments in both countries. The user value proposition for those living in informal settlements and tenements in Nairobi is weaker than other cities due to extensive sewer coverage and relatively reliable services**

# Of the many residential segments in Nairobi and Mombasa, we estimated the market size of two priority segments



Segmentation framework and size of residential segments in Nairobi and Mombasa

Age of construction		Existing construction												New construction			
Type of septage solution		None (incl. bucket users)				Pit (various)				Sewer and septic tank				None			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E	20K				440K				250K				Up to 24K			
	D							70K				380K				10K	
	A+B+C																

← Existing stock in 2016 →      ← Annual flow →

**1**

**Priority segment in Nairobi and Mombasa**  
**Existing construction - Informal building and tenement dwellers accessing pit latrines**

- The total segment size of households in informal buildings and tenements using pit latrines is 316,450 and 123,497 households in Nairobi and Mombasa, respectively. This segment forms 38% of all existing households
- The latent market within this segment is 280,000 and 52,000 households in Nairobi and Mombasa respectively
- The addressable market for this segment, after accounting for space constraints, propensity to adopt the RT, and income levels is **3,500-7,500 SURTs and 4,000-12,000 MURTS ± 40%**, depending on product pricing

**2**

**Priority segment in Nairobi**  
**New formal construction**

- The total segment size of new formal construction taking place annually in Nairobi is 10,000 households (90% of which are apartments)
- At 12% annual growth rate, this amounts to 61,000 additional units built over a 5 years
- The latent market for this segment over 5 years is **2,800 MURT units and 5,000 SURT units**

\* Data for Mombasa are unavailable

Note: I = Informal settlement; T = Tenement; A = Formal apartment building; S = Standalone house

# Of the many residential segments in Lagos and Abuja, we estimated the market size of two priority segments



*Segmentation framework and size of residential segments in Lagos and Abuja*

Age of construction		Existing construction												New construction			
Type of septage solution		None (incl. bucket users)				Pit (various)				Sewer and septic tank				None			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E	230K				1,080K				770K				Up to 75K			
	D							260K				1,650K				4K	
	A+B+C																

← Existing stock in 2016 →
← Annual flow →

**1**

**Priority segment in Nairobi and Mombasa**  
**Existing construction - Informal building and tenement dwellers accessing pit latrines**

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**2**

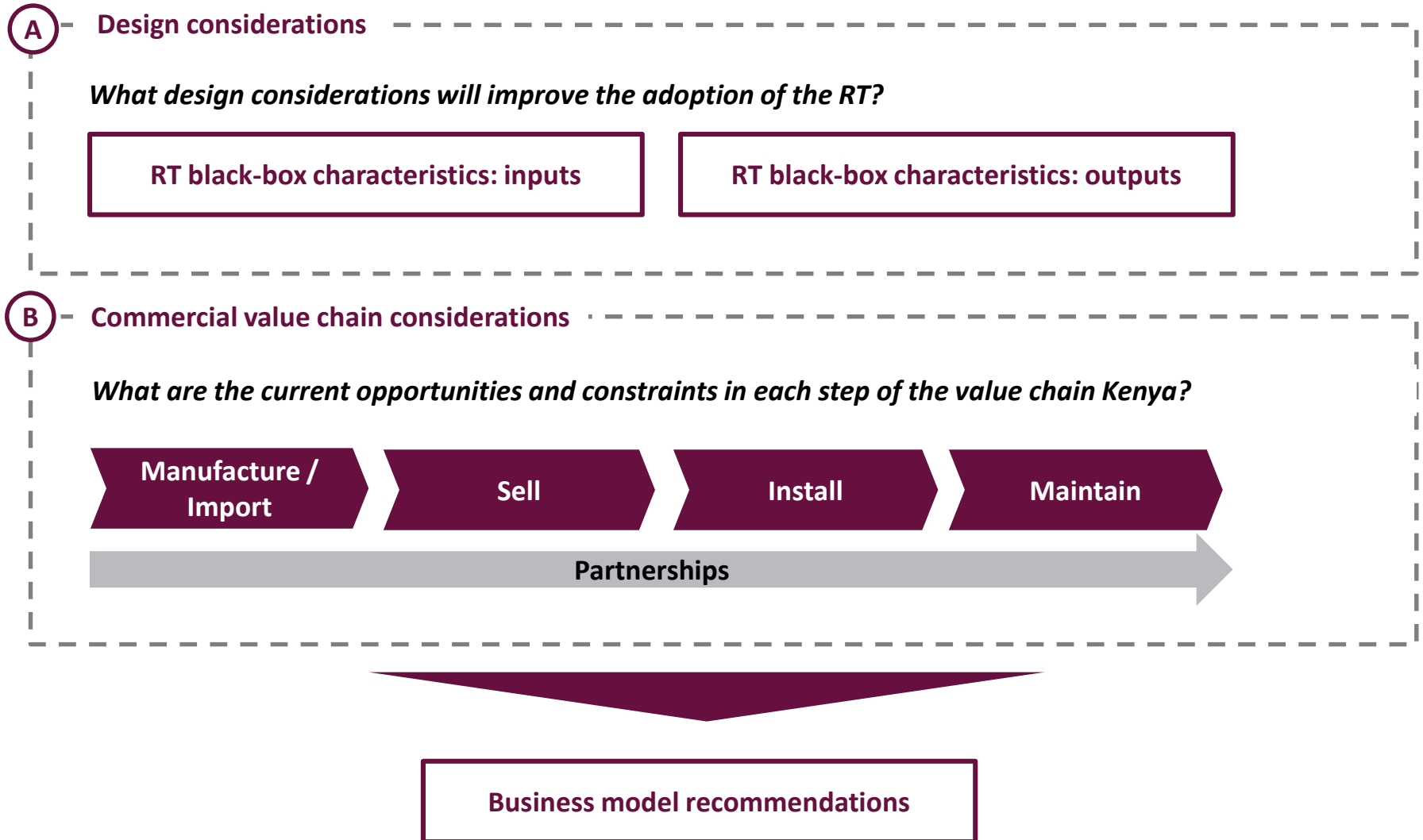
**Priority segment in Nairobi**  
**New formal construction**

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*\* Data for Mombasa are unavailable*

Note: I = Informal settlement; T = Tenement; A = Formal apartment building; S = Standalone house

## Process: For each of these priority segments, we identified design & commercial considerations to improve RT adoption



1

# RT inputs: RT's targeting low-income informal building and tenement dwellers need to be flexible in terms of power, water and space

## Evidence from field research

### RT input related recommendation



#### Kenya



#### Nigeria

**The RT should not run on a user's power source or it should have its own (discreet) power source**

**Instability of the grid:** The electricity service in Mombasa is not very stable. Although the electricity is reliable in Nairobi, it may be a safety hazard because it is an informal connection. Visible off-grid source may be seen as a threat to cartels in Nairobi

**Insufficient power:** Private distribution companies are the main electricity providers in Nigeria. Their service is highly unreliable across all demographics in Lagos. Residents have frequent blackouts and sometimes go for days without electricity

**The RT should not depend on a user's existing water supply**

**Burden of water access:** Although some households have water supply on the plot or within a 5 min walking distance, it is a burden for them to collect and store water at their home. Further, water supply is often intermittent

**Poor water quality:** In informal settlements like Makoko or Ijora where there is often little access to government supplied water, most participants obtained their water from wells or water vendors. However, this water is often perceived to be dirty and often colored

**The RT needs to account for fluctuating urine and feces volumes**

**Insufficient weekly load:** Residents of a plot have other options besides their plot toilet. For example, adults can use a toilet at their workplace or the market and children can use a toilet at their school. The input volume may be low during the week, but high during the weekends if residents are around or if there is a celebration at the compound.

**The RT needs to account for household space configuration**

**Space constraints:** The reality of living conditions in Nairobi is that shared toilets are the only practical option for priority segments. There is no space to install a single toilet and piping in a one room household

**Terrain constraints:** Some informal settlements are precariously situated on a lagoon and often prone to flooding, one of the reasons why they do not construct on-ground sanitation systems

# 1 RT by-products: the value proposition of the RT would improve if the by-products can meet household demand cost effectively

## Evidence from field research

### By-product related recommendation



### Kenya

**The electricity by-product will be most valued if it can meet most household electricity demand**

**Volume of electricity produced:** The RT's electricity would need to meet all electricity demands, and be more reliable for it to be appealing for Nairobi respondents. However, if the RT were to produce electricity, it would be a possible threat to the illegal cartels' business. The electricity value proposition could be more flexible in Mombasa because respondents' current source is not that reliable.

**Biogas could find uptake if it is cheaper than current fuels and meets safety standards**

**Cost effectiveness:** The RT could strength its value proposition if the biogas by-product were cheaper and more accessible than respondents' current sources of cooking fuels. A delivery mechanism of the biogas to the users in these settings where there is no kitchen in sight may also need to be explored

**Non-potable water may find greater uptake if it can be used for flushing waste and cleaning the toilet**

**Preferences for alternatives:** Respondents stated that they would use the non-potable water for household chores (e.g., cleaning and laundry), which would cut down on the cost and time of obtaining jerrycans of water from the tap or the local water vendor. Unlike electricity and biogas, respondents did not aspire to accessing this by-product, especially in Mombasa, where residents could easily access non-potable water through boreholes



### Nigeria

**Volume of electricity produced:** The RT's electricity would need to meet all electricity demands, and be more reliable for it to be appealing for Lagos. This amounts to 0.2 kWh – 1 kWh per household per day

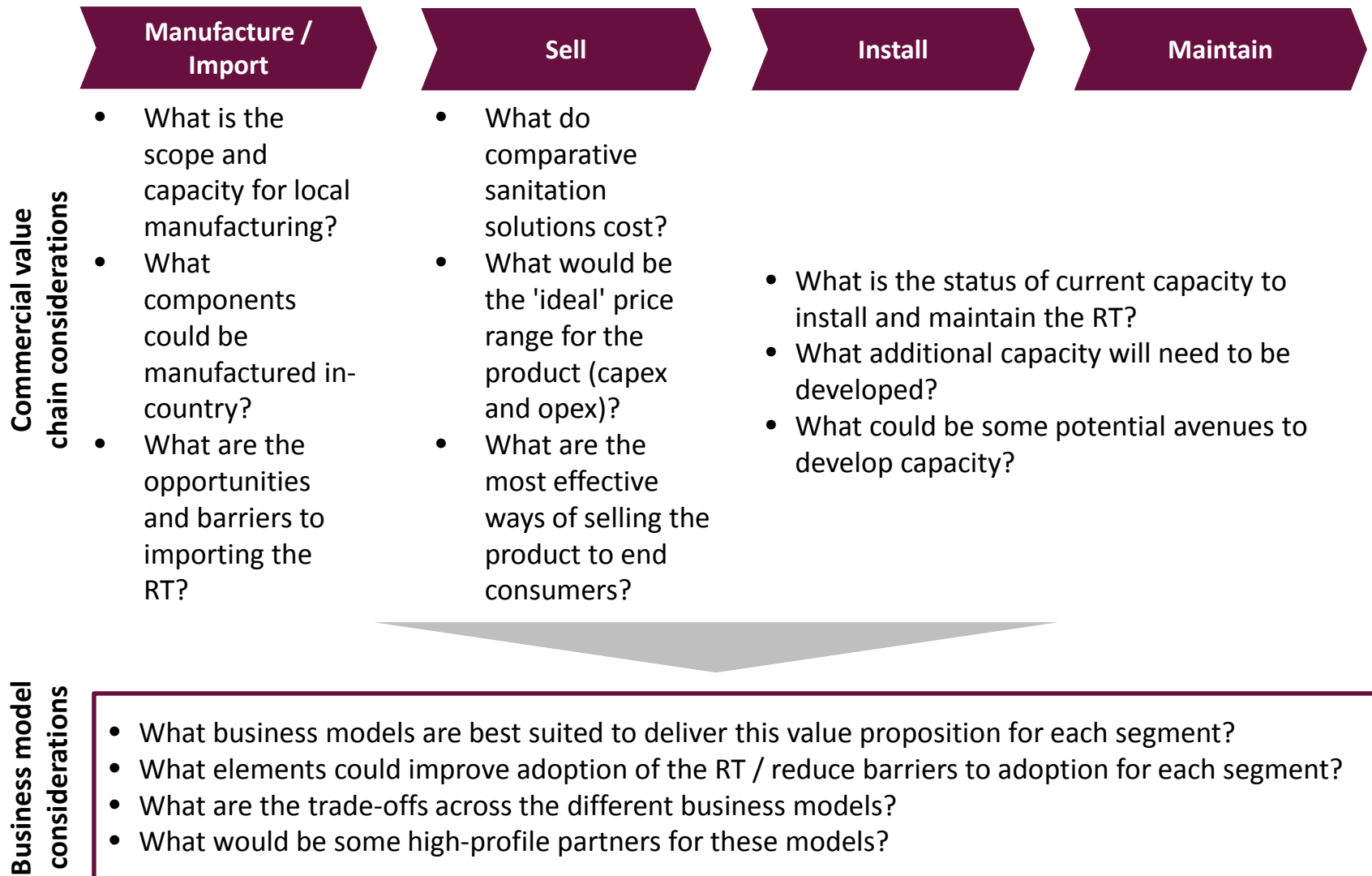
**Safety standards:** Surveyed low-income respondents were concerned about biogas because they thought it would not be safe to use around their children. Gas for cooking was not as prevalent and readily available as kerosene in Nigeria

**Water for flushing:** Lagos's shallow aquifer allowed some participants to access water via a well or borehole easily. However, people who used wells felt it was strenuous to fetch water due to lower water levels during the dry season. Respondents expressed interest in an automatic flush toilet that uses its own water because it would reduce the burden of fetching water

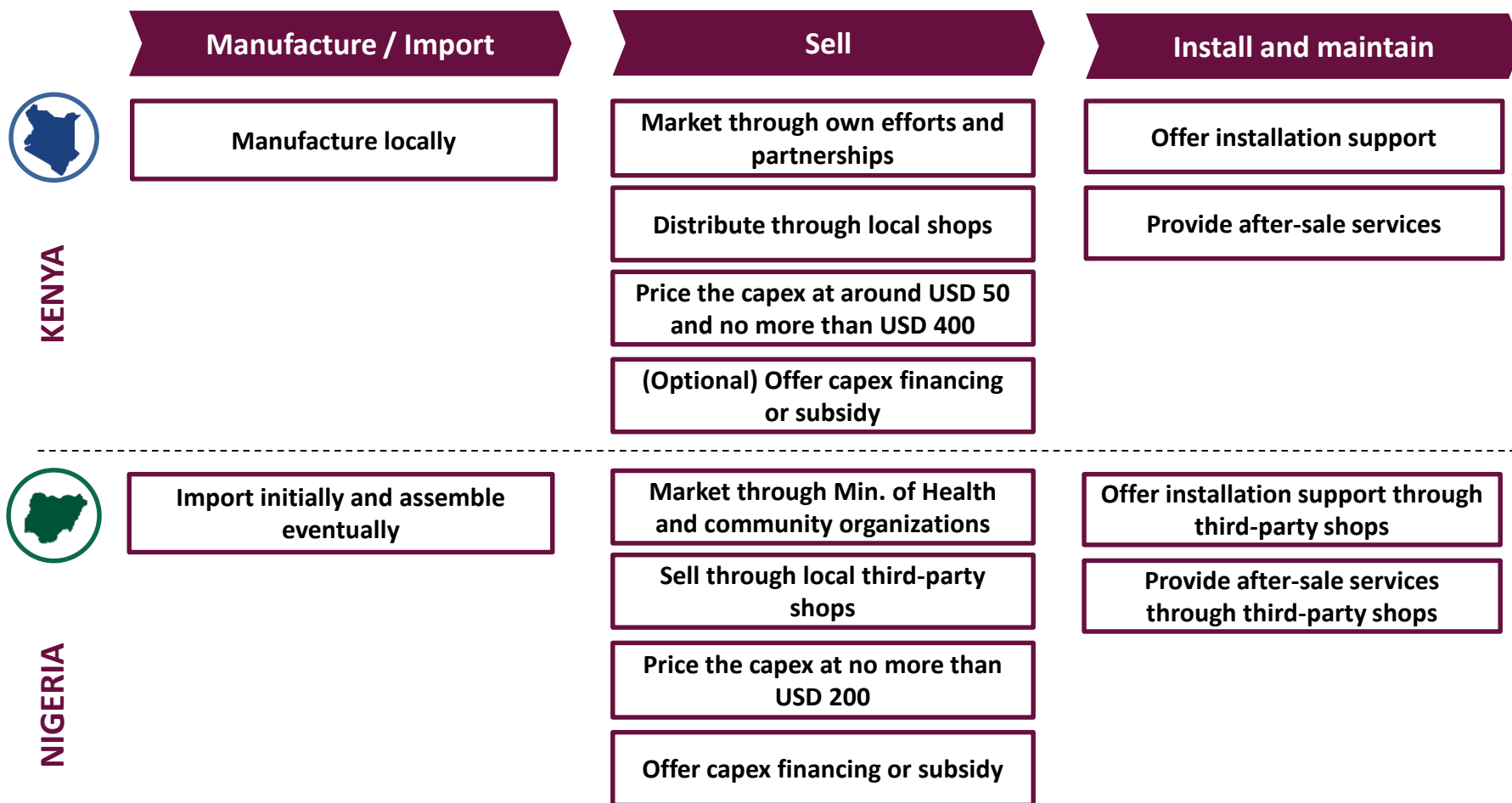
1

# Process: For the priority segments, we explored opportunities and constraints along four links of a commercial value chain

## Key questions explored



# 1 Informal/tenement dwellers: We recommend a product + service + finance model in both countries, with finance being optional in Kenya



A service component is recommended in both countries, given that the product is new, complex, requires customer education, and needs reliable maintenance to minimize reputational risks. Finance is crucial in Nigeria because the population has poorer access to credit and less exposure to similar products than Kenya

# 1 Informal/tenement dwellers: Specific business model considerations for RT's partners to operate in target markets in Kenya include



## Business model considerations for the target residential segment in Kenya

- 1 Manufacture locally**

It may be cheaper to manufacture locally, as importing would add 67% to the factory cost, depending on available funding for a plastic mold. Furthermore, contractors find maintenance of locally-made parts preferable/easier
- 2 Market through own efforts and partnerships**

RT's partners may individually organize or collaborate on community events to activate demand. Regardless of the model, a crucial step is to gain buy-in of key decision-makers such as DPHOs\*
- 3 Distribute through local shops**

Consider leveraging local hardware shops as distribution points where the marketing team can also run events to reach new customers
- 4 Price the capex at around USD 50 and no more than USD 400**

The expressed WTP\*\* within the priority segments suggests a SURT should cost no more than USD 150-400 and a MURT USD 90-280 (per HH). Industry evidence recommends no more than USD 50 for SURTs, which aligns more closely with demonstrated ability to pay

- 5 (Optional) Offer capex financing support or subsidy**

Financing support such as subsidies/pay as you go models could help open up the addressable market, especially for HH earning <USD 100/month. Assets such as gas tanks would also boost the value proposition
- 6 Offer installation support and education**

This step is key to ensuring that household concerns around installation and usage are addressed. It may also be necessary, as local plumbers/masons might not have sufficient existing skills
- 7 Provide after-sale services**

After sales support will mitigate HH concerns and low capabilities around maintenance. It will also mitigate any brand risks that may emerge from poor maintenance of the RT

Note: \*DPHO: District Public Health Officers; \*\*Willingness-to-pay – It is important to note that there are numerous challenges with using expressed WTP numbers, and as such, these benchmarks should be further investigated

Source: Dalberg analysis

# 1 Informal/tenement dwellers: Specific business model considerations for RT's partners to operate in target markets in Nigeria include



## Business model considerations for the target segments in Nigeria

- 1 Import initially and assemble eventually**

We recommend importing the RT initially to secure customers' trust in the quality of the product. Thereafter, begin to import parts not available locally and assemble RT in a local factory
- 2 Market through Min. of Health and community organizations**

There will be great value in demonstrating the RT at the community level to generate buy-in. We recommend involving the Ministry of Health and community organizations/ leaders in early marketing efforts.
- 3 Distribute through local shops**

HHs usually buy toilets and their spare parts from local shops, that are usually associated with an average of 5 plumbers/bricklayers. RT partners could sell through these shops
- 4 Price the capex at USD 200 maximum**

Based on homeowners and landlords responses to willingness to pay questions, price above USD 200 will be considered too expensive. This proposition needs to be tested further as expressed willingness to pay surveys are often unreliable
- 5 Offer financing or subsidy for capex**

Financing support or a subsidy will help open up the addressable market by rendering the product more affordable to cash-strapped households in lower-income categories
- 6 Offer installation support through shops**

To ensure the RT is installed properly, trained bricklayers/plumbers associated with existing sanitation businesses/shops could install the RT
- 7 Offer after-sales service through shops**

To ensure household concerns around maintenance are addressed and that the RT is seen as a reliable product, plumbers attached to local sanitation shops may provide periodic maintenance services

Note: \*Willingness-to-pay – It is important to note that there are numerous challenges with using expressed WTP numbers, and as such, these benchmarks should be further investigated

Source: Dalberg analysis

## 2 Formal new constructions could be an attractive market if the capex of the RT is lower than a septic tank and/or sewer connection

### Projected increase in supply of new housing

- **Kenya:** Although the Nairobi residential market is growing at 12% per annum, the low-income housing gap is estimated at 500,000 units in 2017. In an effort to address the supply shortage, the government is offering a 50 percentage-point reduction in corporate taxes as incentive for developers to target low-income segments
- **Nigeria:** As a result of the recession, national spend on construction decreased significantly, by 80% in 2016; slow recovery is projected at an average of 5.39% over the next 3 years. An average of 4,000 formal new units being built per annum in Lagos, accordingly to government statistics, which are likely underestimates




### Expansion into non-sewered areas

- **Kenya:** Over the last 5 years, housing development has outpaced the expansion of the sewage infrastructure, as real estate development has spiked in Nairobi's non-sewered satellite towns. As a result, ~45% of new construction projects use on-site sanitation solutions, indicating a ready opportunity for the RT
- **Nigeria:** State government in Lagos has no plans to install centralized sewage system and encourages decentralized treatment. Abuja has limited sewer network coverage due to pace of urban development plan roll out. Both stand to benefit from RT on-site sanitation feature. Further, most development is taking place in peri-urban areas where there are no sewers

### Search for cost-savings to help boost profits

- **Kenya and Nigeria:** Developers are looking for more cost savings in their developments, particularly around the reduction of the soil excavation spend for septic tank and sewer line installation, which can account for 25% of total development spend. They are also looking for more affordable interface fixtures and fittings

## 2 Formal new constructions: To improve adoption, RT's partners will need to address housing developer concerns around three main themes:

Theme	Housing developer concerns	
 <p><b>Market perception</b></p>	<ul style="list-style-type: none"> <li>Developers are concerned that potential customers may not be willing to buy or purchase units that use alternative or unconventional materials. In this regard, giving the developer flexibility on choosing the interface will help boost adoption</li> <li>Research on low-income housing in Kenya has shown that households have a strong materials bias towards traditional materials and techniques (esp. stone and cement), and distrust towards alternatives</li> </ul>	<p>“Come to the market with something not too different, in terms of looks”</p> <p><i>Middle-income housing developer in Nigeria</i></p>
 <p><b>Reputation</b></p>	<ul style="list-style-type: none"> <li>If they overcome the first challenge, developers are further concerned with the assurance that the product would have few breakdowns, produce no smell, and be easily maintainable in the long run</li> <li>This is crucial to their ability to maintain reputation/salability, given high IRR and exit pressures from investors</li> </ul>	<p>“We’d need to make sure that there is no smell, given the 6,000 people who will live in this estate”</p> <p><i>Low-income housing developer in Kenya</i></p>
 <p><b>Legal compliance</b></p>	<ul style="list-style-type: none"> <li>Kenya’s Building Code sets regulations about the types of septage solutions permitted, according to geography, soil types, and the availability of sewer solutions</li> <li>In Kenya, high-density buildings (e.g., apartments) are required to be on the sewer line. This law is waived if the area is non-sewered, but still imposes limits on the density possible</li> <li>Developers in Lagos claim the Planning Authority buy-in is necessary for adoption of the RT</li> <li>The local planning authority (in Lagos – Lagos State Physical Planning and Urban Development; in Abuja Urban and Regional Planning Department of the FCTDA*) approves the mechanical drawings, which include the septic plan/dimensions. If mechanical drawings with RT are approved, the chances of adoption increase</li> </ul>	

**These three concerns are common to developers in both Kenya and Nigeria**

## Summary: The value proposition of the RT for priority residential segments is similar in both countries but the market sizes differ

### Priority residential segments



#### Kenya



#### Nigeria

1

#### Existing construction - Informal building and tenement dwellers

- **Value proposition:** households, despite lacking access, do not prioritize sanitation. For the end-user, the value proposition of the RT is the by-product
- **Addressable market:** 3,500-7,500 SURTs and 4,000-12,000 MURTs  $\pm$  40%, depending on product pricing

- **Value proposition:** households, despite lacking access, do not prioritize sanitation. For the end-user, the value proposition of the RT is the by-product
- **Addressable market:** 8,500-26,000 SURTs and 6,000-24,000 MURTs  $\pm$  40%, depending on product pricing

2

#### New formal construction

- **Value proposition:** potential capex cost-savings on developing a septic tank/extending the sewer line
- **Addressable market:** 5,000 SURTs and 2,800 MURTs  $\pm$  40% over five years. Note this is likely to be an underestimate as the data on formal construction are poor

- **Value proposition:** potential capex cost-savings on developing a septic tank/extending the sewer line
- **Addressable market:** 10,000-17,100 SURTs and 1,000-2,000 MURTs  $\pm$  40%, depending on predicted sector growth rates. Note this is likely to be a gross underestimate as the data on formal construction are poor

For both priority residential segments, the addressable market in Nigeria is larger than Kenya, and could be larger still if the RT was made affordable to the poorest of the poor (households earning <100 USD per month). Note that the overall country market size, which includes all segments, is much larger in both countries



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1. Project overview
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3. Residential market: priority segments and go-to-market approach in Kenya and Nigeria
4. **Institutional market: priority segments and go-to-market approach in Kenya and Nigeria**
5. Conclusion: recommended paths to market-entry

# Institutional segment summary: public toilets offer a strong opportunity in both Kenya and Nigeria

## Public toilets (Kenya and Nigeria)

Markets and transport hubs may be the easiest of all the segments to target given high need, low entry barriers and low competition

There are two ways that commercial partners could engage:

- 1) **Direct play** – operating toilets themselves (building new ones or renovating existing ones)
- 2) **Indirect play** – selling the RT to existing operators

**In Kenya, given the fragmentation of public toilet operators, the direct play model may offer a stronger opportunity than the indirect model.** A handful of operators take the same waste-to-value approach (e.g., Sanergy and Ecotact). They have either: a) built a business model around collecting the waste away to decentralized facilities for treatment and resale, or b) are already building on-site systems themselves. This does not mean that these players may not engage with commercial partners, however: several have been BMGF grantees, and many of their business models are still evolving

**In Nigeria, the arduous and time-consuming process of getting permission to use a site and set up a public toilet, means that the indirect model may offer a stronger opportunity than the direct model**

## Educational institutions (Kenya)

- **Universities:** There is an opportunity to impact this segment due to a recent push to develop 30,000+ student housing units in Kenya
- **Schools:** Schools offer a weaker commercial rationale as they are highly fragmented as a segment and lack the financial capability and decision-making power to make their own purchases, often dependent on Ministry of Education budgets. Yet, they have a severe need that requires support to address
- **The go-to-market strategy** could involve partnering with the government or a host of private sectors/CSR/NGO initiatives to improve school sanitation

## State-sponsored housing (Nigeria)

- **There are several planned and ongoing state sponsored housing projects in Nigeria.** For example, nearly 50,000 units are being upgraded/rehabilitated/built in Lagos, with some presenting an opportunity to pilot the RT. The value proposition for this segment is the same as new construction - the potential reduction in construction capex due to elimination of septic tank costs / sewer line extensions
- **The go-to-market strategy** could involve partnering with one state government institution (LASURA or LBIC\* in Lagos) for a pilot, demonstrating its success and extending the offering to the rest of the market

# Public toilets: Operators have high pressure to contain costs, given low price points per user; the RT by-products may help in that regard



## Challenges for public toilet operators

## Value proposition of the RT

### Financial sustainability

- **Low fee per user** – Fee per use has remained stable for over a decade. Toilets charge a maximum of USD 0.10, though in some areas the fee is as low as USD 0.03
- **Low profitability** – Unless companies offer add-on services, these fees may just cover operating and management costs but not allow full cost recovery (esp. for capex of building new toilets) or sizeable periodic maintenance

- RT by-products may help ensure a more consistent supply of electricity, reduce the costs for water, which can account for a significant share of operating costs, and offer additional revenue streams, (e.g., from biogas) to help boost sustainability

### Maintenance

- **Daily maintenance burden** – Maintaining public toilets is a daily, around-the-clock effort, as users' perceptions of cleanliness can make or break the number of users that a toilet might see. While some materials (toilet paper, soap) do not account for a major component of total operating costs, water does, depending on whether the toilets are pour or automatic flush and where the water is sourced (borehole vs. informal vendors vs. water trucks)

- If the RT is durable, it will be highly valued by operators. A strong business case for the RT might be one that demonstrates that medium-term maintenance costs also decrease relative to existing solutions

### User preferences

- **Customer experience** – Users place strong value on the customer experience: the look of the facility, the additional amenities, privacy and safety – all of which can increase costs for the operator. Some operators choose to operate only during the day to save on electricity costs, for example

- If the RT is durable and produces a by-product such as electricity or non-potable water, it could improve customer experience at public toilets

“The challenge is if the sewer blocks around three times in a week, the money we use to remove the [waste] is like [i.e., equal to] the money we have made in a week”

*Public toilet operator*

# Public toilets in Nigeria: The RT may potentially remedy several challenges related to operations, user habits and preferences



## Challenges for public toilet operators

## Value proposition of the RT

### Operation Costs

- **High energy costs** – Utilization of generator to power water pumps and lighting costs up to USD 100 / month. Interviewed public toilet operators expressed strong preferences for the RT that produces electricity (which they would use for lighting and charging phones)
- **Frequent evacuation** – Evacuation takes place once every four months at USD 60 per evacuation

- RT provides **cost saving opportunities** by:
  - Providing electricity byproduct for lighting
  - Eliminating / minimizing the need for evacuation

### User habits

- **Poor user habits** – Some users do not know how to use a seating toilet and stand on the seat or are heavy handed when flushing, causing damage to the interface

- Unclear whether the RT can address this challenge. If RT is **durable** and can withstand poor user habits, it will be highly valued by operators

### User preferences

- **Cleanliness** – Cleanliness is important to public toilet users and drives patronage, but public toilets operators often struggle to keep their toilets clean. Interviewed users expressed willingness to pay NGN 100 – 200 (USD 0.27 – 0.54) per use (up to twice current fee) for a clean toilet

- If RT is relatively easy to maintain and keep clean, it could be very valuable to the operators and users. RT by-products such as water and electricity could help improve the user experience of the public toilet

“If the toilet is clean, I will pay for it.”  
- Public toilet user

“God bless Gates. This is exactly what we are looking for [referring to the RT].”  
- Public toilet operator

# Public toilets in markets: The commercial partner can reach the market for public toilets directly or indirectly



**Direct play** – Enter the market as a public toilet operator and (A) develop new public toilets or (B) or take over and renovate an existing public toilet

## A Develop new public toilets

- 1 Write letter of proposal to the Commissioner or Permanent Secretary of the Ministry of Environment
- 2 Letter will be forwarded to the Public Sanitation Utility Division
- 3 The Lagos Urban and Physical Planning department will be consulted, to determine if the site selection fits into the development plan for the location
- 4 Joint concession visit (to site) between the Public Sanitation Utility Division and the Lagos Urban and Physical Planning Department, for site and technology inspection
- 5 Approval in principle to be granted
- 6 Approval for technology is also to be sought in writing

**Risk:** Process of site approval can take many years

**Indirect play** – Enter the market by (B) partnering with an existing player to renovate existing public toilets or (C) supply existing players with toilets

## B Renovate existing public toilet

Partner with existing community-held / managed, dilapidated public toilets (e.g., in Ijora Badia community in Lagos) and renovate the facilities by installing RT

## C Sell to operators

Engage private business owners like MN Environmental Services to convince them to adopt the RT

**Renovating an existing public toilet or selling to operators are the fastest paths to market in Nigeria. In Kenya, the direct model may offer a stronger opportunity**

# Educational institutions in Kenya is a high-need sector which donors and corporate CSR initiatives frequently target



## Current challenges of educational institutions

## Value proposition of the RT



### Inadequate sanitation infrastructure

- Public schools are intended to have 1 toilet for every 25 girls, and 1 for every 30 boys. However, they lack the recommended number of toilets (estimated shortage of at least 6 toilets per school)

- While schools need toilets, the RT itself cannot address the shortage challenge if schools are unaware of or cannot afford these toilets



### Maintenance challenges

- Existing toilets are commonly in serious state of disrepair, leading students to use bushes for their sanitation needs, to miss lessons as a result of long queues, or school entirely during menstruation. Furthermore, water shortages mean that: sewer-connected toilets operate poorly and are frequently clogged, requiring manual unclogging; students occasionally have no water to wash their hands, and amenities are unsuitable, especially for young female students

- A robust RT supplemented with a service model that includes maintenance would help address the hygiene and maintenance challenges that plague schools. A Gates-funded 2016 study found that schools with toilets with a maintenance component were used 128% more frequently and remained cleaner than typical government-provided toilets (e.g., latrines and pour-flush) throughout the year. The RT itself cannot address cleanliness challenges

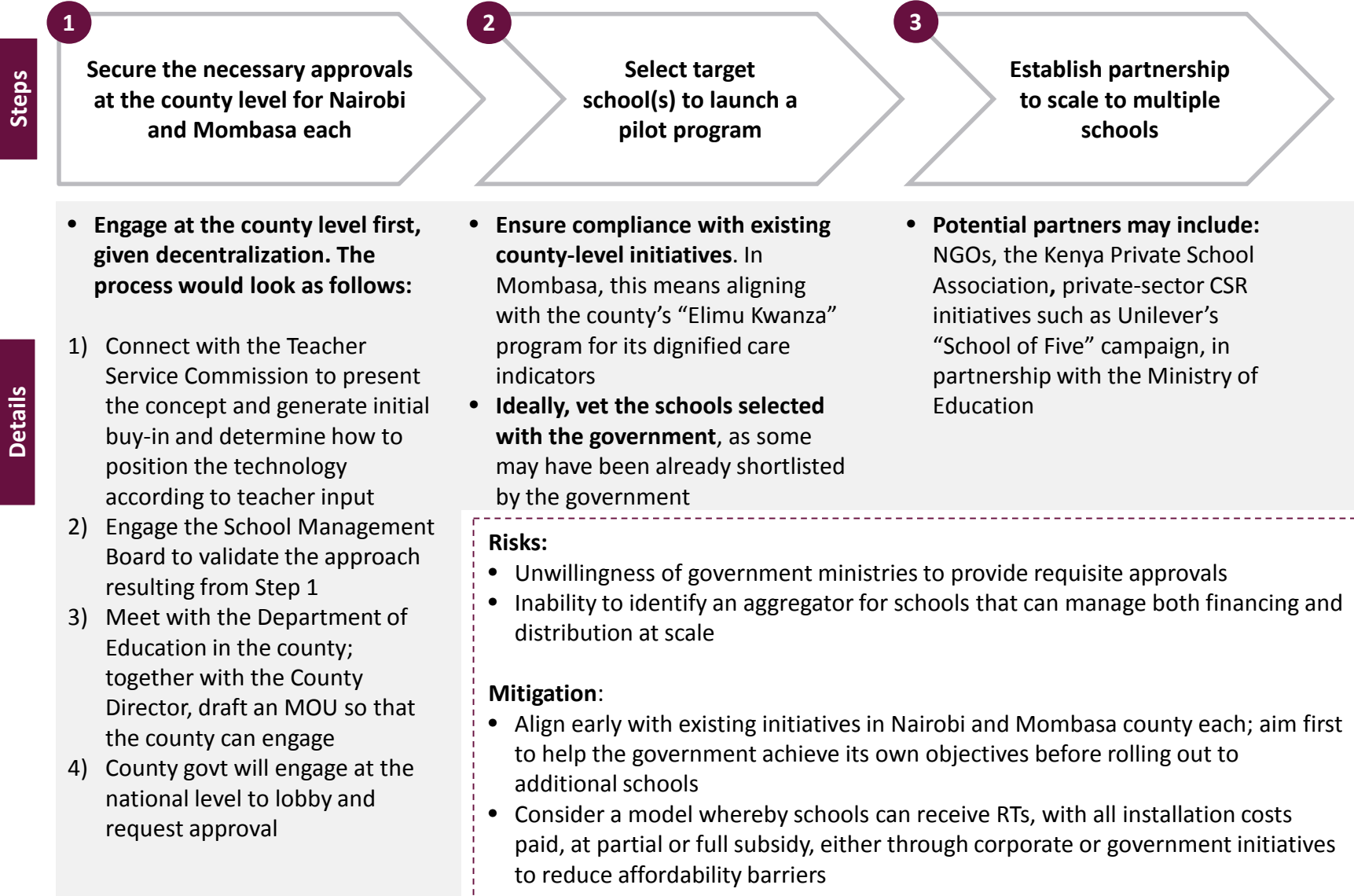


### Budgetary restrictions

- When repairs are needed, schools may not have the resources necessary, especially as sanitation has received the least attention in monetary allocations by the government: Mombasa's government allocated only USD 7 per child for the 2016 school year, for example. When the government provides sanitation-specific funding, it tends to do so for select schools, not the entire county. The private and NGO sectors frequently step in to support

- The main value proposition that the RT offers to schools is in its by-products. Given that primary and secondary schools typically have large open land and farms where students help produce resources for the institution, the RT by-products may help boost the resources available to each school

# Educational institutions: Entering this market in Kenya requires generating buy-in from several ministries before piloting and scaling



# State-sponsored housing schemes in Nigeria have expansion plans and are looking for cost-saving, decentralized sanitation solutions



## Current challenges of state-sponsored housing

## Value proposition of the RT



### Budgetary restrictions

- Lagos has an estimated housing deficit of 2.5 million units and has budgeted USD 138 million for housing and community amenities
- The state government has a total budget deficit of over USD 450 million, indicating substantial challenges in financing housing goals
- In Abuja, sanitation costs such as extension of sewer lines are sizeable project expenses for housing development

Government housing departments / parastatals will benefit from technologies that will reduce installation and maintenance costs of sanitation. If installing the RT amounts to cost savings, state governments will see value in the product



### Water and electricity shortages

- Water and electricity are in scarce supply across Nigeria
- Lagos has planned water infrastructure capital projects to increase government pipeline coverage
- The government recently urged residents to embrace alternative power sources

RT waste byproducts—water and energy—provide alternative sources to supplement existing supply. The volume of these byproducts will determine the extent to which the RT is valued for this particular purpose

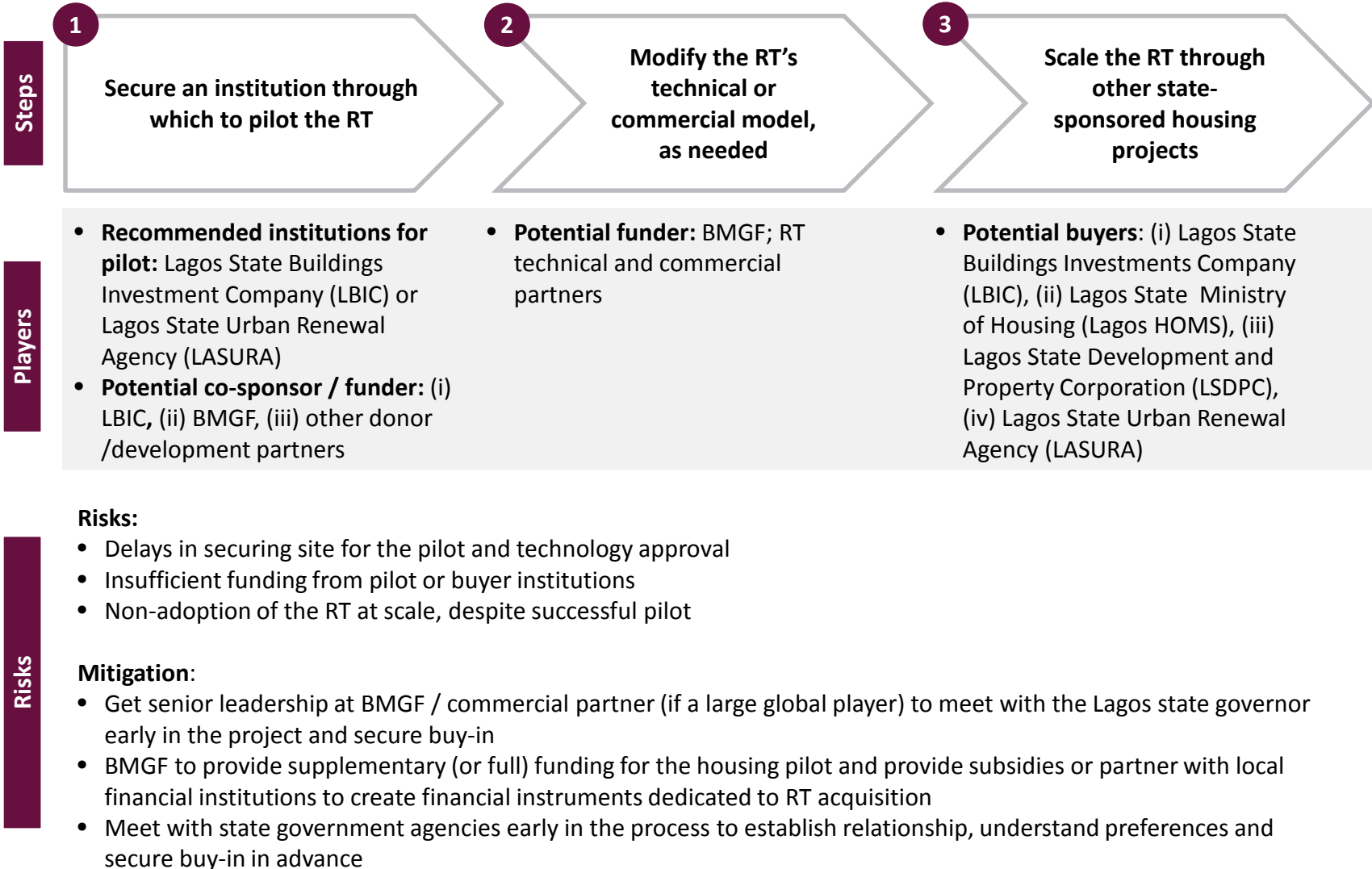


### Inadequate sanitation infrastructure

- Lagos state government aims to decentralize the waste management system and seeks to phase out evacuation trucks due to the environmental hazards they present
- Only 30% of Abuja / FCT is covered by the sewer network due to the slow pace of urban development plan implementation

RT provides an alternative to the centralized system, and is needed as either a stopgap or permanent solution

# State-sponsored housing: Entering this market requires buy-in from senior leadership in Lagos state government throughout the process





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# There are different paths to market-entry in each country, depending on the segment of interest

Putting the recommendations across the four priority segments together, there are three potential paths to market for Kenya and Nigeria – two commercial and one non-commercial:

## **Path 1: Demonstrate in institutional segment to prove the concept to low-income existing residential segments**

### 1. Launch public toilets in various areas

Launch MURTs in public toilets in markets, schools and low-income neighborhoods to demonstrate the concept

### 2. Scale to low-income residential segment

Depending on market feedback, launch more communal MURTs and SURTs / household-level products, possibly using a neighborhood-saturation approach

*The demonstration effect works only for existing low-income residential constructions and is unlikely to spill over to new constructions, as housing developers do not take market cues from the public toilets sector*

## **Path 2: Validate the concept with a target developer and scale to other residential developers directly**

### 1. Validate and demonstrate the value proposition

Dependent on validation of the business case with low-income housing developers (i.e., cost savings and match to customer preferences), pilot with a selected housing developer, market the results of the demonstration project to other developers, architects and surveyors and bring product to scale

### 2. Pilot with a housing developer

### 3. Market to other developers and to the industry

## **Path 3: Take over GIZ's "Upscaling Basic Sanitation for the Urban Poor" program ending in 2018 (Kenya only)**

While a non-commercial option, this approach would allow RT's partners to leverage existing, strong relationships with key water and sanitation players all over the country – not just Nairobi and Mombasa – and build upon an 8,000-household scale


# Path to market-entry (1): In both countries, we recommend piloting the RT in institutional segments to prove concept to residential market

Demonstration through early adoption by institutional segments in Nigeria

**STATE SPONSORED HOUSING**

Lagos State Ministry of Housing	Lagos Building Investments Company	Abuja Management Company	
Lagos State Development and Property Corporation	Lagos State Urban Renewal Agency	Abuja Environment Management board	

**PUBLIC TOILETS**

MH Environmental Services Ltd.	DMT Mobile Toilet	Sangrouse Public Toilet and Shower	
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*...and other public toilet players*

**NGO/DONOR /FBO programs**



...proving concept to low-income residential segment (e.g., shanty and tenement dwellers)

“We need to see it to believe it”



## Path to market-entry (2): Validate the concept with and serve new residential constructions directly

Aim to show a clear business case for the RT and respond to their biases towards high-end fixtures

### 1. Validate and demonstrate the value proposition

### 2. Pilot with a housing developer

### 3. Market to other developers and to the industry

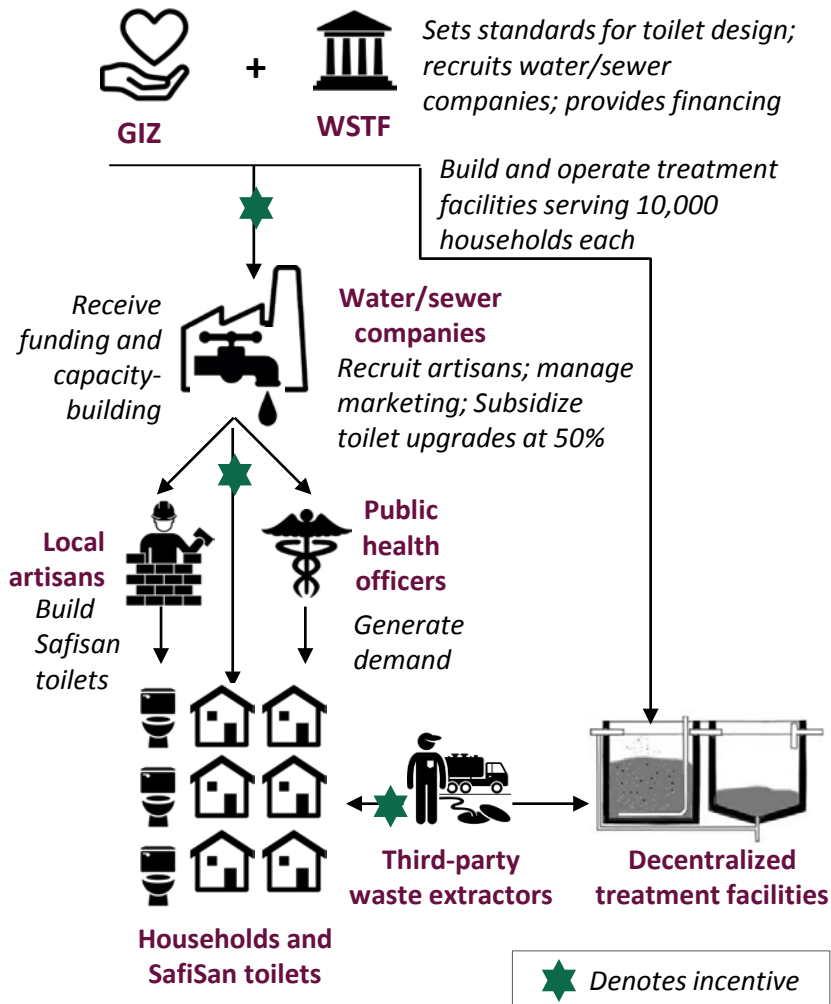
- Demonstrate that implementing the RT can lead to attractive-enough cost savings for developers by reducing spend on extraction. For this it may help to speak directly to a few housing developers to model out what cost savings might be possible with the RT and to validate the assumptions
- Map out how the RT can be integrated into the existing construction process, with the view to addressing legal and engineering constraints. Consult with the **National Construction Authority**, as well as the **Engineers Board of Kenya** for input
- Source and establish partnership with developers to integrate RT into design and architecture plans. This can be done via professional bodies, such as the **Institute of Quantity Surveyors of Kenya** and the **Kenya Architects Association**
- During pilot ensure that the benefits promised are realized (i.e., cost savings) and trade-offs minimized (e.g., smell, compliance challenges, etc.)
- If successful, market the RT to other developers through the **Kenya Architects Association** as well as the **Engineers Board of Kenya** using the pilot developer as a case study

A very similar path to market can be followed in Nigeria too

# Path to market-entry (3): In Kenya only, take over the GIZ program, which has established links to utilities companies and trained artisans



## Overview of GIZ UBSUP\* Program



## Successes and lessons learned

- **Engaging with water and sewer services providers:** The program has successfully engaged with over 60% of the water services providers (WSP) throughout Kenya through tenders. Turnout during its first phase exceeded expectations
- **Providing the right incentives:** It has successfully aligned program and WSP objectives: by increasing the number of HH linked to the sewer line, the UBSUP program is effectively boosting the number of customers for these WSPs (in addition to providing capacity-building and other admin. funding)
- **Adapting the mix of toilet types to demand:** The program eliminated pre-fabricated separation toilets from its portfolio for: lack of demand, difficulty maintaining in the long run, and costs to transport
- **Engaging with local artisans:** The program has worked with artisans all over Kenya, recruited by the WSPs, to build 8,000 toilets according to specific design requirements (only upon verification can the HH subsidy be disbursed)

Note: \*Upscaling Basic Sanitation for the Urban Poor; WSTF: Kenya Water Services Trust Fund

Source: Water Services Regulatory Board – 2016 Impact Report; stakeholder interviews; Dalberg analysis

# These three paths have various trade-offs and the choice of path depends on the commercial partner's short and long-term priorities

## Path 1: Demonstrate in institutional segment to prove the concept to low-income existing residential segments

- **Level of effort: HIGH**
  - This path is the most effort-intensive path as it requires a number of carefully monitored demonstrations, strategic partnerships and patient capital
  - Even if the demonstrations are successful, there is no guarantee that residential segments will adopt the RT
  - The residential segments will require subsidies/financing innovation and significant investment from donors/governments/commercial partners
- **Potential impact: MEDIUM**
  - This path will reach segments most in need of the RT, and is therefore an important long-term play for commercial partners seeking to meet BMGF's development goals

## Path 2: Validate the concept with a target developer and scale to other residential developers directly

- **Level of effort: MEDIUM**
  - This path requires a few flagship demonstrations and partnerships. If successful on account of cost-savings, compliance, and reliability, more and more developers could be convinced to use the RT
- **Potential impact: MEDIUM**
  - Developers may be more interested in this solution than other segments because of the lack of sunk costs, hence adoption may be higher
  - This path will likely not address the low-income segments of key interest to BMGF

## Path 3: Take over GIZ's "Upscaling Basic Sanitation for the Urban Poor" program ending in 2018 (Kenya only)

- **Level of effort: LOW**
  - This path will be relatively easy given existing donor investment and ready partnerships with the government
- **Potential impact: LOW**
  - This path will only reach areas under the GIZ program
  - This path is only viable in Kenya

# Going forward, there are a number of next steps that could be taken to further understand the market in Kenya and Nigeria

## Reflections on the current research

**Location of research:** The research was conducted in the two largest cities in Kenya and Nigeria. The value proposition of the RT may be greater in smaller towns where investment into sanitation infrastructure is limited and households are not space-constrained

**Segment selection:** We chose 6 segments to study in detail and excluded middle-high income households. They may prove to be an attractive market, particularly in Nigeria, where sewer access is poor. Similarly, there may be other attractive institutional segments worth exploring

**User preferences:** It is very difficult to gauge user preferences and attitudes towards a product in theory and all respondents (especially surveyed low-income users) found it difficult to respond to product features without seeing the RT

**Business model considerations:** The market sizing and business model considerations were only laid out for priority segments in each country. The total addressable market in each city is likely to be considerably larger than has been laid out in the report

## Next steps / future research

*Research other less-developed / under-served cities*

*Explore other promising segments in each country*

*Create demonstration projects for the RT*

*Based on new research, map business models and total addressable market in each country*

# STeP

Sanitation Technology  
Platform



## CHAPTER 2: PROJECT OVERVIEW AND APPROACH

Dalberg

DESIGN  
IMPACT  
GROUP

# STeP and BMGF seek to accelerate testing for the Reinvented Toilet (RT) by understanding the market for the RT in urban Kenya and Nigeria

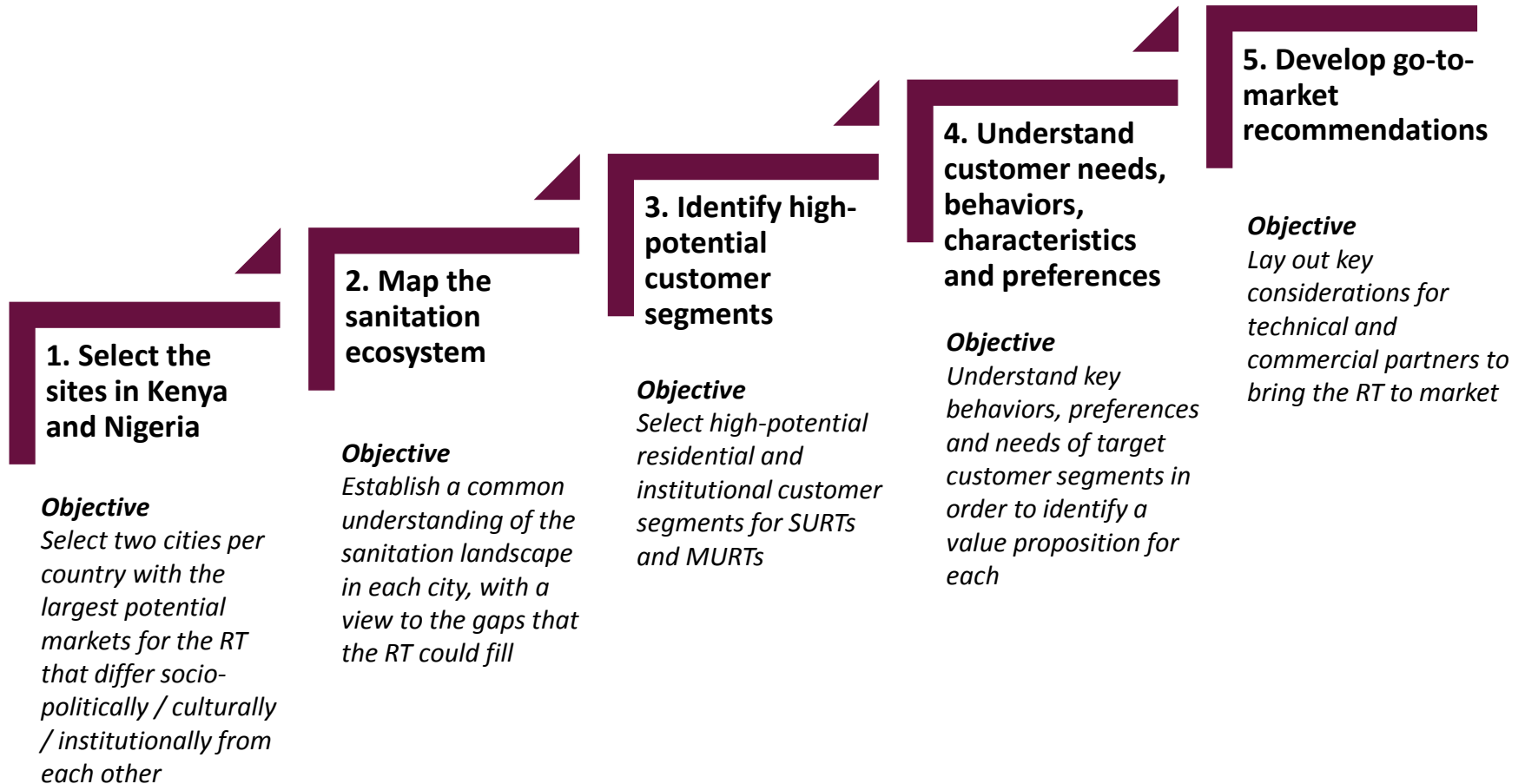
## Project context

- In 2011, the Bill and Melinda Gates Foundation (BMGF) launched the Reinvent the Toilet Challenge—an effort to bring sustainable sanitation solutions to the 2.5 billion people worldwide that lack adequate sanitation access
- The prototypes of the Reinvented Toilet (RT) target the challenge of properly treating waste on-site and extracting value from it, e.g., via combustion, water recycling and transformation into agricultural inputs
- The Sanitation Technology Platform (STeP) is supporting BMGF accelerate and de-risk translation and commercialization of transformative sanitation technologies such as the RT. BMGF and STeP seek insights into the Nigerian and Kenyan urban markets to understand if and how the RT could help address extant sanitation challenges in those countries.

## Project objectives

- Develop a complete understanding of urban sanitation needs in residential and commercial/institutional segments, including understanding users, decision makers and influencers within the ecosystem
- Identify promising segments for the Single User Reinvented Toilet (SURT) and the Multiple User Reinvented Toilet (MURT), analyze market size and propose a value proposition for those markets
- Describe a purchase pathway and points of leverage for each segment
- Develop insights to support technical design and refine product features of the RT
- Build out go-to-market implications, including design and business model considerations to encourage large-scale product adoption

# To meet project objectives, we followed a five-step analytical approach in each country, which is detailed in this chapter



# Taking a portfolio approach, we selected two cities per country that could have large potential markets for the RT but differ socio-politically



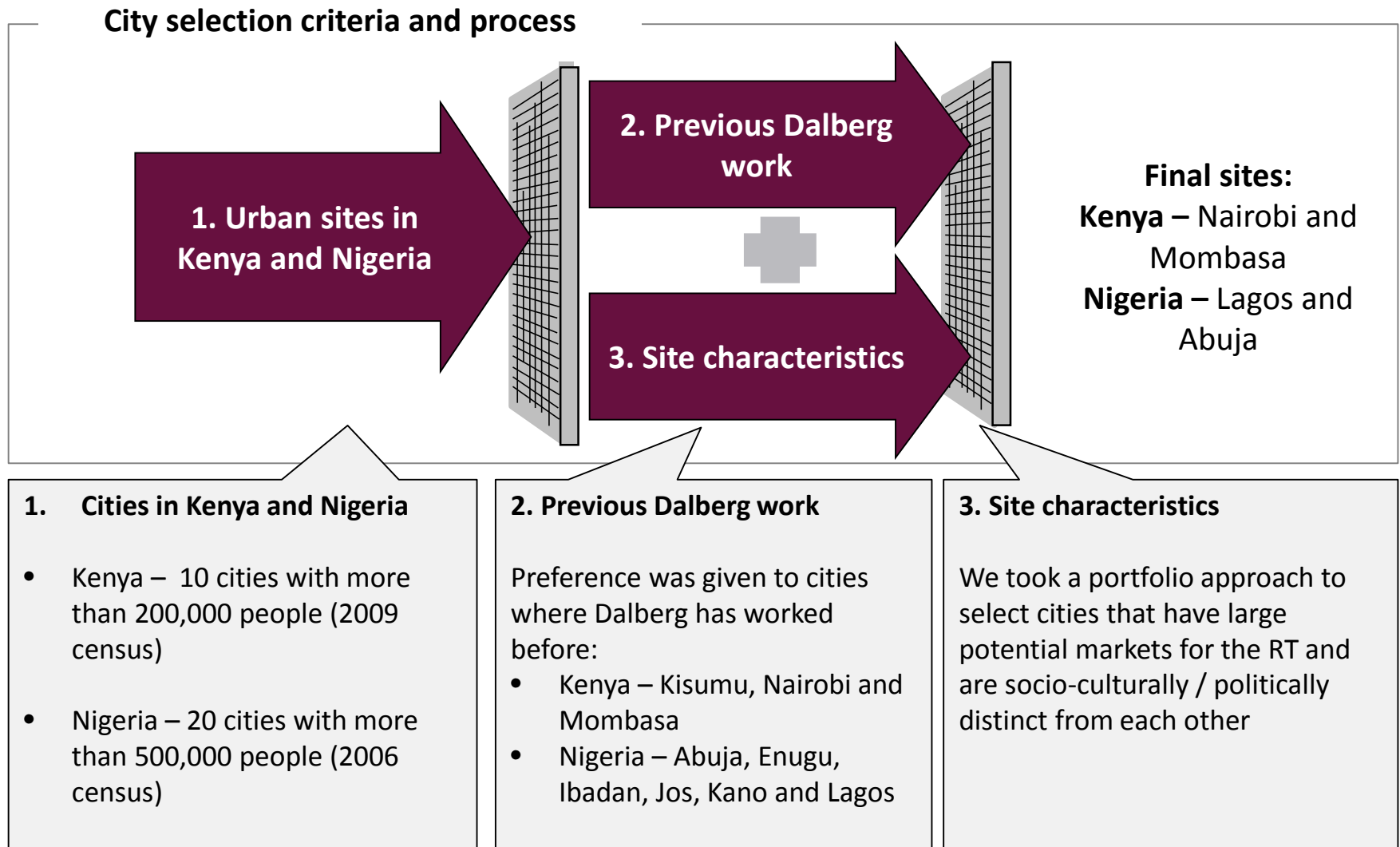
## Objective

*Select two cities per country with the largest potential markets for the RT that differ socio-politically / culturally / institutionally from each other*

## Key questions

- *What selection criteria will help identify the cities?*
- *Which cities in Kenya and Nigeria best match these criteria?*

# We established a three-step process for city selection, first filtering for large cities where Dalberg has worked previously



# We then selected cities that (1) could have large markets for the RT and (2) differ socio-culturally / politically / institutionally from each other

## 1 Large potential market for the RT, as determined by the two following criteria:

### Need for the Reinvented Toilet\*

*Which cities have the highest relative need for improved sanitation technology?*

- **Quality of sanitation facilities:** We used low access to improved sanitation facilities as a proxy for a higher need for the RT. We define poor quality sanitation to include pit latrines, uncovered pit latrines, buckets, and open defecation. We will explore other factors that affect need for RTs during our field research—this may include but is not limited to behavioral and psychological factors such as aspiration, or additional contextual factors such as community infrastructure (for example, drainage)

### Propensity to adopt the Reinvented Toilet\*

*Which cities have the largest potential customer segments for the RT?*

We used two proxies for the propensity to adopt:

- **Population that is lower-middle income:** Based on previous Dalberg work, we assume that lower-middle-income (and above) households will be able to afford the RT. Accordingly, we evaluated cities on the number of households within the lower-middle- and middle-income bracket
- **Quantity of existing and planned new construction:** We assume that new government and/or private construction is likely to present opportunities to adopt the RT at scale

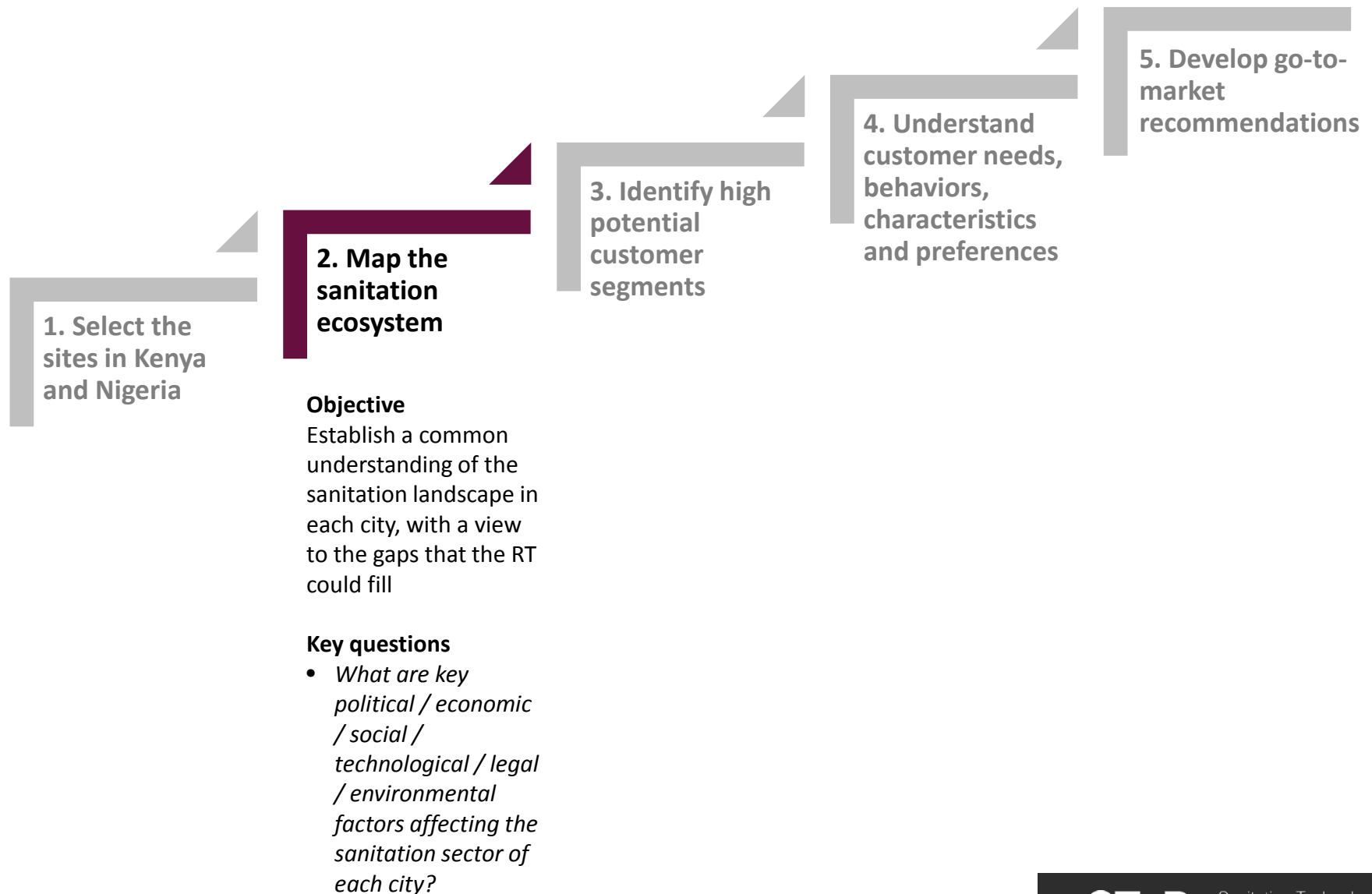
## 2 Socio-cultural, political and institutional characteristics that distinguish sites from each other

Once we identified a portfolio of cities with large potential markets in each country, we picked cities that were distinct from each other in religious makeup, institutional and political culture and/or urban form

Note: “Improved sanitation” = sewer or septic tank, cess pool, VIP and regular, unshared pit latrines.

\* These variables are neither comprehensive nor the best indicators for need and propensity to adopt. However, they are the variables for which data are available in Kenya and Nigeria.

# In each of the selected cities, we mapped the sanitation ecosystem to identify sanitation challenges and opportunities for the RT

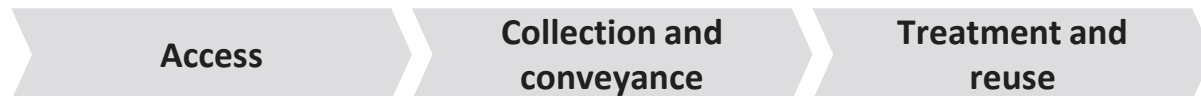


# When mapping the sanitation system we paid attention to three sets of questions

## Key questions

## Framework for analysis

What is current state of sanitation access across the value chain?



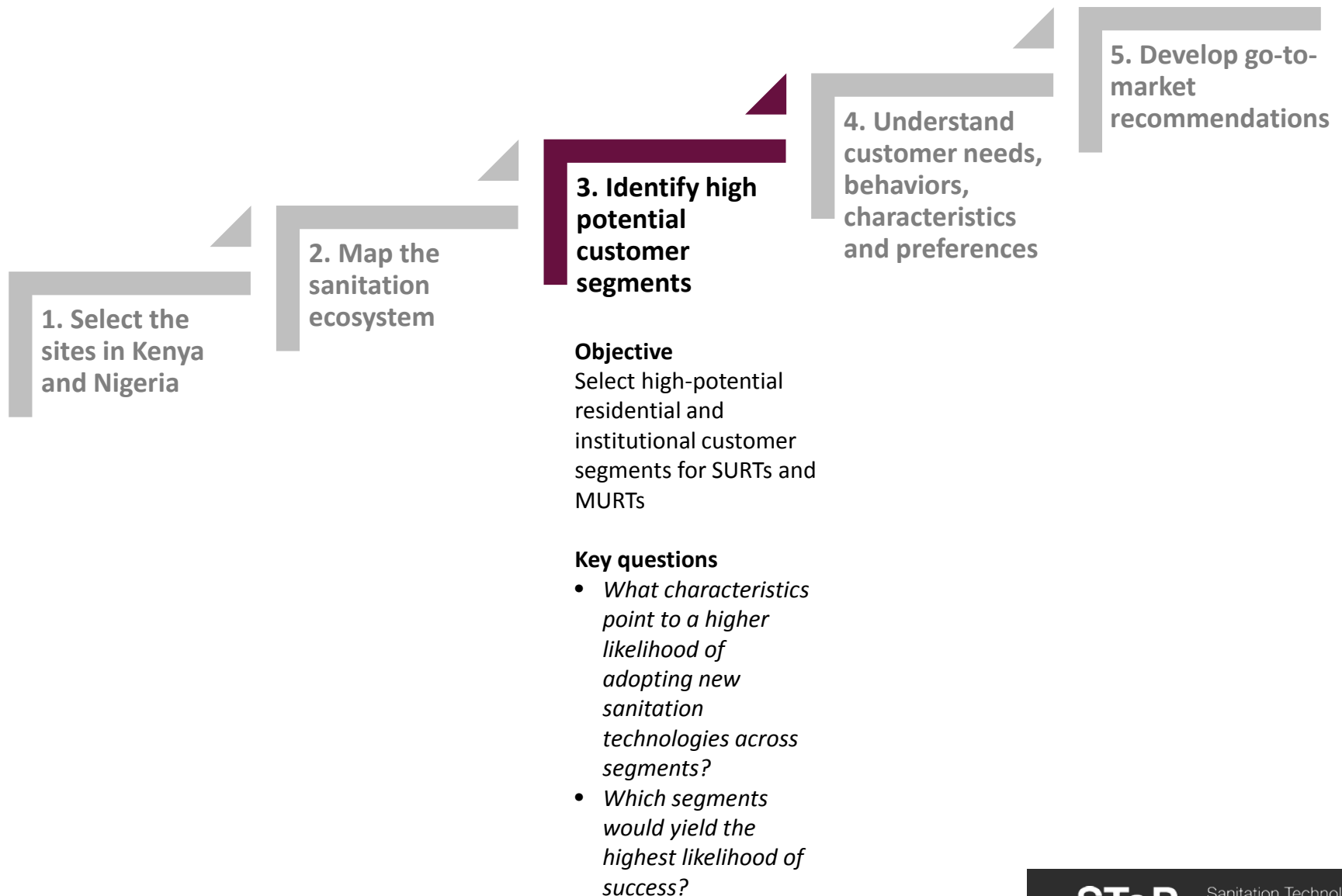
What does the sanitation ecosystem look like and what are the key gaps and opportunities across it?








What policy and institutional trends may impact the sanitation space in the future?



# With our understanding of the sanitation landscape in the two countries, we identified high potential customer segments in each city



# We conducted approximately ~175 interviews with sanitation players in each country to better understand residential and institutional segments

Interview subjects (per country totals)		Key interview objectives
 <b>Sanitation institutions / experts</b>	<ul style="list-style-type: none"> <li>• 10–20 NGOs</li> <li>• 4–6 government officials</li> <li>• 5–8 academic experts</li> <li>• 2–5 development partners</li> </ul>	<ul style="list-style-type: none"> <li>• Map other players within the sanitation ecosystems</li> <li>• Identify existing sanitation models and technologies</li> <li>• Gather data on extent and quality of sanitation in the city</li> <li>• Understand the enabling environment for sanitation in terms of policy, financial and legal support and requirements</li> </ul>
 <b>Suppliers</b>	<ul style="list-style-type: none"> <li>• 15 distributors / wholesalers</li> </ul>	<ul style="list-style-type: none"> <li>• Map the main manufacturers and suppliers</li> <li>• Learn how manufacturers segment their customers and understand their needs</li> <li>• Baseline manufacturing capacity to produce SURTs and MURTs locally</li> <li>• Identify variables driving buyers' behavior and features that are in demand, by customer group</li> <li>• Understand key features of existing products and gaps in the market</li> </ul>
 <b>Contractors / developers</b>	<ul style="list-style-type: none"> <li>• 5–10 developers</li> <li>• 20 contractors</li> </ul>	<ul style="list-style-type: none"> <li>• Map the main developers and contractors</li> <li>• Understand how toilet purchasing decisions are made by customer group</li> <li>• Assess demand for SURTs and MURTs and how it varies by purchasing group</li> <li>• Define technical and other design requirements by customer group</li> </ul>
 <b>Purchasers / users</b>	<ul style="list-style-type: none"> <li>• 30 homeowners</li> <li>• 20 tenants</li> <li>• 10 public toilet users</li> <li>• 2–5 landlords</li> </ul>	<ul style="list-style-type: none"> <li>• Understand decision-making power in residential toilet purchasing decisions</li> <li>• Identify key factors driving acceptance or adoption of toilets</li> <li>• Learn government construction plans and toilet procurement priorities</li> </ul>
 <b>Service providers</b>	<ul style="list-style-type: none"> <li>• 30 plumbers and waste collectors</li> <li>• 15 NGOs / social enterprises (in Kenya)</li> </ul>	<ul style="list-style-type: none"> <li>• Understand usage of various disposal methods by customer group</li> <li>• Identify requirements and barriers for waste disposal</li> </ul>

# We segmented the residential and commercial / institutional markets separately in each country

Market	Country	City
<b>A. Residential</b>  <i>Houses built for residential purposes (i.e., as homes to live in). These can be built by the public sector, private sector and homeowners*</i>	Kenya	Nairobi
		Mombasa
	Nigeria	Lagos
		Abuja
<b>B. Commercial / Institutional</b>  <i>Structures / buildings built to render a service or generate income, e.g., retail, education, transport, etc.</i>	Kenya	Nairobi
		Mombasa
	Nigeria	Lagos
		Abuja

\*Public sector housing has been classified as institutional because (i) the segment has distinct go-to-market implications that differ from other residential construction and (ii) we do not have data to disaggregate residential into public and private housing stock.

# We segmented the residential market in each city using the same segmentation approach

Market	Country	City
A. Residential	Kenya	Nairobi
		Mombasa
	Nigeria	Lagos
		Abuja
B. Commercial / Institutional	Kenya	Nairobi
		Mombasa
	Nigeria	Lagos
		Abuja

## We followed a five-step approach to identify the priority residential segments in urban Kenya and Nigeria

- 1 Developed a long list of segmentation criteria—variables that could explain variation in adoption of the toilet—based on desk research and interviews
- 2 Shortlisted segmentation criteria based on variable relevance, data availability and actionability
- 3 Created a segmentation framework based on the shortlisted segmentation criteria
- 4 Evaluated each of these segments on their (i) propensity to adopt the Reinvented Toilet and (ii) relative market size
- 5 Selected two to three priority segments in each country and evaluated each for the ease of going to market (as defined by ease of reaching the market through a single entry point or an aggregator)

# We established initial residential segmentation criteria and shortlisted four variables based on their relevance, measurability and actionability

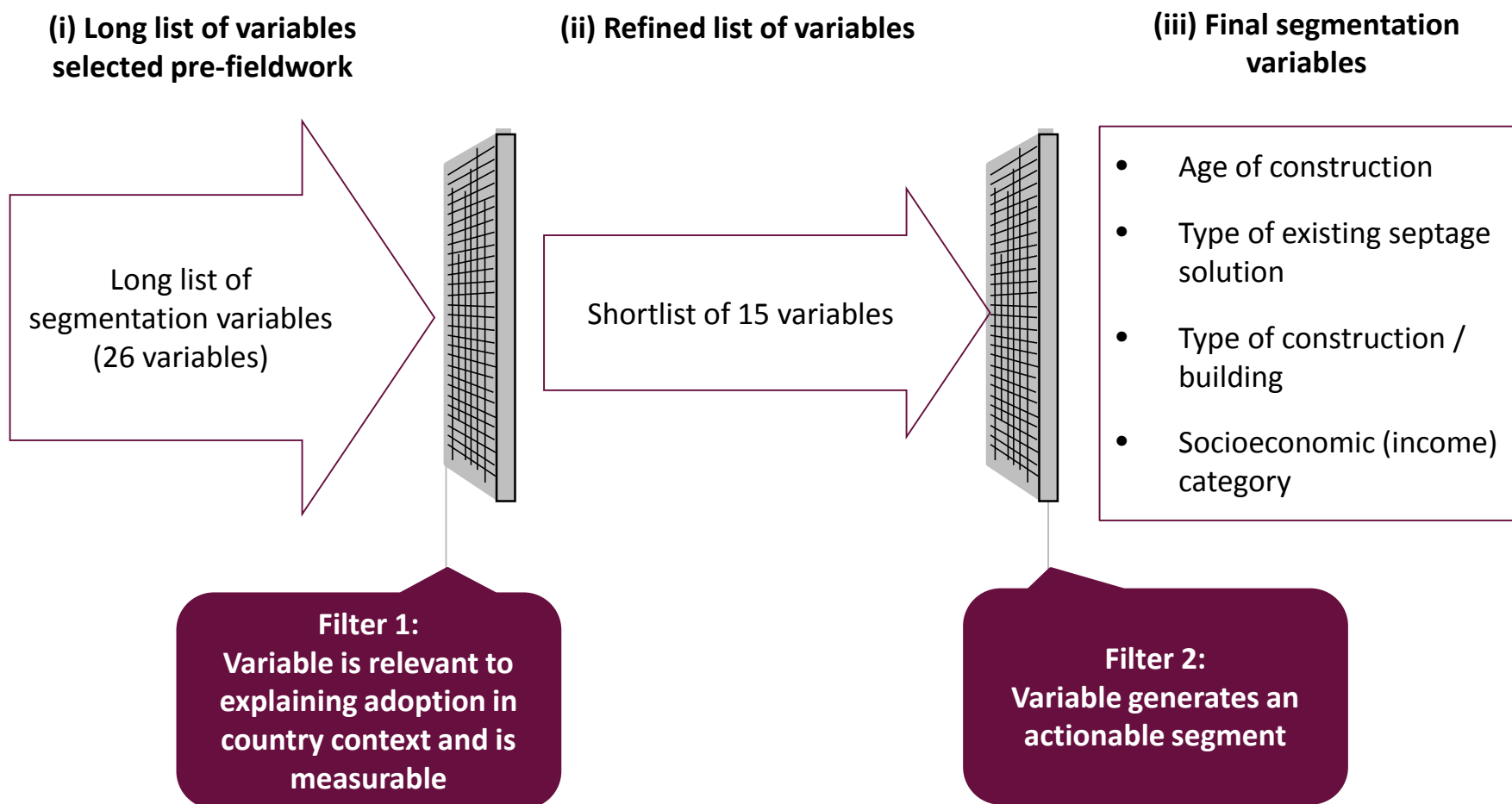
## Long list of initial segmentation criteria (selected pre-fieldwork)

Household characteristics	Building characteristics	Sanitation-related characteristics
1. Household size	1. Type of construction (e.g., apartment, freestanding)	1. Type of septage solution
2. Household composition	2. Age of construction	2. Location of septage solution
3. Socioeconomic (income) category	3. Size of housing structure (area and number of rooms)	3. Frequency of septage collection
4. Education of household head	4. Plot area	4. Cost of septage collection
5. Occupation of household head		5. Flush type
6. Religion		6. Number of toilets
7. Tenancy		7. Location of toilet(s)
8. Ownership of assets (TV, car, etc.)		8. Type of water source
9. Ownership of a bank account		9. Hours of water availability
10. Monthly water expense		
11. Monthly electricity expense		
12. Electricity supply per day		

## Segmentation criteria selection

- We created an initial long list of segmentation criteria from desk research
- We then shortlisted the variables based on their
  - **Relevance:** whether or not the variable can influence the adoption of a new sanitation solution;
  - **Measurability:** whether or not the variable is easy to measure and/or serves as a proxy for the purpose of estimating the segment's market size;
  - **Actionability:** whether or not the resultant segment is easily identifiable for go-to-market purposes

# The four final variables are age of construction, type of existing septage solution, type of construction and household socioeconomic category



## We define three-short-listed variables—age of construction, type of septage solution and socioeconomic category—as follows:

Variable	a Age of construction	b Type of septage solution	c Socioeconomic category
Definition	<ul style="list-style-type: none"> <li>• <i>Unbuilt / new</i> – Construction that is planned for the next year</li> <li>• <i>Existing</i> – A building/home/ construction that already exists</li> </ul>	<ul style="list-style-type: none"> <li>• <i>None</i> – HH has no septage solution (includes bucket).</li> <li>• <i>Pit</i> – HH has pits, soaks, latrines</li> <li>• <i>Septic and sewer</i> – HH connected to a sewer or a septic tank</li> </ul>	Socioeconomic category as proxied by income and assets:* <ul style="list-style-type: none"> <li>• <i>A+B+C</i> – Rich, upper-middle and middle income</li> <li>• <i>D</i> – Lower-middle and poor</li> <li>• <i>E</i> – Very poor/marginalized</li> </ul>
Variable appropriateness in explaining variation in adoption of RT	<ul style="list-style-type: none"> <li>• New construction might be more likely to adopt a new septage solution as there are no switching costs</li> <li>• Existing construction is less likely to adopt, as this would require switching costs and retrofitting the new solution</li> </ul>	<ul style="list-style-type: none"> <li>• Type of existing septage solution impacts the HH's need for the RT.</li> <li>• Type of existing septage solution impacts the willingness to switch to the RT.</li> </ul>	<ul style="list-style-type: none"> <li>• Socioeconomic category impacts the ability to afford the RT</li> <li>• <i>Note: There are other components to socioeconomic class, e.g., education and occupation type, that we can uncover during Phase 3 deep dive research</i></li> </ul>
Variable suitable for go to market strategy	<ul style="list-style-type: none"> <li>• Measurability – high</li> <li>• Actionability – high</li> </ul>	<ul style="list-style-type: none"> <li>• Measurability – high</li> <li>• Actionability – medium</li> </ul>	<ul style="list-style-type: none"> <li>• Measurability – high</li> <li>• Actionability – medium</li> </ul>

\* We use city-specific socioeconomic categories determined by CANBACK Economist Intelligence Unit.

## The fourth variable—type of existing construction—includes different types of building structure, tenure and toilet access

d Type of construction	Informal / shanty	Tenement	Formal apartment building	Formal standalone house
<b>Definition*</b>	<ul style="list-style-type: none"> <li>• Shanty construction</li> <li>• High-density single room homes</li> <li>• May or may not have legal tenure (some informal areas are legal, others are not)</li> </ul>	<ul style="list-style-type: none"> <li>• Single room, low-income rental apartments with shared toilets and other facilities</li> <li>• Buildings owned and run by a single landlord.</li> <li>• Can be up to eight stories high</li> </ul>	<ul style="list-style-type: none"> <li>• Formal apartment.</li> <li>• Apartments have single HH toilets</li> <li>• Apartments within typically (though not always) owned by different owners.</li> <li>• Buildings are legal</li> </ul>	<ul style="list-style-type: none"> <li>• Standalone housing made from permanent materials</li> <li>• Legal tenure</li> </ul>
<b>Category appropriateness in explaining variation in adoption of RT</b>	<ul style="list-style-type: none"> <li>• Lack of legal tenure prevents investment in upgrades</li> <li>• Inadequate space to build a SURT in some areas</li> <li>• Adequate shared space for a MURT</li> </ul>	<ul style="list-style-type: none"> <li>• Already have shared toilets, in various degrees of disrepair</li> <li>• Tenants are willing to pay for improved sanitation services</li> <li>• Single landlord acts as an easily identifiable segment entry point</li> </ul>	<ul style="list-style-type: none"> <li>• Most apartments already have septage management solutions.</li> <li>• Have adequate space to build a single HH toilet</li> <li>• Have adequate space for a MURT</li> </ul>	<ul style="list-style-type: none"> <li>• Legal tenure means owners / landlords may be willing to make improvements to the house</li> <li>• Have adequate space for a SURT</li> </ul>

\* Although some of these distinctions are artificial, e.g., there are informal settlements with permanent tenure, we have defined them as above for the sake of simplicity. In the deep dives, we will explore the full complexity of each segment.

## The four variables segment the residential SURT / MURT market into 23 segments in Kenya and Nigeria.

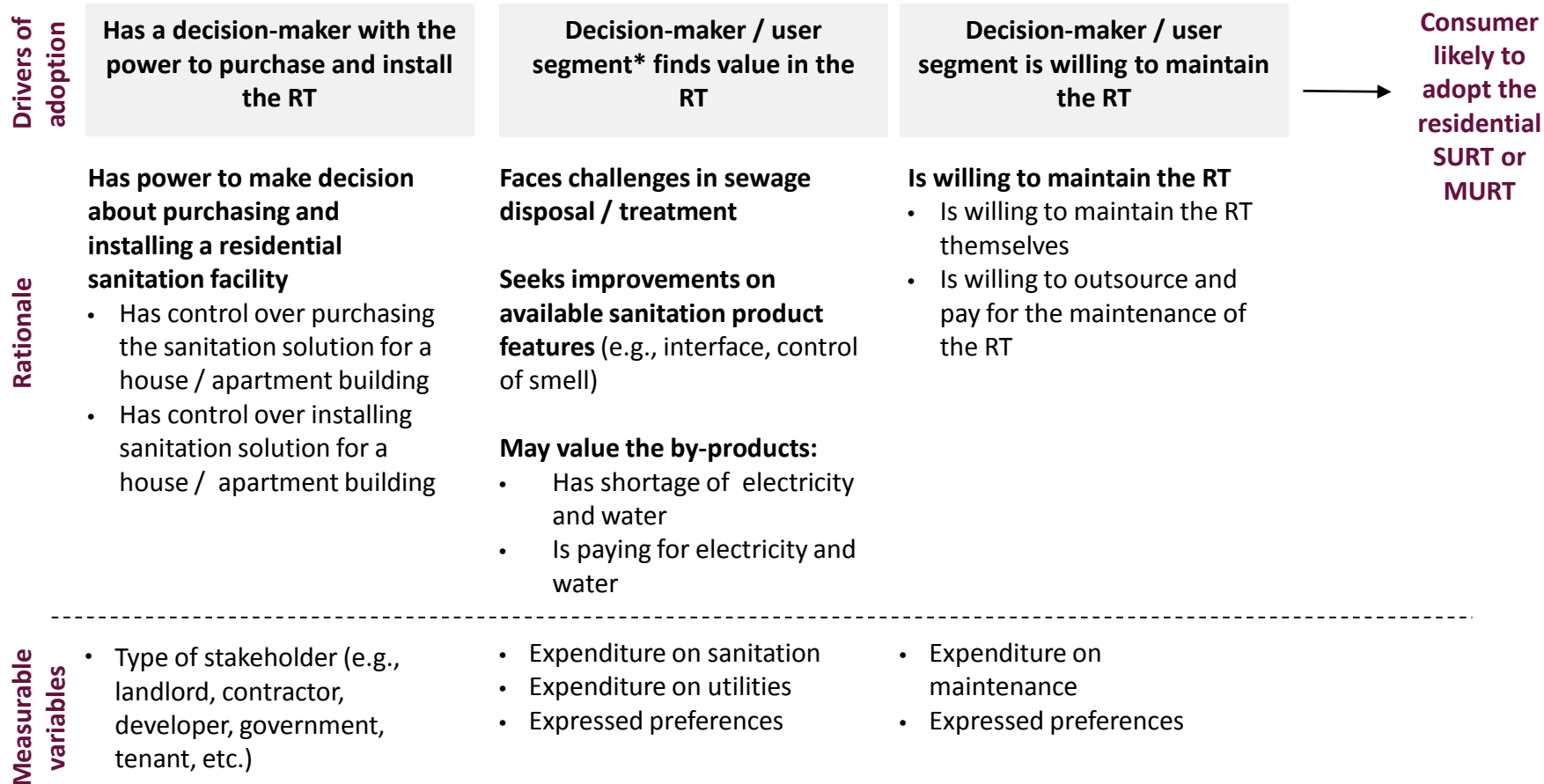
Age of construction		Unbuilt / New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pit (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socioeconomic Category	E	Light Blue / Yellow	Yellow	Dark Grey	Dark Grey	Light Blue / Yellow	Dark Grey	Dark Grey	Dark Grey	Light Blue / Yellow	Yellow	Dark Grey	Dark Grey	Light Blue / Yellow	Yellow	Dark Grey	Dark Grey
	D	Light Blue / Yellow	Yellow	Yellow	Light Blue	Light Blue / Yellow	Dark Grey	Dark Grey	Dark Grey	Light Blue / Yellow	Yellow	Dark Grey	Light Blue	Light Blue / Yellow	Yellow	Yellow	Light Blue
	A+B +C	Dark Grey	Dark Grey	Yellow	Light Blue	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Yellow	Light Blue

Potential segments for SURT
  Potential segments for MURT
  Non-existent or negligible segment

I = Informal settlement; T = Tenement; A = Formal apartment building; S = Standalone house

**We used this segmentation framework for the residential market in each city and assessed each segment's (i) propensity to adopt the RT and (ii) potential market size**

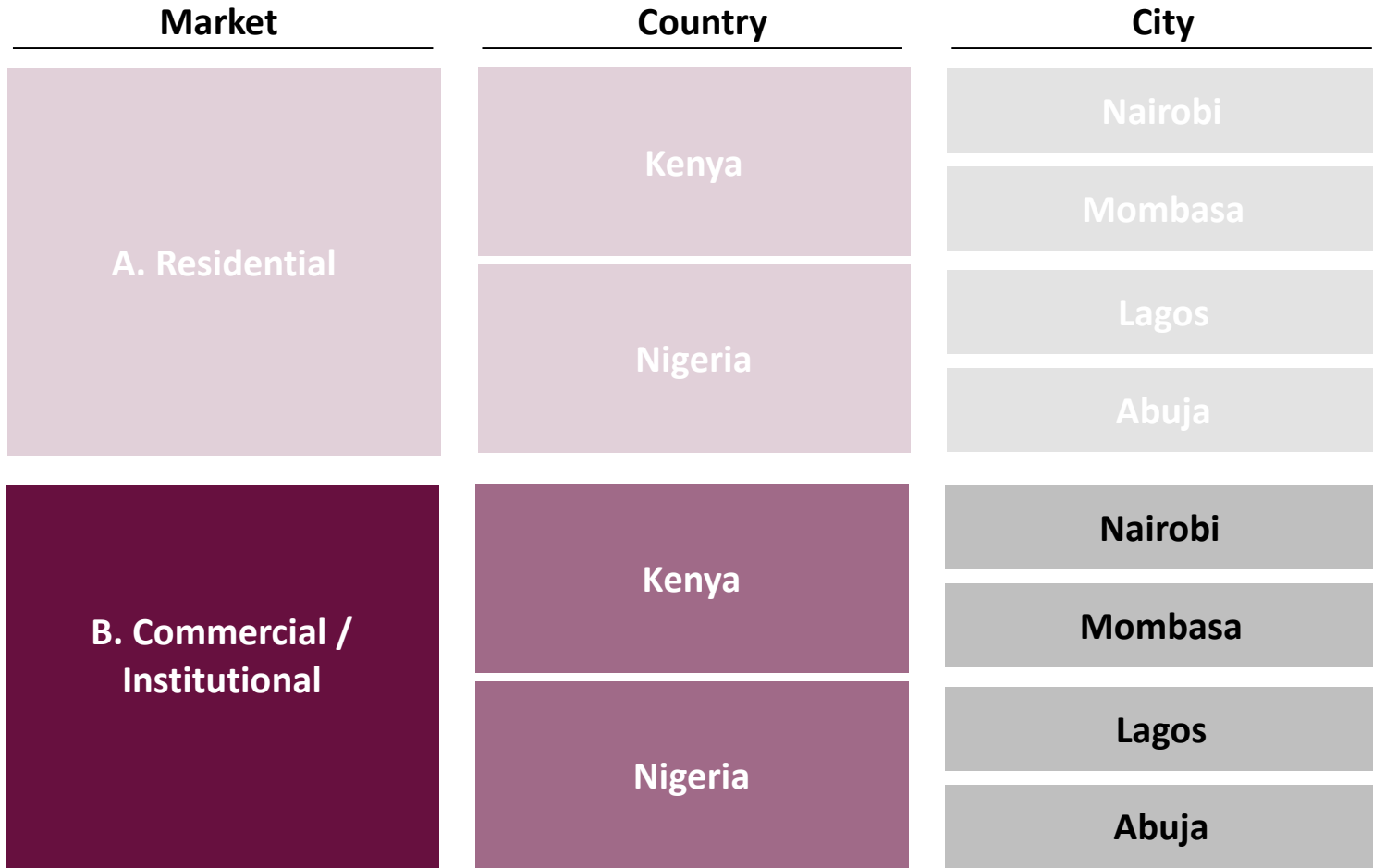
# We evaluated each segment on three main criteria that impact the propensity of a segment to adopt the SURT / MURT



**We selected priority segments that demonstrate the propensity to adopt the RT and have a relatively large potential market size**

\* Decision-maker and user segment may or may not be the same—e.g., landlords vs. tenants.

# We applied the another segmentation framework to identify commercial / institutional segments in Kenya and Nigeria

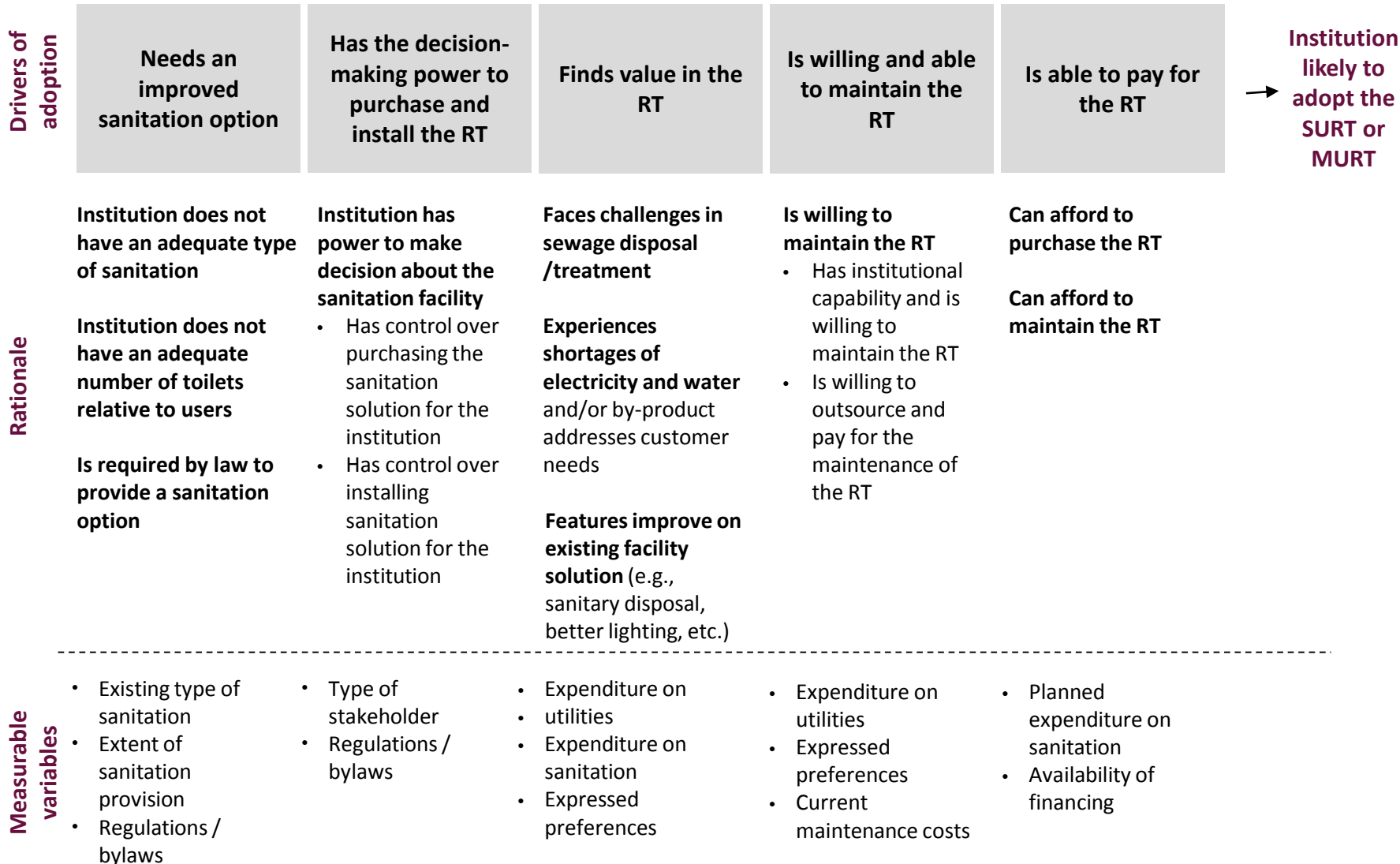


## For the commercial and institutional toilet market, we identified segments by following a three-step approach

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- 1 Through desk research and stakeholder interviews, we identified key private and public institutions that are either (i) constructing new buildings / infrastructure or (ii) have control over existing buildings / infrastructure
- 2 We evaluated each of these commercial / institutional segments on its (i) potential opportunity and (ii) propensity to adopt the Reinvented Toilet
- 3 Based on this evaluation, we selected two priority segments for the commercial / institutional toilet market in each country

# We identified five criteria that impact the propensity of a commercial / public institution to adopt the SURT / MURT



# Summary: We shortlisted 12 priority segments and, in collaboration with BMGF, selected a portfolio of six segments for deep-dive research

## Short-listed segments

### Kenya

### Nigeria

#### Residential market

1. Poor and lower-middle-income existing tenements (MURT)
2. Poor and lower-middle-income existing informal dwellings using pit latrines (SURT/MURT)
3. All formal new construction in Nairobi (for all income groups) (SURT/MURT)
4. Standalone houses in Mombasa (SURT)

1. Lower-middle-income existing tenements (MURT)
2. Lower-middle-income existing informal dwellings using pit latrines (SURT/MURT)

#### Commercial / institutional market

1. State-sponsored housing (SURT/MURT)
2. Educational institutions (MURT)
3. Commercial retail (MURT)
4. Public toilets in markets and transport hubs (MURT)

1. State-sponsored housing (SURT/MURT)
2. Public toilets in markets and transport hubs (MURT)

## Selected priority segments

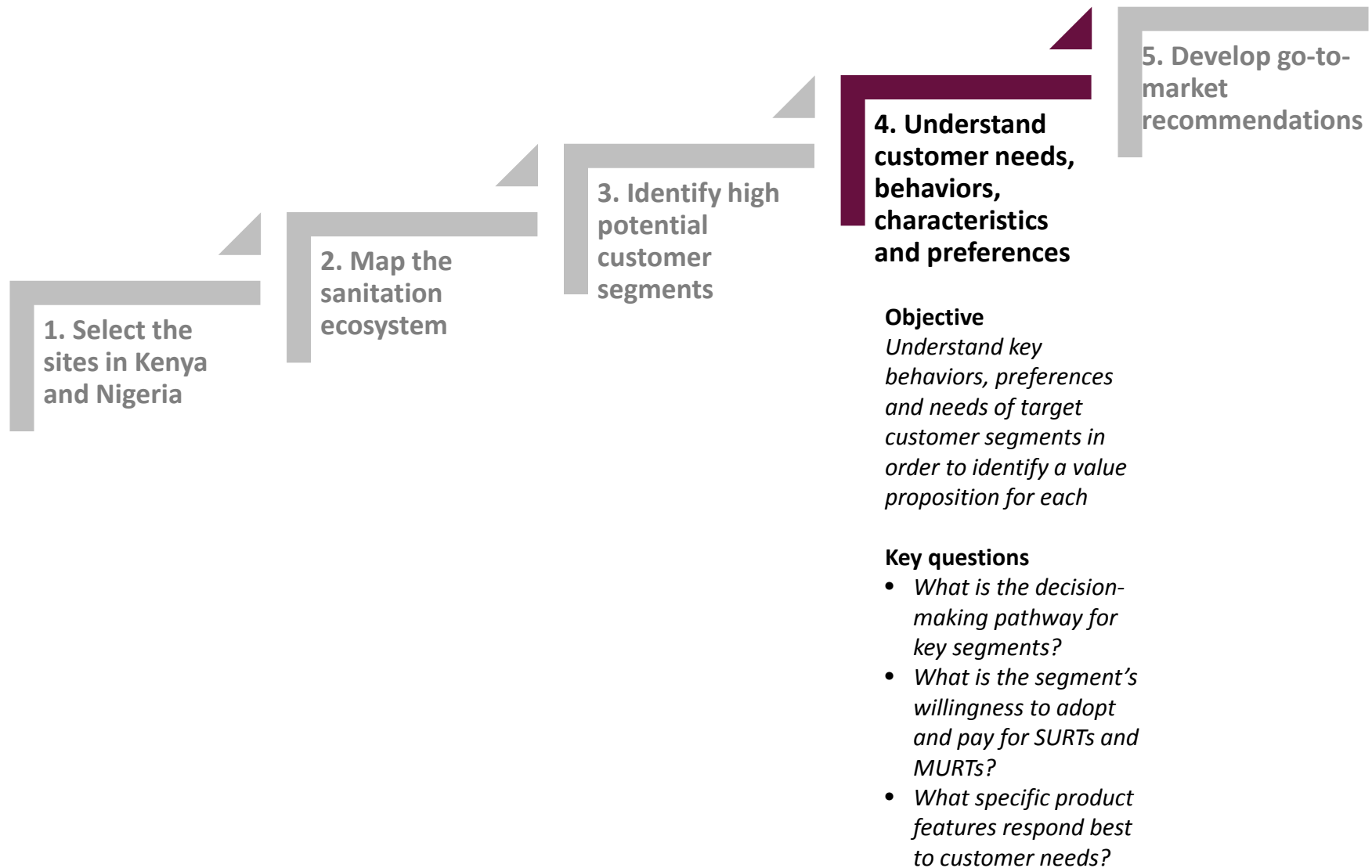
### Residential

- (i) Poor and lower-middle income existing tenements (MURT) in Kenya and Nigeria
- (ii) Poor and lower-middle income existing informal dwellings with pit latrines (SURT/MURT) in Kenya and Nigeria
- (iii) Formal new construction in Nairobi and Lagos (SURT / MURT)

### Institutional

- (iii) State-sponsored housing in Nigeria (SURT / MURT)
- (iv) Educational institutions in Kenya (MURT)
- (v) Public toilets in market places in Kenya and Nigeria (MURT)

# We researched the behaviors, needs and preferences of priority segments to identify a value proposition for each



# We conducted human centered design (HCD) research and quantitative survey research in tandem to answer the following questions:

1 What are the characteristics of the target customer segments (household demographics, home structure and environment, expenditures, existing sanitation preferences, etc.)?

2 What currently constrains the target segments from accessing / adopting improved sanitation solutions?

3 What characteristics of the RT respond best to customer needs and preferences? What features do customers value / not value? What features are they agnostic toward?

4 What value proposition would make the RT (as proxied by black box characteristics) a compelling investment for each target segment?

5 What is the decision pathway for the target segments? What influencer channels and entry points can be leveraged across segments?

6 What is the stated and observed willingness and ability to pay for the RT (as expressed in surveys and inferred through other expenditure and purchases)?

7 What is the willingness and capacity of households, communities and plumbers to maintain the RT?

8 What are the costs of and who pays for purchasing, installing, maintaining and evacuating current sanitation technologies (e.g., pit latrines, septic tank etc.)?

# The ~600 quantitative surveys provided a generalizable overview of priority segment needs, characteristics, and preferences...

We identified big-picture needs, preferences, and capacities, through a total of 300 quantitative surveys with homeowners, landlords, tenants, and plumbers in each country and sampled as follows:

Respondent type	Kenya		Nigeria		Total sample
	Nairobi	Mombasa	Lagos	Abuja	
Homeowners	40	41	43	44	168
Landlords	20	20	20	24	84
Tenants	71	72	70	71	284
Plumbers	15	17	17	18	67
<b>Total interviews</b>	<b>296</b>		<b>307</b>		<b>603</b>

## These surveys allowed us to understand:

- Common sanitation needs across selected user segments
- Existing living and household financial conditions
- Expressed preferences for the RT and interest in by-products
- Ability and willingness to pay for SURTs and MURTs
- Ability and willingness to maintain the RT

# ...and the HCD research allowed us to understand the robustness of those preferences and the rationale behind them

To understand key stakeholders, map out the decision-making pathways and capture preferences and constraints, Our immersive research was aimed at understanding challenges, aspirations, needs, behaviours and preferences. We used a combination of research methods to engage a range of participants.



## Contextual interviews

Interviewing, observing and carefully documenting attitudes and behaviours.



## Participatory design sessions

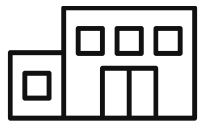
Engaging participants in a dialog around crafted prototypes to gauge preferences.



## Group Interviews

Leveraging groups of 3-5 participants for quick supplemental insights.

We conducted our research in Nigeria and Kenya and focused efforts on understanding insights from the following:



Tenements



Informal settlements

**51**

Participants interviewed

**17**

Landlords

**34**

Tenants



Lagos  
Nairobi  
Mombasa

# Together, the two approaches informed our understanding of the segment value proposition and technical & commercial considerations

## What we studied...

### Quantitative surveys

- Understood the common sanitation needs across selected user segments
- Mapped existing living and household financial conditions
- Captured expressed preferences for and interest in by-products
- Assessed expressed interest in, ability and willingness to pay for SURTs and MURTs

### Human centered design research

- Understood the key actors, relationships and influencers
- Landscaped decision-making pathways related to toilet usage and installation and behavioural patterns that underlie decision making
- Captured how users think about toilets, user constraints and key requirements
- Identified specific design characteristics that respond best to customer needs and behavioral patterns

## What the findings informed...

### Segment value proposition

- What currently constrains the target segments from adopting improved sanitation solutions?
- How, if at all, can the RT address these constraints?

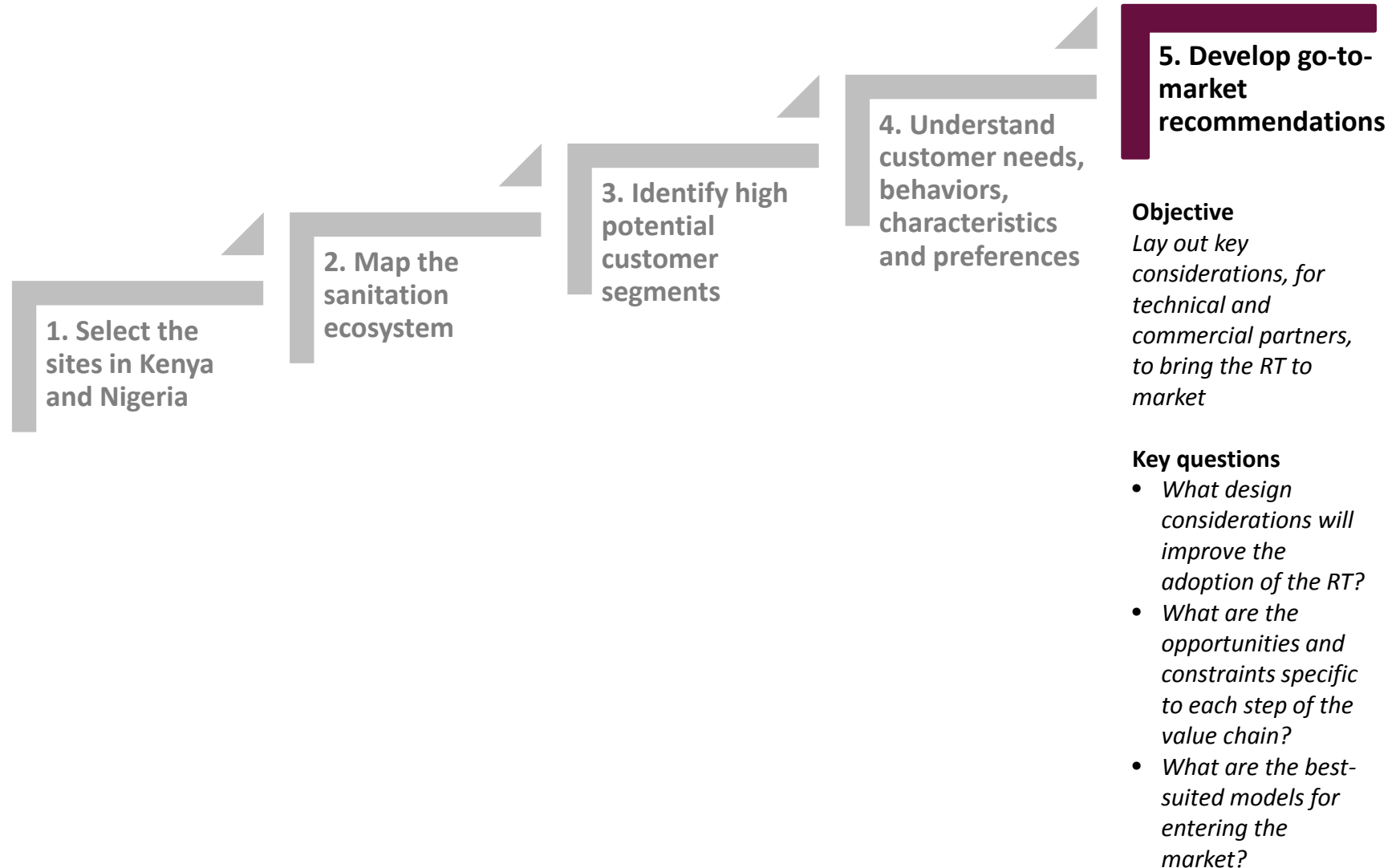
### Technical considerations

- What characteristics of the RT respond best to customer needs and preferences?
- What design elements do the RT's technical partners need to reconsider / adapt, given preferences?
- What design changes could improve the adoption of the RT?

### Commercial considerations

- What business models are best suited to reaching the priority segments?
- What is the addressable market?
- What should the product be priced at and how should it be financed?
- What would be the optimal path to market-entry?

# Using the research, we developed go-to-market recommendations and identified best-suited models for entering the market



# We identified design and commercial considerations to improve adoption of the RT and recommended best-suited business models

## A Design considerations

*What design considerations will improve the adoption of the RT?*

RT black-box characteristics: inputs

RT black-box characteristics: outputs

## B Commercial value chain considerations

*What are the current opportunities and constraints in each step of the value chain in each country?*

Manufacture /  
Import

Sell

Install

Maintain

## C Business models

*What are the business models best suited for the RT in each country?*

Product/services offered

Financing model

Partnership model

## The country chapters that follow are structured as follows:

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- Country sanitation landscape: stakeholders, challenges and opportunities
- Residential market: priority segments and go-to-market approach
  - Go-to-market considerations for existing construction priority residential segments
    - Overview, size, needs and preferences of priority segments
    - Recommended go-to-market approach for existing construction residential segments – design considerations, commercial value chain considerations, and business models
  - Go-to-market considerations for new construction priority residential segment
- Institutional market: priority segments and go-to-market approach
  - Overview of institutional segments
  - Go-to-market considerations for priority institutional segments
- Conclusion: Recommended paths to market entry



## CHAPTER 3: KENYA COUNTRY REPORT

# Executive summary (1/6): Context and as-is outlook for the RT in Kenya



## Sanitation gaps and opportunities in Kenya

- **Despite living in the largest and most urbanized cities in Kenya, 13% of dwellers in Mombasa and Nairobi, collectively, access unimproved sanitation solutions** – defined as uncovered pit latrines, buckets or open spaces. 43% of households in these cities are connected to the sewer line, and Nairobi’s share of such households (51%) exceeds Mombasa’s (16%)
- **Kenya’s government is committed to advancing sewer development** but recognizes that its goals are ambitious for the intended timeline (Year 2030). There are efforts to promote alternative solutions in parallel, but sewers remain a policy priority
- **Private players have achieved some success in providing alternative sanitation solutions in Kenya**, particularly in Nairobi. As such not only are there many lessons to draw from, but this also means that Kenyans have some degree of exposure to waste-to-value as a concept

## Kenya target segments for the Reinvented Toilet (RT)

**The Kenya go-to-market strategy for the RT considers three distinct categories of buyers and/or users:**

- 1) Existing residential constructions
- 2) New residential constructions
- 3) Institutional locations

No single go-to-market (G2M) approach will suit all three categories, as each will require either a business to consumer (B2C) or business to business (B2B) approach, or both. For existing residential constructions, buyers will be landlords, tenants and homeowners and this segment will likely require a B2C approach. In contrast, for formal new constructions, buyers will be housing developers, therefore requiring a B2B sales approach likely contingent on partnerships with construction-related professional organizations. Finally, the institutional segments will likely require B2B and/or B2C – for schools/universities (B2B) and markets/transport hubs (B2B or B2C, depending on whether STeP partners operate their own public toilets or sell to exiting operators

## As-is-outlook for the RT

**To be successful in Kenya, STeP partners should be aware of two key aspects:**

- For technology partners, tweaking the product design to enhance the value proposition for these respective groups may boost the salability of the product
- For commercial partners, establishing an on-the-ground presence to manage multiple aspects of the value chain may boost the success for the product, though it will render the business model considerably more complex

# Executive summary (2/6): Segment value proposition of the RT for existing residential construction in Kenya



## Existing residential construction: segment value proposition and market size

**Within this category, low-income pit latrine households in informal settlements and tenements in Nairobi and Mombasa are priority segments for the RT.** These are the largest segments in both cities and have the highest estimated propensity to adopt the RT

**Of the 440,000 households that make up the two priority segments in Nairobi and Mombasa combined, 2-5% (or 7,500-20,000 households) are the most likely to adopt depending on product pricing:**

- The addressable market is larger in Nairobi for both SURTs and MURTs (up to 13,500 units in Nairobi, vs. up to 6,700 in Mombasa)
- The addressable market appears larger for MURTs than for SURTs (up to 10,000 units in Nairobi vs. up to 5,000 for SURTs)

It is important to note that the addressable market has been calculated only for priority segments. The addressable market for Nairobi and Mombasa as a whole will be much larger.

**The by-product value proposition of the RT is greater than the waste treatment / sanitation access value proposition for households in the priority segments:** Most households appear comfortable with their existing solutions. The by-product offerings, however, generated significantly more interest during our human-centered design sessions. The value proposition may therefore rest on these by-products, as many households are looking to either enhance the reliability or lower the costs of their basic services (i.e., cooking fuel)

## Existing residential construction: technical / design considerations

**A few design modifications will likely enhance product-market fit:**

- **Electricity:** Electricity in Mombasa is somewhat unreliable and while the electricity in Nairobi is reliable, it may be a safety hazard because it is an informal connection and experiences power surges. It is highly recommended that toilet not run on a user's existing power source. If the RT is power off-grid, then the power source should be discrete, so as to not attract attention of the cartels
- **Water:** The RT should not depend on a user's existing water supply. Although some participants access water (via tap or borehole) on the plot or within a 5 min walking distance, it was a burden for them to collect and store water at their home
- **Space:** There is no space to install a single toilet and piping in many one-room households (our market sizing excludes households with space restrictions). Further, it would be difficult to retrofit a building that did not follow standard building codes. There may be opportunity to experiment with smaller portable toilets, as some players are doing
- **By-products:** The by-products most valued by the users are electricity and biogas. The value proposition of these by-products will be enhanced if the by-products are able to meet most household needs e.g. all electricity needs

# Executive summary (3/6): Go-to-market recommendations for existing residential constructions in Kenya



## Existing residential construction: business model considerations

**RT's commercial partners may need to see themselves not strictly as toilet providers but also as asset financiers (or will have to partner with an organization that does so):**

- Industry benchmarks suggest that a SURT should be priced at USD 50. Expressed willingness to pay for the SURT reaches USD 400, but these estimates are somewhat unreliable given lack of experience of using the product. A price of USD 400 is twice the monthly income for most households in the segments, which may strain the affordability. Comparable solutions (i.e., latrines) typically cost 50% of that to install
- Households may require additional assets to fully "enjoy" the resulting by-products; for example, for one of the most promising by-product, biogas, only 13% of our surveyed households own a gas tank that could be utilized
- Financing may be required. Many solar product companies that sell products at the similar price points in Kenya offer financing

**We recommend a product + service model to bring the RT to Kenya, with different levers of complexity, depending on RT's partner's appetite:** in-house support for installation and maintenance, add-on assets (e.g., low-wattage appliances or gas tanks), and/or pay-as-you-go services for the by-products themselves. A product + service model would address low consumer awareness among households, especially in Mombasa, who are less exposed to alternative on-site solutions, boost trust with would-be customers, and match the standards set by the competition. **Barring identification of capable implementation partners with segment-specific knowledge, the trade-offs of pursuing a product-only model, or of having no on-the-ground presence, are significant and may compromise product success**

**The main buyers in this segment would be households themselves (landlords and homeowners), although a subsidy model may include institutional co-buyers.** It may not be easy to partner with government actors currently involved in fecal sludge management:

- While the makers of the RT and waste municipalities share similar waste treatment goals, the RT may be (but not necessarily) seen as competing with waste municipalities' core business, which is heavily focused on sewers (connections and fees)
- However, it would not be impossible to engage municipalities as a marketing/promotion partner, as other organizations have done so successfully. RT's commercial partners would need to be aware, however, that waste companies may need tangible incentives to engage

**For manufacturing/importing, marketing and distribution, no single option emerges as an absolute recommendation:** each will depend on the willingness and capability (operational and financial) of the commercial partners

# Executive summary (4/6): Go-to-market recommendations for new residential construction in Kenya



## Formal new residential constructions

**The approach for new residential constructions differs significantly from that of existing constructions.** New constructions will require a business-to-business approach – as buyers would be housing developers rather than households themselves

**This segment, with an estimated annual flow of 10,000 units in Nairobi, is high-stakes, with strong reputational opportunities and risks for RT's commercial partners:**

- The majority of units in this segment fall into the high-income and "luxury" categories, with strong bias towards high-end plumbing fixtures and fittings
- The sector is highly return-driven, with investors expecting at least 20% IRR for each development, meaning less willingness to take risks with building architecture and design
- Though there are dozens of players, they aggregate into a handful of associations with the ability to influence sector-wide decisions

**Nevertheless, the opportunities within this segment are compelling:**

- Developers are looking for ways to increasingly and profitably sell to low-income segments – either by stripping the units of nice-to-have features or by introducing alternative, cheaper designs entirely
- Below-ground construction, as is needed for sewer connections and septic tanks, can account for a significant share (25%) of the total development costs. Sizeable savings in this category could have a notable impact on overall spend
- The segment is one of the fastest growing, having achieved a 12.3% CAGR in the last five years and likely to grow at the same pace

**The go-to-market approach for this segment requires testing and demonstrating the value proposition for housing developers** (especially around cost savings and legal compliance), closely monitoring the success of an initial pilot, and leveraging the various professional organizations to market the RT to others. We have mapped the process in the respective section of this report

# Executive summary (5/6): Go-to-market recommendations for institutional segments – educational institutions and public toilets



In Kenya, we recommend educational institutions (schools and universities) as well as markets and transport hubs as target segments. The go-to-market approach varies significantly for each:

## Educational institutions

- **Universities:** The opportunity and go-to-market approach for this segment, for which there is a push to develop 30,000+ student housing units, will look similar to that of residential new construction as development is outsourced to commercially-driven housing developers, with many of the same key players
- **Schools:** Schools offer a weaker commercial rationale but are still a worthwhile market from a needs and impact perspective:
  - Schools are highly fragmented as a segment
  - They lack the financial capability and decision-making power to make their own purchases, often dependent on Ministry of Education budgets, but have a severe need that requires support to address

## Public markets and transport hubs

**Markets and transport hubs may be the easiest of all the segments to target given high need, low entry barriers and low competition.** There are two ways that commercial partners could engage:

- 1) **Direct play** – operating toilets themselves (building new ones or renovating existing ones)
- 2) **Indirect play** – selling the RT to existing operators.

**Given the fragmentation of public toilet operators, the direct play model may offer a stronger opportunity than the indirect model.** A handful of operators take the same waste-to-value approach (e.g., Sanergy and Ecotact). They have either: a) built a business model around collecting the waste away to decentralized facilities for treatment and resale, or b) are already building on-site systems themselves. This does not mean that these players may not engage with commercial partners, however: several have been BMGF grantees, and many of their business models are still evolving

**Regardless of the approach, the financial sustainability in this segment is challenging:** it requires high volumes of users, especially as fees-per-use have remained unchanged in nearly a decade, as well as the ability to keep costs, especially indirect (e.g., overhead), low and manageable. Forging partnerships with NGOs/the government could partially address this challenge

# Executive summary (6/6): Recommended paths to market-entry for the 4 priority segments in Kenya



Putting the recommendations across the four priority segments together, there are three potential paths to market-entry for priority segments in Kenya:

## **Path 1: Demonstrate in public toilets to prove the concept to low-income existing residential segments**

### 1. Launch public toilets in various areas

Launch MURTs in public toilets in markets, schools and low-income neighborhoods to demonstrate the concept

### 2. Target households by saturating a neighborhood

Depending on market feedback, launch more communal MURTs and SURTs / household-level products using a neighborhood-saturation approach

The demonstration effect works only for existing low-income residential constructions and is unlikely to spill over to new constructions, as housing developers do not take market cues from the public toilets sector

## **Path 2: Validate the concept with a target developer and scale to new residential constructions**

### 1. Validate and demonstrate the value proposition

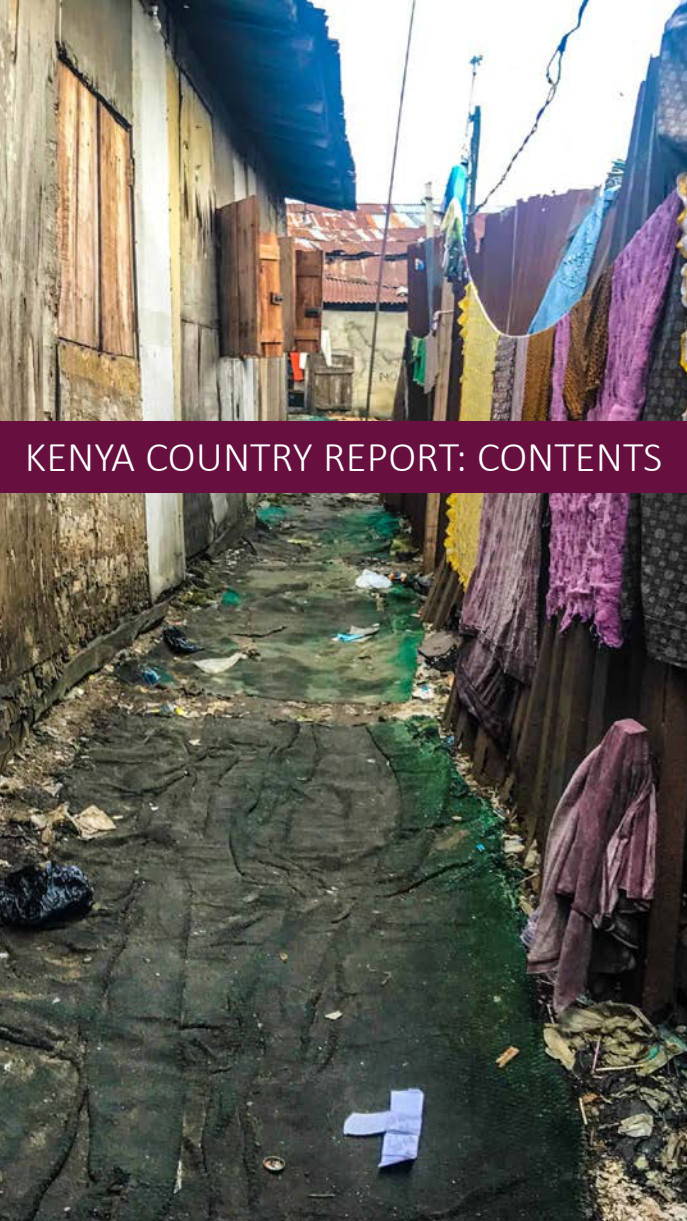
### 2. Pilot with a housing developer

### 3. Market to other developers and to the industry

Dependent on validation of the business case with low-income housing developers (i.e., cost savings and match to customer preferences), pilot with a selected housing developer, market the results of the demonstration project to other developers, architects and surveyors and bring product to scale

## **Path 3: Take over GIZ's "Upscaling Basic Sanitation for the Urban Poor" program ending in 2018**

This program, implemented by the German development agency and partly funded by the Bill and Melinda Gates Foundation, is ending as of December 2018 as the primary partners shift sector priorities. While a non-commercial option, taking over the program would allow STeP partners to leverage existing, strong relationships with key water and sanitation players all over the country – not just Nairobi and Mombasa – and build upon an 8,000-household scale



## KENYA COUNTRY REPORT: CONTENTS

- **Kenya sanitation landscape: stakeholders, challenges and opportunities**
- Residential market: priority segments and go-to-market approach
- Institutional market: priority segments and go-to-market approach
- Conclusion: Recommended paths to market entry
- Annex

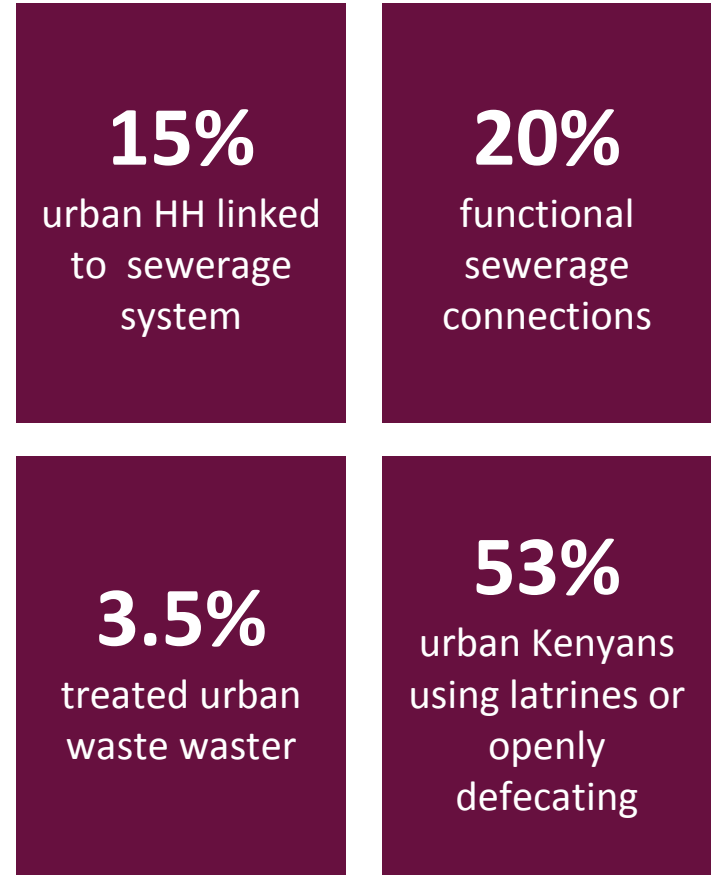
# In Kenya, population growth has so outpaced sanitation access that the proportion of people connected to the sewer has declined since 2011



## Context

- From 2007 to 2015, progress in the total number of Kenyans with access to improved sanitation stagnated, with only 3 million additional people gaining access during that period
- To meet its UN Sustainable Development Goals (SDG) objectives, the government estimates that 350,000 new sewer connections would be required per year for the next 15 years
- Yet, there is a budget shortfall of USD 10 billion—70% of the funding required—to meet its sanitation access goals, and spending on sanitation has historically been approximately 0.2% of GDP, low by recommended international standards
- Much of the sanitation funding has targeted hygiene promotion / messaging by health service workers rather than sanitation infrastructure
- Due to the growth rate of Kenya's urban areas, the percentage of households connected to the sewer is lower than it was in 2014

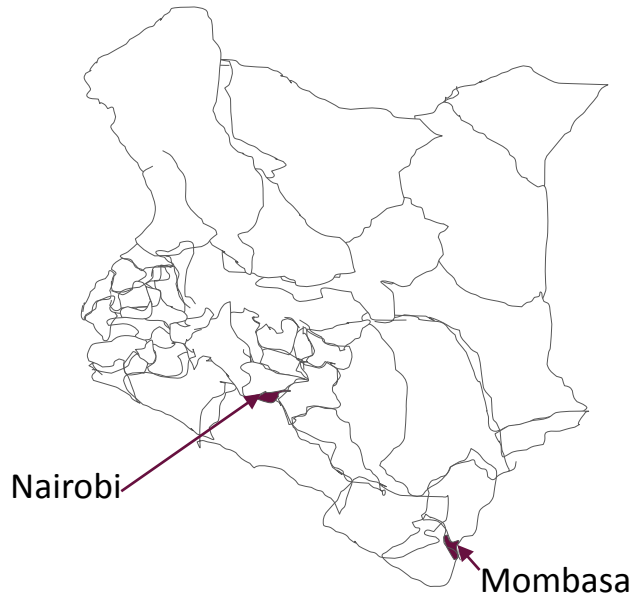
## Persistent sanitation challenges in Kenya



# Our selected Kenyan cities, Nairobi and Mombasa, are the largest and most urbanized in the country but are unique in several ways

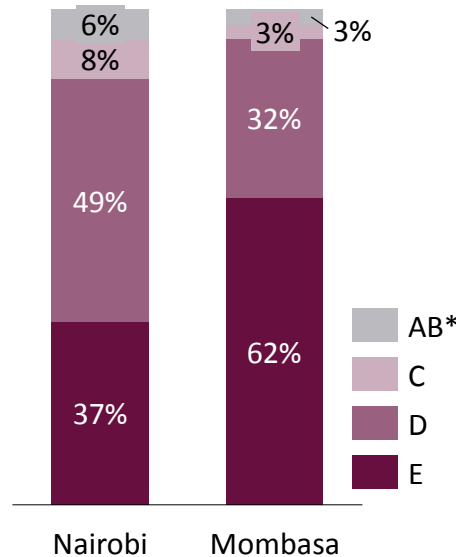


Location of selected cities in Kenya

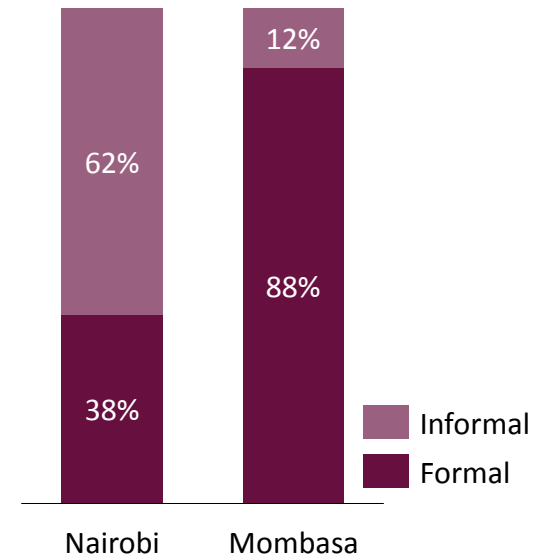


Mombasa is poorer than Nairobi

Socioeconomic distribution



But has a smaller share of the population living in informal housing



## Selected attributes of Nairobi and Mombasa:

<b>Population size</b>	Population of Mombasa is 1.1 million and that of Nairobi is 4 million; both 100% urban
<b>Income levels</b>	35% of Mombasa and 22% of Nairobi lives below the USD 28 / KSH 2908 poverty line
<b>Toilet type</b>	39% of households in Mombasa share toilets, compared to 64% in Nairobi
<b>Religious composition</b>	Mombasa is 59% Muslim compared to the national average of 11%
<b>Homeownership</b>	7% of Nairobi households own their homes, compared to 27% in Mombasa

# Nairobi leads in sanitation access nationally, yet 64% of households share sanitation facilities and less than 5% of the waste is treated

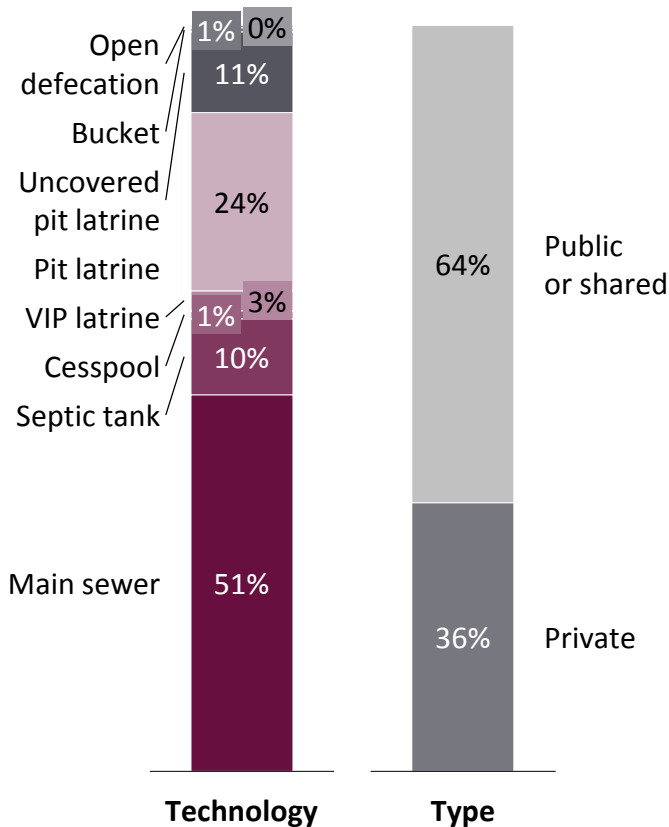


## Access

*One out of eight urban Nairobians still use unimproved sanitation facilities*

### Type of sanitation facility – 2013

(In millions of individuals, % of total)

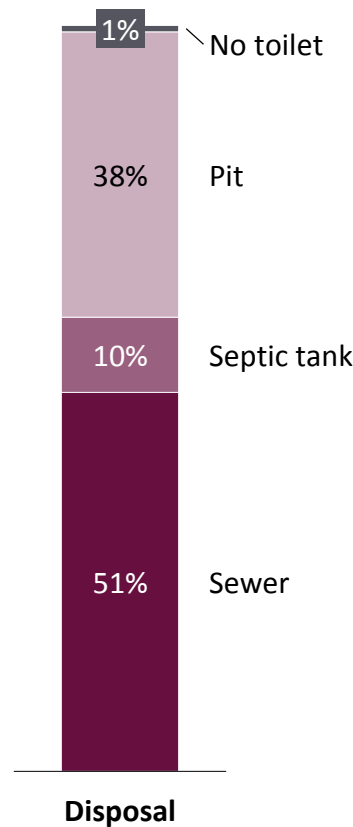


## Collection and conveyance

*Nearly five out of 10 households in Nairobi are not connected to a sewer*

### Type of collection facility – 2013

(In millions of individuals, % of total)



## Treatment and reuse

*Non-compliance and non-functional plants exacerbate treatment challenges*

- Although 51% of Nairobi's 905,000 households are connected to the central sewer, only 20% of these connections are active
- For unconnected households, fecal sludge extraction can cost up to USD 120 per household per session
- The largest waste treatment plant, which treats 80% of the city's waste, is located at least 30 km from the city center. As a result, professional extractors routinely dispose sludge into storm water drains and streams, or at a formal dumping ground near the city
- Because of the distance and the share of inactive sewer connections, waste treatment plants operate at only 16% capacity and, cumulatively, treat less than 5% of Nairobi's waste water
- Nairobi is heavily investing into sewerage infrastructure development, but these investments so far have yielded only incremental coverage

Note: "Unimproved" sanitation facilities: uncovered pit latrines, bucket, bush, or other

Source: 2013 Report: Kenya Bureau of National Statistics; Water Research Commission (2015) "The status of fecal sludge management in eight African countries"; Surbana Jurong Group; Dalberg analysis

# 64% of Mombasa households use pit latrines; the city has pervasive open disposal of fecal sludge (open spaces, drainage channels, etc.)



## Access

*One out of five people in Mombasa still use unimproved sanitation facilities*

## Collection and conveyance

*Seven out of 10 households use pit latrines or dispose openly*

## Treatment and reuse

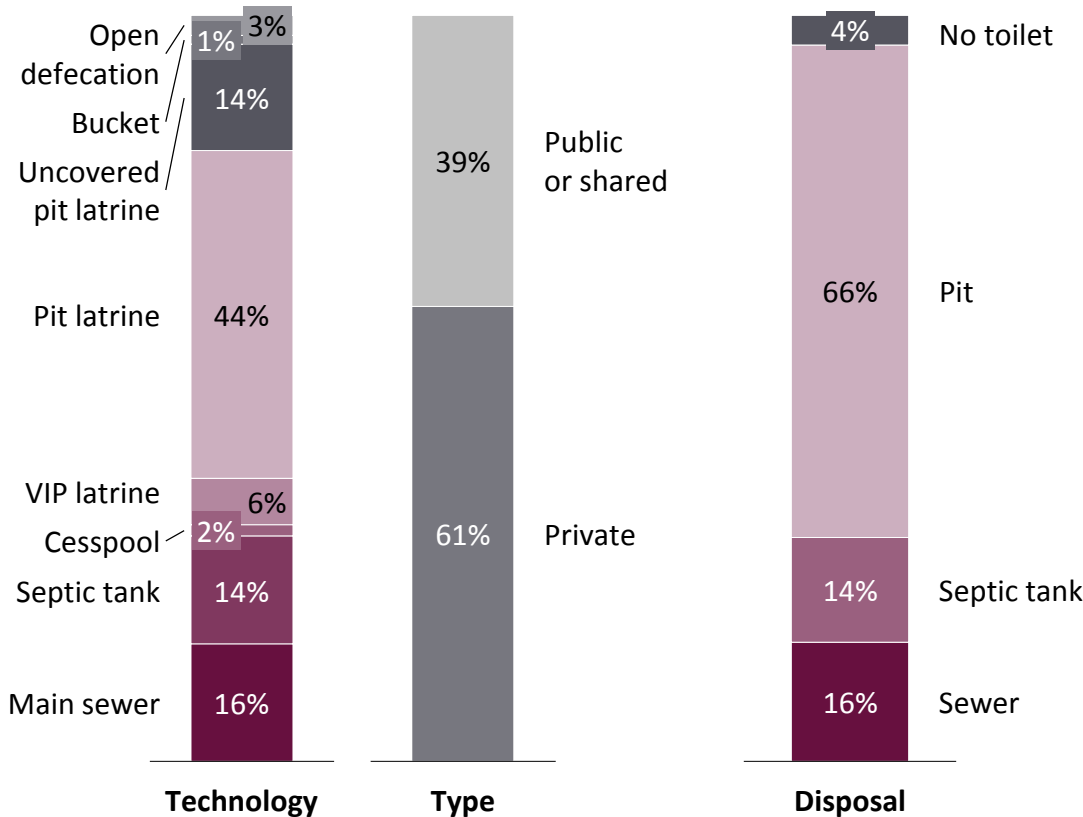
*Mombasa significantly lags behind Nairobi in waste treatment efficacy and innovation*

### Type of sanitation facility – 2013

(In millions of individuals, % of total)

### Type of collection facility – 2013

(In millions of individuals, % of total)

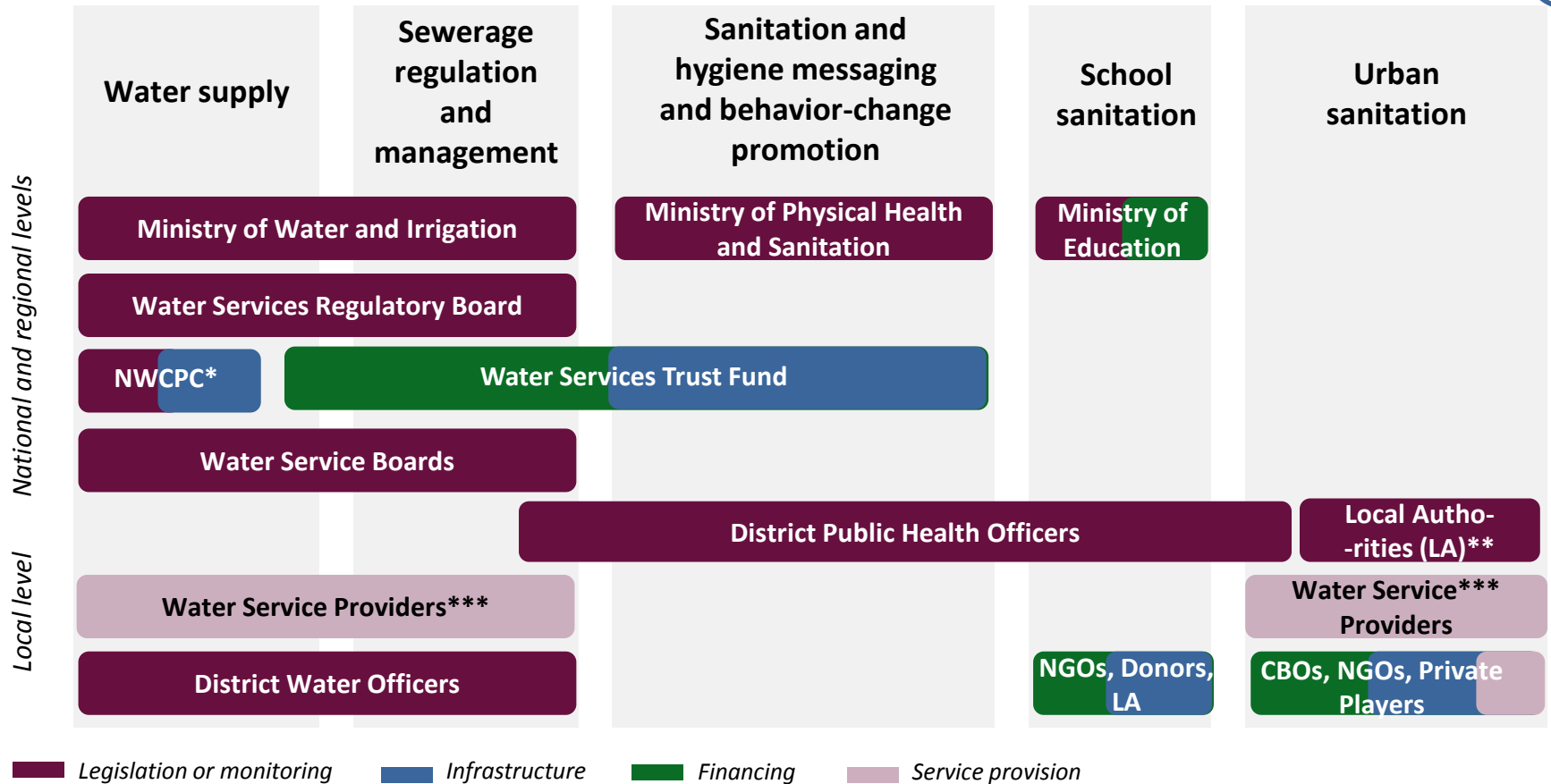


- Mombasa’s percentage of connections to the central sewer lags behind the national urban average (16% vs. 19%, occasionally reported as low as 5%)
- The city has a greater treatment need than Nairobi: only one of its treatment plants is operational. The other borders and openly dumps waste into the bay
- Given the prevalence of pit latrines, the high water table in Mombasa further exacerbates fecal sludge management. Some households dig very deep pits, which allows the waste to seep into the ocean
- Prices for pit clearing / extraction range from USD 60 to USD 120 (despite lower average income in Mombasa) and can surprisingly be higher for households with less space (i.e., for the added labor of the “frogmen” who manually clear these pits)

Note: “Unimproved” sanitation facilities: uncovered pit latrines, bucket, bush, or other.

Source: Kenya Bureau of National Statistics (2013); Water Research Commission (2015) “The status of fecal sludge management in eight African countries”; Dalberg analysis

# Within government, sanitation lacks an official ministry home and spans multiple offices, none of which solely develops infrastructure

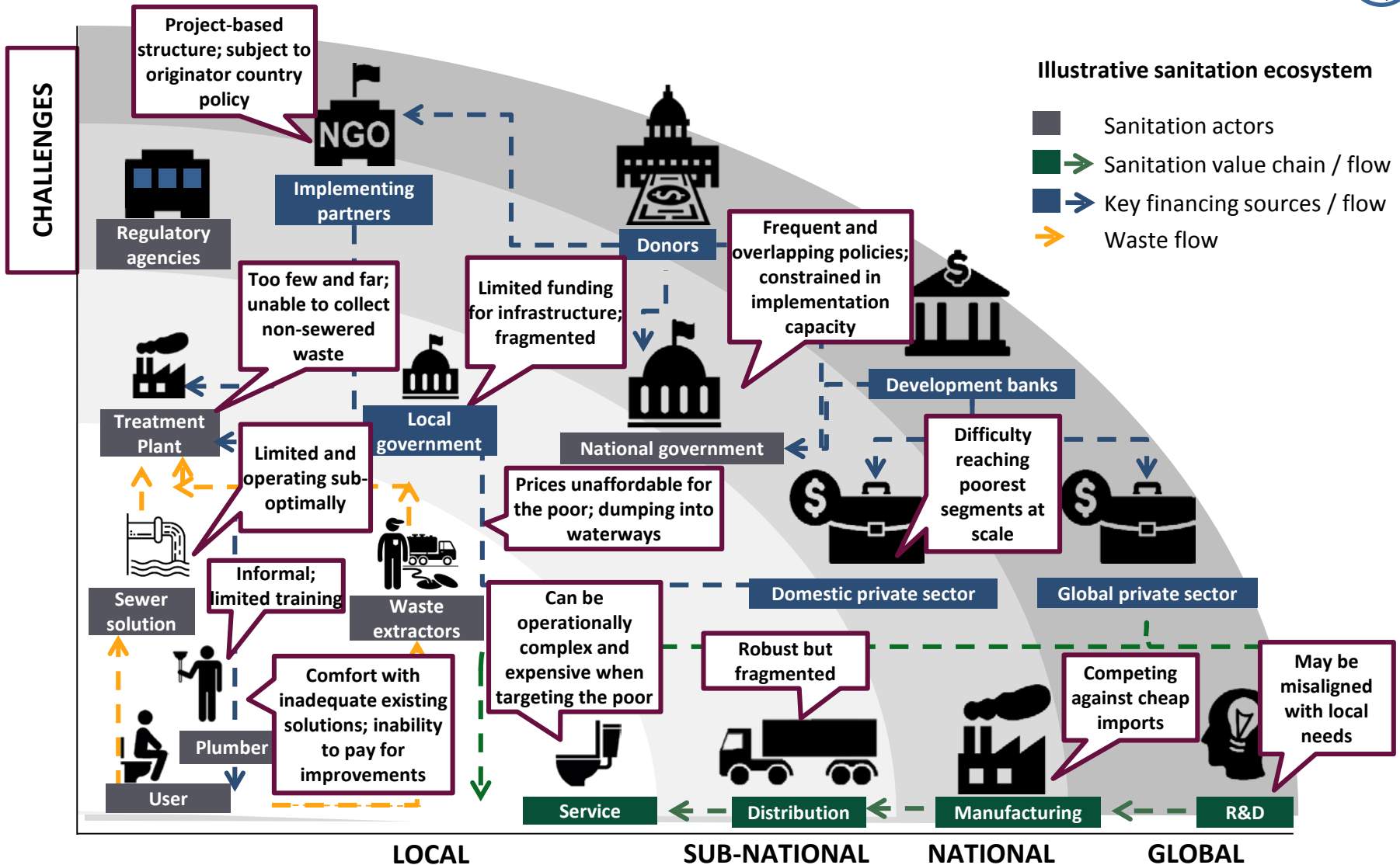


**Fewer entities are involved in infrastructure development and service provision in urban sanitation. There is room for non-government parties (private sector and NGOs) to boost access at the household level**

Note: \*National Water Conservation and Pipeline. \*\*Local authorities are formal roles in public administration in Kenya, such as town clerks, etc. \*\*\*Water service providers are also involved in sanitation maintenance; their official names, however, are water service providers.

Source: World Bank Water and Sanitation Program (2015) "Turning finance into services for 2015 and beyond"; Water Research Commission (2015) "The Status of Fecal Sludge Management in Eight African Countries"; Dalberg analysis

# Ecosystem challenges include misdirected funding, inadequate infrastructure and demand that wanes unless consistently activated



# Private and non-profit players have stepped in to provide alternatives along the entire sanitation value chain, though at limited scale



<i>Non-exhaustive list</i>	<b>Offering</b>	<b>Access</b>	<b>Collection</b>	<b>Treatment</b>	<b>Reuse/sell</b>	<b>Scale</b>
<b>Sanergy</b>	<i>Franchisee model of public and shared toilets; testing household toilets</i>	✓	✓	✓	✓	<b>1,100 units</b>
<b>Sanivation</b>	<i>Household toilets offered at monthly fee; no upfront cost</i>	✓	✓	✓	✓	<b>1,500 households</b>
<b>Ecotoilet</b>	<i>Public toilet blocks in highly urbanized, commercial areas</i>	✓		✓	✓	<b>30 blocks</b>
<b>SafiSan</b>	<i>Household toilet upgrading fund (50% subsidy) through water utilities</i>	✓		✓		<b>8,000 units</b>
<b>Umande Trust</b>	<i>Community-run shared toilet blocks; pay-per-use with add-on services</i>	✓		✓	✓	<b>88 bio-centers</b>
<b>Ecomaji</b>	<i>Wastewater treatment offerings – residential and commercial scale</i>			✓	✓	<b>50 units</b>
<b>EcoCast</b>	<i>Improved and affordable septic tank solution – residential and commercial scale</i>			✓	✓	<b>10,000 units</b>

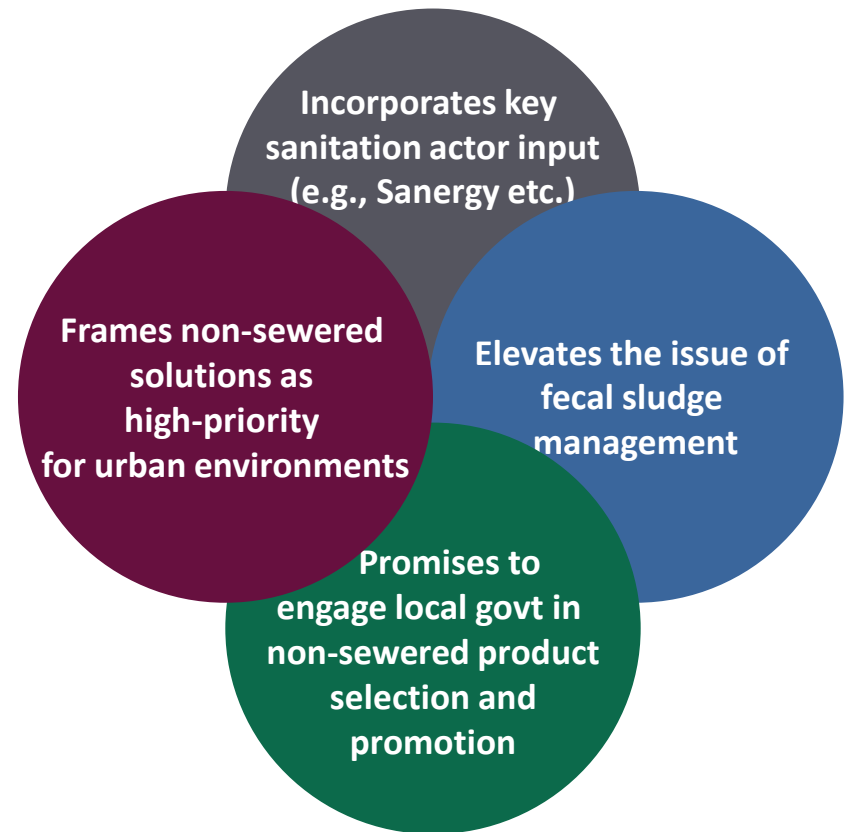
# To help meet the 2030 goal, the current government appears willing to also promote alternative solutions



The Government of Kenya (GoK) is unlikely to reach its goal of 80% sewer access by 2030 for the following reasons:

- 1 Fast population\* and urbanization\*\* growth will persist: 0.5 million people are moving to Kenya's urban centers each year
- 2 New sewer connections in the last five years average around 2,000/annum, far short of the 350,000 required per year
- 3 Initiatives to expand sewer coverage are capital intensive, donor-driven and only yield incremental coverage
- 4 The private sector lacks sufficient incentives to invest in municipal facilities: the time horizon is too long to recoup the investment
- 5 A notable component of closing the GoK's 70% funding gap would be to raise tariffs, which households already consider high

GoK recently launched a 2016 – 2030 Sanitation Policy that states clear buy-in for non-sewered solutions. It has promising features:



Note: \*Population growth rate: 2.5%; \*\*urbanization growth rate: 4.2%.

Source: Kenya Water Services Regulatory Board (WASREB) 2016 impact report: "A performance review of Kenya's water services sector, 2014-2015"; stakeholder interviews; Dalberg analysis

# The new Sanitation Policy mandates county-level action planning, provides a fund for sanitation and promotes innovative technologies



Theme	Recommendations
Planning	<ul style="list-style-type: none"><li>• The Boards of cities and municipalities and town committees should develop Urban Environmental Sanitation and Hygiene Strategic and Action Plans (UESHSAPs) and Urban Strategic Environmental Sanitation Investment and Financing Plans (USESIFP)</li><li>• County governments and city or town authorities, in coordination with all other agencies involved in sanitation, will develop sanitation plans for all urban settlements</li></ul>
Financing	<ul style="list-style-type: none"><li>• The policy seeks to establish the National Sanitation Fund (NASF) by 2018</li><li>• The Fund is expected to implement innovative financing mechanisms to draw new resources, ring-fenced for high-priority areas and interventions as well as underfunded areas within the sanitation service delivery chain</li><li>• The Fund's mandate will direct it to support the identification, development, testing and implementation of innovative sanitation solutions for both rural and urban areas</li></ul>
Technology	<ul style="list-style-type: none"><li>• The policy promotes 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 centers</li><li>• The government is expected to establish a National ESH Research and Development Institute (NESHARDI) to respond to the changing sanitation needs. NESHARDI will support research and development interventions in appropriate technologies, improved sanitation systems, waste management and behavioral studies</li></ul>

**While the National Environmental and Health Sanitation Policy is a step in the right direction, its implementation is likely to face considerable challenges around decentralization and financing**

# But policy is not an indication of country-wide alignment: waste municipalities are still pursuing sewer development, aided by the govt



1

The government and the waste municipality are not one and the same and may act in parallel

- Municipal waste providers in Kenya are parastatal companies that have received full control of municipal waste management



- As a result, they and the government may act in parallel, with different – though related – objectives. **Therefore the waste policy is not indicative of country-wide alignment towards specific behavior**

2

Promoting on-site treatment solutions is not the current core business of the waste municipalities

The revenue streams of municipal treatment plants are primarily driven by sewerage waste:

- Sewer line connection fees
- Monthly tariffs from sewer-connected households
- Monthly truck membership fees for third-party extractors
- Fees from extraction services offered by the treatment plants themselves
- Non-operating revenue (e.g., grants with administrative support)

According to WASREB, enforcing monthly fees for third-party extractors has been challenging; and households do not prefer the municipality's extraction services

3

Municipalities in both cities, aided by the govt, are actively pushing for sewer development

There are **at least three plans to further develop sewer coverage in both Nairobi and Mombasa**, funded by the Japanese development agency, the African Development Bank, and the Kenyan government:

- Nairobi Rivers Sewerage Improvement Project – Phase 2
  - USD 93M for ~300KM sewer lines in Nairobi
- Kenya Towns Sustainable Water Supply and Sanitation Program
  - USD 391M for sewer systems in 17 towns across Kenya
- Mombasa Gate City Master Plan
  - Funds not yet determined; ambitious goals for sewerage development

**The waste treatment municipalities would not be the main beneficiary of the RT but they may support the RT in areas they cannot reach. If they don't, their partnership is not necessary to succeed in the market**

# Given the landscape, some actors involved in the sanitation value chain may find value in the RT and others may not, unless incentivized (1/2)



Actors	Involvement	Incentivized to promote / buy / use the RT	Rationale
<b>Government</b>	Policy-setting	◐	<ul style="list-style-type: none"> <li>The government has recognized non-sewered solutions as a pathway to its sanitation goals but nevertheless prioritizes sewer, as manifested through multiple million-dollar infrastructure plans</li> </ul>
<b>Donors and NGOs</b>	Policy-influencing, service provision, financing	●	<ul style="list-style-type: none"> <li>NGOs may find value in promoting the RT through their existing programs, as they typically test a variety of sanitation solutions; many such players in Kenya are currently involved in facilitating improved sanitation access</li> </ul>
<b>Plastics manufacturers</b>	Production and supply of toilets, at small scale	◑	<ul style="list-style-type: none"> <li>Plastics manufacturers produce toilets for NGOs on a per-project basis. However, left to their own volition, they do not target low-income customers nor offer sanitation products in their core business</li> </ul>
<b>Public health and sanitation officers</b>	Product and behavior-change promotion	◑	<ul style="list-style-type: none"> <li>Public health and sanitation officers are key influencers in the sanitation ecosystem. If products align with their overall objectives, they can serve as product promoters, or at least as channels to connect to local communities</li> </ul>
<b>Alternative sanitation providers</b>	Design and sale of non-sewered solutions; occasionally treatment of waste	◐	<ul style="list-style-type: none"> <li>Typically, these are social or small enterprises. The most innovative are looking into the waste-to-value chain, transforming fecal matter into charcoal briquettes or using as feed input for worms for composting. The RT would cut off supply for a key resource, unless it is integrated into their business model</li> </ul>

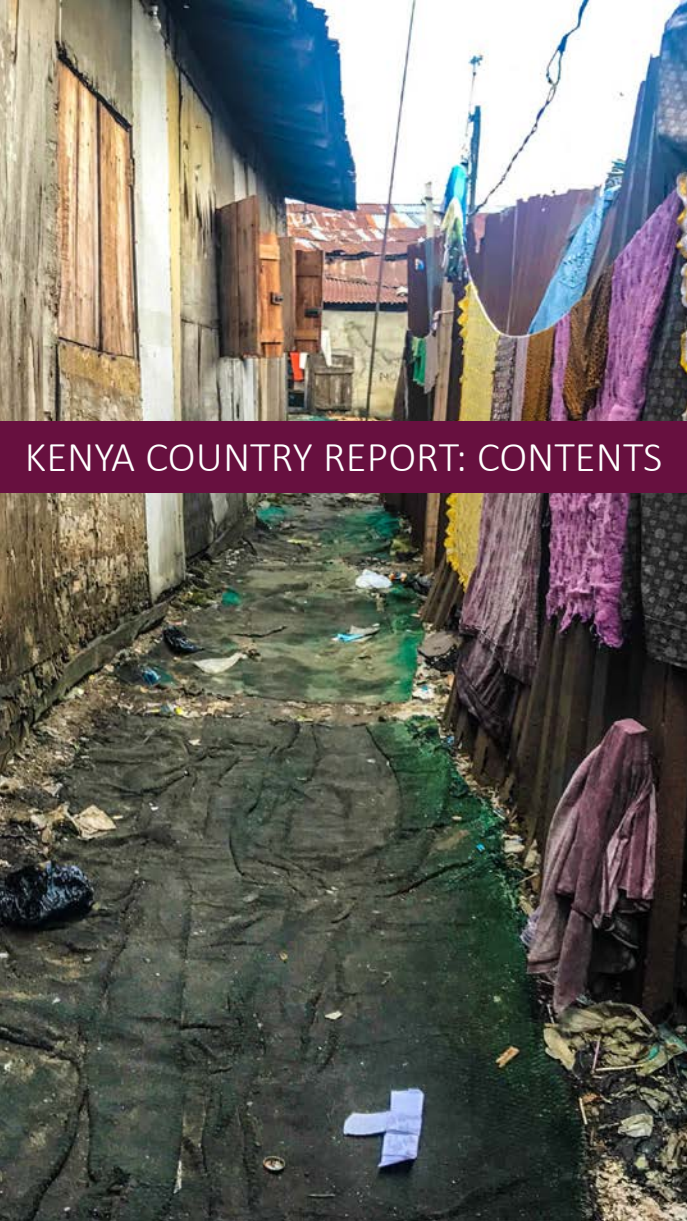
○ Low or no incentive   ● High incentive

# Given the landscape, some actors involved in the sanitation value chain may find value in the RT and others may not, unless incentivized (2/2)



Actors	Involvement	Incentivized to promote / buy / use the RT	Rationale
<b>Masons and contractors</b>	Construction across income segments	●	<ul style="list-style-type: none"> <li>Masons and contractors would continue to benefit from the RT if they are leveraged as installers and maintainers, especially if the opportunity offers stable employment</li> </ul>
<b>Plumbers and informal laborers</b>	Installation and maintenance	●	<ul style="list-style-type: none"> <li>Plumbers (informal or not) may still find value, insomuch as they remain a key component of the RT's value chain (i.e., that they are able to continue to provide their services)</li> </ul>
<b>Local hardware stores</b>	Distribution and sale of construction materials	●	<ul style="list-style-type: none"> <li>Local hardware stores can be found in neighborhoods across income levels. However, they too are conscious of product selection, typically opting for faster-moving products, or those that are typically purchased in bulk (e.g., cement bags, etc.)</li> </ul>
<b>Fecal sludge extractors</b>	Sludge extraction and disposal	○	<ul style="list-style-type: none"> <li>Nairobi and Mombasa each have 12-15 companies offering fecal sludge extraction, in addition to numerous "frogmen" who manually extract latrines and informal laborers employed as USD 1/task for pipe cleaning and unclogging. They are unlikely to find value in a purely on-site solution that requires no extraction</li> </ul>
<b>Waste treatment municipality</b>	Development and maintenance of sewer infrastructure; sludge treatment	○	<ul style="list-style-type: none"> <li>Sanitation services are managed by parastatal Water Services Boards. On-site solutions are counter to their core business, as their revenue streams are largely linked to sewers: connection fees, monthly tariffs for households. Though they operate below capacity, this has no negative financial impact on the treatment plants</li> </ul>

○ Low or no incentive    ● High incentive



## KENYA COUNTRY REPORT: CONTENTS

- Kenya sanitation landscape: stakeholders, challenges and opportunities
- **Residential market: priority segments and go-to-market approach**
  - Go-to-market considerations for existing construction priority residential segments
    - **Overview, size, needs and preferences of priority segments**
    - Design considerations, commercial value chain considerations, and business models
  - Go-to-market considerations for new construction priority residential segment
- Institutional market: priority segments and go-to-market approach
- Conclusion: Recommended paths to market entry
- Annex

# Summary: Overview, size, needs and preferences of priority segments within existing residential construction



## Existing residential construction: segment value proposition and market size

**Within this category, low-income pit latrine households in informal settlements and tenements in Nairobi and Mombasa are priority segments for the RT.** These are the largest segments in both respective cities and have the highest estimated propensity to adopt the RT

**Of the 440,000 households that make up these segments in both cities, 2-5% (or 7,500-20,000 households) are likely addressable, depending on product pricing:**

- The addressable market is larger in Nairobi for both SURTs and MURTs (up to 13,500 units in Nairobi, vs. up to 6,700 in Mombasa)
- The addressable market appears larger for MURTs than for SURTs (up to 10,000 units in Nairobi vs. up to 5,000 for SURTs)

It is important to note that the addressable market has been calculated only for priority segments. The addressable market for Nairobi and Mombasa as a whole will be much larger.

**The by-product value proposition of the RT is greater than the waste treatment / sanitation access value proposition for households in the priority segments:** Most households appear comfortable with their existing solutions. The by-product offerings, however, generated significantly more interest during our human-centered design sessions. The value proposition may therefore rest on these by-products, as many households are looking to either enhance the reliability or lower the costs of their basic services (i.e., cooking fuel)

# Process: We segmented the residential market in Nairobi and Mombasa to identify priority segments for the RT

RECAP

## Segmentation approach

- 1 Developed a long list of segmentation criteria—variables that could explain variation in adoption of the toilet—based on desk research and interviews
- 2 Shortlisted segmentation criteria based on variable relevance, data availability and actionability
- 3 Created a segmentation framework based on the shortlisted segmentation criteria
- 4 Evaluated each of these segments on their (i) propensity to adopt the Reinvented Toilet and (ii) relative market size
- 5 Selected two to three priority segments in each country and evaluated each for the ease of going to market (as defined by ease of reaching the market through a single entry point or an aggregator)

## Segmentation framework

Age of construction		Unbuilt / New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pit (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socioeconomic category	E	Light Blue	Yellow	Dark Grey	Dark Grey	Light Blue	Dark Grey	Dark Grey	Dark Grey	Light Blue	Yellow	Dark Grey	Dark Grey	Light Blue	Yellow	Dark Grey	Dark Grey
	D	Light Blue	Yellow	Yellow	Light Blue	Light Blue	Dark Grey	Dark Grey	Dark Grey	Light Blue	Yellow	Dark Grey	Light Blue	Light Blue	Yellow	Yellow	Light Blue
	A+B +C	Dark Grey	Dark Grey	Yellow	Light Blue	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Yellow	Light Blue

Light Blue Potential segments for SURT

Yellow Potential segments for MURT

Dark Grey Non-existent or negligible segment

Note: I = Informal settlement; T = Tenement; A = Formal apartment building; S = Standalone house

# In Nairobi we recommended existing low-income informal housing and tenements with pit, and formal new constructions. Total size: 288K HH



## Segment total market sizes in Nairobi

Age of construction		Unbuilt/New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pits (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E	Up to 24K per year				9K				278K				213K			
	D			9K per year	1K per year								66K			214K	
	A+B+C															126K	

Informal new builds are unlikely to adopt because of affordability challenges. Donors / governments typically do not work with this segment

New builds are likely to be willing to adopt the RT given lack of switching costs but strict building regulations may prohibit experimentation with the RT

Pit latrines have routine maintenance challenges and Nairobi households evacuate them frequently. Users / landlords may be willing to switch to the RT, if affordable

Tenement sewer pipes suffer from routine blockages. Landlords pay to unblock them, indicating potential value for the RT

Not applicable; negligible
  Low; <10,000 HH
  Medium; up to 200,000 HH
  High; >200,000 HH

Note: I = Informal settlement; T = Tenement; A = Formal apartment building; S = standalone house

Source: Desk research; Stakeholder interviews; Dalberg analysis

# In Mombasa we recommended existing low-income informal housing and tenements with pits latrines. Total size: 127K HH



Segment total market sizes in Mombasa

Age of construction		Unbuilt/New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pits (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E	Up to 6.5K per year				10K				127K				35K			
	D			Up to 10K per year									40K			40K	
	A+B+C																

New build informal is unlikely to adopt due to land tenure challenges. Donors/governments typically do not work with this segment

Collectively fewer than 10,000 HH, given less active real estate market

66% of households in Mombasa use pit latrines, for which the cost of extraction ranges from USD 80-USD 120, equivalent to the median monthly household income. These users may find value in the RT

Households in this sanitation category are almost equally split between septic tanks and sewer access. Given the risk of flooding in Mombasa, septic tank users might find incentive to adopt the RT

Not applicable; negligible    Low; <10,000 HH    Medium; up to 200,000 HH    High; >200,000 HH

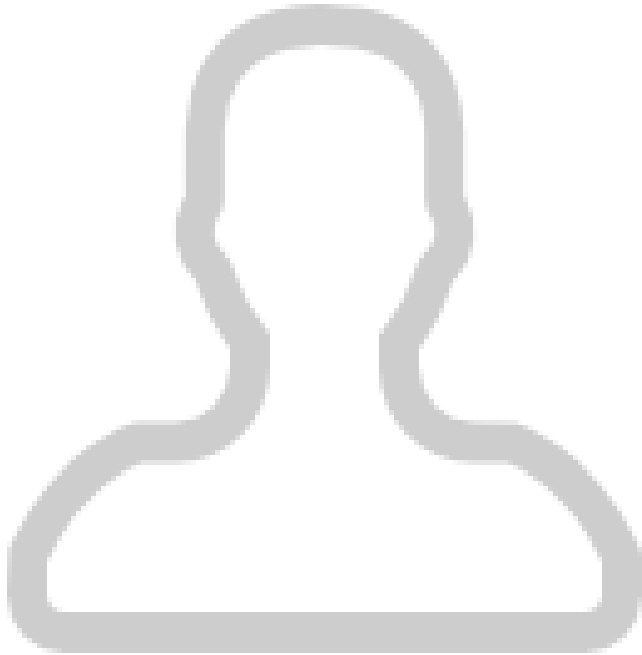
# In Kenya, combined, we selected existing low-income informal and tenement housing using pit latrines, and formal new constructions



Priority segment	Propensity to adopt and market size	Ease of targeting
<p>Nairobi/Mombasa</p> <p><b>Existing informal HH in SEC D and E with pit latrines</b></p>	<ul style="list-style-type: none"> <li>Households in this segment have the highest needs, which are insufficiently met by existing solutions in the market</li> <li>Given the reluctance of landlords and insufficient sewerage development for this segment, this lack of access will persist</li> <li><b>Estimated at 278,000 HH (Nairobi) and 127,000 HH (Mombasa)</b></li> </ul>	<ul style="list-style-type: none"> <li>This segment is congregated into dense neighborhoods. While these households may be difficult to target through suppliers, they can be reached through a neighborhood saturation approach</li> </ul>
<p>Nairobi/Mombasa</p> <p><b>Existing tenements HH in SEC D and E with pit latrines</b></p>	<ul style="list-style-type: none"> <li>Tenements are the fastest growing housing segment, suggesting that the sanitation challenge will persist</li> <li>As in informal settlements, landlords have limited incentive, but early findings suggest that they can be incentivized with the possibility of charging slightly higher rent (e.g., Sanergy experience) for providing better sanitation</li> <li><b>Included in the estimates in previous section</b></li> </ul>	<ul style="list-style-type: none"> <li>Similar to the above about entry points for this segment.</li> <li>Landlords may need to see a business case for providing improved sanitation to their tenants</li> </ul>
<p>Nairobi</p> <p><b>All formal new construction</b></p>	<ul style="list-style-type: none"> <li>Nairobi's residential real estate market is growing at 9.6% per year. Recent regulation has created incentives for formal developers to boost the supply of affordable housing. These developers are looking for ways to cut costs with house features and may find an attractive value proposition in the RT</li> <li><b>Roughly estimated at 10,000 HH, with a 12% CAGR</b></li> </ul>	<ul style="list-style-type: none"> <li>This segment has a few major players, which might facilitate ease of entry</li> <li>However, entry strategy will need to account for building regulations and investor pressure on developers to make the RT attractive</li> </ul>

**As part of our surveys, we further segmented informal and tenement dwellers into homeowners, landlords, and tenants to better grasp the decision-making strengths of these actors**

# Informal dwellings are characterized by single-room units, high density, severely inadequate access to sanitation and low-earning households



*When the pit latrine's not accessible, the cost can go up. I have to hire day laborers to go down into the pit with buckets to clean it out. That is in addition to the fee for the extractor truck that takes away the water, the lorry [truck] for the solid waste and the tipping fee at Kipevu [a treatment plant in Mombasa]. [Costs] can go up to KSH 30,000 [USD 300] when those latrines are not accessible. – Fecal waste extractor*

## About informal construction with pits

- 90% HH in informal settlements live in 1-room structures, housing 4-8 people.
- Lack of space significantly hinders installation of improved sanitation solutions.
- Households in these settlements typically use communal and public toilets. These may be run by landlords or by local entrepreneurs (e.g., Sanergy or youth groups). Where shared, toilets can serve up to 50 HH each
- Tenants have limited decision-making power; many landlords are not motivated to provide better accommodation and amenities

## Drivers of adoption of the RT

- There are ways to incentivize landlords to provide better sanitation solutions:
  - Sanergy's experience shows that improving sanitation option allows landlord to charge more rent per HH
  - The Water Services Trust Fund has successfully provided 50% subsidy to thousands of landlords and homeowners. Better sanitation facilities may lead to lower tenant turnover for these landlords
- Households themselves are beginning to tap into HH-level sanitation solutions:
  - Sanergy is piloting with 40 HH for a container-based portable toilet
  - Sanivation has supplied 1,500 HH toilets in Naivasha (western Kenya)

## Barriers to adoption of the RT

- The challenge for this segment is less one of technology and more of operations and maintenance (i.e., the required innovation is in the business model)
- Cost and affordability: efforts tested in Kenya show that HH can afford roughly USD 50 upfront and no more than USD 5 in monthly fees. There is no financing currently for toilets in this segment
- Lack of land tenure: landlords may require significant convincing
- Vacillating HH demand: successful efforts in this segment require significant demand activation via a salesforce and district public health officers, who are key influencers

# Tenement dwellers typically earn slightly higher wages and live in slightly better conditions, though high density and poor access persist



*Landlords don't want to be identified and are hard to reach. There is a lot of illegality in the entire business model. It is a difficult market to serve but one with great need – Tenement expert*

## About tenements

- There are 10,000 – 20,000 tenements in Nairobi—the exact number is not known and the Ministry of Lands and Housing is currently conducting a tenement audit. There is no available figure for Mombasa
- Tenements are densely populated and up to eight stories high, with single-room homes and a shared toilet on each floor; they are often known as ‘vertical slums’. High rise tenements tend to be connected to the sewer
- The construction is often illegal, flouting building norms
- Most tenement buildings are privately owned by a single landlord, who often owns a portfolio of buildings. The government also owns some tenements

## Drivers of adoption of the RT

- High-rise tenements in Nairobi are usually connected to sewer pipes, which often suffer blockages. Landlords typically have to pay youth groups to clear sanitation blockages, indicating routine expenditure on sanitation
- The rental market is competitive, therefore there is some pressure on landlords to provide basic services to tenants
- Some rooms now have a prepaid electricity meter, indicating landlords’ willingness to charge individual households for services

## Barriers to adoption of the RT

- Landlords often do not want to be identified / are hard to reach because the tenement business is rife with building violations
- Few development institutions work in tenements and it is a difficult market to serve—landlords are elusive and there are no tenant organizations
- Existing sanitation service providers (e.g., youth groups) may protect their turf

## Process: We used the findings from ~300 quantitative surveys to better understand the living and earning conditions of these segments

RECAP

We identified big-picture needs, preferences, and capacities, through a total of 300 quantitative surveys with homeowners, landlords, tenants, and plumbers in each country and sampled as follows:

Respondent type	Kenya	
	Nairobi	Mombasa
Homeowners	40	41
Landlords	20	20
Tenants	71	72
Plumbers	15	17
<b>Total interviews</b>		<b>296</b>

### These surveys allowed us to understand:

- Common sanitation needs across selected user segments
- Existing living and household financial conditions (e.g., incomes, utilities spends, asset ownership)
- Expressed preferences for the RT and interest in by-products
- Ability and willingness to pay for SURTs and MURTs
- Ability and willingness to maintain the RT

# Survey findings: Tenement dwellers look fairly similar to informal dwellers in their incomes, rent, and utilities expenditures (1/2)



## Household characteristics across informal settlements and tenements



- Average household sizes are comparable across housing type: 4-5 members

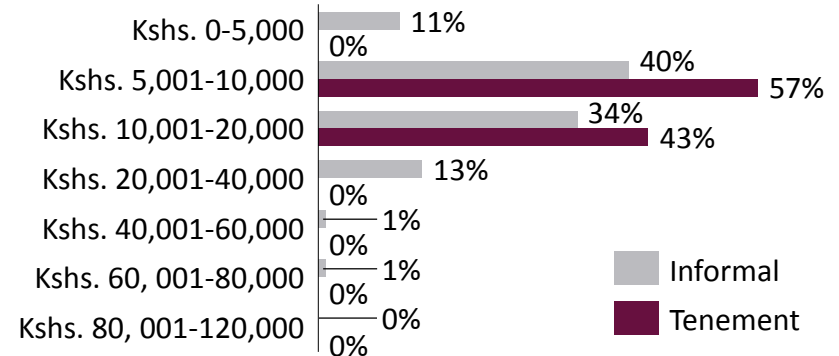


- Tenement dwellers appear "better off" than informal dwellers, but the difference is not statistically significant:
  - 48% of tenement dwellers, compared to 57% of informal dwellers earn less than USD 100/month
  - 9% of tenement dwellers earn USD 400+, compared to 2% of informal dwellers
  - 88% of tenants earn between USD 50-200 per month

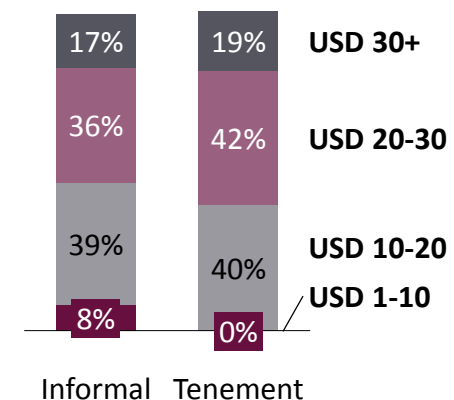


- Rent is comparable across housing type:
  - 65-70% of both segments pay between USD 10 and 25 per month in rent
  - Average rent of both samples is USD 20, with a minimum of USD 7 and maximum of USD 70
- Most renters do not have utilities included in their rent: 92% of informal renters compared to 74% tenement dwellers pay for their own utilities
- 97% of the sample uses a shared latrine

### Monthly income distribution (tenants + homeowners)



### Monthly rent



If we compare them on household composition, income, and utilities spend, there is no major difference between the two priority segments

# Survey findings: Tenement dwellers look fairly similar to informal dwellers in their incomes, rent, and utilities expenditures (2/2)



## Household characteristics across informal settlements and tenements



- **Source of and average monthly spend on water is comparable:** At least 80% of each segment access water through the municipality (directly or via cartels) and the average spend is ~USD 7.2/month across segments



- **Electricity is the primary utility where spend varies across segments:** The municipality (directly or via cartels) is the main provider across segments, but tenement dwellers pay nearly double compared to informal dwellers (USD 6 vs. 2.7)

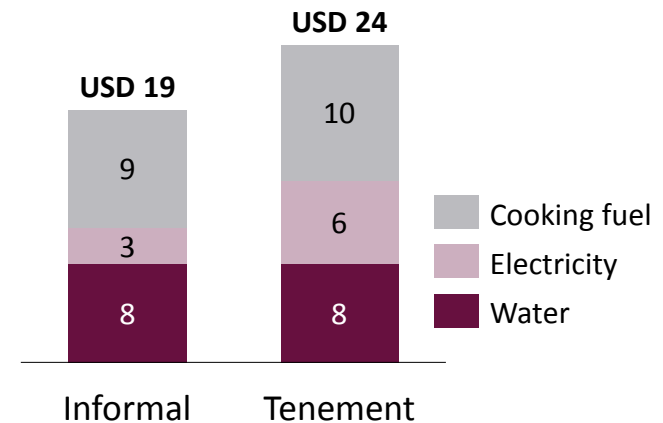


- **HH are mainly using unimproved cooking fuels and paying more per month than if they were using cooking gas:**
  - Kerosene and charcoal are the primary cooking fuels across segments (57%)
  - Charcoal and firewood users spend more per month than everyone else (~USD 4 more)

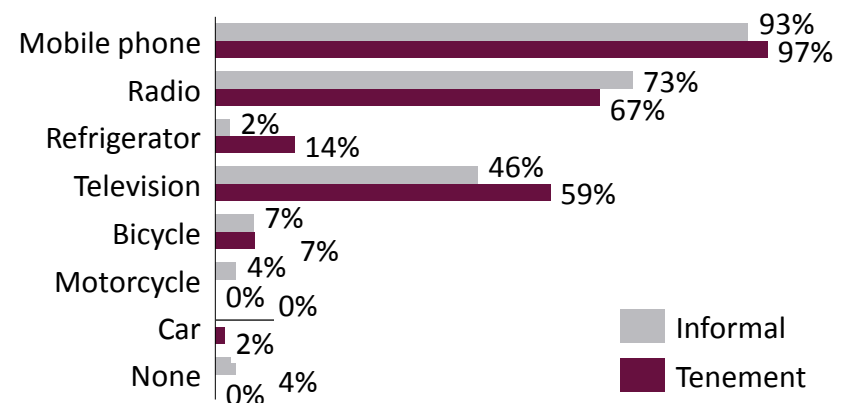


- **Three most common assets are: mobile phones, radios, and TVs. There is no variation across segments**
  - Mobile phone ownership: 94% of homeowner and tenant sample; radios: 71%; TVs: 54% of the sample

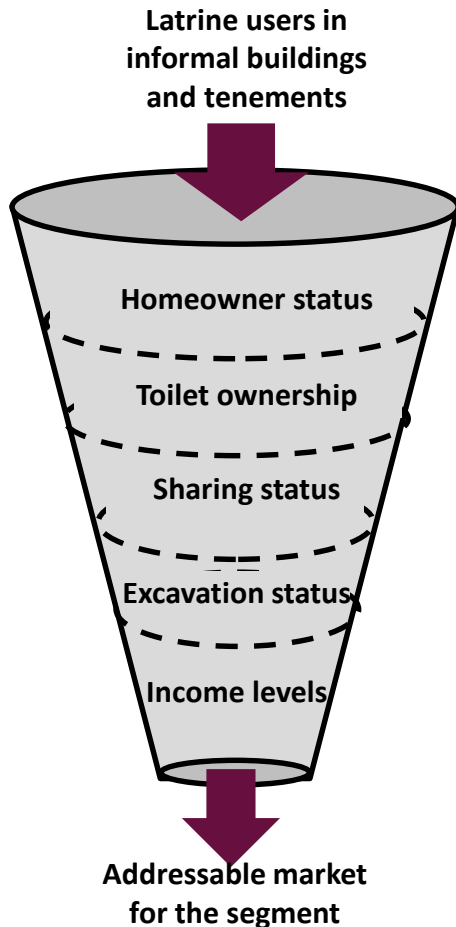
### Monthly spend on utilities (tenants + homeowners)



### Ownership of assets (tenants + homeowners)



# Process: The survey findings also helped arrive at the latent and addressable market size in priority segment in Nairobi and Mombasa



We identified the following criteria from the quantitative surveys and used them as follows:

**Latrine use:** There are a total of 316,450 and 123,497 households in informal buildings and tenements that use pit latrines in Nairobi and Mombasa, respectively. They form 38% of all households in the two cities, collectively

**Homeowner status:** Used this as an initial filter to assess decision-making power; assuming that homeowners and tenants have different incentives, preferences and constraints to installing the RT

**Toilet ownership:** Toilet ownership in priority segments help identify the number of households that do not have a toilet and could be a potential market for the SURT or MURT

**Toilet sharing status:** Provided a benchmark for the number of households that currently use SURTs vs MURTs

**Habit of latrine excavation:** Was used as a proxy for homeowners/landlords finding value in on-site sanitation from an opex cost-saving perspective

**Household income levels:** Would help move from latent to addressable market by providing benchmarks of the % of households in the priority segments who could afford the product

The addressable market size was only calculated for the priority segment and not for all the segments in Kenya. Therefore, the addressable market presented here is considerably smaller than the total addressable market in Kenya

# Combining homeowner and tenant markets in the priority segments in Nairobi, the addressable market for MURTs is larger than SURTs



## Homeowners in priority segments

Assuming the RT requires household monthly income > USD 200 and 11 households share a MURT

**270 MURT units ± 40%**

**841 SURT units ± 40%**

Assuming the RT requires household monthly income > USD 100 and 11 households share a MURT

**1,112 MURT units ± 40%**

**3,271 SURT units ± 40%**

## Tenants in priority segments

Assuming the RT requires household monthly income > USD 200; tenants will partially pay for RT and 11 households share a MURT

**3,184 MURT units ± 40%**

Assuming the RT requires household monthly income > USD 100; tenants will partially pay for RT and 11 households share a MURT

**9,063 MURT units ± 40%**

**Lower-bound scenario**

=

**~3,500 MURTs**

**~850 SURTs**

**± 40%**

**Upper-bound scenario**

=

**~ 10,000 MURTs**

**~3,500 SURTs**

**± 40%**

**Making the RT affordable to those who earn USD 100 per month increases the market for SURTs four-fold and increases it three-fold for MURTs**

# Combining homeowner and tenant markets in the priority segments in Mombasa, the addressable market for SURTs is greater than MURTs



## Homeowners in priority segments

**Lower-bound scenario**  
=  
**~600 MURTs**  
**~2,500 SURTs**  
**± 40%**

Assuming the RT requires household monthly income > USD 200 and 11 households share a MURT

**395 MURT units ± 40%**  
**3,202 SURT units ± 40%**

**Upper-bound scenario**  
=  
**~1,700 MURTs**  
**~6,000 SURTs**  
**± 40%**

Assuming the RT requires household monthly income > USD 100 and 11 households share a MURT

**720 MURT units ± 40%**  
**5,821 SURT units ± 40%**

## Tenants in priority segments

Assuming the RT requires household monthly income > USD 200; tenants will partially pay for RT and 11 households share a MURT

**221 MURT units ± 40%**

Assuming the RT requires household monthly income > USD 100; tenants will partially pay for RT and 11 households share a MURT

**947 MURT units ± 40%**

**Making the RT affordable to those who earn USD 100 per month doubles the addressable market for both SURTs and MURTs**

# Combined, the addressable market in priority segments for MURTs is larger than SURTs in Nairobi, and the reverse is true in Mombasa



## Lower and upper bound addressable market

Lower bound (households earning > USD 100)

Upper bound (households earning > USD 200)

	Nairobi	Mombasa
SURT	~850 – 3,500 ± 40%	~2,500 – 5,000 ± 40%
MURT	~ 3,500 – 10,000 ± 40%	~600 – 1,700 ± 40%

## Implications

- **The addressable market for MURTs is larger than it is for SURTs** (up to 10,000 units compared to 5,000 units for SURTs) – driven mostly by Nairobi. This is likely driven by the fact most households in Nairobi (relative to Mombasa) share toilets with their neighbors, with a typical ratio of 1 toilet per 11 households
- **Nairobi appears more attractive as a city:** in the upper-bound scenario, Nairobi has double the addressable market size as does Mombasa
- If the RT is priced so that it is affordable to a household with a monthly income of USD 100, the addressable market for both SURTs and MURTs will double in Mombasa and triple in Nairobi
- While the market may appear small, it reflects scale of existing players: (optional) in 5+ years of operation, most private alternative providers have not yet sold 2,000 units

**It is important to note that this is the addressable market for the priority existing residential segments only. The addressable market for all segments in Nairobi and Mombasa will be much larger**

## Process: We completed the survey research with human centered design research to understand segments' decision making and preferences

RECAP

To understand key stakeholders, map out the decision-making pathways and capture preferences and constraints, our immersive research was aimed at understanding challenges, aspirations, needs, behaviors and preferences. We used a combination of research methods to engage a range of participants.



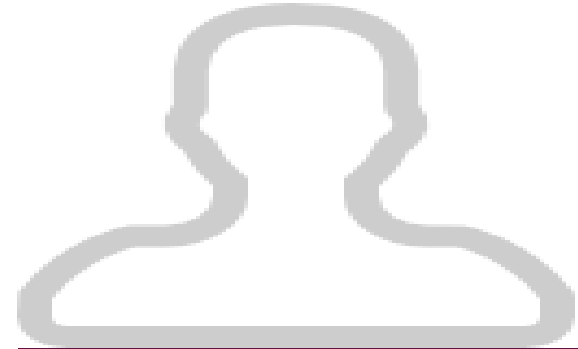
### Contextual interviews

Interviewing, observing and carefully documenting attitudes and behaviours.



### Participatory design sessions

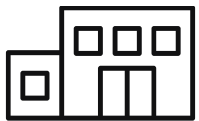
Engaging participants in a dialog around crafted prototypes to gauge preferences.



### Group Interviews

Leveraging groups of 3-5 participants for quick supplemental insights.

We conducted our research in Nigeria and Kenya and focused efforts on understanding insights from the following:



Tenements



Informal settlements

51

Participants interviewed

17

Landlords

34

Tenants



Lagos  
Nairobi  
Mombasa

# We identified 6 key personas within the informal shanty/tenement priority segment, each representing different needs and preferences



## About personas

Across the sanitation ecosystem, we have identified 6 personas – 4 tenant personas and 2 landlord personas – that represent behavioral segments with patterns of common preferences and needs. These personas are important influencers of demand for the RT, and serve as starting points for testing ideas and concepts throughout the design process. These personas also interact with other actors in the ecosystem



### 4 Tenant Personas



The Concerned Go-Getter  
(Nairobi Shanty)



The Budding Entrepreneur  
(Nairobi Tenement)



The Stay-At-Home Mum  
(Mombasa Shanty)



The Respected Elder  
(Mombasa Tenement)



### 2 Landlord Personas



The Inheritor  
(Nairobi)



The Standalone Homeowner  
(Mombasa)

### Additional Ecosystem Actors

*Village elders* are consulted – and paid – by landlords for the approval to build a home on land.

*Labourers* work closely with landlords to design homes and recommend sanitation solutions.

*Illegal cartels* tap into the electricity grids or water supplies to informally provide services to low-income residents.

# The Concerned Go-Getter (Shanty | Tenant, Nairobi)



## Mary Anyango

Married with 3 children

34 years old

Korogocho slums – Nairobi

USD 88/month

Mary lives in a 10 x 12 ft one bedroom home made of iron sheets with mud floor together with her husband and three children. She works late hours in a food processing company as a packer and her husband works in transport as a motorcycle rider.

*“I can’t stand it when the neighbors’ children leave the toilet dirty!”*

**Water:** Access ● Reliability ● **Payment to: Cartels**

Mary gets her water from a nearby tap that is supplied by illegal cartels and perceives it as clean. She collects her water with 20 L jerrycans and spends roughly USD 0.25 per day. The availability of water is affected by the dry season and when the city council removes illegal connections. The price of water triples when these issues occur.

### Key needs:

- Cheap and reliable supply of clean water
- A water tap that is located on her plot, so she does not have to worry about collecting water at night in an unsafe area

**Energy:** Access ● Reliability ● **Payment to: Cartels**

Mary gets power from a cartel for a flat fee of USD 3 per month. The electricity is reliable and can meet her daily needs without experiencing frequent blackouts.

**Sanitation:** Access ● Reliability ● **Payment to: Landlord**

The 14 units in the compound share a pit latrine toilet made of iron sheet wall and a concrete floor. Despite having a cleaning roster for the toilet, it sometimes gets dirty. The toilet becomes unpleasant to use, and Mary is concerned about her family contracting diseases from the dirty toilet. Due to the shallow depth of the latrine, the toilet is evacuated every 3 months, and the tenants collectively pay for the evacuation service. Mary’s household contributes USD 2.00 to the evacuation fee.

### Key needs:

- Clean and hygienic toilet
- Fewer evacuations of the latrine
- Increase in toilet to tenant ratio

**Cooking fuel:** Access ● Reliability ● **Payment to: Vendor**

Mary uses kerosene to cook quick meals. She uses her jiko (i.e., charcoal) stove for meals that take a longer time to cook because charcoal lasts longer than kerosene. Her jiko causes smoke and is not as efficient as her kerosene stove. She spends USD 0.25 and USD 0.40, on kerosene and charcoal, respectively, every few days.

### Key needs:

- A cheaper and faster way to cook food that takes a long time

Good ● Average ● Poor ●

Access - the ability to obtain the service

Reliability - the performance of the service

# The Budding Entrepreneur (Tenement | Tenant, Nairobi)



## Regina Mwangi

Lives with her husband and 2 children

34 years old

Karioabangi – Nairobi

USD 125/month

Regina has rented a spacious, one room concrete house where she stays with her husband and children. She is vegetable seller and is always looking for ways to grow her business. Her husband runs a gambling business.

*“I wish I could use cooking gas all the time. It would save me so much time.”*

### Water: Access ● Reliability ● Payment to: Water Vendor

Previously, Regina’s plot was connected to government-piped water, but the service is no longer accessible because the landlord had a large outstanding bill. Currently, she buys 3 to 5 jerrycans (20 L) of water from a water vendor who charges USD 0.05 per jerrycans. Some vendors have illegally tapped the main water system and sell it. Sometimes, the vendor closest to her tap might not work, which results in her searching another source of water.

#### Key needs:

- A functioning water tap on her plot

### Energy: Access ● Reliability ● Payment to: Cartels

When she moved in her house it had no power. Regina’s neighbor recommended that use the cartel’s electricity service because it was a faster and cheaper process to install the electricity than KPLC (i.e., Kenya’s official electricity provider). Regina followed her neighbor’s advice, and now pays a flat fee of USD 2.50 per month. Her power is reliable, and she does not experience that many blackouts.

### Sanitation: Access ● Reliability ● Payment to: Landlord

She has access to two pour-flush squat toilets, which is shared with 15 households. The waste is re-routed to a drainage right outside the compound where the rain water pushes the waste into the river. The tenants sometimes contribute their money to pay the local youth to unclog the pipes during the dry season. The local youth charge USD 10 for the service.

#### Key needs:

- A closed piped system that transports the waste out of her plot

### Cooking fuel: Access ● Reliability ● Payment to: Vendor

Regina owns a kerosene stove, a jiko (i.e., charcoal) stove, and a gas cylinder. She uses kerosene and cooking gas for her daily cooking and charcoal for food that takes more time (e.g., beans). Unlike cooking gas that requires a full upfront payment (i.e., USD 10), she can buy small quantities of kerosene and charcoal that cost USD 0.20 and USD 0.45, respectively, every few days.

#### Key needs:

- Affordable cooking gas so she can cook food faster

Good ● Average ● Poor ●

Access - the ability to obtain the service

Reliability - the performance of the service

# The Stay-at-Home Mum (Shanty | Tenant, Mombasa)



## Saumu Njeri

Married with 4 children

34 years old

Mishomoroni slum –  
Mombasa

USD 68/month

Saumu lives in a one room mud house together with her husband and 4 children. Saumu buys and cook the food, cleans the house, washes the clothes, sews, fetches water, tends to the children, and cleans the latrine. Her husband is a casual laborer and is always on the lookout for new jobs.

***“I hope we get electricity one day.”***

**Water:** Access ● Reliability ● **Payment to: Water Vendor**

Saumu buys fresh water from water vendors. She spends USD 0.15 per day on fresh water, but when fresh water is scarce, she spends up to USD 1.00 per day. To save money, Saumu buys water from a well, which is salty, from her neighbor. She can only use that water for cleaning and laundry and spends USD 0.10 on days when her fresh water supply is limited.

### Key needs:

- Access to cheap and quality fresh water that can meet her family's daily needs

**Energy:** Access ● Reliability N/A **Payment to: Landlord**

Saumu plot does not have electricity. She is hoping that her landlord will install electricity for the plot. She heard in the market that KPLC was running a promotion to install electricity. Saumu told her neighbors and landlord about the promotion.

### Key needs:

- Cheap and dependable power especially at night to enable her children to do their homework

**Sanitation:** Access ● Reliability ● **Payment to: Landlord**

The 8-unit plot has one wooden pit latrine that is surrounded by old iron sheets and a piece of cloth that serve as a door. The wooden slab has to be replaced at least once a year due to the rainy season. The pit needs evacuation every two years, and tenants are responsible for paying for this service. The landlord collects USD 1.60 from each household to pay for the service.

### Key needs:

- A toilet that is sturdy and does not deteriorate
- Slab that is easier to clean than wood
- Better privacy

**Cooking fuel:** Access ● Reliability ● **Payment to: Vendor**

She owns a kerosene and a charcoal stove. She uses them interchangeably depending on the type of food she is cooking. For daily cooking, she uses the kerosene stove, and for food that takes longer, she prefers using charcoal. She spends USD 0.15 and USD 0.25, on kerosene and charcoal, respectively, every few days.

Good ● Average ● Poor ●

Access - the ability to obtain the service

Reliability - the performance of the service

# The Respected Elder (Tenement | Tenant, Mombasa)



## Reuben Otieno

Lives with his wife and 3 children

54 years old

Mtwapa – Mombasa

USD 109/month

Reuben lives in a stony one roomed unit together with his wife and 3 children. He is a businessman dealing with clothes. His wife is a casual laborer. He is searching for ways to improve his living conditions without depending on others.

*“I do not like sharing the electricity meter with my neighbors.”*

**Water:** Access ● Reliability ● **Payment to: Neighbor**

Mr. Otieno's family buys fresh water from their neighbor's tap which is located a few meters from their home. The tap water is only available twice a week because Mombasa Water Company supply cannot meet the demands of the city. His family spends USD 0.20 per day on fresh water, but when fresh water is limited, they spend up to USD 1.50 per day. His plot has a well, but the water is salty. Tenants are not charged a fee for the use of the well water.

### Key needs:

- Access to cheap fresh potable water

**Energy:** Access ● Reliability ● **Payment to: Landlord**

The whole compound shares one power meter from KPLC. The power bill is split equally between the six units, and the total charge is about USD 24 per month. Due to delays in payments, KPLC terminated their connection. He prefers every household have their own meter.

### Key needs:

- Independent access electricity

**Sanitation:** Access ● Reliability ● **Payment to: Landlord**

The concrete pit latrine, which also serves a bathroom is shared among six households. The ladies of the plot are responsible cleaning the toilet. The toilet was built over 20 years ago and has never been evacuated. The landlord believes that the salty water breaks down the fecal waste.

**Cooking fuel:** Access ● Reliability ● **Payment to: Vendor**

He owns a jiko (i.e., charcoal) and kerosene stove. Mr. Otieno's wife prefers using kerosene because it cooks things fast. However, they are on a budget, so they use jiko to cook things that take a long time (e.g., green grams and beans). Mr. Otieno feels that their two sources of fuel are more than sufficient. His family spends USD 0.20 and USD 0.30, on kerosene and charcoal, respectively, every few days.

Good ● Average ● Poor ●

Access - the ability to obtain the service

Reliability - the performance of the service

# The Inheritor (Tenement | Landlord, Nairobi)



## Peter Mwangi

Lives with his wife and 2 children

34 years old

Karioabangi – Nairobi

USD 185/month

Peter is a businessman who trades car parts. He lives in one of the rentals which he inherited from his parents with his family. He is always looking for ways to gain more income.

***“The rent we charge is too little for me to do major upgrades.”***

## Background

Peter together with his four siblings inherited rental units built by his father 20 years ago. There are 14 single room units made of concrete and two squat toilets and two bathrooms. He stays in one of the units and manages the other units. Peter is responsible for ushering in new tenants, collecting rent and addressing tenants' complaints. He consults his siblings before making major decisions about the rental units.

He wants to connect to Mombasa Water Company's water main so that he can sell water to his neighbors.

## Key needs

- **Decision-making:** If the plot requires major repairs or if Peter wants to change the foundational structure of the plot he needs his sibling's consent. Sometimes Peter's siblings disagree on a topic. In results, it takes them a long time to reach a consensus.
- **Rent collection:** Most of the tenants are either businessmen or casual laborers who do not have a steady source of income. They struggle to come up with rent at the end of the month.
- **Maintenance cost:** The amount of rent charged is not sufficient to cover regular maintenance of the building. The tenants are responsible for any maintenance work themselves.

## Decision-making Process

Since inheriting the building, Peter and his siblings have made gradual upgrades. His decision-making process is as follows:

1. **Personal benefit and motivation:** He assesses if an upgrade benefits him and his family. If yes, he proceeds to step 2. If no, he leaves it to the tenants to address.
2. **Approvals:** He has to consult with his siblings if wants to make significant upgrades. If it is an upgrade that might have an impact on his neighbors, he has to consult and get approval from the village elders. If all parties approve, he proceeds to step 3.
3. **Cost:** Due to financial constraints, he searches for the cheapest options for the intended upgrade.
4. **Contribution:** Depending on the cost and personal benefit, Peter might ask tenants to contribute to the upgrade.

**Note:** Peter rarely seeks or bothers to get approval from formal channels (e.g., licensed contractor, government, etc. ) before proceeding with upgrades.

# The Standalone Homeowner (Landlord, Mombasa)



## Mrs. Ndeda

Lives with her husband and 2 children

34 years old

Mtwapa, Mombasa

USD 154/month

Mrs. Ndeda is a business lady who sells clothes, and her husband is a taxi driver. She inherited a piece of land and built a one bedroomed mud house where she resides with her family.

***“We build up slowly depending on the money we get.”***

## Background

Mrs. Ndeda and her husband were approved by the village elders to build on a certain piece of land. Initially, they paid the village elders USD 435 to get access to the land, but now they pay a yearly fee (i.e., USD 60) to the elders to maintain good grace. Due to their shortage of money, Mrs. Ndeda and her husband developed a mud structure where she stays with her family.

She hopes to build a brick-walled home with concrete floors. Also, she wants a title deed from the government so that her family can officially own their plot.

## Key needs

- **Cost of upgrade:** In comparison to a temporary structure, it is more expensive to construct a permanent structure. The cost of materials, labor, and regulatory permits are expenses, and Mrs. Ndeda's family cannot afford all those things at once.
- **Land ownership:** Getting a title deed is an expensive process.

## Decision-making Process

### Upgrading process:

- **Saving:** Mrs. Ndeda and her husband save portions of their income throughout the year to buy materials (e.g., concrete bricks, pipes, etc.) or install basic services (e.g., pit latrine, electricity, water) for their home.
- **Approvals:** For the home's infrastructure, which includes the sanitation system, they do not seek any approvals. For basic service installation, Mr. Ndeda applies to municipalities requesting for service.
- **Installation:** For the home, Mr. Ndeda looks for someone with experience to help with construction. For basic services, the municipalities install the necessary infrastructure (e.g., meter) and leave the rest to the homeowner to complete. Mr. Ndeda contracts an experienced worker to complete the installation.

# For priority segments, the by-product value proposition of the RT is greater than the waste treatment / sanitation access value proposition

For the RT to be attractive in Kenya, it needs to appeal to both landlords and tenants. Based on the key needs described in the landlord and tenant personas and the insights and design considerations emerging from landlords' and tenants' perspectives on the black box input and output parameters, the value proposition for the RT should be as follows:

## Landlords

**By-products:** The RT creates electricity or biogas that landlords can use for a variety of home needs, particularly if they live on the property. The RT may also allow landlords to charge higher rent due to the availability and reliability of these particular by-products

**Price:** The RT is cost-competitive with existing sanitation solutions available on the market

**Installation:** The RT is easy to install and is flexible enough to fit into most residential configurations. It is straightforward to approve and cheap to install using standard sources of materials and labor.

**Sanitation:** The RT is low maintenance and self-sustaining without the need for an existing power or a water supply. It is easy to clean and and it requires minimal evacuation.

## Tenants

**By-products:** The RT creates electricity or biogas as by-products that tenants can use for a variety of home needs. This capability is differentiated from any other sanitation solution on the market.

**Price:** The RT does not require any significant costs incurred by tenants associated with ongoing usage, maintenance or evacuation.

**Sanitation:** The RT offers a sanitation solution that is cleaner and more hygienic than all other available solutions. It is also low maintenance. It is self-sustaining without the need for an existing power or a water supply, it's easy to clean and it requires minimal evacuation.

**Additional considerations:** The RT should be as private as possible, even in shared usage contexts, to better appeal to women. It should be easy to access and use by children and elderly

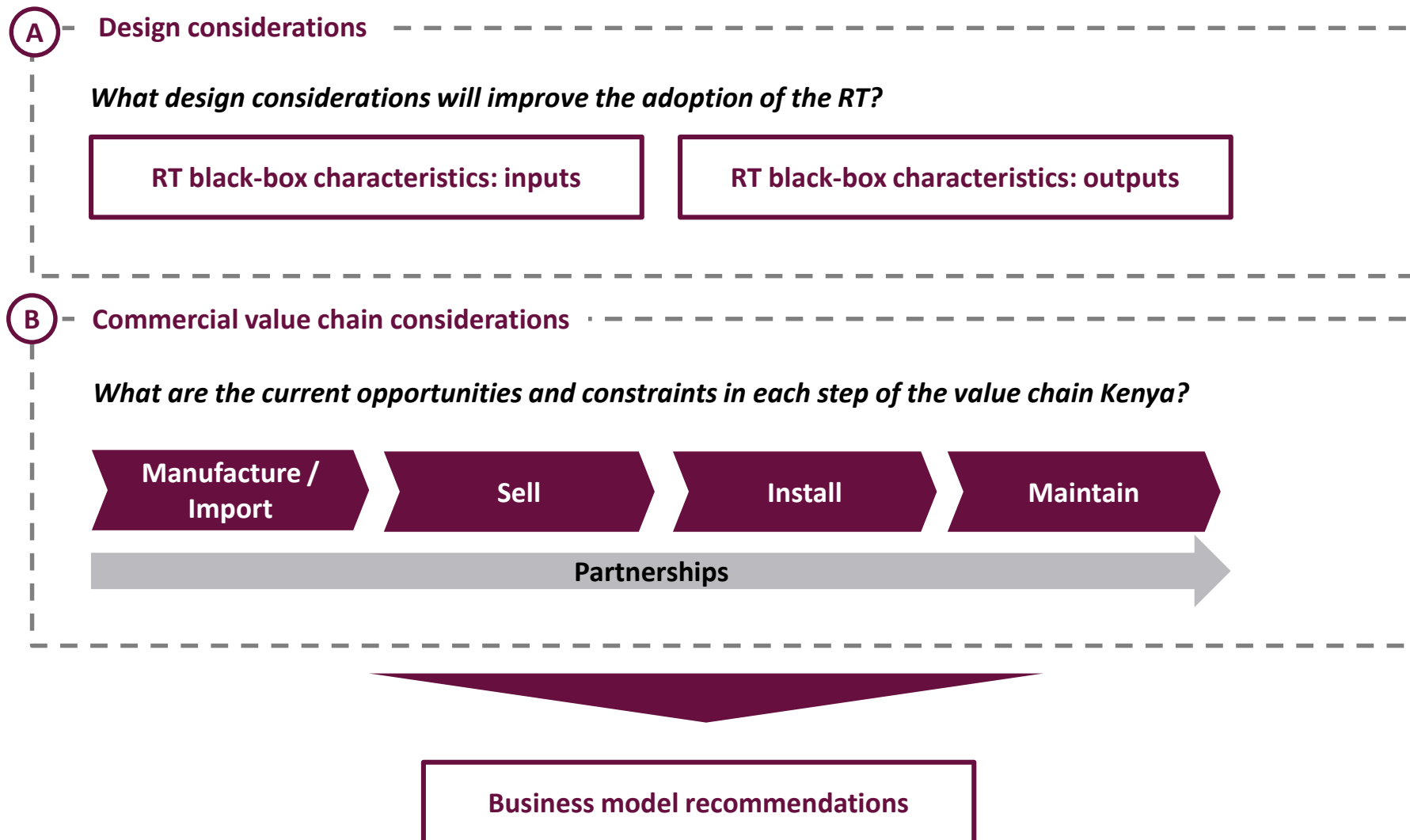
**Most respondents in priority segments were somewhat satisfied with their existing sanitation solutions. The value proposition of the RT may therefore rest on the by-products, as many households are looking to either enhance the reliability or lower the costs of their basic services (i.e., cooking fuel / electricity)**

## KENYA COUNTRY REPORT: CONTENTS

- Kenya sanitation landscape: stakeholders, challenges and opportunities
- **Residential market: priority segments and go-to-market approach**
  - Go-to-market considerations for existing construction priority residential segments
    - Overview, size, needs and preferences of priority segments
    - **Design considerations, commercial value chain considerations, and business models**
  - Go-to-market considerations for new construction priority residential segment
- Institutional market: priority segments and go-to-market approach
- Conclusion: Recommended paths to market entry
- Annex

# Process: We uncovered the preferences of the target segments and identified design considerations to improve adoption of the RT

RECAP



## Process: In interviewing tenants and landlords, we developed design recommendations on the RT's black box parameters



The RT has 12 potential input parameters and 11 potential output parameters. These parameters are intended to describe ideal operating ranges for RT developers to consider when designing/modifying the RT. We used a variety of research methods with tenants and landlords to understand preferences, needs and behaviors related to the black box input and output parameters:

Potential input	Research method
Electricity	Interview questions and design activity
Water for initial charge	Interview questions and design activity
Urine & Feces	Interview questions
Footprint	Observations and interview questions
Weight	Attempted, but hard to conceptualize
Steps up platform	Observations and interview questions
Additives/consumables	Interview questions and design activity
Maintenance	Interview questions and design activity
Manual operation	Interview questions and visual card sort
3rd party servicing	Interview questions
Waste processed	Interview questions
Vent	Attempted, but hard to conceptualize

Potential output	Research method
Nothing	N/A
Electricity	Interview questions and visual card sort
Biogas	Interview questions and visual card sort
Liquid fertilizer	Interview questions and visual card sort
Ash	Interview questions
Non-potable water	Interview questions and visual card sort
Radiant heat	Attempted, but hard to conceptualize
Odor	Attempted, but hard to conceptualize
Noise	Attempted, but hard to conceptualize
Fire flame	Attempted, but hard to conceptualize
Potable water	Interview questions and visual card sort

# Black Box Parameter Insights – Input: Electricity (0-50 kWh)



*“We get our power from the cartel and it’s reliable.”*

*- Susan, Kariobangi, Nairobi*

**Common appliances:**  
19in CRT TV (~80W),  
1 phone charging  
(~5.5 W), 1 light bulb  
(~60W)

**Cost:** USD 2-4  
per month  
(cartels’ flat  
fee); USD 2.50  
per month –  
avg. (KPLC)

**Power:**  
0.281 -  
1.01 kWh  
per day

## **Current Experience in Nairobi and Mombasa**

Kenyan power (KPLC) is the main electricity provider of Kenya, and its service is reliable in certain regions. It is so reliable that illegal cartels developed a service that taps into the KPLC grid to informally provide electricity to low-income residents. Everyone we met in Nairobi used this service because of the lower connection cost and lower ongoing costs, and stated that this service is consistent but sometimes dangerous (e.g., the system sometimes short circuits). Illegal energy cartels were not as strong in Mombasa. 75% of the people we met in Mombasa stated that KPLC was their main energy providers, but over 50% stated that the service was unreliable. Outages and incorrect billing were the main pain points.

## **Design Considerations**

Although the electricity is reliable, it may be a safety hazard because it is an informal connection. If the power goes out, there is an informal method to address such issues (e.g., cartels’ “engineers”). Therefore, **it is highly recommended that toilet not run on a user's electricity source. If a power supply is required, it should be derived off-grid and discreet.** Obvious off-grid sources (e.g., solar panels) may cause a threat to the cartels’ energy business. In Mombasa, as that KPLC’s service is not very stable, it is also recommended that the RT not run on the user's power source.

## Black Box Parameter Insights – Input: Water for initial charge (0-700 L)



### Current Experience in Nairobi and Mombasa

Nairobi Water and Sewerage Company (NW) is the main water supplier for Nairobi. Water is also provided by illegal cartels. Participants stated that water was not as reliable as electricity because the Nairobi City Council often disconnects illegal connections, the dry season creates shortages, and the development of new infrastructure disrupts supply. No participants had water directly piped to their home or sanitation system.

Mombasa Water Supply Company (MW) is the main water supplier for Mombasa. We heard that MW's supply cannot meet the demand – water is available ~2-3 times a week. Residents obtain their fresh water via illegal tapping and water vendors. Salty water was readily available via wells, and was used when fresh water was limited. No participants had water directly piped to their home or sanitation system.

**“Water is scarce, and it takes more energy to collect it when the taps shut off”**  
- Mohammed, Mishomoroni, Mombasa

#### Household usage:

The majority of participants used pit latrines that did not require a flushing mechanism.

For participants whose sanitation system was a concrete slab, tiled flooring, or a squat toilet, water was used to either clean or flush waste. Some toilets also served as a bathroom, with greywater from bathing used for flushing and cleaning.

#### Amount used:

Unclear

### Design Considerations

**The RT should not depend on a user's existing water supply.** Although some have a water supply (i.e., tap or borehole) on their plot or within a 5 minute walking distance, it's a burden for them to collect and store water at their home.

# Black Box Parameter Insights – Input: Urine and feces (10-100 ppl)



## **Current Experience in Nairobi and Mombasa**

The majority of participants lived in a small (~10 ft x 12 ft) single room home. The average household size consists of five members in informal settlements and four in tenement dwellings. Due to the major space constraints, there was often one toilet per building. Some participants questioned if the RT would have had a sufficient amount of waste per day to operate. People who work were gone for the majority of the day and may not defecate in their household toilet.

***“Look around you, there is no one here to use the toilet during the day”***

**– Mr. Kamua, Mtwapa, Mombasa**

### **Number of persons per toilet:**

- Tenement: 24-56 people
- Shanty: 30-70 people
- Standalone home: 4-8 people

### **Design Considerations**

**The RT needs to account for fluctuating urine and feces volumes.** Residents have other options besides their plot toilet. For example, adults can use a toilet at their workplace or the market and children can use a toilet at their school. The input volume may be low during the week, but high during the weekends if residents are around or if there is a celebration at their compound.

# Black Box Parameter Insights – Input: Footprint (1mx1mx1m- 2.5mx6.5m/20' container)



## **Current Experience in Nairobi and Mombasa – tenements and shanties**

Due to the major space constraints, there was often one toilet (e.g., shallow pit latrine) per plot. Cost and restricted space would make it extremely difficult to install a septic tank or a soak pit. Also, it would be hard for fecal sludge trucks to navigate through densely populated spaces. Some participants expressed the desire to have a private toilet but couldn't imagine how it would fit inside their single room home. Others participants stated that the toilet was meant to be outside of the home.

**“Where do you see space inside this room for a toilet?”**

**– Hussein, Bamburi, Mombasa**

## **Design Considerations**

There has been a debate if shared toilets are considered improved sanitation. **The reality of the situation is that shared toilets were the only practical options for many, so the RT should support a shared toilet model.** There is no space to install an individual toilet, which connects to an on-site treatment system, in a small single room household. Also, it would be difficult to retrofit a building that did not follow standard building codes.

Sanergy is starting to experiment with individual portable toilets in informal settlements. These toilets require no adjustment to the existing infrastructure but require a service provider to collect the waste from the toilet. **We recommend further exploring the individual portable toilet business model. Determine the current pain points and opportunities of that business model and test it in particular segments.**

# Black Box Parameter Insights – Input: Footprint (1mx1mx1m- 2.5mx6.5m/20' container)



*“I like my toilet because it is always clean.”*  
– Ms. Rachel, Mtopanga, Mombasa

## *Design Considerations*

**The RT would need to have a strong value proposition (e.g., stable electricity) for it to be appealing for this particular segment.**

### ***Current Experience in Mombasa – standalone homes***

All standalone home participants did not live in tightly constrained areas as compared to participants that lived in tenement and shanty areas. The standalone participants all had toilets, and it took approximately 5 years for half of the participants to install a toilet at their property. Participants’ financial constraints was the main barrier for slow installation.

The majority of participants were quite proud of their existing toilet. Based on our observation and personal experience, the majority of those toilets were clean and pleasant to use.

## Black Box Parameter Insights – Input: Steps up platform (0-4 steps)



***“Children are not allowed to use the toilet because they spoil it. That is why we have a lock on the door”***

**– Peter, Mtopanga, Mombasa**

### ***Design Considerations***

**Steps are not recommended because it further limits certain demographics (i.e., children and elderly) from accessing the toilet.** Also, limited space would make it hard to implement steps in highly densely populated areas. However, it may address flooding of the pit for participants who experienced flooding during the rainy season.

### ***Current Experience in Nairobi and Mombasa***

All the toilets that we visited were either a squat toilet or a pit latrine. Inside the toilet, we did not observe steps. However, outside of the toilet room, we observed handful superstructures that had one to two steps that lead to the toilet.

# Black Box Parameter Insights – Input: Additive/consumables (*none-monthly purchase/weekly additions*)



***“Which additives are these? How much do they cost? I need to know this first.”***  
– Lucy Njeri, Kariobangi, Nairobi

### Common household cleaning products in the grocery store:

- Bleach (JET, Astonish brands)
- Toilet cleaning gel (Brands: Harpic, Hurricane, Jeyes Bloo)
- All purpose cleaning powder (Brands: Morning Fresh, ATA, Pride)
- Bathroom cleaners (Brand: Astonish)

### *Design Considerations*

**If additives/consumables are necessary, it is recommended that they are sold in small and cheap portions.**

### ***Current Experience in Nairobi and Mombasa***

Participants were willing to purchase additives, but only if the RT had a strong value proposition that they favored (e.g., stable electricity). Participants were interested in the types of additives, cost, amount, and frequency of addition of additives required for the RT. People that live in low-income areas operate in a kidogo (i.e., small) society. They cannot afford to buy products in their original packaging. Usually, vendors within their community sell small portions of product (e.g., selling a cup of flour instead of a bag of flour).

## Black Box Parameter Insights – Input: Maintenance (*annual to monthly*)



*“The tenants have a cleaning schedule among all ladies in the plot – men don’t clean the toilet.”*

– Reuben, Mtwapa Mombasa

### *Design Considerations*

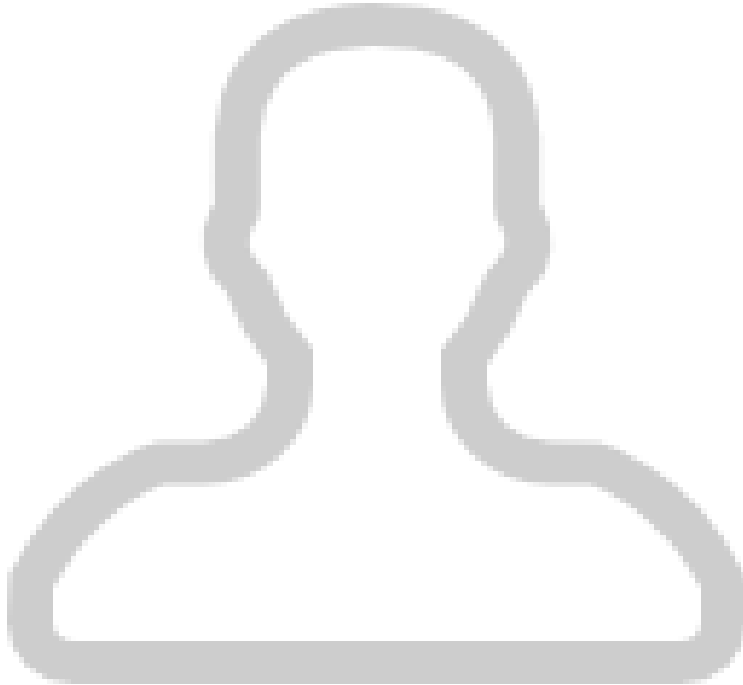
**The RT should be easy and simple to maintain. If waste disposal is required for the RT, it should be cheap and easily accessible,** or people will use alternative cheaper informal methods.

### ***Current Experience in Nairobi and Mombasa***

In tenements and shanties, users’ existing mental models around maintenance of the toilet were associated with cleaning the front interface of the toilet (e.g., the squat plate and toilet slab) and using informal fecal sludge service providers (e.g., local youth) to empty the pit latrine. Gender also seemed to play a role. Women from each household on a plot took turns cleaning the toilet. For fecal waste disposal, participants mentioned their service providers usually dumped the waste in the surrounding environment (e.g., river). In standalone homes in Mombasa, some participants stated they dug a shallow hole near their home and transferred the waste from the pit into the hole.

# Black Box Parameter Insights – Input:

## Manual operation (*flush toilet to user technical input*)



***“Squat is better because I don’t want to contract a disease from the toilet seat or use a lot of water to flush.”***

**– Mr. Otieno, Korogocho, Mombasa**

### Usage:

- Front interface: All participants either used a pit latrine or a squat toilet
- Flush mechanism: none or pour flush

### Design Considerations

Participants ideal toilet for a shared environment was a squat toilet with automatic flush. **The RT should be a self-sustaining system that produces its water supply for flushing.** Users would find it appealing because it would not require them to fetch water for the toilet, and the system could be kept clean with a constant supply of water.

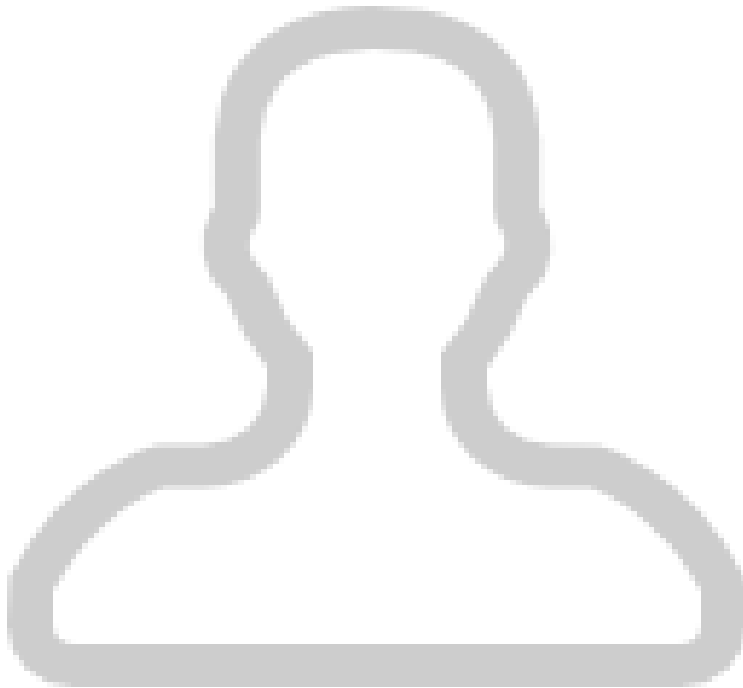
### **Current Experience in Nairobi and Mombasa – tenements and shanties**

The majority of participants preferred a squat over a sitting toilet because of hygiene and water usage reasons. They felt they could contract a disease from sharing a toilet seat. Also, participants mentioned for sitting toilets, it took more water to flush the waste.

Most participants preferred an automatic flush. They mentioned that automatic flush would reduce the burden of fetching water that is needed for a pour flush toilet. However, none of the participants had water directly piped to their existing system. They were completely unfamiliar with adding a dry additive (e.g., sawdust) to toilet waste. A few participants mentioned they would give it a try, while others stated it was another expense that they did not want.

# Black Box Parameter Insights – Input:

## Manual operation (*flush toilet to user technical input*)



*“It is like you’ve made it if you have a seated toilet.”*

– Mrs. Ndeda, Mtwapa Mombasa

### Usage:

- Front interface: All participants either used a pit latrine or a squat toilet
- Flush mechanism: none or pour flush

### *Design Considerations*

**The RT should be a self-sustaining system that produces its own water supply for flushing.** Users would find it appealing for two reasons: it reduces the amount of water they have to fetch, and it improves hygiene. **As previously mentioned, it is not recommended for the RT to rely on any of the users' water supply.**

### *Current Experience in Mombasa – standalone homes*

The majority of participants stated that they preferred to use a sitting toilet with automatic flush. Some participants mentioned it was aspirational to have a sitting toilet while others stated it was more comfortable to use.

# Black Box Parameter Insights – Input:

## Third party servicing (*annual to monthly*)



### **Current Experience in Nairobi and Mombasa**

Landlords and homeowners hire informal fecal sludge service providers (e.g., frogmen or youth groups) to evacuate the waste from their pit latrine manually. When probed about using a third-party service to maintain their RT, participants who saw value in the RT, stated they would either call the frogmen or remove and dispose of the waste themselves.

Some Mombasa participants, who used the same pit latrines for the past 15 to 30 years, stated that they have never had to evacuate the waste. They said that the salt water from the ocean degraded their waste. *Note: Mombasa has a high water table. It is most likely that some of the Mombasa pit latrines were dug just above the water table, and the waste from the latrines are leaking into the groundwater.*

***“We don’t use those evacuation trucks. We have people here who use buckets and drums to collect and dispose of the waste in the river.”***

***– Faith, Korogocho Nairobi.***

#### **Cost:**

- USD 14 to USD 30 per evacuation

#### **Frequency:**

- Once a year during dry season; once a month during rainy season for shallow pits.

### ***Design Considerations***

Informal service providers are cheap and readily available in the community. **The RT ecosystem may want to incorporate and train these informal service providers.** Also, some participants wanted to manage the RT on their own, presumably so they can save money. We were asked several times to train participants as to how to operate the RT. **Training services and materials could be an additional RT opportunity.**

# Black Box Parameter Insights – Input: Waste processed (*human waste to bio waste*)



***“The tenants are never allowed to throw trash in the toilet.”***

**– Lucy, Korogocho , Nairobi**

#### **Cost:**

- USD 14 to USD 30 per evacuation

#### **Frequency:**

- Once a year during dry season; once a month during rainy season for shallow pits.

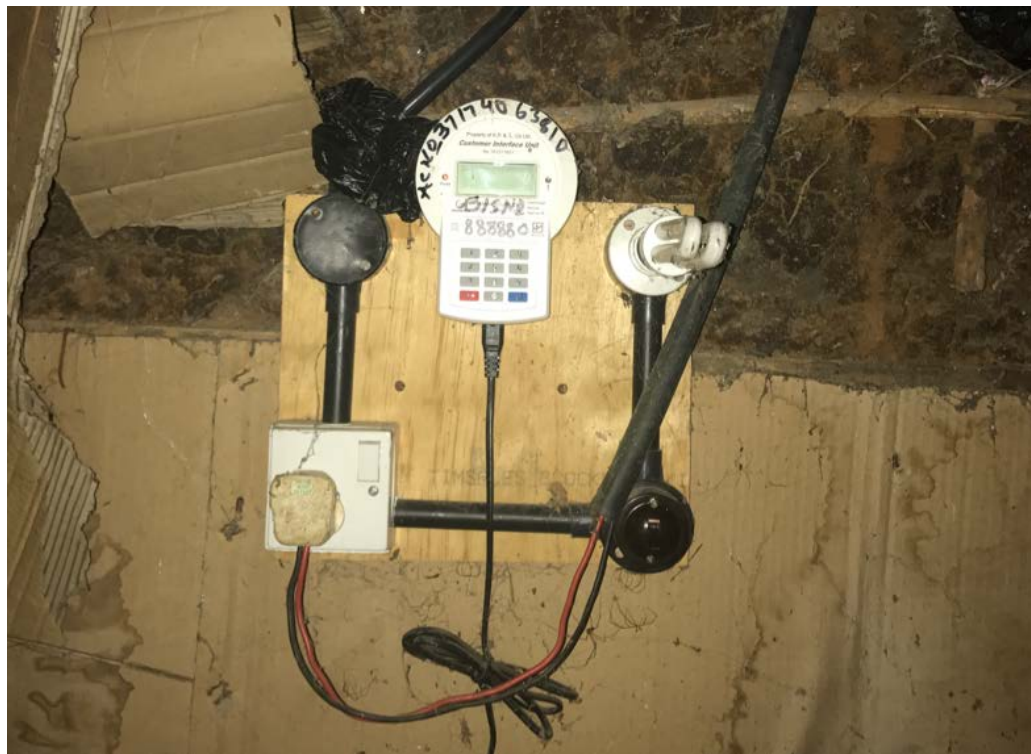
#### ***Design Considerations***

**The RT should be able to process more forms of waste**, given the unpredictability and diversity of waste put in toilets.

#### ***Current Experience in Nairobi and Mombasa***

Participants stated that human waste, toilet paper, and water from anal cleaning or greywater from bathing went into the toilet. Landlords were against putting any other forms of waste in the toilet because it would increase evacuations.

# Black Box Parameter Insights – Output: Electricity (0-10 kWh)



*“I like this because I will have an alternative light incase there are blackouts.”*  
– Mr. Kimweli, Mtwapa, Mombasa

### Commons appliances:

1- 19in CRT TV (~80W),  
1 phone charging (~5.5 W), 1 light bulb (~60W)

### \*Electrical power demand (per day):

For 10 households (~50 ppl): \*L: 2.81 - H: 10.1 kWh  
For 16 households (~80 ppl): L: 4.50 - H: 16.16 kWh

### Design Considerations

**The RT's electricity would need to be cheaper, meet all electricity demands, and be more reliable for it to be appealing in Nairobi.** However, the RT could be a threat to the illegal cartels' business. Some participants mentioned that cartels had damaged KPLC's equipment so that residents depend on their services. Cartels are an integral component of the ecosystem, and they are not going away anytime soon. Sanergy had to deal with cartels at the start of their business and may have lessons to share. **The electricity value proposition could be more flexible in Mombasa** as the current source is not that reliable. The Mtwapa area did have the presence of cartels. It was unclear if that was an anomaly or if cartels are growing in Mombasa.

### Current Experience in Nairobi and Mombasa

*Nairobi – second choice / Mombasa – first choice*

Participants in Nairobi did not have a strong need for an improved source of electricity, but some in Mombasa had a clear need. Some participants envisioned that the electricity from the RT would supplement their primary source when there are power outages. Others stated that it would be a complete replacement for the cartel's electricity or KPLC's supply and that they would not have to pay any money to obtain the RT's electricity.

\*Low Usage: Light (2 hr), phone charging (15 min), TV (2hr)

High Usage: Light (6 hr), phone charging (2 hr), TV (8 hr)

# Black Box Parameter Insights – Output: Biogas (0 to 70 kWh (10 families))



*“I wouldn’t have to purchase cooking fuel anymore and it will cook food faster than a jiko.” – Susan, Kariobangi*

### Costs (Nairobi shanties / tenements)

- Kerosene: USD 9-18/month | USD 6-10.5/month
- Charcoal: USD 12-15 /month | USD 15-21 /month
- \*Gas (6 kg cylinder): USD 3-10/month | USD 6-10/month (\*purchased once every 3 months)

### Costs (Mombasa shanties & tenements / homes)

- Kerosene: USD 6-10/month | USD 15-16/month
- Charcoal: ~USD 24 /month | USD 15-24 /month
- \*Gas (13 kg cylinder): N/A | USD 5 - 10/month
- Firewood: N/A | USD 9-15/month

### Current Experience in Nairobi and Mombasa

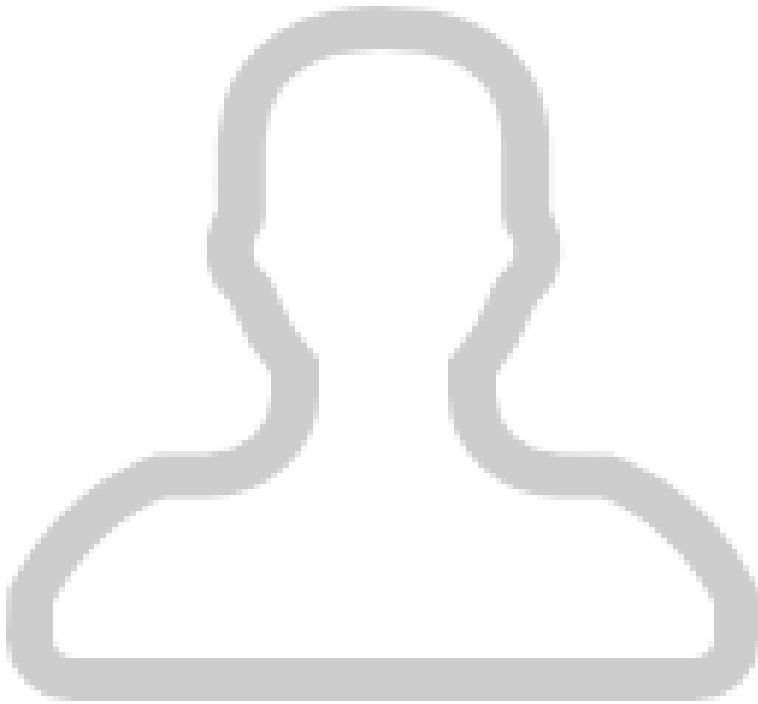
*Nairobi – first choice / Mombasa – second choice*

The majority of participants who selected the RT biogas by-product as their top choice believed it would reduce their cooking fuel expenditures. Cooking gas is readily available in Nairobi, but participants have to pay a large upfront cost to purchase a gas cylinder. Another appeal of the RT biogas was participants believed it would cook things at a faster rate than other cooking fuels (i.e., kerosene and charcoal). Nairobi participants had an existing mental model of human waste being converted into biogas (e.g., Umande Trust). They did not ask as many questions about the RT’s ability to produce biogas compared to the other participants.

### Design Considerations

**The RT could strengthen its value proposition if the biogas by-product were cheaper and more accessible than current sources of cooking fuels.** A key design challenge for both shanties and tenements is that there is no central kitchen. People cook inside their homes or outside next to their front door. **A delivery mechanism of biogas for users in these particular settings needs to be explored.**

# Black Box Parameter Insights – Output: Liquid fertilizer (0-150 L/day)



***“I will pack the fertilizer and sell it to farmers. It will be a good business opportunity.”***

**- Edwin, Kibera, Nairobi**

### ***Design Considerations***

**It is recommended to explore Kenya’s agricultural ecosystem and determine if the RT’s fertilizer by-product would address any of their pain points.**

### ***Current Experience in Nairobi and Mombasa***

#### ***Nairobi – third choice***

The majority of participants stated that they lived in urban areas and due to limited space, could not farm. However, they saw the RT fertilizer by-product as a business opportunity. Many stated that they would sell the fertilizer in their village where farming is done. However, when probed about how they would transport the fertilizer from their plot to the farm, they questioned their selection because they did not consider the costs and logistics of transporting the fertilizer.

## Black Box Parameter Insights – Output: Non-potable water (60 L/day to 600 L/day)



*"I guess it is okay to wash clothes and the toilet with that RT water."*

– Charity, Bamburi, Mombassa

### *Design Considerations*

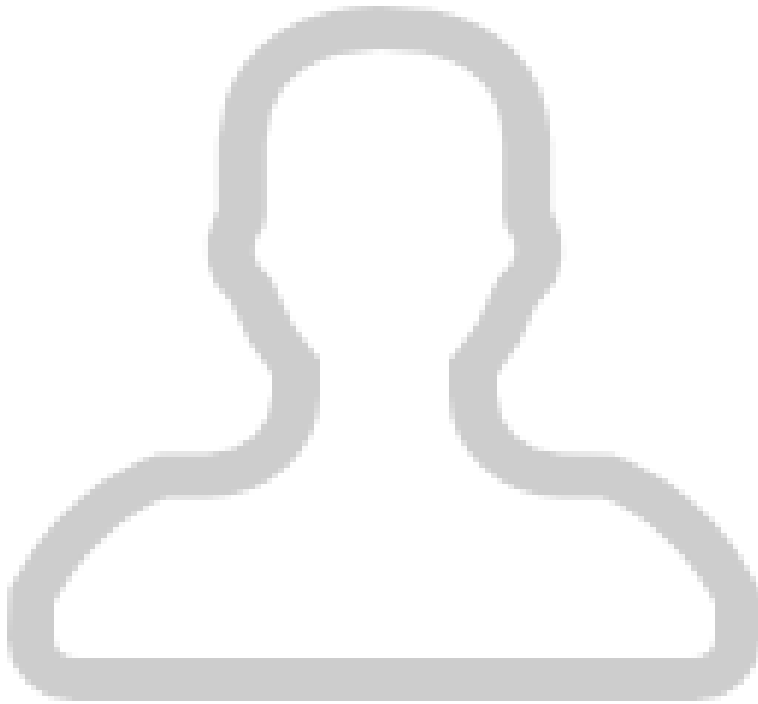
Non-potable water is appealing for flushing waste. **For the RT to be appealing, it should combined non-potable water for flushing with the respondent's top by-product preference.**

### ***Current Experience in Nairobi and Mombasa***

The majority of participants were comfortable using non-potable water from the RT, but they were not excited about it. Many questioned the quality of the water. They stated that they would use the non-potable water for household chores (e.g., cleaning and laundry), which would cut down on the cost and time of fetching jerrycans of water. Non-potable water alone seemed to be a weak value proposition. We got the sense that people would tolerate rather than aspire to obtain it, especially in Mombasa. Mombasa residents could easily access non-potable water (i.e., salty water for a well).

# Black Box Parameter Insights – Output:

## Potable water (25-250 L/day)



***“I can’t drink water from the toilet!”***  
**– Mrs. Njeri, Mishomoroni, Mombasa**

### Common use cases:

Fresh water:  
 cooking,  
 drinking,  
 cleaning,  
 laundry, bathing

Well water  
 (salty):  
 cleaning,  
 laundry

### Nairobi

*Piped & Water Vendor:*  
 USD 0.15 - USD 0.30 per day

### Mombasa

*Piped & Water Vendor:* USD 0.10 - USD 0.25 per day

*Well:* USD 0.06 - USD 0.11 per day

### Amount used:

**Tenement:** 60 - 100 L per day

**Shanty:** 80 - 140 L per day

### ***Current Experience in Nairobi and Mombasa***

The majority of participants were not interested in potable water as a by-product. They stated that they did not want to know the source of their drinking water and couldn't believe that a shared toilet could produce potable water. Participants were not this suspicious about biogas, electricity, and fertilizer by-products.

Despite Mombasa residents having a clear need for potable water, they were extremely skeptical and displeased with the thought of consuming treated water from the RT.

### ***Design Considerations***

**It is strongly recommended that the potable water by-product is only used for non-human consumption purposes (e.g., flushing of toilet waste, cleaning). Also, the potable water should be combined with users’ top by-product preference for the RT to have a strong appeal.**

## Black Box Parameter Insights – Output: Ash (*annually to quarterly*)



*“I will take the waste outside and dispose of it.”*  
– Ms. Regina, Korogocho, Nairobi

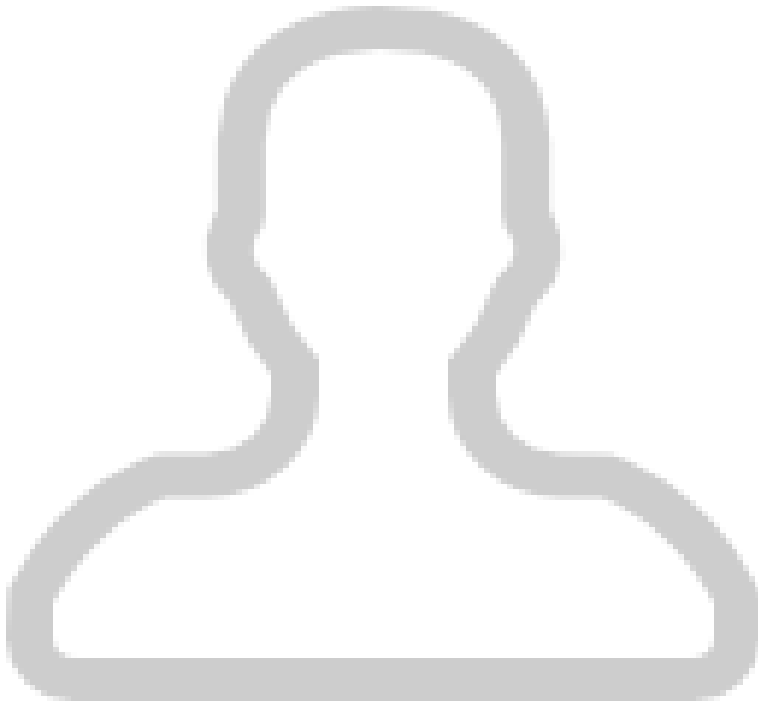
### *Design Considerations*

**The RT needs to investigate the health and environmental impacts of its outputs and determine feasible solutions to address possible issues.**

### ***Current Experience in Nairobi and Mombasa***

Participants stated that they were willing to deal with ash if the RT had a strong value proposition that they favored (e.g., cheaper & reliable electricity or biogas). When probed as to how they plan to dispose of the waste, they stated that they would call someone (i.e., youth groups) to extract the ash or remove it themselves. Currently, waste is disposed of in their surrounding environment.

# Black Box Parameter Insights – Output: Noise



***"My neighbors will complain about the noise."  
– Keziah, Mtopanga, Mombasa***

### *Design Considerations*

**The RT should be as quiet as possible.**

### ***Current Experience in Nairobi and Mombasa***

The majority of participants did not like the idea of the RT making noise. They thought it would disturb their neighbors. Also, because of security reasons, it would be unsafe to have something making noise throughout the night. Others stated they would tolerate the noise if the toilet had a strong value proposition that they favored. However, if the noise were too much, they would "turn off" the RT.

## Summary: Black-box input parameter insights



POTENTIAL INPUT	DESIGN CONSIDERATIONS
<b>ESSENTIAL DESIGN PARAMETERS TO CONSIDER</b>	
Electricity	It is highly recommended that toilet not run on a user's electricity source. If a power supply is required, it should be derived off-grid and discreet.
Water for initial charge	The RT should not depend on a user's existing water supply.
Footprint	The RT should support a shared toilet model. In areas where it would be challenging to develop permeant infrastructure, it is recommended to explore the individual portable toilet business model. Determine the current pain points and opportunities of that business model and test it in particular segments.
Maintenance	The RT should be easy and simple to maintain. If waste disposal is required, it should be cheap and easily accessible.
3rd party servicing	The RT ecosystem should incorporate and train informal service providers.
<b>IMPORTANT DESIGN PARAMETERS TO CONSIDER</b>	
Urine & Feces	The RT needs to account for fluctuating urine and feces volumes.
Steps up platform	Steps are not recommended because they will further limit certain demographics (i.e., children and elderly) from accessing the toilet.
Manual operation	A squat toilet with automatic flush, which is not dependent on the user's water supply is the ideal shared toilet interface. The RT should be a self-sustaining system that produces its water supply for flushing.
<b>ADDITIONAL DESIGN PARAMETERS TO CONSIDER</b>	
Additives/consumables	If additives/consumables are necessary, it is recommended that they be sold in small and cheap portions.
Waste processed	The RT should be able to process more forms of waste.

## Summary: Black-box output parameter insights



POTENTIAL OUTPUT	DESIGN CONSIDERATIONS
<b>ESSENTIAL DESIGN PARAMETERS TO CONSIDER</b>	
Electricity <i>(Nairobi's 2<sup>nd</sup> choice, Mombasa 1<sup>st</sup> choice)</i>	The RT's electricity would need to be cheaper, meet all electricity demands, and be more reliable for it to be appealing in Nairobi. The electricity value proposition could be more flexible in Mombasa.
Biogas <i>(Nairobi's 1<sup>st</sup> choice, Mombasa 2<sup>nd</sup> choice)</i>	The RT could strengthen its value proposition if the biogas by-product were cheaper and more accessible than current sources of cooking fuels. A delivery mechanism of biogas for users in these particular settings needs to be explored.
<b>IMPORTANT DESIGN PARAMETERS TO CONSIDER</b>	
Non-potable water	It is recommended to use the non-potable water by-product for the flushing of waste. Also, non-potable water should be combined with the users' top by-product preference so that RT has a stronger value proposition.
Ash	The RT needs to investigate the health and environmental impacts of its outputs.
<b>ADDITIONAL DESIGN PARAMETERS TO CONSIDER</b>	
Potable water	It is strongly recommended that the potable water by-product is only used for non-human consumption purposes (e.g., flushing of toilet waste, cleaning). Also, the potable water should be combined with users' top by-product preference for the RT to have a strong appeal.
Liquid fertilizer	It is recommended to explore Kenya's agricultural ecosystem and determine if the RT's fertilizer by-product would address any of their pain points.
Noise	The RT should be as quiet as possible.

# Process: We scoped the business landscape and identified commercial considerations for RT's partners



## A - Design considerations

*What design considerations will improve the adoption of the RT?*

RT black-box characteristics: inputs

RT black-box characteristics: outputs

## B - Commercial value chain considerations

*What are the current opportunities and constraints in each step of the value chain Kenya?*

Manufacture /  
Import

Sell

Install

Maintain

Partnerships

Business model recommendations

# Summary: Go-to-market recommendations for informal building and tenement dwellers in Kenya



## Existing residential construction: business model considerations

**RT's commercial partners may need to see themselves not strictly as toilet providers but also as asset financiers (or will have to partner with an organization that does so):**

- Industry benchmarks suggest that a SURT should be priced at USD 50. Expressed willingness to pay for the SURT reaches USD 400, but these estimates are somewhat unreliable given lack of experience of using the product. A price of USD 400 is twice the monthly income for most households in the segments, which may strain the affordability. Comparable solutions (i.e., latrines) typically cost 50% of that to install
- Households may require additional assets to fully "enjoy" the resulting by-products; for example, for one of the most promising by-product, biogas, only 13% of our surveyed households own a gas tank that could be utilized
- Financing may be required. Many solar product companies that sell products at the similar price points in Kenya offer financing

**We recommend a product + service model to bring the RT to Kenya, with different levers of complexity, depending on RT's partner's appetite:** in-house support for installation and maintenance, add-on assets (e.g., low-wattage appliances or gas tanks), and/or pay-as-you-go services for the by-products themselves. A product + service model would address low consumer awareness among households, especially in Mombasa, who are less exposed to alternative on-site solutions, boost trust with would-be customers, and match the standards set by the competition. **Barring identification of capable implementation partners with segment-specific knowledge, the trade-offs of pursuing a product-only model, or of having no on-the-ground presence, are significant and may compromise product success**

**The main buyers in this segment would be households themselves (landlords and homeowners), although a subsidy model may include institutional co-buyers.** It may not be easy to partner with government actors currently involved in fecal sludge management:

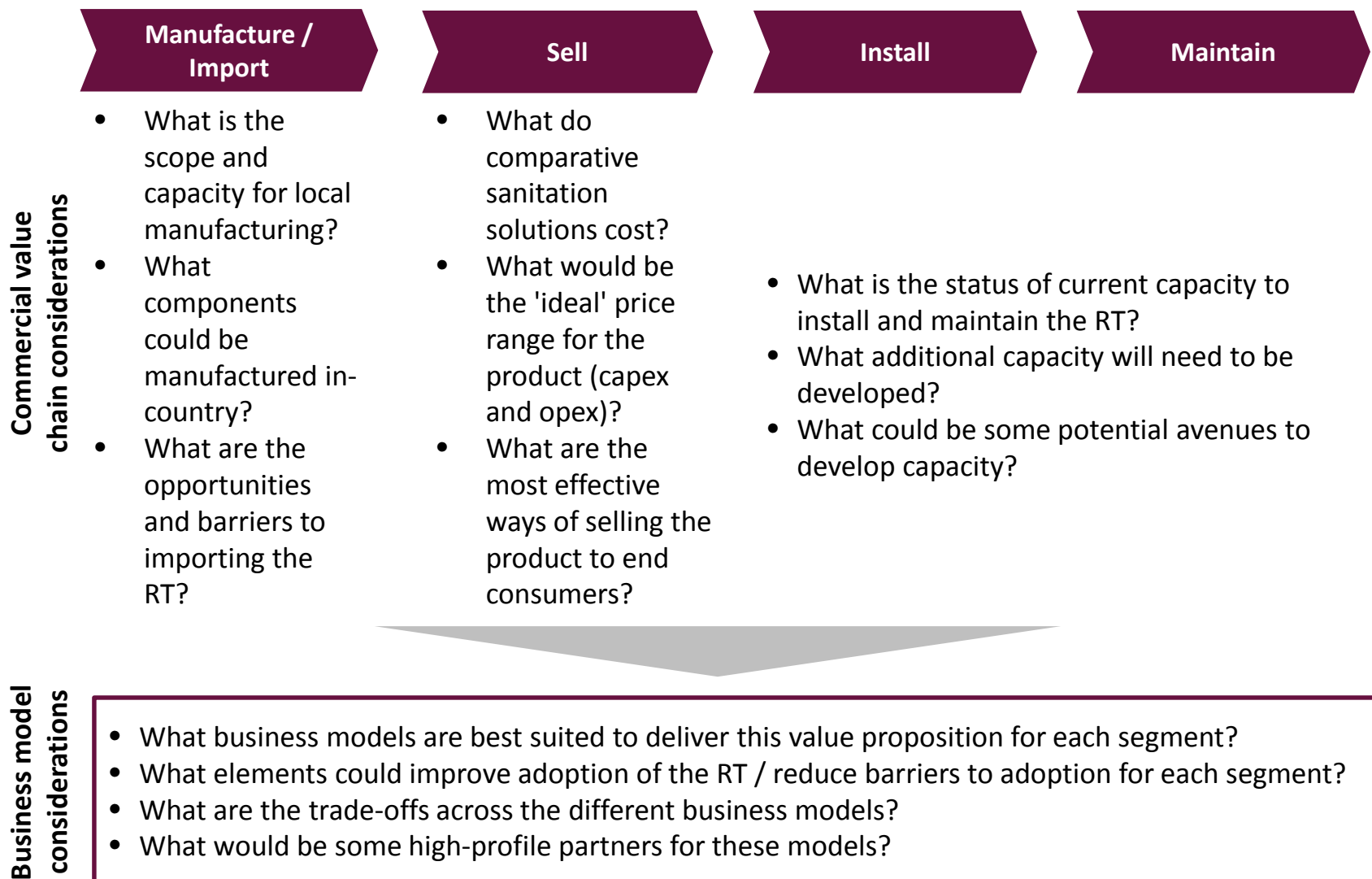
- While the makers of the RT and waste municipalities share similar waste treatment goals, the RT may be (but not necessarily) seen as competing with waste municipalities' core business, which is heavily focused on sewers (connections and fees)
- However, it would not be impossible to engage municipalities as a marketing/promotion partner, as other organizations have done so successfully. RT's commercial partners would need to be aware, however, that waste companies may need tangible incentives to engage

**For manufacturing/importing, marketing and distribution, no single option emerges as an absolute recommendation:** each will depend on the willingness and capability (operational and financial) of the commercial partners

# Process: Our key questions explored opportunities and constraints along four links of a commercial value chain



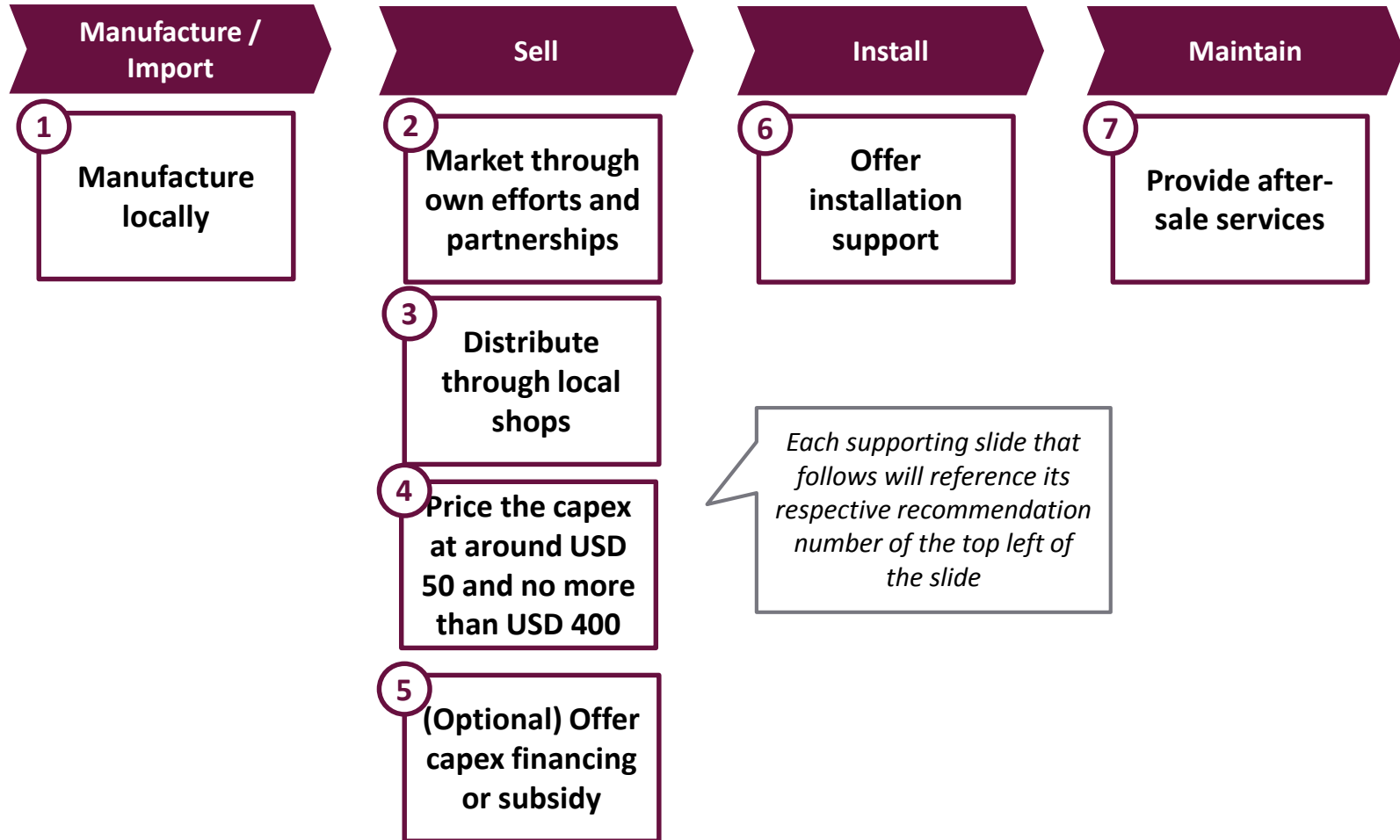
## Key questions explored



# Along four links of the commercial value chain, the recommended commercial considerations are as follows:



## Snapshot of possible commercial considerations



# Informal/tenement dwellers: Specific business model considerations for RT's partners to operate in target markets in Kenya include



## Business model considerations for the target residential segment in Kenya

- 1**

**Manufacture locally**

It may be cheaper to manufacture locally, as importing would add 67% to the factory cost, depending on available funding for a plastic mold. Furthermore, contractors find maintenance of locally-made parts preferable/easier
- 2**

**Market through own efforts and partnerships**

RT's partners may individually organize or collaborate on community events to activate demand. Regardless of the model, a crucial step is to gain buy-in of key decision-makers such as DPHOs\*
- 3**

**Distribute through local shops**

Consider leveraging local hardware shops as distribution points where the marketing team can also run events to reach new customers
- 4**

**Price the capex at around USD 50 and no more than USD 400**

The expressed WTP\*\* within the priority segments suggests a SURT should cost no more than USD 150-400 and a MURT USD 90-280 (per HH). Industry evidence recommends no more than USD 50 for SURTs, which aligns more closely with demonstrated ability to pay
- 5**

**(Optional) Offer capex financing support or subsidy**

Financing support such as subsidies/pay as you go models could help open up the addressable market, especially for HH earning <USD 100/month. Assets such as gas tanks would also boost the value proposition
- 6**

**Offer installation support and education**

This step is key to ensuring that household concerns around installation and usage are addressed. It may also be necessary, as local plumbers/masons might not have sufficient existing skills
- 7**

**Provide after-sale services**

After sales support will mitigate HH concerns and low capabilities around maintenance. It will also mitigate any brand risks that may emerge from poor maintenance of the RT

Note: \*DPHO: District Public Health Officers; \*\*Willingness-to-pay – It is important to note that there are numerous challenges with using expressed WTP numbers, and as such, these benchmarks should be further investigated

Source: Dalberg analysis

# 1 In deciding between manufacturing and importing: the cost of tariffs and transportation could add 67% to factory cost of the RT



Manufacture / Import

Sell

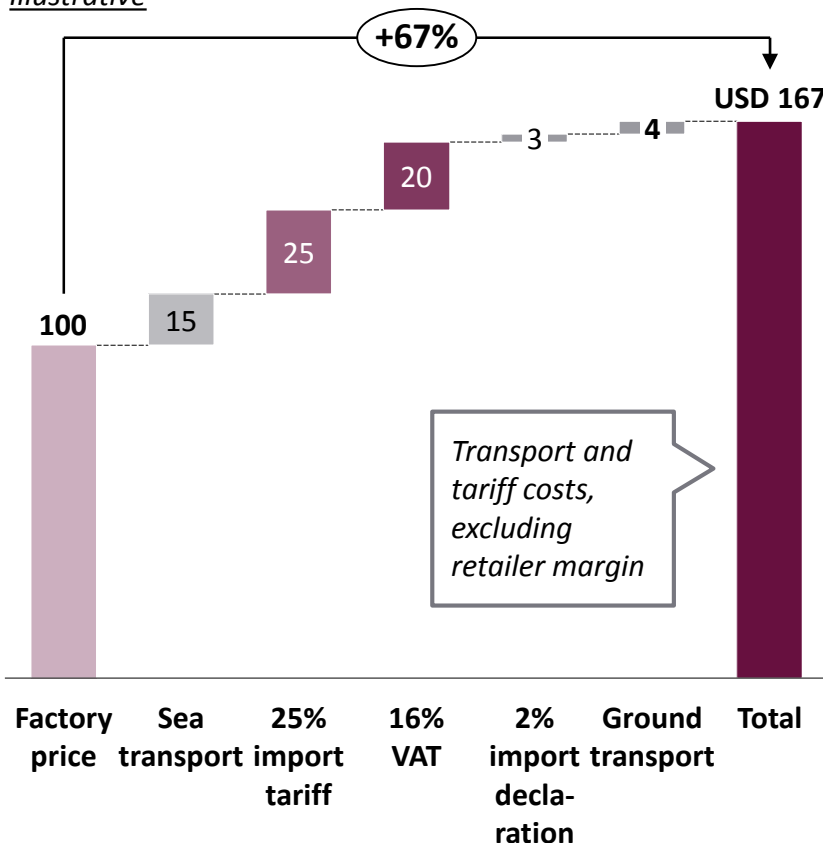
Install

Maintain

Import and transport costs on a USD 100 product

Considerations

*Illustrative*



- Tariffs:** Kenya charges a tariff of 25% on imported bath products, reservoirs, tanks and similar plastic containers,\* plus an additional 16% VAT and, finally, a 2% fee for import declaration. Cumulatively, import duties account for 48%
- Sea transport:** Shipping to Kenya would add an estimated USD 15.4 / unit for the smallest SURT (0.5 x 0.5 x 0.6 meters) based on transport on a 20-foot or 39-cubic-meter container\*\*
- Ground transport:** Transporting a 20-foot container from Mombasa to Nairobi can cost up to an additional USD 1,000, or USD 3.8 / unit for the smallest SURT

Note: \*Unclear under which category the RT would fall; however, bath products, flushing cisterns, and tanks /reservoirs etc. made of plastics all have a tariff of 25%. \*\*Shipping a 20-ft container costs ~USD 4,000

Source: Kenya Common External Tariffs; Kenya Revenue Authority; stakeholder interviews; Dalberg analysis

# There is a strong case for local production: small enterprises do so successfully, and buyers respond favorably to local brands



Manufacture /  
Import

Sell

Install

Maintain

- **Contractor preferences:** Unlike in Nigeria, in Kenya there is no strong negative bias toward local brands. A government survey of construction professionals found that 36 – 40% believe that having local materials that workmen can understand is an effective way of reducing maintenance costs
- **Manufacturing capability:** UNICEF identified Kenya as a potential latrine manufacturing hub, given the local presence of several manufacturers of plastic, cement and of other materials typically used in latrine construction, as well as good trade relationships with its neighbors
- **Examples of locally manufactured sanitation products in Kenya:**
  - Sanergy manufactures cement slabs for the toilet superstructure
  - Sanivation has succeeded in creating a container-based toilet at USD 35 by using wood and iron sheets carved by local artisans
  - The GIZ Upscaling Basic Sanitation for the Urban Poor (UBSUP) program shifted from providing pre-fabricated toilets to training artisans to build with local materials to reduce costs; this allowed the program to scale to 8,000 toilets

## Sanivation's "Blue Box" toilet



**In the absence of the capital to finance a plastic mold, RT components made of wood, cement and iron could be manufactured in Kenya**

1

# But if utilizing large amounts of plastic, STeP partners may need to balance tradeoffs against high local production costs



## Kenya plastics manufacturing landscape

## Sample manufacturers

### Product offerings

- Products range from plastic latrine slabs and container-based toilets to superstructures (e.g., portable toilet structures) to plastic septage solutions such as septic tanks and bio-digesters

### Local capacity

- In 2014, Roto Moulders had a production capacity of 500 plastic tanks per day. No information on other players is available

### Costs

- A mold to manufacture plastics products at scale can cost between USD 50,000 – 100,000

### Distribution channels

- Distribution models vary: KenTainers focuses on production and outsources to a single distributor; PolyTanks uses smaller distributors around the country; Roto Moulders distributes directly to hardware retail stores through its own fleet

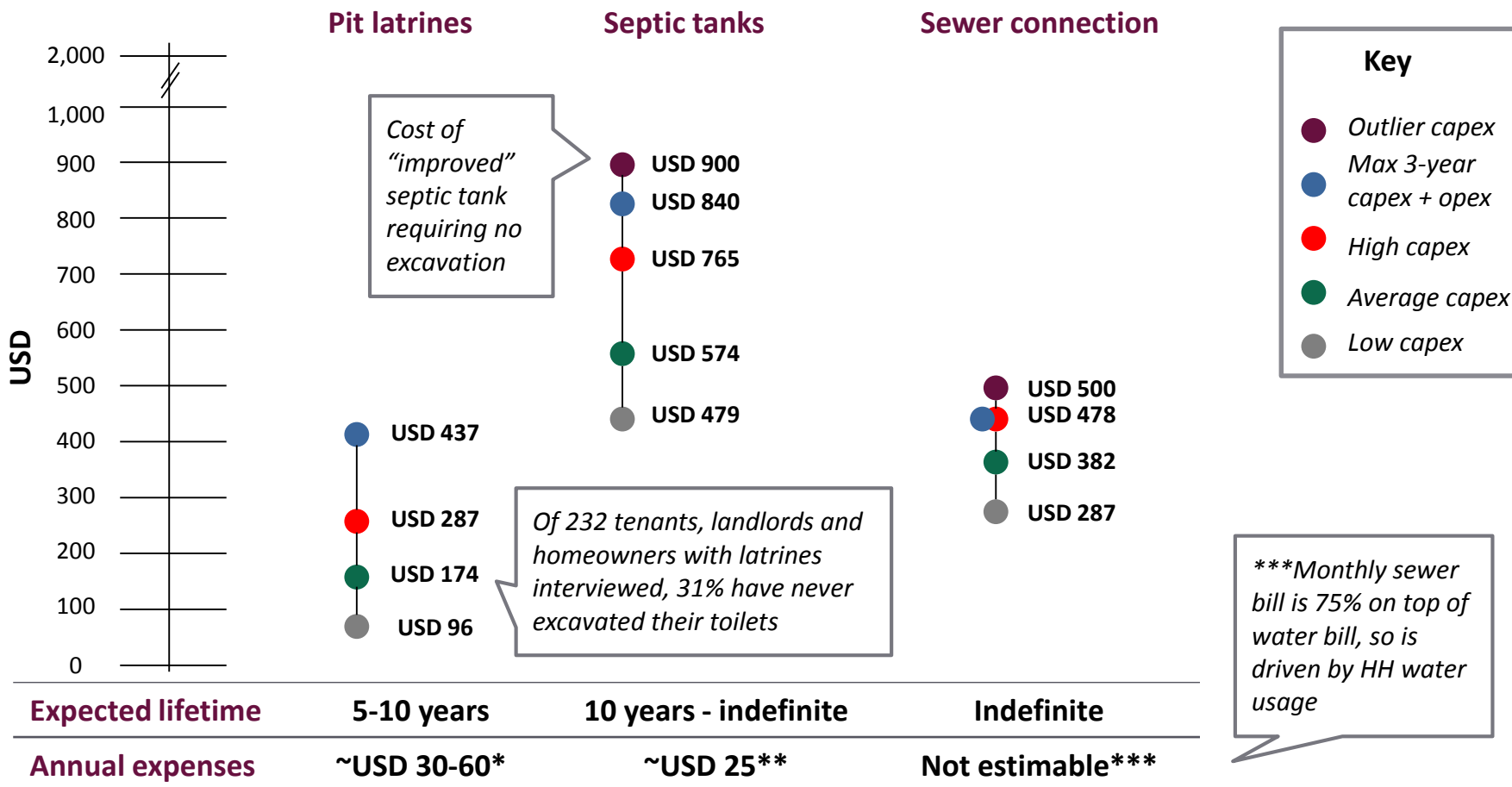
**These players sell virtually 100% of their sanitation products to NGOs and not on the open market. One reason may be the steep cost of the plastics mold, which the demand for sanitation products may not justify**

5

# In deciding how to price the RT: priority segments currently spend USD 97-287 on installation of latrines and ~USD 30 on annual maintenance



Installation and annual maintenance costs per septage solution (USD) – each serving at least 10 people



Note: \*Based on excavations every 2 years on average; \*\*Excavation costs for septic tank at year 10 can reach USD 250.

Source: Contractor surveys; stakeholder interviews; JojoTanks; KenTainers; KenyaCast; Dalberg analysis

# Process: To arrive at possible price points for the RT, we ran willingness-to-pay surveys; there are a few things to know about the methodology



Manufacture /  
Import

Sell

Install

Maintain

## Background and methodology

- **Van Westendorp's Price Sensitivity Meter** is one of a number of **direct** techniques to research pricing. Direct techniques assume that people have some understanding of what a product or service is worth, and therefore that it makes sense to ask explicitly about price
- **Lack of knowledge presents challenges for radically new products.** This aspect is one reason why pricing research should be treated as providing an input into pricing decisions, not a complete or absolute answer

**Sample survey question:** *"For a toilet that produces biogas for 5 hours for cooking for 10 families daily: at what price would you think the toilet is a bargain?"*

## Limitations of willingness-to-pay (WTP) surveys

1

**Studies show that expressed willingness to pay is somewhat unreliable, especially when target customers have not interacted with the product**

2

**WTP can increase if people experience the product;** This has been noted in the case of solar lanterns, where the willingness to pay increased three-fold after households were able to use the product for three nights

3

**WTP can decrease if the product does not meet the observer's expectations;** In this research, there were differences in willingness to purchase and pay for the RT in the quantitative survey and the human centered design research. The latter walked users through the product in more detail

**[Asked about willingness to use the RT and after much hesitation]** "I would have to see it to understand it." – Respondent in Mombasa

Given these challenges there can be differences between **demonstrated** ability to pay (according to income levels and competitor pricing) and **expressed** willingness to pay

5

# Recommendation: RT capex should be priced at USD 50-400, and annual opex at USD 25-60 to align with current spend and WTP



## Potential price points

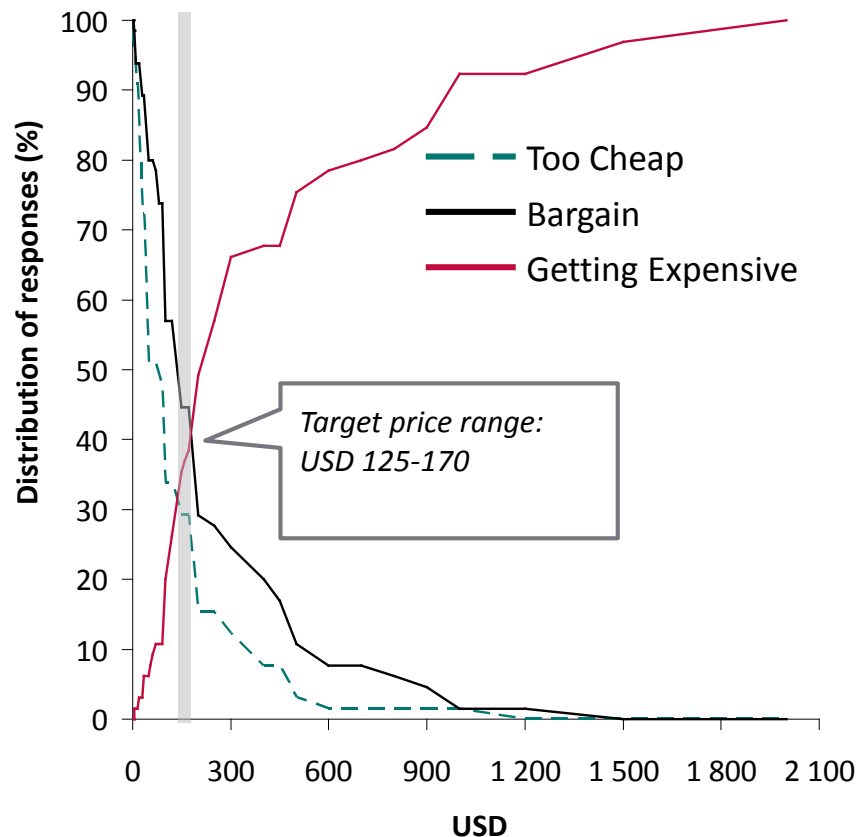
CAPEX

- **Reported willingness to pay (WTP)\*:** According to our surveys of homeowners and landlords, a SURT should cost USD 150 – 400; a MURT should cost USD 90 – 280
- **Relative to competitors (without subsidy):** According to an E&Y and WSUP study, container-based toilet businesses become unviable when the capital expense to the household significantly exceeds USD 50 (requiring uptake of 10,000+ HH). Pit latrines on average cost USD 174 to install

OPEX

- **Relative to annual maintenance cost of existing solutions:** The annual cost of maintaining (excavating) existing sanitation solutions is USD 25 – 60
- **Relative to competitors (without subsidy):** The sanitation providers we interviewed have learned that uptake dropped when the monthly cost of their sanitation service exceeded 5% of the HH’s monthly income (USD 10 for HH earning USD 200 / month, per the addressable market thresholds). Households in our survey who pay for toilet use spend USD 2.9 – 4.3 per month

## Illustrative WTP\* graph (for biogas by-product)



Note: \*We used the [Van Westendorp Price Sensitivity Meter](#) to determine WTP and asked questions such as: “For a toilet that produces biogas for 5 hours for cooking for 10 families daily: at what price would you think the toilet is a bargain?”  
 Source: Household surveys; stakeholder interviews; “The world can’t wait for sewers.”2017. Ernst & Young;

# 6 Given low demonstrated ability to pay in the target segments, various payment models exist but may complicate the business model (1/2)



Manufacture / Import

Sell

Install

Maintain

## Models that have been used to sell sanitation products to the priority segment market

#	Model	Who pays CapEx	Who pays OpEx	Payment channel for OpEx	When would this work?	Example org.	Appropriate for the RT
1	Pay-as-you-go	Minor capex paid by user or absorbed in opex	User	Direct (monthly)	Works when there is a service or product (e.g., collection) which can be stopped / turned off if the HH misses a payment, as well as the ability to monitor HH usage and payment history	Sanivation (charges landlords USD 8.5 /month)	●
2	Pay-as-you-go with asset financing	User (on credit)	User	Direct (monthly)	Requires asset financing, either in-house or through third-party. Works when there are institutions, such as MFIs, willing to provide toilet loans, for which payment can be collected by officers. May require loan collateral	IDE Cambodia (asset costs <USD 100)	●
3	Standard sale, lease or layaway model	User or landlord (varies)	User	Direct or indirect (e.g., through rent)	Works when the upfront investment is low enough for the HH, or when an entity (e.g., a women's group) holds on to the product as the user makes incremental payments, in a layaway model	Sanergy (charges USD 300)	●

● Least appropriate   ● Moderately appropriate   ● Most appropriate



6

# Given low demonstrated ability to pay in the target segments, various payment models exist but may complicate the business model (2/2)



Models that have been used to sell sanitation products to the priority segment market

#	Model	Who pays CapEx	Who pays OpEx	Payment channel for OpEx	When would this work?	Example org.	Appropriate for the RT
4	<b>Partial subsidy</b>	Landlord and / or user + Subsidy	Landlord and / or user	Indirect (through rent)	Works when (i) the cost post-subsidy is equivalent or less than that of unimproved sanitation solutions, or (ii) there are bundled incentives (e.g., reduced water installation fee), or (iii) adoption is required (e.g., product mandated by law)	GIZ-UBSUP (provides 50% subsidy)	
5	<b>Full subsidy</b>	NGO	User	Direct (per use)	Works when NGO or donor builds or helps acquire product/building, with no expectation of repayment. Requires identifying, vetting, and training youth groups on business practices	CLTS*, Umande Trust, Kibera toilets	

Least appropriate  
 Moderately appropriate  
 Most appropriate

**The appropriateness of the payment models may change depending on the technical modifications brought to the RT and on the business model selected (e.g., if there is a service component to the RT, then payment model #1 would now lean towards “more appropriate”)**

Note: \*Community-Led Total Sanitation  
 Source: Desk research; stakeholder interviews; Dalberg analysis

## 3 RT's commercial partners have two potential marketing approaches

## 4 and three distribution models to choose from



Manufacture /  
Import

Sell

Install

Maintain

### Potential marketing mix

#### Do-It-Yourself

Use channels such as radio, print advertising, demonstrations, social media, community meetings to generate demand

#### Use existing promoters

Potential parties that could be leveraged as promoters:

- **Utilities services providers** (e.g., GIZ and water service providers)
- **Community-based organizations** (e.g., women's groups sponsored by institutions)
- **NGOs** that provide related services (e.g., Oxfam, Practical Action, etc.)
- **District Public Health Officers:** In Kenya, DPHOs are crucial actors in the ecosystem; they exercise extensive influence on household behavior and uptake of new products

### Potential distribution models

#### Option 1: Deploy an on-foot salesforce

- **Ease of implementation: LOW- MEDIUM.** Several models, in sanitation, solar, health and other sectors have successfully done this in East Africa and developing countries globally. They utilize a multi-purpose salesforce that does marketing, customer training, distribution and maintenance. Examples include: WaterSHED
- **Impact: HIGH**

#### Option 2: Build your own community-level shops

- **Ease of implementation: MEDIUM.** Several companies in East Africa employ a combination of Options 1 and 2. Managing their own stores allows these companies oversight over the in-store customer experience (marketing, training, etc.) that other distributors would either not be capable or be unwilling to do. Examples include: Bboxx and Mobisol (solar); Sanivation (sanitation)
- **Impact: MEDIUM-HIGH**

#### Option 3: Place the product at third-party shops

- **Ease of implementation: MEDIUM.** This model is not yet proven for large, durable products (unlike for fast moving consumer goods). There is risk that distributors either do not have interest nor the knowledge to invest the time, resources, and effort to "push" the sanitation products
- **Impact: LOW-MEDIUM**

7

# Recommendation: RT's partners should consider offering in-house installation support or partner with a reputable institution for this task



## Potential installation and maintenance models

Model	Description	Considerations	Level of effort & risk
<b>1. DIY / no support</b>	Only the product is provided; the buyer is responsible for finding his own installer.	<ul style="list-style-type: none"> <li>Typical model for standard toilet types; no known examples for alternative solutions. However, a sanitation company in Southeast Asia learned that when it did not provide installation support, households purchased but did not install the product for another nine months</li> <li>It then integrated existing artisans into the value chain to reduce the installation lag</li> </ul>	<b>LOE: LOW. Risk: HIGH.</b> Given the complexity of the product, this would require a strong ecosystem of possible maintainers, which may not be available.
<b>2. Outsourced installation / maintenance</b>	The company links the buyer to affiliated, pre-trained installers.	<ul style="list-style-type: none"> <li>There is evidence that plumbers and artisans can be upskilled: GIZ has successfully worked with hundreds of artisans to build toilets according to program-specific design requirements</li> <li>Utilities services providers are high-potential avenues to reach artisans for training</li> </ul>	<b>LOE: MED. Risk: MED.</b> For the target segments, it may be difficult, though not impossible, to find aggregated maintainers.
<b>3. In-house installation / maintenance support</b>	The company dispatches its own group of installers once a product is purchased.	<ul style="list-style-type: none"> <li>Mobisol, a solar company in East Africa, runs a Mobisol Academy to train solar installation and maintenance officers</li> <li>For products that require no formal installation but may require some behavior change, some companies use agents to train customers on proper use once the product is delivered to the HH</li> </ul>	<b>LOE: MED-HIGH. Risk: LOW.</b> This model offers control over the quality of the service provided by maintainers but requires significant oversight

**Models 2 or 3 are ideal for complex products such as the RT, as these models allow the company to address initial barriers to adoption.**

# Local artisans will require training to help maintain the RT: only 15% of plumbers receive follow-on training since starting the trade



Manufacture / Import

Sell

Install

Maintain

## Maintainers

## Overview of current capacity



Plumber

- According to survey results, **56% of plumbers receive 1+ year of training**, either through apprenticeships or technical colleges. Twenty-two percent have no formal training; 15% have follow-on training
- **Most are informal**, not linked to a company. Those who are affiliated with a company or hardware store\* may receive additional training
- **Plumber capabilities vary by city**: more Mombasa plumbers report being comfortable with septic tank installation, and fewer with bio-digester installation
- **Evacuation services range in formality**: the sewer company and other formal players offer this service in competition with “frogmen,” who do the job manually at a significantly cheaper cost (KSH 3,000 or USD 30 compared to USD 60)
- Efforts to engage community youth in the maintenance of sanitation solutions have not succeeded in the long term: they are often disorganized, and there have been occasional integrity issues (e.g., price hiking and vacillating commitment)



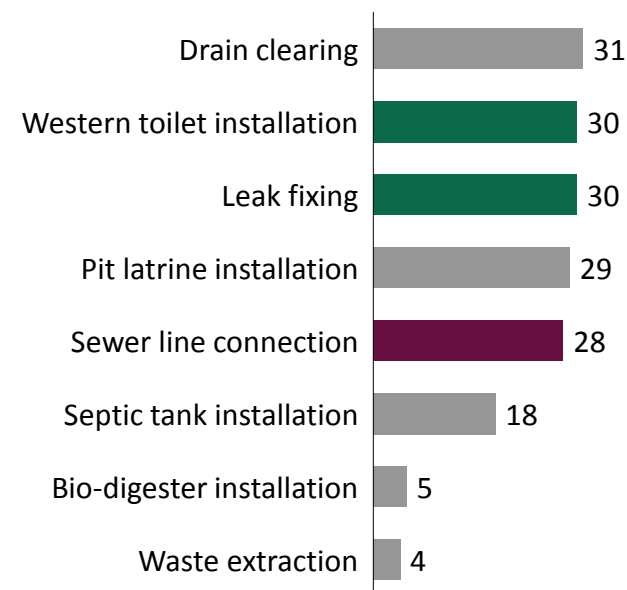
Evacuators



Community youth

## Of 32 plumbers surveyed in Kenya, number who offer these services

Basic service      Complicated service

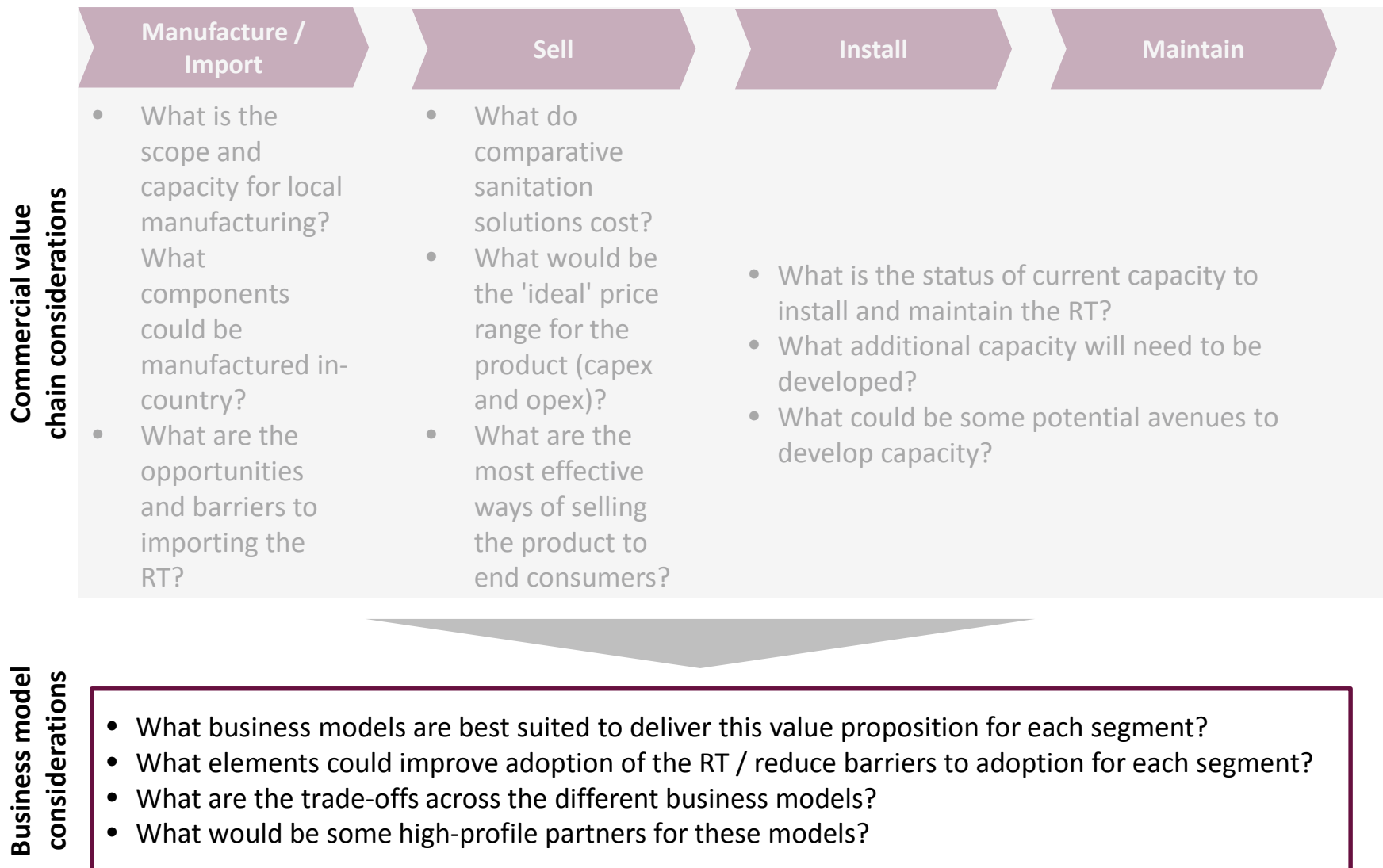


**There is evidence that local artisans, including plumbers, can be successfully upskilled. Who manages the upskilling process will depend on the operational model that RT's commercial partners select**

# Process: Our key questions explored opportunities and constraints along four links of a commercial value chain

RECAP

## Key questions explored



# The complexities of the RT, need to establish trust, and standards set by the competition should influence which model RT's partners choose



RT's partners should choose a model that addresses the following:

	Installation and maintenance	Usage	Usability of the by-products
<b>The inherent complexities of the RT</b>	Households are overwhelmingly concerned about RT's installation and maintenance burden, and plumber capacities suggest that only 15% receive follow-on training since starting their trade. Significant reassurance and upskilling would be required	Given that the majority of the RTs are separation toilets, users will require education about how to properly use it to keep it clean, which may require a change in behavior (i.e., sitting on the toilet for men). This is crucial information that can make or break user experience	Many households interviewed have little conceptual understanding or lack the appliances to use the resulting by-products (e.g., gas tanks to use the biogas). RT partners can strengthen the value proposition by ensuring that households can indeed extract value from the waste
<b>The need of establishing trust</b>	Stakeholders interviewed want assurance that the product will work as intended and to be able to call upon the company as necessary. If there is no on-the-ground presence, households may be less willing to take the risk		<p>"Reputation matters; we want to ensure that our buildings have a certain look and are durable." – Housing developer</p>
<b>The standards set by competition</b>	Current alternative sanitation providers have built brand recognition by capitalizing on the strong hygiene preferences and providing cleaning and maintenance services alongside the toilets. Alternative offerings without this component may struggle to compete		<p>Over 38% of developers shy away from using certain technologies because they do not understand them or are concerned about their maintenance (Source: KNBS)</p>

**The trade-offs of choosing a product-only model are significant: there is likely no major distributor already serving the target segments that would have the interest and capability to address the above considerations – without notable reputation and operational risk for RT's partners**

# Recommendation: We recommend a product + service model to boost adoption of the RT in priority segments in Kenya



## Awareness

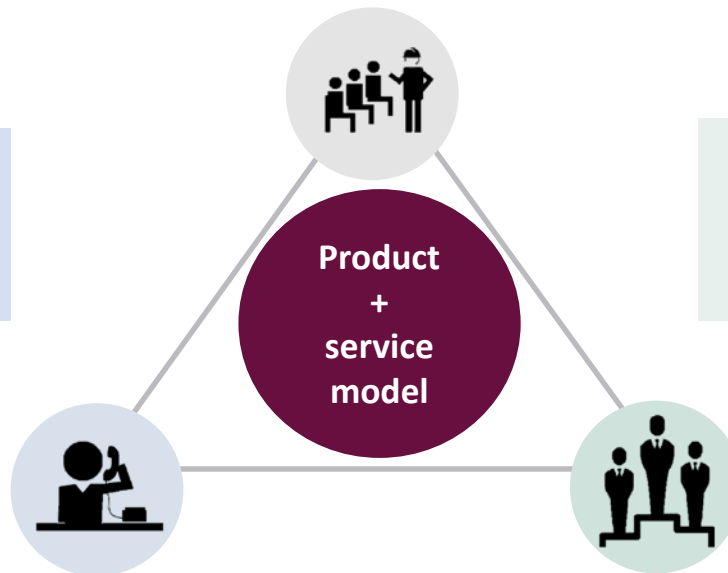
To ensure that less-exposed households have the knowledge necessary to effectively use and extract value from the RT

## Trust

To convey to customers that there is a company is within reach for maintenance challenges

## Competition

To match the comparative advantage that competitors have established with their after-sales offerings



# In fact, for Kenya's low-income segments few players offer just the product; most supplement with add-on services or capacity building



## Current business models utilized in sanitation in Kenya

Model	Example org.	Product offering	Target beneficiary	Trade-offs
<b>1. Product only</b>	KenyaCast EcoMaji, LIXIL	Interface solution only (i.e., water-saving toilet) or waste water treatment only (e.g., bio-digester)	High-income households and institutional clients (e.g., malls, apartments)	<ul style="list-style-type: none"> <li>• Missed opportunity for customer education in the long-run</li> <li>• Requires establishing own sales channel or a finding reputable distributor willing to also do product promotion</li> </ul>
<b>2. Product + service</b>	Sanergy, Sanivation	Interface solution (i.e., container-based toilets) + sludge collection	Working-poor households Public toilets Institutions	<ul style="list-style-type: none"> <li>• Requires presence on the ground, unless can outsource to a reputable company</li> <li>• Is more operationally complex, given logistics of service provision</li> </ul>
<b>3. Product + capacity-building (NGO model)</b>	GIZ, Videns Evides International	Capacity-building and infrastructure support for implementing organization + front-end solution, with financing, for end-beneficiary	Combination of households and institutions, such as schools	<ul style="list-style-type: none"> <li>• Is dependent on donor timelines</li> <li>• May distort the market with competing incentives</li> </ul>

**Outside of sanitation, M-KOPA has sold 500,000 solar products across Kenya through a product + sales + financing model, indicating scalability of the model**

# For the RT, there are multiple permutations of product + service possible; some are entirely DIY while others require ecosystem partners



## What would a product + service model look like for the RT?

Service options	Product options		
	RT only	RT + appliances	RT + appliances + PAYG meter
Installation and customer education	✓	✓	✓
Periodic maintenance	✓	✓	✓
Disposal of unwanted by-products	✓	✓	✓
Cleaning services	✓	✓	✓
By-products on a fee-for-service basis			✓

### Possible combinations\*

**Low-effort example 1: Product + maintenance**  
Customer purchases the RT, using RT's partners preferred payment model. The company dispatches own or third-party installation specialist, who also educates the customer on proper product use. Every few months, RT specialists are dispatched to customer HH for product maintenance and collection of unwanted by-products

**High effort example 2: Product + PAYG service**  
RT's partners estimate the capex for RT + gas tank (in-case of biogas by-product), as well as the dollar equivalent of the biogas to be produced over a 2-3 year period. Customer pays 20% of that total cost upfront. RT's partners charge a monthly fee, over 2-3 years, that covers capex, any maintenance, and the biogas produced. Biogas reactor is turned off when customer does not pay, either through own or third-party software\*\* (several potential partners available in East Africa)

Note: \*Non-exhaustive. \*\* Companies offering PAYG software: [Angaza](#), [PayGo Energy](#), [Mobisol](#), [Greenlight Planet](#)

Source: Dalberg analysis

# Summary: Specific business model considerations for RT's partners to operate in priority residential segment in Kenya include

RECAP

## Business model considerations for the target residential segment in Kenya

1

### Manufacture locally

It may be cheaper to manufacture locally, as importing would add 67% to the factory cost, depending on available funding for a plastic mold. Furthermore, contractors find maintenance of locally-made parts preferable/easier

2

### Market through own efforts and partnerships

RT's partners may individually organize or collaborate on community events to activate demand. Regardless of the model, a crucial step is to gain buy-in of key decision-makers such as DPHOs\*

3

### Distribute through local shops

Consider leveraging local hardware shops as distribution points where the marketing team can also run events to reach new customers

4

### Price the capex at around USD 50 and no more than USD 400

The expressed WTP\*\* within the priority segments suggests a SURT should cost no more than USD 150-400 and a MURT USD 90-280 (per HH). Industry evidence recommends no more than USD 50 for SURTs, which aligns more closely with demonstrated ability to pay

5

### (Optional) Offer capex financing support or subsidy

Financing support such as subsidies/pay as you go models could help open up the addressable market, especially for HH earning <USD 100/month. Assets such as gas tanks would also boost the value proposition

6

### Offer installation support and education

This step is key to ensuring that household concerns around installation and usage are addressed. It may also be necessary, as local plumbers/masons might not have sufficient existing skills

7

### Provide after-sale services

After sales support will mitigate HH concerns and low capabilities around maintenance. It will also mitigate any brand risks that may emerge from poor maintenance of the RT

Note: \*DPHO: District Public Health Officers; \*\*Willingness-to-pay – It is important to note that there are numerous challenges with using expressed WTP numbers, and as such, these benchmarks should be further investigated

Source: Dalberg analysis

# Successfully implementing this model will require cross-functional partnerships\*, an adept salesforce and robust distribution channels



## Key partnerships

- City council (for permits)
- District public health officers (for marketing support)
- Manufacturing partners, if choosing to manufacture part of the product locally
- Supplier partners, if choosing wood or cement inputs
- Low-wattage suppliers, if needed
- Pay-as-you-go software providers, if choosing this service for the model: Angaza, PayGo Energy, Greenlight Planet, Mobisol

## Key activities

- Have the RT tested and approved for use by the Kenya National Bureau of Standards. Process takes 3 weeks
- Set up business registration, if not already available
- Set up city council and DPHO partnerships
- Identify 1 target neighborhood to start; a neighborhood model will help contain costs and closely monitor uptake
- Organize (individually or with partners) community events to test the value proposition and identify early buyers / adopters
- Set up and train salesforce on customer acquisition, product installation and maintenance
- Set up a mechanism for collecting and responding to customer feedback early and quickly

## Key resources

- A salesforce that is knowledgeable about the target neighborhoods and is well trained to sell, install and maintain
- A strong supplier relationship (is reliable and delivers quality at the right price points)
- A tight delivery process
- A process for monitoring customer experience
- Friendly relationships with relevant city and government bodies

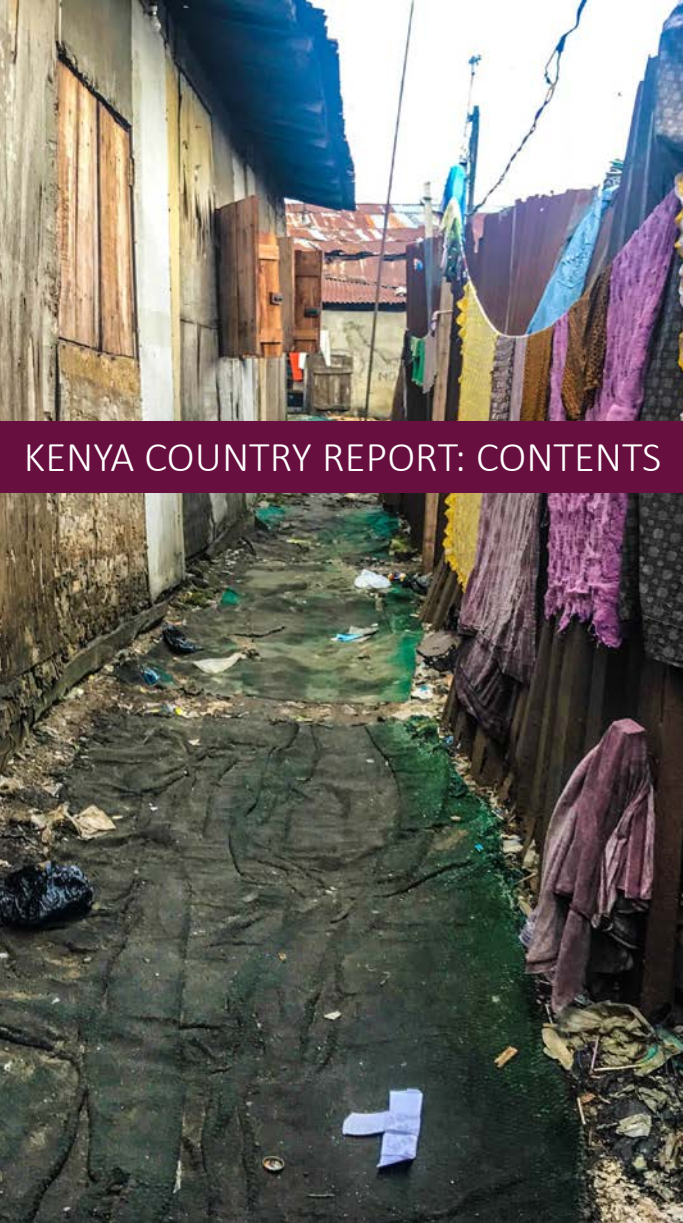
**\*As RT's partners consider partnerships they should be clear on who would have the incentive to promote the RT. Some entities that would be expected to, in fact may not, unless they have the right incentives**

# There are three roles that waste municipalities could play wrt. the RT; two are costly and would need to be strengthened with incentives



## Evaluation of potential roles for the waste treatment municipalities

Role	Description	Pros	Cons	Feasibility
<b>Promoter</b>	Water/sewer company helps with marketing the product only, as an add-on to its own promotion efforts	Low LOE; sewer company can leverage household touch-points and credibility as services provider	This may not significantly influence uptake	<b>MED-HIGH</b> <i>Evidence of successful model through GIZ program*</i>
<b>Buyer</b>	Water/sewer company is buyer and reseller of the product, according to its own business plan	Sewer company can leverage household touch-points and credibility as services provider	This is resource-intensive, considering cash constraints of these companies; would require high LOE and may jeopardize current revenue streams	<b>LOW</b> <i>Nairobi and Mombasa can barely cover O+M costs with tariffs (104% and 83% coverage, resp.)</i>
<b>Distributor</b>	Municipality acquires the RT at fully-subsidized cost and only manages the distribution to households	Eliminates Capex costs for cash-strapped municipalities; moderate LOE relative to “Buyer”	This step is simpler than the above but is still operationally complex, as it would require distributor salesforce	<b>LOW</b> <i>Same as above</i>



- Kenya sanitation landscape: stakeholders, challenges and opportunities
- **Residential market: priority segments and go-to-market approach**
  - Go-to-market considerations for existing construction priority residential segments
  - **Go-to-market considerations for new construction priority residential segment**
- Institutional market: priority segments and go-to-market approach
- Conclusion: Recommended paths to market entry
- Annex

# Summary: Go-to-market recommendations for new residential constructions

## Formal new residential constructions

**The approach for new residential constructions differs significantly from that of existing constructions.** New constructions will require a business-to-business approach – as buyers would be housing developers rather than households themselves

**This segment is high-stakes, with strong reputational opportunities and risks for RT's commercial partners:**

- The majority of units in this segment fall into the high-income and "luxury" categories, with strong bias towards high-end plumbing fixtures and fittings
- The sector is highly return-driven, with investors expecting at least 20% IRR for each development, meaning less willingness to take risks with building architecture and design
- Though there are dozens of players, they aggregate into a handful of associations with the ability to influence sector-wide decisions

**Nevertheless, with an estimated annual flow of 10,000 units in Nairobi, the opportunities within this segment are compelling:**

- Developers are looking for ways to increasingly and profitably sell to low-income segments – either by stripping the units of nice-to-have features or by introducing alternative, cheaper designs entirely
- Below-ground construction, as is needed for sewer connections and septic tanks, can account for a significant share (25%) of the total development costs. Sizeable savings in this category could have a notable impact on overall spend
- The segment is one of the fastest growing, having achieved a 12.3% CAGR in the last five years and will likely grow at the same pace

**The go-to-market approach for this segment requires testing and demonstrating the value proposition for housing developers** (especially around cost savings and legal compliance), closely monitoring the success of an initial pilot, and leveraging the various professional organizations to market the RT to others. We have mapped the process in the respective section of this report

# Formal new constructions in both cities could offer an attractive market for the RT given the size, growth rate, and incentives in that segment



## Opportunities with formal new builds

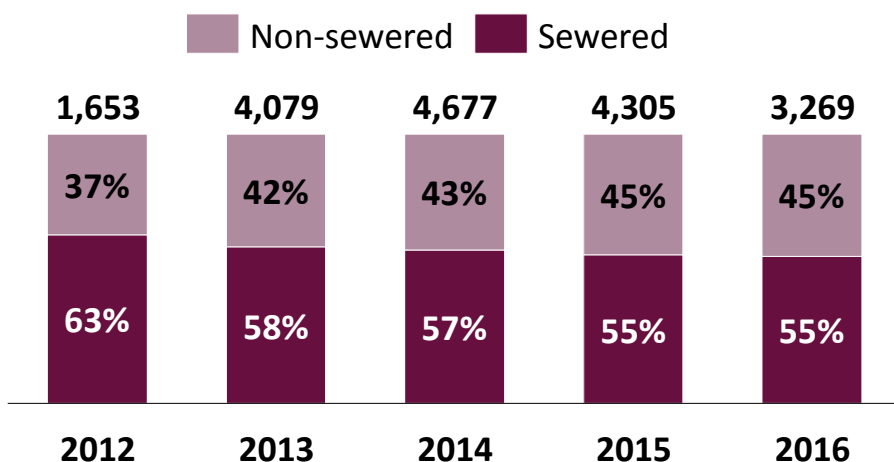
### 1 Projected increase in supply of low-income housing

- Although the residential market is growing at 12% per annum, the low-income housing gap is estimated at 500,000 units in 2017
- In an effort to address the supply shortage, the government is offering a 50 percentage-point reduction in corporate taxes as incentive for developers to target low-income segments

### 2 Expansion into non-sewered areas

- Over the last 5 years, housing development has outpaced the expansion of the sewage infrastructure,
- As real estate development spikes in Nairobi's non-sewered satellite towns, so does the share of new buildings that are non-sewered (see chart)

## Septage solutions in new formal builds/permits in Nairobi



### 3 Search for cost-savings to help boost profits

Developers are looking for more cost savings to profitably serve low-income segments. Cost savings could include:

- Reduction of the soil excavation spend for septic tank and sewer line installation, which can account for 25% of total development spend
- More affordable interface fixtures and fittings

# Residential formal new constructions in Nairobi alone could offer a market for 5,000 SURTs and 2,800 MURTs over the next 5 years



~10,000 formal units were constructed in Nairobi last year. The real estate market has been growing at a steady pace of 12.3% CAGR since 2012:

## 1. Total number of units built in 2015-2016

= 10,000 units

## 2. Apply 12.3% compound annual growth rate for 5 years

= 61,000 additional units (cumulative over 5 years)

### 3a. Assume 91% new construction are apartments\*

= 56,000 additional units

### 3b. Assume 9% new construction are standalone\*

= 5,000 additional units

## Latent market over 5 years

(assuming 1 MURT per 20 apartment units and 1 SURT per standalone house)

= 2,800 MURT units and 5,000 SURT units  $\pm$  20% over a 5 year period

# However, RT's partners will need to address housing developer concerns around market perception, reputation and legal compliance



## Theme

## Housing developer concerns

### Market perception

- Developers are concerned that potential customers may not be willing to buy or purchase units that use alternative or unconventional materials
- Research on low-income housing in Kenya has shown that households have a strong materials bias towards traditional materials and techniques (esp. stone and cement), and distrust towards alternatives

"I don't think that the income segments that we target would be willing to use the by-products"

*Middle-income housing developer*

### Reputation

- If they overcome the first challenge, developers are further concerned with the assurance that the product would have few breakdowns, produce no smell, and be easily maintainable in the long run
- This is crucial to their ability to maintain reputation/salability, given high IRR and exit pressures from investors

"We'd need to make sure that there is no smell, given the 6,000 people who will live in this estate"

*Low-income housing developer*

### Legal compliance

- Kenya's Building Code sets regulations about the types of septage solutions permitted, according to geography, soil types, and the availability of sewer solutions
- High-density buildings (e.g., apartments) are required to be on the sewer line. This law is waived if the area is non-sewered, but still imposes limits on the density possible
- While there is allowance for non-sewered solutions, Article 206 of the Building Code mandates that buildings upgrade to sewer when the line becomes available. In these cases, for large-scale developments, the risk and cost implications can be significant

"Precedent development and cost savings are the only things that will convince us of adopting a new technology. Govt seal of approval is not relevant to us"

*Mixed-income housing developer*

# Recommendation: If these concerns are addressable, RT's partners should engage developers long before construction plans are finalized



## Overview of the new construction process

### Stakeholders involved



### Steps and roles in construction process

- 1** Developer and investors finalize plan for development
- 2** Architect receives a design brief from developer, outlining the overall vision for the construction
- 3** Master planner\* collects approvals from city council for construction, including for chosen septage solution
- 4** Architect lays out design for the blocks of homes (role is to focus on what goes inside the unit)
- 5** Master planner maps all infrastructural layout (everything outside the unit, incl. septage solution)
- 6** Contractor builds the unit, overseen by developer and master planner
- 7** Quantity surveyor oversees procurement of finishings, with input from contractor and developer

■ Best time to engage 
 ■ Opportunity closing 
 ■ Too late

## Select low-income housing developers\*\*

Developer	Details	Stock (units)
<b>Tatu City</b>	<ul style="list-style-type: none"> <li>Is part of Kenya's Vision2030, as a new city with mixed-income and mixed-use developments, already underway</li> </ul>	<ul style="list-style-type: none"> <li><b>Current:</b> None</li> <li><b>Planned:</b> 6,000 (ongoing)</li> </ul>
<b>Urbanis Africa</b>	<ul style="list-style-type: none"> <li>Has completed 4 phases of low-income housing developments serving 2,000+ households. Has presence in 7 countries in Africa, incl. Nigeria</li> </ul>	<ul style="list-style-type: none"> <li><b>Current:</b> 3,000</li> <li><b>Planned:</b> unknown</li> </ul>
<b>Karibu Homes</b>	<ul style="list-style-type: none"> <li>Has completed 286 units and planning additional 526. Looking for ways to reduce apartment price by 2/3 for target segment</li> </ul>	<ul style="list-style-type: none"> <li><b>Current:</b> 286</li> <li><b>Planned:</b> 526</li> </ul>
<b>SunCity Kenya</b>	<ul style="list-style-type: none"> <li>Is projected to be the largest housing development in Kenya, and will house a population of 50,000 people. Funded by AfDB</li> </ul>	<ul style="list-style-type: none"> <li><b>Current:</b> None</li> <li><b>Planned:</b> 10,000</li> </ul>

Note: \*May be called a Civil or Structural Engineer \*\*These developers all build in peri-urban areas, where sewer infrastructure is still developing. Source: Stakeholder interviews; Desk research; [Acumen Fund: Affordable Housing in Kenya](#)

# A G2M strategy for formal new builds would require demonstrating RT value proposition for one target developer before marketing to others



## 1. Validate and demonstrate the value proposition

## 2. Pilot with a housing developer

## 3. Market to other developers and to the industry

### Description and Key Partners

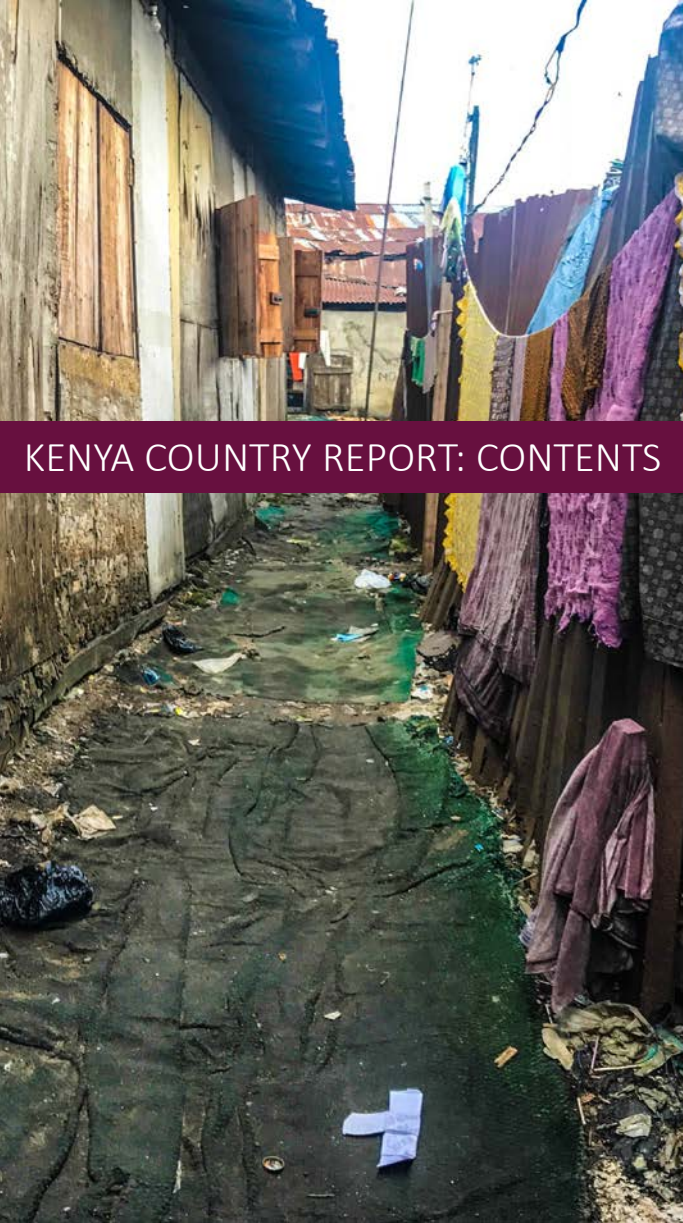
- Demonstrate that implementing the RT can lead to attractive-enough cost savings for developers by reducing spend on extraction. For this it may help to speak directly to a few housing developers to model out what cost savings might be possible with the RT and to validate the assumptions
- Map out how the RT can be integrated into the existing construction process, with the view to addressing legal and engineering constraints. Consult with the **National Construction Authority**, as well as the **Engineers Board of Kenya for input**
- Source and establish partnership with developers to integrate RT into design and architecture plans. This can be done via professional bodies, such as the **Institute of Quantity Surveyors of Kenya and the Kenya Architects Association**
- During pilot ensure that the benefits promised are realized (i.e., cost savings) and trade-offs minimized (e.g., smell, compliance challenges, etc.)
- If successful, market the RT to other developers through the **Kenya Architects Association** as well as the **Engineers Board of Kenya** using the pilot developer as a case study

### Risks

- The RT may not be able to compete relative to other solutions available in the market in Kenya (e.g., cement septic tanks, plastic bio-digesters, etc.) on factors such as costs, look of the interface (strong bias towards high-end fixtures), maintenance effort
- The planning stage can be opaque, limiting the ability of the commercial partners to initiate conversations at the right time
- The process includes multiple actor types with varying stakes in the investment; all need to be onboard for the implementation

### Mitigation

- RT's commercial partners should evaluate the willingness, capability and resources necessary to target this market segment
- Once the price of the RT is determined, assess its competitiveness against the solutions available in the Kenyan market
- Meet with developers early in the process – before or as the construction plan is being defined. Once the plan is defined and partners are brought on board, it will be more difficult to propose an alternative design
- Engage all necessary stakeholders in the construction process beyond the developer himself: architects, master-planners, quantity surveyors, investors as necessary in marketing the value proposition of the RT



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# Summary: Go-to-market recommendations for institutional segments – educational institutions and public toilets

RECAP

In Kenya, we recommend educational institutions (schools and universities) as well as markets and transport hubs as target segments. The go-to-market approach varies significantly for each:

## Educational institutions:

- **Universities:** The opportunity and go-to-market approach for this segment, for which there is a push to develop 30,000+ student housing units, will look similar to that of residential new construction as development is outsourced to commercially-driven housing developers, with many of the same key players
- **Schools:** Schools offer a weaker commercial rationale but are still a worthwhile market from a needs and impact perspective:
  - Schools are highly fragmented as a segment
  - They lack the financial capability and decision-making power to make their own purchases, often dependent on Ministry of Education budgets, but have a severe need that requires support to address

## Public markets and transport hubs:

**Markets and transport hubs may be the easiest of all the segments to target given high need, low entry barriers and low competition.** There are two ways that commercial partners could engage:



- 1) **Direct play** – operating toilets themselves (building new ones or renovating existing ones)
- 2) **Indirect play** – selling the RT to existing operators.

**Given the fragmentation of public toilet operators, the direct play model may offer a stronger opportunity than the indirect model.** A handful of operators take the same waste-to-value approach (e.g., Sanergy and Ecotact). They have either: a) built a business model around collecting the waste away to decentralized facilities for treatment and resale, or b) are already building on-site systems themselves. This does not mean that these players may not engage with commercial partners, however: several have been BMGF grantees, and many of their business models are still evolving

**Regardless of the approach, the financial sustainability in this segment is challenging:** it requires high volumes of users, especially as fees-per-use have remained unchanged in nearly a decade, as well as the ability to keep costs, especially indirect (e.g., overhead), low and manageable. Forging partnerships with NGOs/the government could partially address this challenge



# Institutional opportunity (1/3): State-sponsored housing and educational institutions could present interesting market opportunities



Institution	Potential opportunities	Potential barriers
 <p><b>State-sponsored housing</b></p>	<ul style="list-style-type: none"> <li>• <b>Housing for government staff:</b> In 2015, the Government of Kenya announced plans to build 8000 units of civil servant housing (status unknown at present)</li> <li>• <b>Affordable housing:</b> Implementation lies with various government ministries and programs are typically established through PPPs. Current national plans include: Housing Finance (construction of 1,300 units); Slum upgrading initiative (15,000 units); National Housing Corporation (30,000 units by 2017); Ministry of Housing (200,000 units annually in the long term) ; Mombasa plans to provide 30,000 units as part of its Vision 2035</li> <li>• <b>University housing:</b> Kenya has a shortage of nearly 500,000 beds for student housing (approx. 64% of the demand). Public universities are just beginning to access PPPs for dorm construction, the first of which (funded by a World Bank credit facility) will build a 34,000-bed set of facilities for 5 universities</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Delays:</b> Housing programs often suffer delay e.g., a World Bank-funded slum upgrading programme ran into extensive legal battles with slum landlords and tenants such that the project has built only 800 units during its 5+ year life-span</li> <li>• <b>Volatility:</b> Judging by permits issued from 2012-2016 for state-sponsored housing, annual construction varies significantly– as low as 45 units one year to approx. 2,000 another</li> </ul>
 <p><b>Educational institutions</b></p>	<ul style="list-style-type: none"> <li>• <b>Public schools:</b> <ul style="list-style-type: none"> <li>• Nationally, 80% of primary and secondary schools fail to meet the mandated ratio of 1 toilet for 30 students. This translates into an average shortage of 6 toilets per school</li> <li>• Through a 5-year school health strategy, the government planned to build or renovate 10,000 school toilets, but data on the status of the programme are scant</li> </ul> </li> <li>• The sanitation challenge in schools is recognized and has been prioritised by many donors, NGOs, and CSR initiatives (e.g., UNICEF, Sanergy, Unilever). However, efforts are fragmented and have not reached scale (e.g., NGO projects tend to target approx. 50 schools)</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Lack of decision-making power:</b> the Ministry of Education must provide approval for all purchases, but its capabilities are limited: for the 2016-2017 school year, only USD 7 allocated per student</li> <li>• <b>Heavy use:</b> Schools would benefit from technology suited for heavy use and irregular water supply, given the persistently weak infrastructure. RT may or may not be suitable</li> </ul>

# Institutional opportunity (2/3): Markets and transport hubs, though a complex segment, appear to have high need and low competition



Institution	Potential opportunities	Potential barriers
  <p><b>Public toilets in markets and transport hubs</b></p>	<ul style="list-style-type: none"> <li>• <b>Structure of transport hubs:</b> Transport hubs are largely informal (typically open plots of land with limited amenities) or in various stages of disrepair. City governments may allocate land for transport termini, but few formal transport hubs are built</li> <li>• <b>Private companies provide public toilet solutions:</b> <ul style="list-style-type: none"> <li>• Private long-distance bus companies occasionally partner with nearby businesses (e.g., gas stations, restaurants) for toilet access for passengers (e.g., Nairobi-Mombasa bus lines)</li> <li>• In both cities, the largest grocery retailers (e.g., Nakumatt, Tusky's, etc.) build and operate or sponsor private toilet blocks, run at a fee, on their grounds</li> <li>• Ikotoilets (run by Acumen Fund investee Ecotact) in Nairobi are one of the most well-known models, with locations in parks and commercial areas</li> <li>• These privately-run toilets serve market places and transport hubs and charge approximately USD 0.07-0.23 (PPP*) per use</li> </ul> </li> <li>• <b>Existing shortage of public toilets:</b> <ul style="list-style-type: none"> <li>• In Mombasa, 31 'official' public toilets serve about 600,000 people</li> <li>• In Nairobi, 150 'official' public toilets serve the central business district. That area would benefit from an additional 50, according to the East African newspaper</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Need for service-based model:</b> There is a commercial opportunity to provide toilets in public markets and transport hubs. However, this requires a service-based model (i.e., to have toilet operators, etc.)</li> <li>• <b>Low profitability:</b> Current public toilet blocks in Kenya struggle to reach profitability: at rates of USD 0.05/user on average, will require significant volumes to reach high revenues. Toilet operator/attendant salaries can account for upwards of 50% of monthly toilet block revenues when number of users is low</li> <li>• <b>Need for high density and possible cross-subsidy:</b> successful models in Kenya see higher profitability in high-density commercial areas and where toilet services can be supplemented with adjacent offerings (e.g., water, phone credit sales) and advertising</li> </ul>

Note: \*PPP: purchasing power parity

Source: Stakeholder interviews; Britam Asset Management; TravelMombasa; The East African;

Dyer and Blair – Real Estate Report; Dalberg analysis

# Institutional opportunity (3/3): Commercial retail spaces and healthcare institutions are promising but untested markets



## Institution

## Potential opportunities

## Potential barriers



Commercial retail spaces

- Nairobi has a “mall glut” with 53 malls completed or in construction as of the end of 2016, several of which operate below target occupancy (17% excess capacity in the sector) Despite this, Nairobi has 7 malls still in the pipeline, but mall construction may slow down beyond 2017
- Mombasa, in contrast, has significantly less formal retail space (9 in stock and 2 in the pipeline)
- Mombasa’s current stock relies disproportionately (5 of 9 malls) on anchor retailer “Nakumatt,” which is facing major financial challenges that, if unaddressed, may lead to a slow-down in expansion or nationwide closures
- Several malls are testing alternative septage solutions, such as bio-digesters

- **Impending slow-down:** The existing glut in availability of retail space may lead to a slowdown beyond 2017 and discourage expenditure on mall amenities
- **High-end preferences:** This segment may have restrictive customer preferences given high-income customer target and bias towards luxury finishings



Healthcare institutions

- There are approximately 650 and 250 health facilities in Nairobi and Mombasa, respectively, close to 10% of the health facilities nationally, according to a Kenyan Facility Master List
- At the national level, the majority (48%) of these facilities are publicly run. The rest are split between the private sector (38%) and FBOs, NGOs, etc. (14%). The share of privately-run facilities is likely much higher in Nairobi than nationally, though data are not available to confirm
- Surveys estimate that 42% of facilities nationally lack basic hygiene, and that another 2% have inadequate sanitation facilities
- The Gates Foundation could leverage its existing partnerships in the health care space to roll out the RT

- **Set design for health facilities:** The government has laid out a set design for new constructions. These typically involve WC connected to sewer lines. Stakeholders believe that the best value proposition is for rural institutions

# We evaluated each of the commercial/institutional segments on its propensity to adopt the Reinvented Toilet (1/2)



Commercial / Institutional segment	Propensity to adopt the RT				
	Needs new sanitation	Is a decision maker	Values the RT	Willing to maintain the RT	Able to afford the RT
<b>State-sponsored housing</b>	Both cities plan to build a significant number of new units (e.g., 30,000 in Mombasa alone)	The county govts have outsourced construction to commercial developers; they may have limited input	Depending on product economics, cost savings might be attractive, given the large scale of planned units	Tenants maintain their own units, not the state. Same factors would be applicable from residential analysis	Govt. pursues PPP set-up: they provide land and commercial builders build/make necessary decisions. Affordability unclear
<b>Educational institutions</b>	80% of public schools nationally have a shortage of 6 toilets per school	Purchasing decisions are heavily influenced by the Ministry of Education, which has limited resources	Schools have land to use fertilizer on; could benefit from biogas / electricity given severe resource constraints	Schools already maintain own sanitation facilities, albeit poorly. Willingness to maintain the RT unclear*	Unlikely to be able to afford, given cash constraints at school and Ministry level. Could raise private funds from various CSR, NGO and donor initiatives
<b>Public toilets in markets and transport hubs</b>	Nairobi and Mombasa both have a shortage of public toilets. Day-time population swells to 130% of night-time population	No clear single decision-maker, unlike the other segments. Numerous private and public toilet operators exist	Public toilet operators expressed interest in RT that sterilizes wastewater (which they can use to clean the toilets) and electricity	Existing operators show high willingness to maintain the RT as their business directly depends on it	Depends on whether STeP partners help build or replace existing toilets. Partnership with NGOs/donors/government could assist

\*To be validated, if necessary, in future interviews and research; \*\*Depends on product economics

Source: Stakeholder interviews; Dalberg analysis

# We evaluated each of the commercial/institutional segments on its propensity to adopt the Reinvented Toilet (2/2)



Commercial / Institutional segment	Propensity to adopt the RT				
	Needs new sanitation	Is a decision maker	Values the RT	Willing to maintain the RT	Able to afford the RT
<b>Commercial retail</b>	Despite a glut in retail space availability, there are several new malls planned for 2017, which will need septage solutions	Only a few developers manage these constructions; they have significant authority over design	The clientele at these malls is middle to high-income individuals, likely with high-end product interface preferences (i.e., white ceramic, automatic flush)	Malls tend to outsource maintenance to cleaning firms. This may lower the barrier to maintenance	Malls are likely to be able to afford the RT, given the scale of the construction investment
<b>Healthcare institutions</b>	Health facilities have a need for improved facilities, but this is difficult to quantify	Decision-making power unclear*	by-products may help to reduce water shortage at facilities. Institutions may have particular regulatory standards they need to abide by*	Unclear*	Donor agencies and governments fund housing programs and will likely be able to afford the RT**

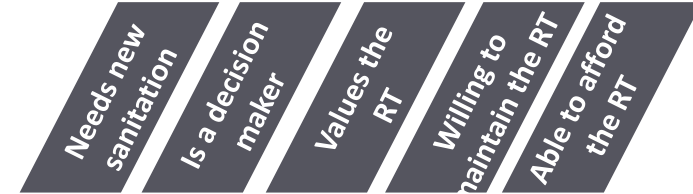
\*Unable to discern through stakeholder interviews \*\*Depends on product economics

Source: Stakeholder interviews; Dalberg analysis

# In our assessment, educational institutions and public toilets in markets /transport hubs appear to have the highest propensity to adopt

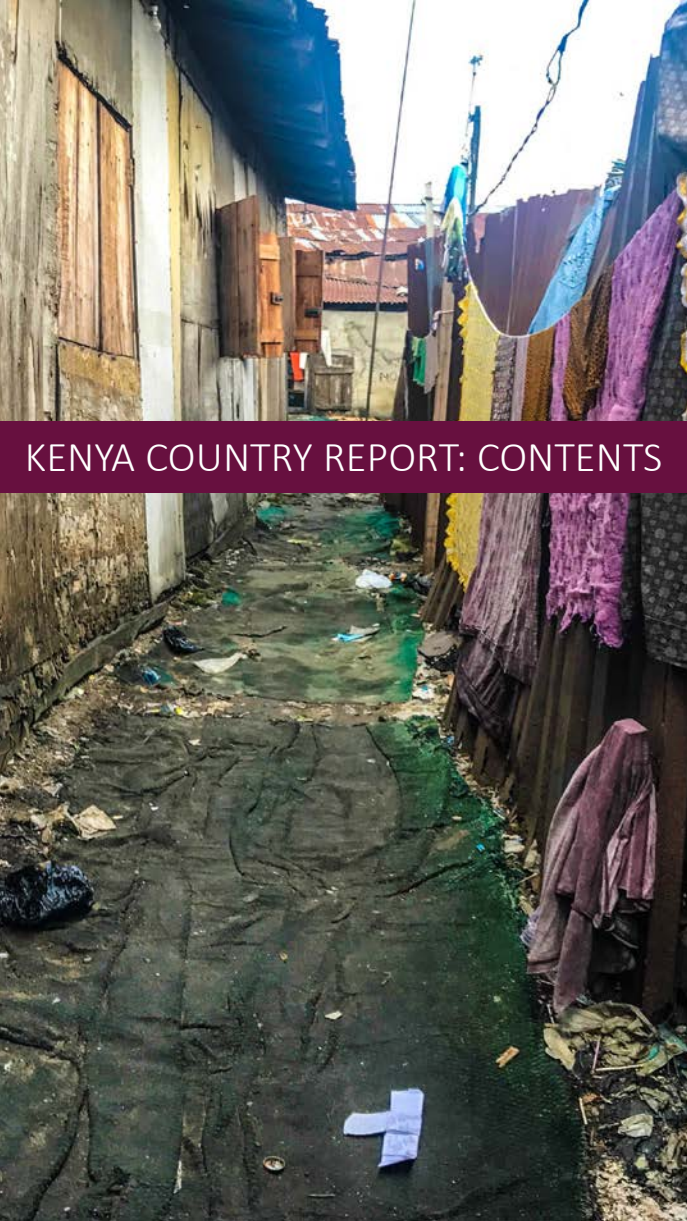


← Propensity to adopt the RT →



	Potential opportunity	Needs new sanitation	Is a decision maker	Values the RT	Willing to maintain the RT	Able to afford the RT
State-sponsored housing	Numerous programs to build new housing stock. Likely to work only for new builds, at start of PPPs or with universities	◐	●	◐	◑	◐
Educational institutions	High need, though schools' decision-making power is severely limited. Commercial opp. not demonstrated (typically donation-based)	●	◐	◐	◐	◑
Markets and transport hubs	Demonstrated opportunity and there are many existing private public toilet operators in markets. Public toilet operators keen to experiment with RT	◐	●	●	●	◐
Commercial retail	Several medium-to-large malls exist and a few more are being constructed. However, may have restrictive (luxury) customer preferences given high-income customer target	◑	●	◑	◑	●
Healthcare institutions	Few upcoming constructions in health facilities, though exact details are unknown. New private sector play in this segment is at small scale	◐	◐	◑	○	○

**We recommend educational institutions and markets and transport hubs as priority institutional segments in Kenya**



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# Educational institutions are a high-need sector which donors and corporate CSR initiatives frequently target



## Current challenges of educational institutions



**Inadequate sanitation infrastructure**

- Recap: Public schools are intended to have 1 toilet for every 25 girls, and 1 for every 30 boys. However, they lack the recommended number of toilets (estimated shortage of at least 6 toilets per school)



**Maintenance challenges**

- Existing toilets are commonly in serious state of disrepair, leading students to use bushes for their sanitation needs, to miss lessons as a result of long queues, or school entirely during menstruation. Furthermore, water shortages mean that: sewer-connected toilets operate poorly and are frequently clogged, requiring manual unclogging; students occasionally have no water to wash their hands, and amenities are unsuitable, especially for young female students



**Budgetary restrictions**

- When repairs are needed, schools may not have the resources necessary, especially as sanitation has received the least attention in monetary allocations by the government: Mombasa’s government allocated only USD 7/child for the 2016 school year, for example. When the government provides sanitation-specific funding, it tends to do so for select schools, not the entire county. The private and NGO sectors frequently step in to support

## Value proposition of the RT

- While schools need toilets, the RT itself cannot address the shortage challenge if schools are unaware of or cannot afford these toilets
- A robust RT supplemented with a service model that includes maintenance would help address the hygiene and maintenance challenges that plague schools. A Gates-funded 2016 study found that schools with toilets with a maintenance component were used 128% more frequently and remained cleaner than typical government-provided toilets (e.g., latrines and pour-flush) throughout the year
- The main value proposition that the RT offers to schools is in its by-products. Given that primary and secondary schools typically have large open land and farms where students help produce resources for the institution, the RT by-products may help boost the resources available to each school

## Educational institutions: Schools are heavily fragmented as a segment, but a few institutions could serve as high-leverage entry points



Institution	Details	Target location	Reach
Unilever	<ul style="list-style-type: none"> <li>Unilever has recognized that educating the youth on sanitation today may be good for business down the line: the FMCG company organizes a handwashing campaign targeting 100,000 children, introducing them to Unilever soap and the practice of hand washing, with the idea that the message will be passed on to their families</li> </ul>	Nairobi	<b>Current:</b> 80 schools <b>Planned:</b> Unknown
Videns Evides International (NGO)	<ul style="list-style-type: none"> <li>Videns Evides, a Dutch NGO, partnered with the Mombasa Ministry of Education and water service providers to build toilets in 97 schools in Mombasa. 13 schools have thus far received new sanitation facilities, but the program has run into a shortage of funds to continue its expansion</li> </ul>	Mombasa	<b>Current:</b> 13 schools <b>Planned:</b> 76 schools
Elimu Kwanza program in Mombasa	<ul style="list-style-type: none"> <li>This 12-year program, started in 2012, is a multi-ministry partnership aimed at boosting “dignified care” for Mombasa’s children. It will focus on protection and school feeding, sports and culture, pediatric health, school sanitation, and ‘green’ initiatives in schools. Under the school sanitation objective, it will build sanitation blocks in 35 county schools</li> </ul>	Mombasa	<b>Current:</b> 3 schools <b>Planned:</b> 32 schools
Tandem and Stark (Quantity surveyor firm)	<ul style="list-style-type: none"> <li>To address the severe bed-shortage in Kenya’s universities, five universities are part of a consortium to receive hostels to house 34,000 students – funded by the World Bank. The project is currently undergoing a feasibility study lead by Genesis Analytics, a South-Africa based consulting firm, alongside multiple local construction companies</li> </ul>	Kenya-wide	<b>Current:</b> None <b>Planned:</b> 34,000 beds (unclear number of units)
Bridge International Academies	<ul style="list-style-type: none"> <li>Bridge International Academies is the largest network of primary schools in Kenya, with over 400 facilities. As the school continues to expand and strives to meet the government’s school sanitation standards, there could be an opportunity to increase the number and quality of toilets per school in the network</li> </ul>	Kenya-wide	<b>Current:</b> 405 schools <b>Planned:</b> Unknown

# Educational institutions: Entering this market requires generating buy-in from several ministries in each county before piloting and scaling



## Steps

1

Secure the necessary approvals at the county level for Nairobi and Mombasa each

2

Select target school(s) to launch a pilot program

3

Establish partnership to scale to multiple schools

## Details

- Engage at the county level first, given decentralization. The process would look as follows:

- 1) Connect with the Teacher Service Commission to present the concept and generate initial buy-in and determine how to position the technology according to teacher input
- 2) Engage the School Management Board to validate the approach resulting from Step 1
- 3) Meet with the Department of Education in the county; together with the County Director, draft an MOU so that the county can engage
- 4) County govt will engage at the national level to lobby and request approval

- Ensure compliance with existing county-level initiatives. In Mombasa, this means aligning with the county's "Elimu Kwanza" program for its dignified care indicators
- Ideally, vet the schools selected with the government, as some may have been already shortlisted by the government

- Potential partners may include: NGOs, the Kenya Private School Association, private-sector CSR initiatives such as Unilever's "School of Five" campaign, in partnership with the Ministry of Education

### Risks:

- Unwillingness of government ministries to provide requisite approvals
- Inability to identify an aggregator for schools that can manage both financing and distribution at scale

### Mitigation:

- Align early with existing initiatives in Nairobi and Mombasa county each; aim first to help the government achieve its own objectives before rolling out to additional schools
- Consider a model whereby schools can receive RTs, with all installation costs paid, at partial or full subsidy, either through corporate or government initiatives to reduce affordability barriers

# Public toilets: Operators have high pressure to contain costs, given low price points per user; the RT by-products may help in that regard



## Challenges for public toilet operators

## Value proposition of the RT

### Financial sustainability

- **Low fee per user** – Fee per use has remained stable for over a decade. Toilets charge a maximum of USD 0.10, though in some areas the fee is as low as USD 0.03
- **Low profitability** – Unless companies offer add-on services, these fees may just cover operating and management costs but not allow full cost recovery (esp. for capex of building new toilets) or sizeable periodic maintenance

- RT by-products may help ensure a more consistent supply of electricity, reduce the costs for water, which can account for a significant share of operating costs, and offer additional revenue streams, (e.g., from biogas) to help boost sustainability

### Maintenance

- **Daily maintenance burden** – Maintaining public toilets is a daily, around-the-clock effort, as users' perceptions of cleanliness can make or break the number of users that a toilet might see. While some materials (toilet paper, soap) do not account for a major component of total operating costs, water does, depending on whether the toilets are pour or automatic flush and where the water is sourced (borehole vs. informal vendors vs. water trucks)

- If the RT is durable, it will be highly valued by operators. A strong business case for the RT might be one that demonstrates that medium-term maintenance costs also decrease relative to existing solutions

### User preferences

- **Customer experience** – Users place strong value on the customer experience: the look of the facility, the additional amenities, privacy and safety – all of which can increase costs for the operator. Some operators choose to operate only during the day to save on electricity costs, for example

- If the RT is durable and produces a by-product such as electricity or non-potable water, it could improve customer experience at public toilets

“The challenge is if the sewer blocks around three times in a week, the money we use to remove the [waste] is like [i.e., equal to] the money we have made in a week”

*Public toilet operator*

# Public toilets: There is an established market for privately-owned public toilets; however financial viability rests on high volumes and low costs



## Illustration of success drivers and costs for public toilets in Kenya

### Drivers of success

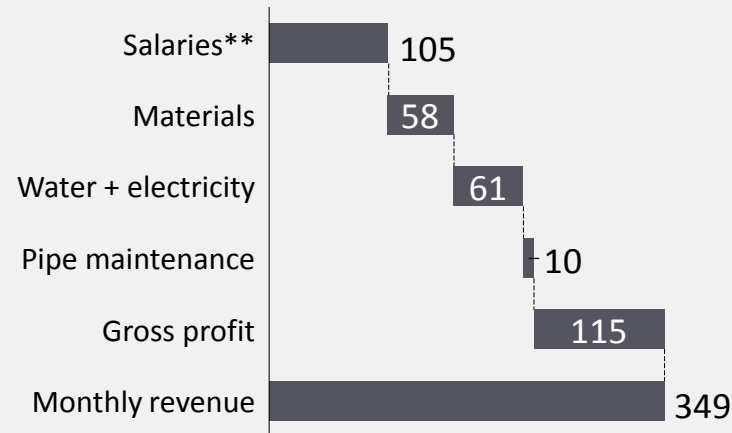
<b>Location</b>	<b>Public markets see high traffic of 200-500 users per day for 4-8 cubicles.</b> However, toilets in residential areas may see as few as 50 users per day
<b>Affordability</b>	<b>Usage drops when fee per use exceeds USD 0.10.</b> Many toilets – especially in less commercial areas – charge USD 0.03-0.05, which can negatively impact profitability
<b>Add-on services</b>	<b>To boost profitability, several players offer add-on B2B or B2C services</b> such as: advertising space, water, phone credit, etc.
<b>Cost containment</b>	<b>Utilities costs can significantly erode the operating margin.</b> This is especially true for toilets linked to sewer lines, as they require higher per-capita water use
<b>Maintenance</b>	<b>Cleanliness is a major driver of adoption for public toilet users.</b> Toilets that lack cleaning attendants are more likely to lose customers, as they are more likely to fall into disrepair

**CAPEX\*: USD 14,000**

*\*for 4 cubicles (2 per gender; linked to sewer line)*

### Breakdown of direct costs and gross profit

USD, 2017



**Revenue: USD 349; gross profit: USD 115**  
 (Avg. fee per use: USD 0.075) x (users per day: 200) x  
 (active days per month: 24)

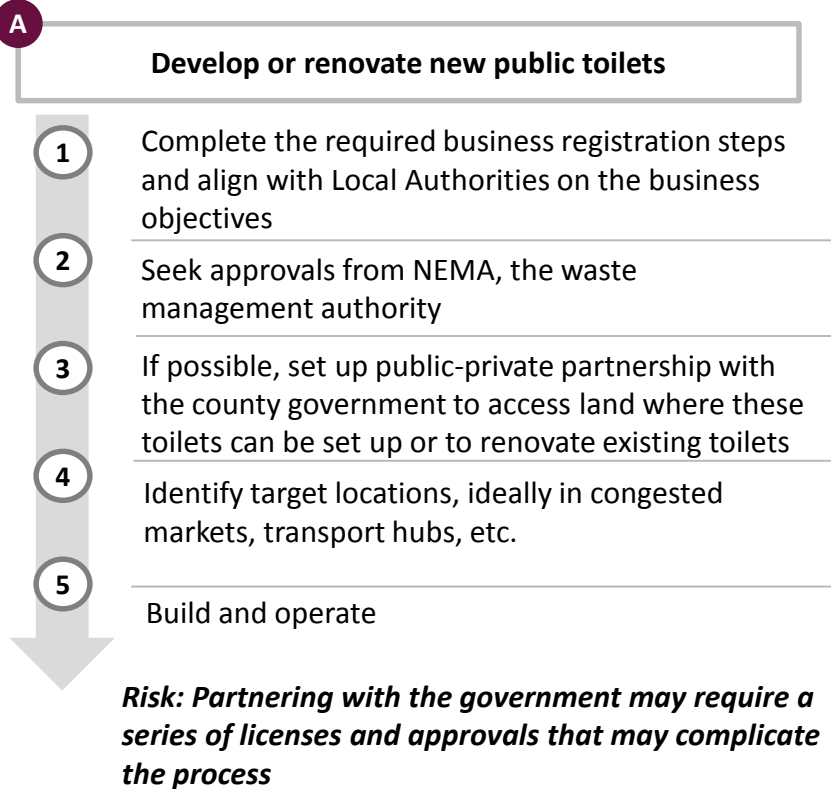
Note: \*The capex is estimated based on average of [USD ~3,500 per toilet](#); \*\*Salaries are those of the operator and cleaner.

Many toilets operate through partnerships with the government; they are unlikely to pay rent, though there may be incidental fees that could bring down the operating profit. Source: Stakeholder interviews; Dalberg analysis

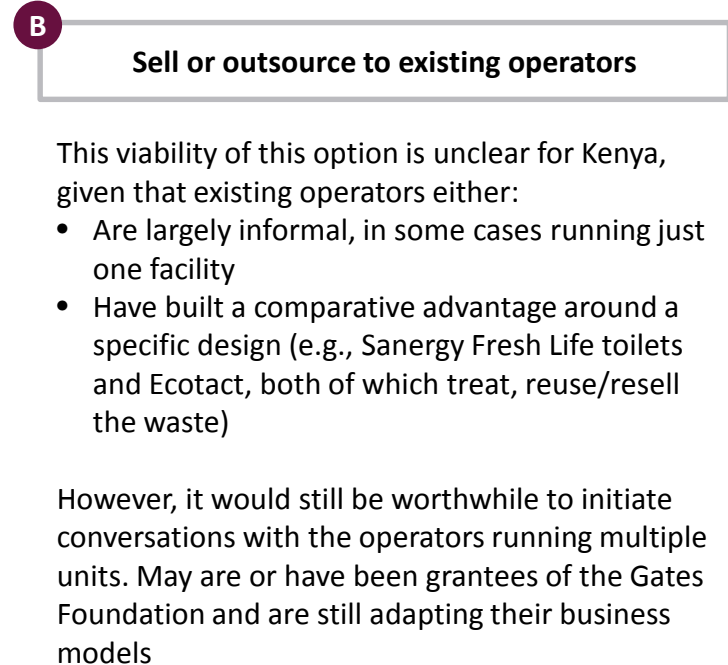
# Public toilets: The commercial partners could either set up their own public toilet operations or supply existing operators with the RT



**Direct play** – Enter the market as a public toilet operator and secure site and approval for new technology, as shown in Option A



**Indirect play** – Enter the market by supplying existing operators



**Barring an available existing operator, developing new or renovating existing public toilets would be the fastest path to market**



## KENYA COUNTRY REPORT: CONTENTS

- Kenya sanitation landscape: stakeholders, challenges and opportunities
- Residential market: priority segments and go-to-market approach
- Institutional market: priority segments and go-to-market approach
- **Conclusion: Recommended paths to market entry**
- Annex

# Summary: Recommended paths to market-entry for Kenya

Putting the recommendations across the four priority segments together, there are three potential paths to market for Kenya – two commercial and one non-commercial:

## **Path 1: Demonstrate in public toilets to prove the concept to low-income existing residential segments**

### 1. Launch public toilets in various areas

Launch MURTs in public toilets in markets, schools and low-income neighborhoods to demonstrate the concept

### 2. Target households by saturating a neighborhood

Depending on market feedback, launch more communal MURTs and SURTs / household-level products using a neighborhood-saturation approach

The demonstration effect works only for existing low-income residential constructions and is unlikely to spill over to new constructions, as housing developers do not take market cues from the public toilets sector

## **Path 2: Validate the concept with a target developer and scale to other residential developers directly**

### 1. Validate and demonstrate the value proposition

### 2. Pilot with a housing developer

### 3. Market to other developers and to the industry

Dependent on validation of the business case with low-income housing developers (i.e., cost savings and match to customer preferences), pilot with a selected housing developer, market the results of the demonstration project to other developers, architects and surveyors and bring product to scale

## **Path 3: Take over GIZ's "Upscaling Basic Sanitation for the Urban Poor" program ending in 2018**

This program, implemented by the German development agency and partly funded by the Bill and Melinda Gates Foundation, is ending as of December 2018 as the primary partners shift sector priorities. While a non-commercial option, taking over the programme would allow STeP partners to leverage existing, strong relationships with key water and sanitation players all over the country – not just Nairobi and Mombasa – and build upon an 8,000-household scale

# Path to market (1): Operate or renovate highly visible public toilets to prove the concept and capture the more attractive market for MURTs



## Demonstration through public toilets or schools...

### PUBLIC TOILETS

*Either through direct or indirect play*



#### Rationale:

- Commercial partners would have the opportunity to test and refine the concept with less reputational risk
- The segment is highly fragmented and has low competition
- The bar for success is low, given that the main value proposition is around cleanliness and maintenance

### EDUCATIONAL INSTITUTIONS



#### Rationale:

- Commercial partners would have the opportunity to test and refine the concept in a segment that is a priority segment for many NGOs
- Schools have high footfalls and will serve as a reputable demonstration site within communities

...proving concept to existing low-income residential segment

“We need to see it to believe it”



**While this recommendation may be true for low-income existing residential segments, it would not necessarily hold for new constructions, as housing developers are unlikely to take market cues from the public toilets sector**

# Path to market (2): Validate the concept with and serve new residential constructions directly

RECAP

Aim to show a clear business case for the RT and respond to their biases towards high-end fixtures

## 1. Validate and demonstrate the value proposition

## 2. Pilot with a housing developer

## 3. Market to other developers and to the industry

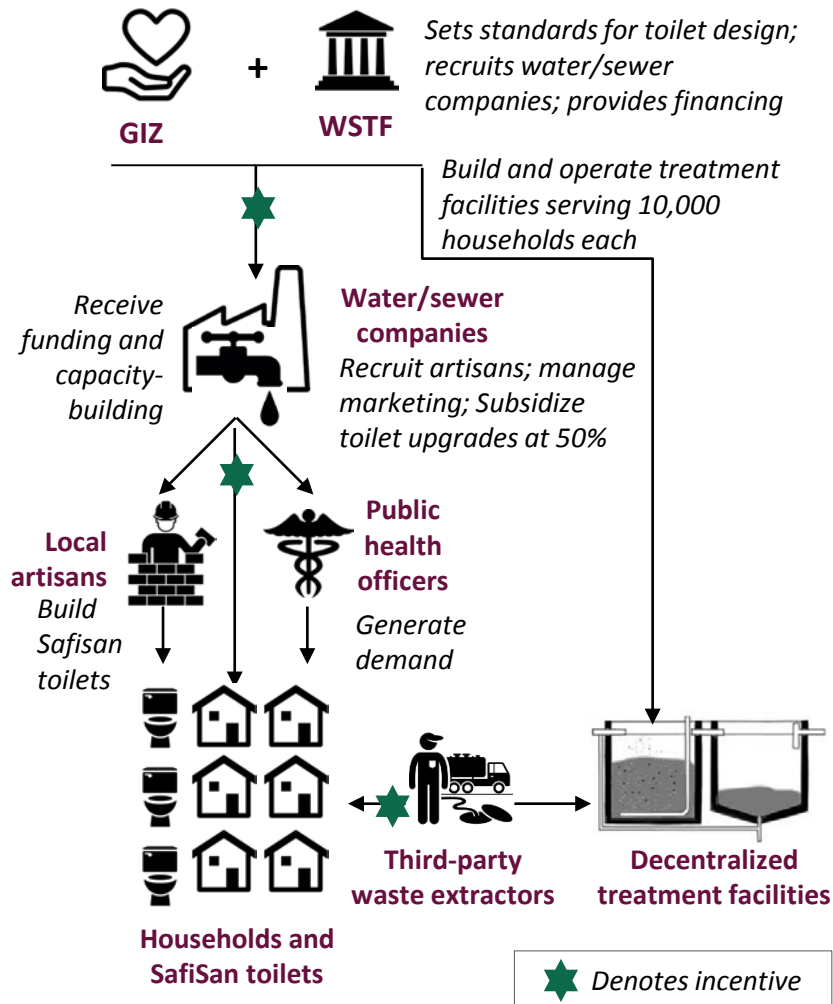
### Description and Key Partners

- Demonstrate that implementing the RT can lead to attractive-enough cost savings for developers by reducing spend on extraction. For this it may help to speak directly to a few housing developers to model out what cost savings might be possible with the RT and to validate the assumptions
- Map out how the RT can be integrated into the existing construction process, with the view to addressing legal and engineering constraints. Consult with the **National Construction Authority**, as well as the **Engineers Board of Kenya for input**
- Source and establish partnership with developers to integrate RT into design and architecture plans. This can be done via professional bodies, such as the **Institute of Quantity Surveyors of Kenya and the Kenya Architects Association**
- During pilot ensure that the benefits promised are realized (i.e., cost savings) and trade-offs minimized (e.g., smell, compliance challenges, etc.)
- If successful, market the RT to other developers through the **Kenya Architects Association** as well as the **Engineers Board of Kenya** using the pilot developer as a case study

# Path to market (3): Take over the GIZ program, which has established links to utilities companies and trained artisans



## Overview of GIZ UBSUP\* Program

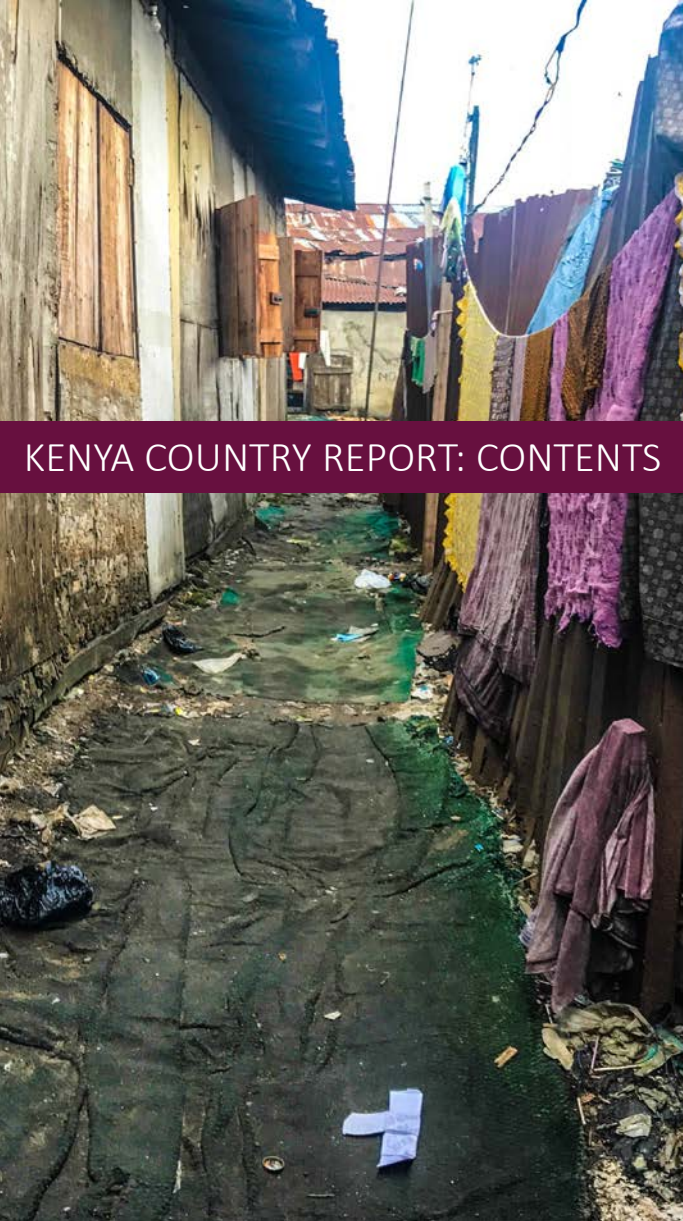


## Successes and lessons learned

- **Engaging with water and sewer services providers:** The program has successfully engaged with over 60% of the water services providers (WSP) throughout Kenya through tenders. Turnout during its first phase exceeded expectations
- **Providing the right incentives:** It has successfully aligned program and WSP objectives: by increasing the number of HH linked to the sewer line, the UBSUP program is effectively boosting the number of customers for these WSPs (in addition to providing capacity-building and other admin. funding)
- **Adapting the mix of toilet types to demand:** The program eliminated pre-fabricated separation toilets from its portfolio for: lack of demand, difficulty maintaining in the long run, and costs to transport
- **Engaging with local artisans:** The program has worked with artisans all over Kenya, recruited by the WSPs, to build 8,000 toilets according to specific design requirements (only upon verification can the HH subsidy be disbursed)

Note: \*Upscaling Basic Sanitation for the Urban Poor; WSTF: Kenya Water Services Trust Fund

Source: Water Services Regulatory Board – 2016 Impact Report; stakeholder interviews; Dalberg analysis



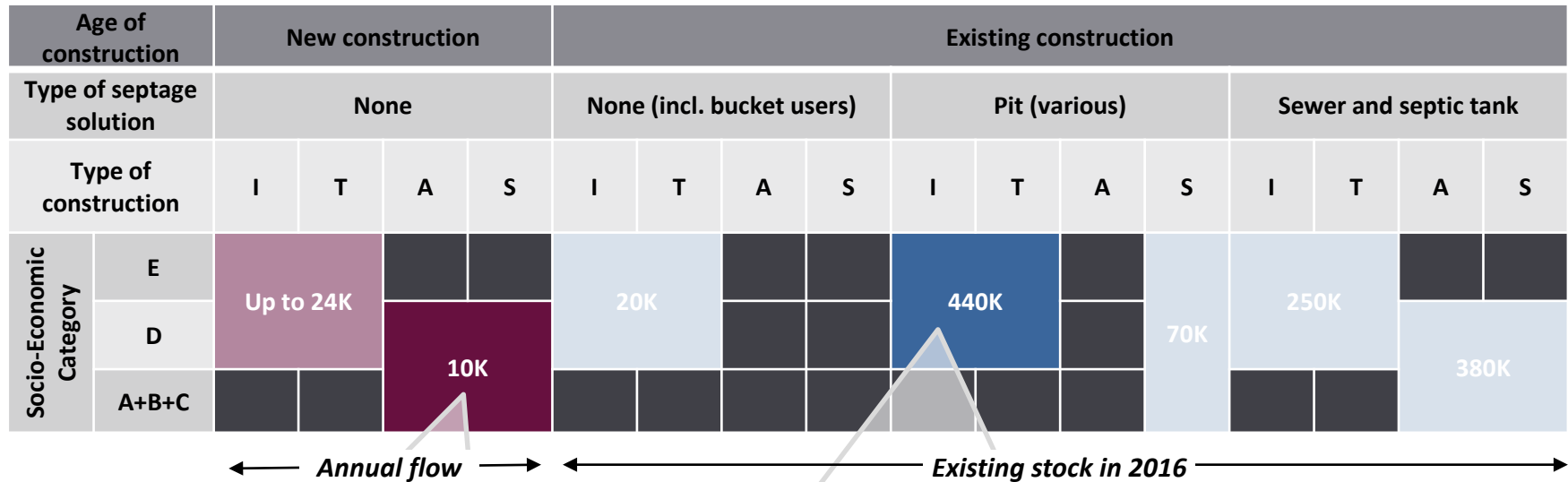
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# Of the many residential segments in Nairobi and Mombasa, we estimated the market size of two priority segments



*Segmentation framework and size of residential segments in Nairobi and Mombasa*



### Priority segment in Nairobi

#### *New formal construction*

- The total segment size of new formal construction taking place annually in Nairobi is 10,000 households (90% of which are apartments)
- At 12% annual growth rate, this amounts to 61,000 additional units built over a 5 years
- The latent market for this segment over 5 years is **2,800 MURT units and 5,000 SURT units**

\* Data for Mombasa are unavailable

### Priority segment in Nairobi and Mombasa

#### *Existing construction - Informal building and tenement dwellers accessing pit latrines*

- The total segment size of households in informal buildings and tenements using pit latrines is 316,450 and 123,497 households in Nairobi and Mombasa, respectively. This segment forms 38% of all existing households
- The latent market within this segment is 280,000 and 52,000 households in Nairobi and Mombasa respectively
- The addressable market for this segment, after accounting for space constraints, propensity to adopt the RT, and income levels is **3,500-7,500 SURTs and 4,000-12,000 MURTS ± 40%**, depending on product pricing

# Annex: Nairobi residential market sizing methodology (1/2)



Age of construction		Unbuilt/New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pit (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E	<b>FLOW</b> Total HH/units of formal new builds per annum = 10,000 + estimated HH of informal build = 24,000				<b>STOCK</b> Total HH with no sanitation = 9,052				<b>STOCK</b> Total HH with pit sanitation = 343,967				<b>STOCK</b> Total HH with access to sewer and septic tank = 552,157			
	D																
	A+B+C																

### Source: KNBS 2017

For formal HH: we used the number of approved residential units for 2016 (8,623) and the CAGR (12%) for the last 5 years + a buffer for the boost in construction as a result of the latest land regulations to get an annual flow

For informal, apply the 4.2% urbanization growth rate to the number of Nairobi HH in informal settlements (550,000HH). This is an upper-limit, high overestimate.

*Confidence in calculation: low; difficult to triangulate estimates*

### Source: KNBS 2013; DHS 2014; EIU CANBACK 2016

We applied % access to different types of septage solutions to total 905,000 HH in Nairobi to calculate no of HH in each category:

- 1% have no septage solution (including bucket)
- 38% use different types of pits as a septage solution
- 61% use sewer and septic tanks

*Confidence in calculation: high, % triangulated with census (2009)*

# Annex: Nairobi residential market sizing methodology (2/2)



Age of construction		Unbuilt/New				Existing												
Type of septage solution		None				None (incl. bucket users)				Pit (various)				Sewer and septic tank				
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S	
Socio-Economic Category	E	Up to 24K								316K					212K			
	D			9.1K	0.9K	9K							28K	213K				
	A+B+C															126K		

**Source: HassConsult Report 2013; Ministry of Lands – Kenya National Housing Survey 2012**

For formal, apply the following % to the total 10K HH of new builds:

- 91% of new buildings are formal apartments
- 9% are standalone houses

For informal, apply the 4.2% urbanization growth rate to the number of Nairobi HH in informal settlements (550,000HH). High overestimate.

*Confidence in calculation: medium; have not been able to triangulate with another source for informal*

**Assume all 9,000 HH who have no sanitation access live in informal housing**

*Confidence in calculation: medium; have not been able to triangulate with another source*

**Source: DHS 2014; EIU Canback 2016**

Apply the following % to the total 343,967 HH that have pit septage solution:

- 0% of houses with pit latrines are apartments (in Nairobi)
- 92% of HH that access pit latrines share toilets. Assuming that those who share toilets live in informal settlements and tenements, we apply 92% to the total sample = 316,450 HH

*Confidence in calculation: medium; shared toilet use is an imperfect proxy for type of construction, there could be apartments and stand alone houses in SEC D with shared facilities*

**Source: DHS 2014; Ministry of Lands – Kenya National Housing Survey 2012; EIU Canback 2016**

Apply the following % to the total 535,911 HH that access sewers or septic tanks:

- Of all HH that have sewer or septic tank access, 38.49% HH share toilets and 61.51% do not (DHS 2014)
- SEC A+B+C is 126,000 HH (EIU Canback)

*Confidence in calculation: medium; shared toilet use is an imperfect proxy for type of construction, there could be apartments and stand alone houses in SEC D with shared facilities*

# A total of ~22,000 homeowners in priority segments in Nairobi could be latent markets for SURTs and MURTs, depending on product economics



There are a total of 316,450 households in informal buildings and tenements that access pit latrines in Nairobi, and they can be split into homeowners and tenants. For homeowners, the addressable market is:

## 1. Segment size of homeowners in informal shanties and tenements with pit latrines

Of the 316,450 households in this segment, 7% are homeowners\*  
= 22,151 HH

### 2a. % of sub-segment (1) that does not own a toilet\*\*

60% of sub-segment (1)  
= 13,290 HH

### 2b. % of sub-segment (1) that owns a toilet\*\*

40% of sub segment (1)  
= 8,861 HH

### 3a. % of sub-segment (2a) that does not have space for a toilet\*\*

69% of sub segment (2a)  
= 9,170 HH

### 3b. % of sub-segment (2a) that has space for a toilet\*\*

31% of sub segment (2a)  
= 4,119 HH

### 4. % of sub-segment (2b) that excavates their latrine (and will therefore value the RT)\*\*

100% of sub segment (3b)  
= 8,861 HH

### 5a. % of sub-segment (4) that shares their toilet\*\*

94% of sub segment (3b)  
= 8,307 HH

### 5b. % of sub-segment (4) that does not share their toilet\*\*

6% of sub segment (3b)  
= 554 HH

## Latent market of homeowner HH (MURT)

= 17,477 HH  $\pm$  20%

## Latent market of homeowner HH (SURT)

= 4,673 HH  $\pm$  20%

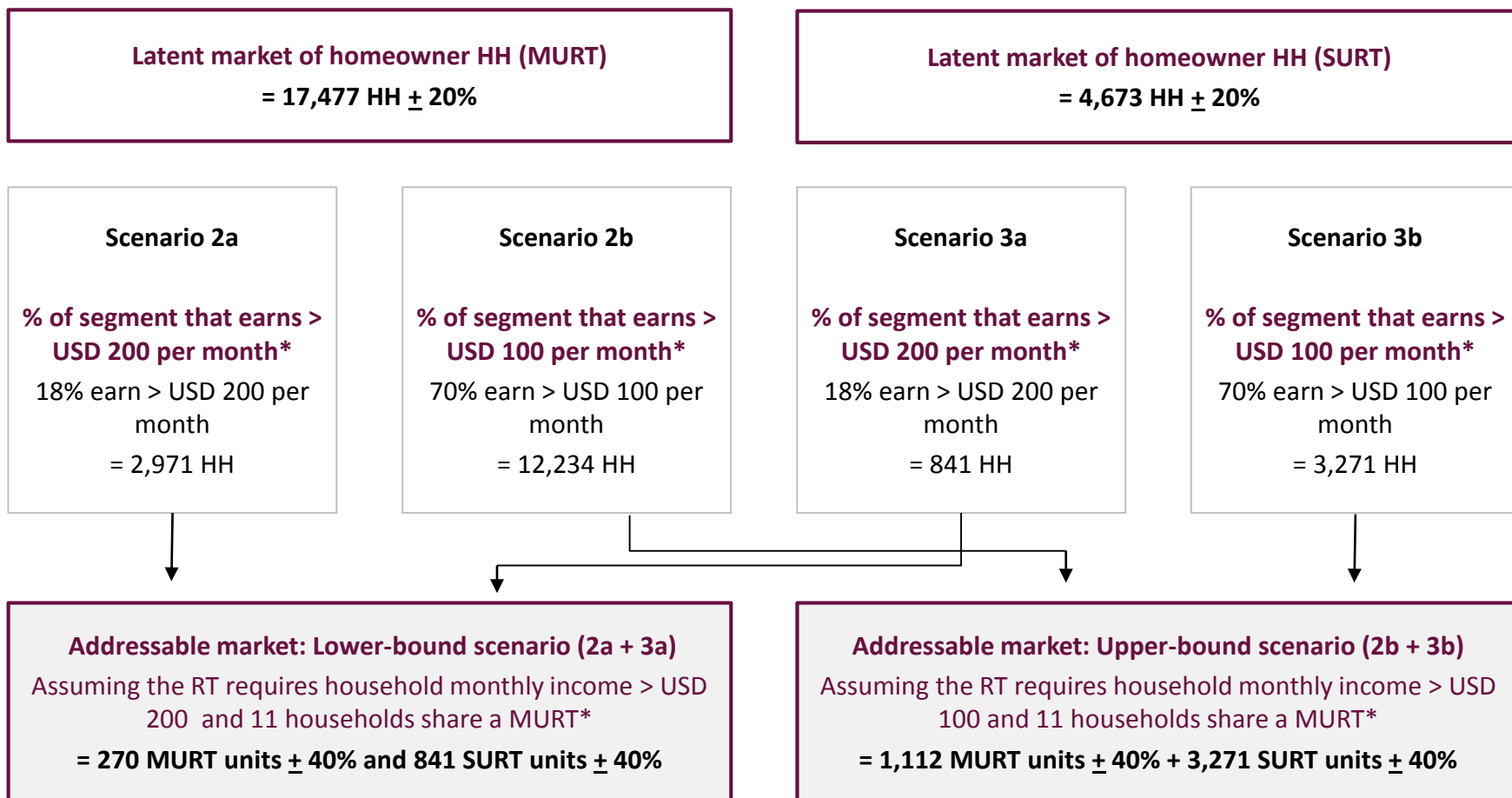
Note: margin of error gets larger as you moved down the steps because of the decrease in sample size

Source: \*DHS (2014);\*\*Assumptions and values based on survey data of 81 homeowners

# The addressable market size for homeowners in priority segments in Nairobi is 250 –1300 MURTs and 700– 3800 SURTs



Homeowners' ability to pay for the RT may restrict the total addressable market for MURTs and SURTs



\*Note: margin of error gets larger as you move down the steps because of the decrease in sample size  
Assumptions and data based on survey of 81 homeowners

# The addressable market size for tenants in priority segments in Nairobi is 2,500 – 11,000 MURTs, depending on product pricing



There are a total of 316,450 households in informal buildings and tenements that access pit latrines in Nairobi, and they can be split into homeowners and tenants. For tenants, the addressable market is:

## 1. Segment size of tenants in informal shanties and tenements with pit latrines

Of the 316,450 households, 93% are tenants  
= 294,298 HH

## 2. % that excavates the latrine more than once every 2 years (i.e., landlord will value the RT)\*

92% of sampled tenants and landlords in Nairobi report that the latrine is excavated more than once every 2 years  
= 269,430 HH

### Scenario 3a

% of sub-segment (2) that earns > USD 200 per month\*  
(assuming landlord will pass some cost on to the tenant)

13% earn > USD 200 per month  
= 35,026 HH



### Addressable market: Lower-bound scenario

Assuming the RT requires household monthly income > USD 200; tenants will partially pay for RT and 11 households

share a MURT

= 3,184 MURT units ± 40%

### Scenario 3b

% of sub-segment (2) that earns > USD 100 per month\*  
(assuming landlord will pass some cost on to the tenant)

37% earn > USD 100 per month  
= 99,689 HH



### Addressable market: Upper-bound scenario

Assuming the RT requires household monthly income > USD 100; tenants will partially pay for RT and 11 households

share a MURT

= 9,063 MURT units ± 40%

Note: margin of error gets larger as you move down the steps because of the decrease in sample size

Source: \*Assumptions and values based on survey data of 81 homeowners

# Combining homeowner and tenant markets in the priority segments in Nairobi, the addressable market for MURTs is larger than SURTs



## Homeowners in priority segments

Assuming the RT requires household monthly income > USD 200 and 11 households share a MURT

**270 MURT units ± 40%**

**841 SURT units ± 40%**

Assuming the RT requires household monthly income > USD 100 and 11 households share a MURT

**1,112 MURT units ± 40%**

**3,271 SURT units ± 40%**

## Tenants in priority segments

Assuming the RT requires household monthly income > USD 200; tenants will partially pay for RT and 11 households share a MURT

**3,184 MURT units ± 40%**

Assuming the RT requires household monthly income > USD 100; tenants will partially pay for RT and 11 households share a MURT

**9,063 MURT units ± 40%**

**Lower-bound scenario**

=

**~3,500 MURTs**

**~850 SURTs**

**± 40%**

**Upper-bound scenario**

=

**~ 10,000 MURTs**

**~3,500 SURTs**

**± 40%**

**Making the RT affordable to those who earn USD 100 per month increases the market for SURTs four-fold and increases it three-fold for MURTs**

# Annex: Mombasa residential market sizing methodology (1/2)



Age of construction		Unbuilt/New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pit (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E	<b>FLOW</b> Formal HH = Unknown, less than 10,000 HH annual flow Informal HH = 4500 HH annual flow				Total HH with no sanitation = 10,156				<b>STOCK</b> Total HH with pit sanitation = 167,575				Total HH with access to sewer and septic tank = 76,171			
	D																
	A+B+C																

### World Bank 2017

For apartments + standalones: We estimate that the number of new units is less than 10,000 – i.e., fewer than in Nairobi. During Phase 3, we will interview formal housing developers in Mombasa

For informal, apply the 4.2% urbanization growth rate to the number of Mombasa inhabitants living informal settlements (0.7M). Then, divide the balance by the average HH size (4.5) to get an annual 4500 HH flow of informal HH

*Confidence in calculation: Low*

### Source: KNBS (2013); DHS (2014); EIU CANBACK (2016)

We applied % access to different types of septage solutions to total 254,000 HH in Mombasa to calculate no. of HH in each category:

- 4% have no septage solution (including bucket)
- 66% use different types of pits as a septage solution
- 30% use sewer and septic tanks

*Confidence in calculation: high, % triangulated with Census (2009)*

# Annex: Mombasa residential market sizing methodology (2/2)



Age of construction		Unbuilt/New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pits (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E	Up to 6.5K	Collectively fewer than 10,000 households	10K	124K	40K	35K	40k									
	D																
	A+B+C																

### World Bank 2017

For informal, apply the 4.2% urbanization growth rate to the number of Mombasa inhabitants living in informal settlements (0.7M). Then, divide the balance by the average HH size (4.5)

For apartments + standalones: We estimate that the number of new units is less than 10,000 – i.e., fewer than in Nairobi. During Phase 3, we will interview formal housing developers in Mombasa

*Confidence in calculation: Low*

Assume that **100% of the 10,000 HH who have no sanitation access live in informal housing.**

*Confidence in calculation: medium; have not been able to triangulate with another source*

### Source: KNBS 2013; DHS 2014; EIU Canback 2016

Apply the following % to the total 168,000 HH that have pit septage solution:

- 0% of houses with pit latrines are apartments (given regulations)
- 76% HH with pits use a shared toilets and 24% have their own pit toilets (DHS 2014). Assume (i) those who live in informal settlements and tenements use shared toilets, and (ii) SEC D income standalone HH use single HH toilets → to calculate HH in each segment

*Confidence in calculation: medium; shared toilet use is an imperfect proxy for type of construction*

### Source: DHS 2014; EIU Canback 2016

Apply the following % to the total 76,000 HH that access sewers or septic tanks:

- 46% HH with pits use a shared toilets and 54% have their own pit toilets (DHS 2014). Assume (i) those who live in informal settlements and tenements use shared toilets, and (ii) SEC D income standalone HH use single HH toilets → to calculate HH in each segment

*Confidence in calculation: medium; we use bathroom sharing as a proxy for informal settlements + tenements vs. apartments and standalone houses*

# A total of ~17,000 homeowners in priority segments in Mombasa could be a latent market for SURTs and MURTs



There are a total of 123,497 households in informal buildings and tenements that access pit latrines in Nairobi, and they can be split into homeowners and tenants. For homeowners, the addressable market is:

## 1. Segment size of homeowners in informal shanties and tenements with pit latrines

Of the 123,497 households within this segment, 27% are homeowners\*  
= 33,344 HH

### 2a. % of sub-segment (1) that does not own a toilet\*\*

3% of sub-segment (1)  
= 1,000 HH

### 2b. % of sub-segment (1) that owns a toilet\*\*

97% of sub segment (1)  
=32,344 HH

### 3a. % of sub-segment (2a) that does not have space for a toilet\*\*

100% of sub segment (2a)  
= 1,000 HH

### 3b. % of sub-segment (2a) that has space for a toilet\*\*

0% of sub segment (2a)

### 4. % of sub-segment (2b) that excavates their latrine (and will therefore value the RT)\*\*

50% of sub segment (3b)  
= 16,172 HH

### 5a. % of sub-segment (4) that shares their toilet\*\*

55% of sub segment (3b)  
= 8,895 HH

### 5b. % of sub-segment (4) that does not share their toilet\*\*

45% of sub segment (3b)  
= 7,277 HH

## Latent market of homeowner HH (MURT)

= 9,985 HH  $\pm$  40%

## Latent market of homeowner HH (SURT)

= 7,277 HH  $\pm$  40%

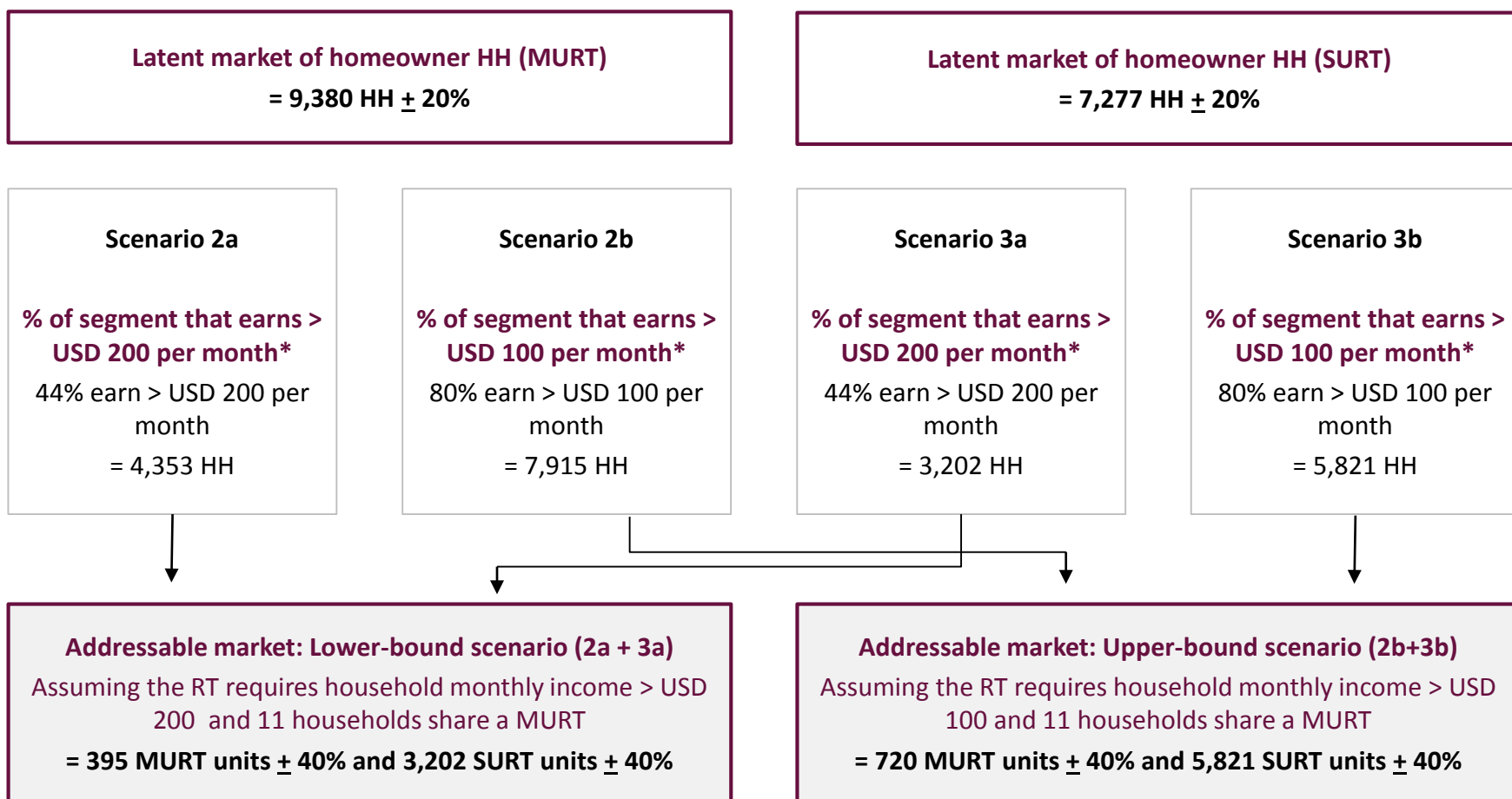
Note: Margin of error gets larger as you move down the steps because of the decrease in sample size

Source: \*DHS (2014);\*\*Assumptions and values based on survey data of 81 homeowners

# The addressable market size for homeowners in priority segments in Mombasa is 300–1,000 MURTs and 2,000 – 8,000 SURTs



Homeowners' ability to pay for the RT may restrict the total addressable market for MURTs and SURTs



Note: Margin of error gets larger as you move down the steps because of the decrease in sample size

Source: \*Data based on survey data of 81 homeowners

# The addressable market size for tenants in priority segments in Mombasa is 200 – 1400 MURTs, depending on product pricing



There are a total of 316,450 households in informal buildings and tenements that access pit latrines in Nairobi, and they can be split into homeowners and tenants. For tenants, the addressable market is:

## 1. Segment size of tenants in informal shanties and tenements with pit latrines

Of the 123,497 households within this segment, 73% are tenants  
= 90,153 HH

## 2. % that excavates the latrine more than once every 2 years (i.e., landlord will value the RT)\*

39% of sampled tenants and landlords in Mombasa report that the latrine is excavated more than once every 2 years  
= 34,709 HH

### Scenario 3a

**% of sub-segment (2) that earns > USD 200 per month\***  
(assuming landlord will pass some cost on to the tenant)

7% earn > USD 200 per month  
= 2,430 HH



### Addressable market: Lower-bound scenario

Assuming the RT requires household monthly income > USD 200; tenants will partially pay for RT and 11 households

share a MURT

= 221 MURT units  $\pm$  40%

### Scenario 3b

**% of sub-segment (2) that earns > USD 100 per month\***  
(assuming landlord will pass some cost on to the tenant)

30% earn > USD 100 per month  
= 10,413 HH



### Addressable market: Upper-bound scenario

Assuming the RT requires household monthly income > USD 100; tenants will partially pay for RT and 11 households

share a MURT

= 947 MURT units  $\pm$  40%

Note: Margin of error gets larger as you move down the steps because of the decrease in sample size

Source: \*Assumptions and values based on survey data of 81 homeowners

# Combining homeowner and tenant markets in the priority segments in Mombasa, the addressable market for SURTs is greater than MURTs



## Homeowners in priority segments

**Lower-bound scenario**

=

**~600 MURTs  
~2,500 SURTs  
± 40%**

Assuming the RT requires household monthly income > USD 200 and 11 households share a MURT

**395 MURT units ± 40%  
3,202 SURT units ± 40%**

**Upper-bound scenario**

=

**~1,700 MURTs  
~6,000 SURTs  
± 40%**

Assuming the RT requires household monthly income > USD 100 and 11 households share a MURT

**720 MURT units ± 40%  
5,821 SURT units ± 40%**

## Tenants in priority segments

Assuming the RT requires household monthly income > USD 200; tenants will partially pay for RT and 11 households share a MURT

**221 MURT units ± 40%**

Assuming the RT requires household monthly income > USD 100; tenants will partially pay for RT and 11 households share a MURT

**947 MURT units ± 40%**

**Making the RT affordable to those who earn USD 100 per month doubles the addressable market for both SURTs and MURTs**

# Summary: In Kenya, Nairobi presents a relatively attractive test market for MURTs and Mombasa for SURTs (for the priority segments)

Lower and upper bound addressable market for informal shanties and tenements with pit latrines

Implications

Nairobi	Mombasa
<b>Lower-bound scenario</b>  ~3,500 MURTs ~850 SURTs ± 40%	<b>Lower-bound scenario</b>  ~600 MURTs ~2,500 SURTs ± 40%
<b>Upper-bound scenario</b>  ~ 10,000 MURTs ~3,500 SURTs ± 40%	<b>Upper-bound scenario</b>  ~1,700 MURTs ~6,000 SURTs ± 40%

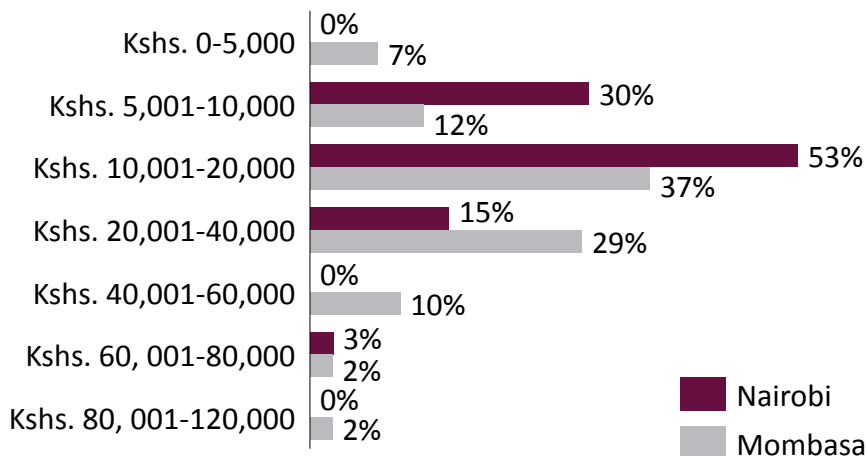
- The addressable market for MURTs is similar in both Mombasa and Nairobi, given the large number of renters using shared facilities in both cities
- The addressable market for SURTs in Mombasa is larger than in Nairobi because homeowners tend to have more space in their homes
- If the RT is priced so that it is affordable to a household with a monthly income of USD 100, the addressable market for both SURTs and MURTs will double in Mombasa and triple in Nairobi

It is important to note that this is the addressable market for the priority segments only. The addressable market for all segments in Nairobi and Mombasa will be much larger

# Kenya: Surveyed homeowners in target segments earn between USD 50 and 400 per month and some are able to access credit

88% of the homeowners surveyed in Kenya have a monthly income between USD 50 and 400

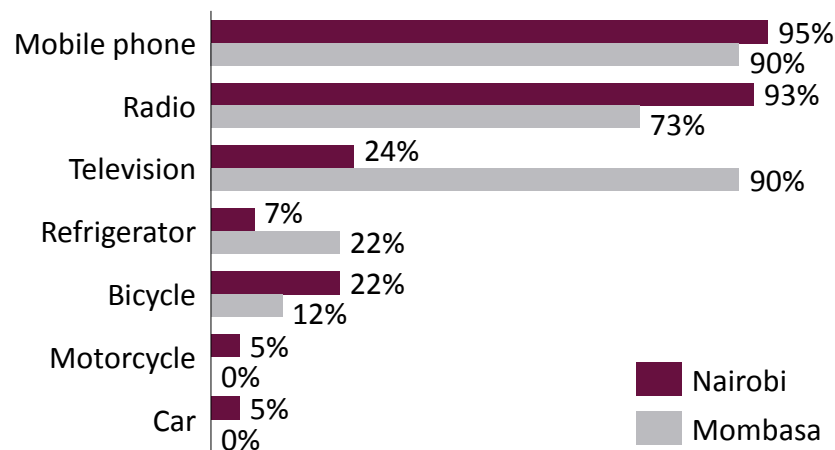
Income distribution (homeowners)



- Sampled tenants had lower income levels than homeowners; 80% of tenants have a monthly income in between USD 50 and 200
- Average monthly rent in Lagos and Abuja is NGN 3700 (USD 10) (Range: NGN 2,000-12,000 (USD 6-33)) and includes partial payment of utilities

Homeowners and tenants in Kenya are able to purchase assets and have access to credit through banks, savings groups, and mobile money

Ownership of assets (homeowners)



- 92% of the television owners also purchased this asset outright with cash
- 53% and 37% of surveyed homeowners in Nairobi and Mombasa, respectively, have access to bank accounts
- 90% and 54% of surveyed homeowners in Nairobi and Mombasa, respectively, have access to credit through banks, savings groups and mobile money

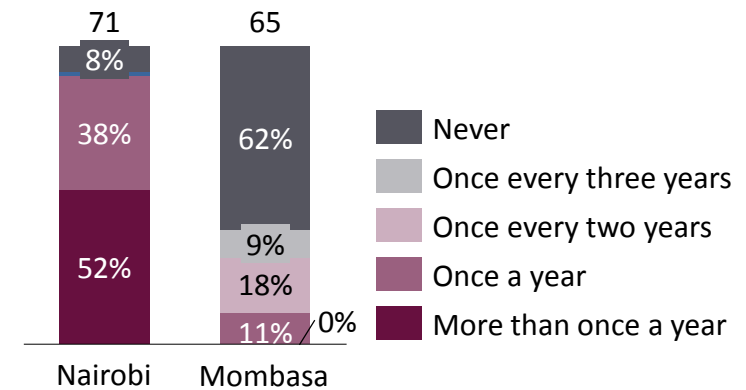
# Kenya: Most landlords do not include utilities in rent but they do pay for excavation of pit latrines, which takes place at varying intervals

Majority of surveyed landlords lived in the same plot as their tenants, do not pay for utilities but do pay for excavation

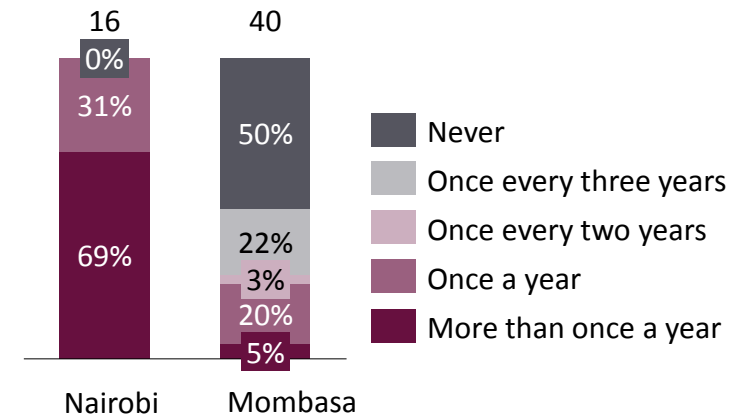
- 60% of the surveyed landlords in Nairobi and 90% of landlords in Mombasa live in the same plot as their tenants
- Rent and utilities:** Average rent charged by surveyed landlords falls between KSH 500-2500 (USD 5-20) per month and seldom includes utilities
- Water cost:** Average monthly household expenditure on water is KSH 829 (USD 8.2) in Nairobi and KSH 568 (USD 5.6) in Mombasa
- Excavation responsibility:** 75% and 92% of sampled tenant households Nairobi and Mombasa, respectively, have landlords pay for excavation
- Excavation costs:** The cost of excavating pit latrines is significantly higher in Mombasa than Nairobi and may account for infrequent excavation in the former. The average cost of excavating latrine is KSH 3187 (USD 31) (range KSH 500-10,000) in Nairobi and KSH 9123 (USD 91) (range KSH 5,000 – 10,000) in Mombasa

Pit latrines are excavated more frequently in Nairobi than in Mombasa\*

Reported frequency of pit-latrine excavation (tenants)



Reported frequency of pit-latrine excavation (homeowners)



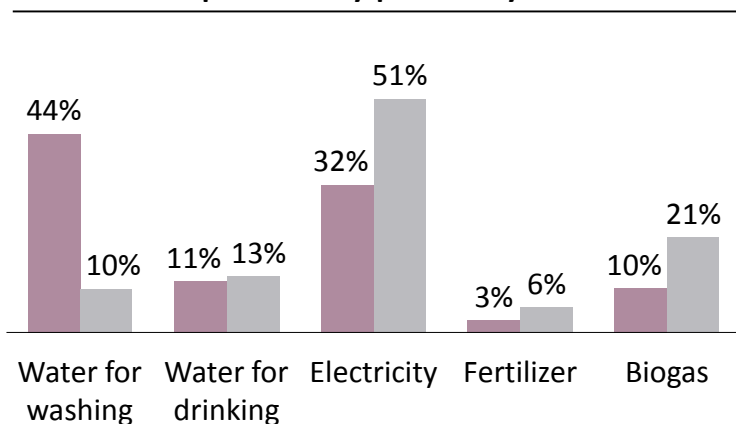
Source: Stakeholder surveys; Dalberg analysis

\*Note: It is unclear why this is the case. It may be because the pits in Mombasa tend to be deeper and have fewer users

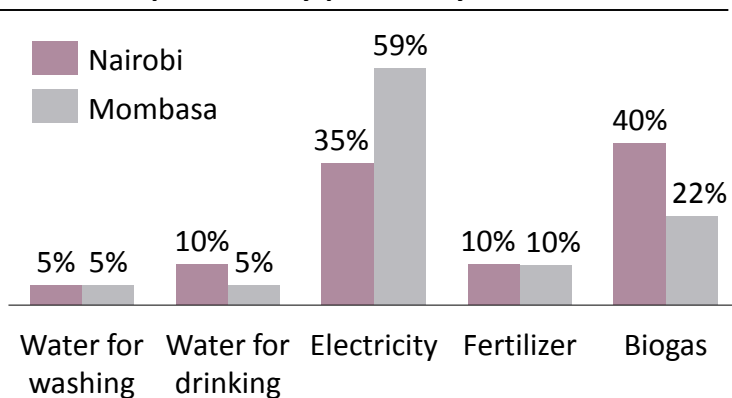
# Kenya: Homeowners, landlords, and tenants expressed preferences for by-products and RT inputs indicate some willingness to adopt the RT

Of the by-products, Kenyan homeowners and tenants expressed highest preference for electricity, biogas and water for cleaning

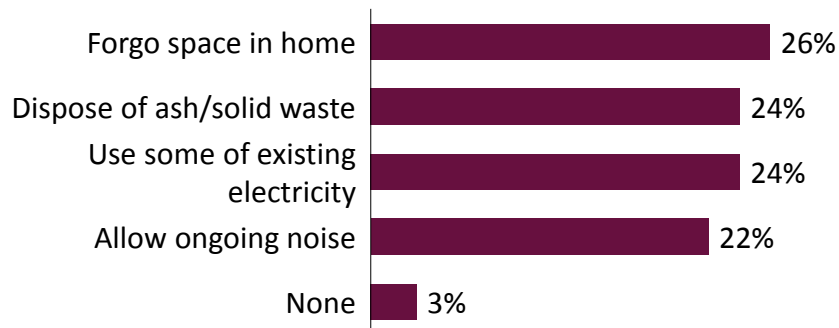
Most preferred by-product by tenants



Most preferred by-product by homeowners



Of the actions they would be willing to undertake to accommodate an RT, 26% of homeowners stated they would be willing to forgo some space in their home\*



Landlords would need to pay to install the RT and it could allow them to charge more rent

- 73% of the surveyed landlords stated that they would have to pay for installing the RT, and 27% felt that it should be paid for jointly by landlords and tenants
- 75% of the landlords felt that installing the RT would result in them being able to charge KSH 200-1000 (USD 2-10) additional monthly rent and tenants indicated a willingness to pay additional rent if the toilet was in their unit
- 88% and 28% of tenants in Nairobi and Mombasa, respectively, stated that space is the primary barrier to having a toilet inside their unit

Source: Stakeholder surveys; Dalberg analysis

\*Note: this question allowed respondents to enter multiple answers

# Kenya: Surveyed plumbers that serve the priority segments are largely informal, have basic training and can perform basic plumbing services

## Most plumbers in informal settlements and tenements work informally

- All surveyed plumbers served customers in informal settlements and tenements
- Most surveyed plumbers were informal, not affiliated with a company

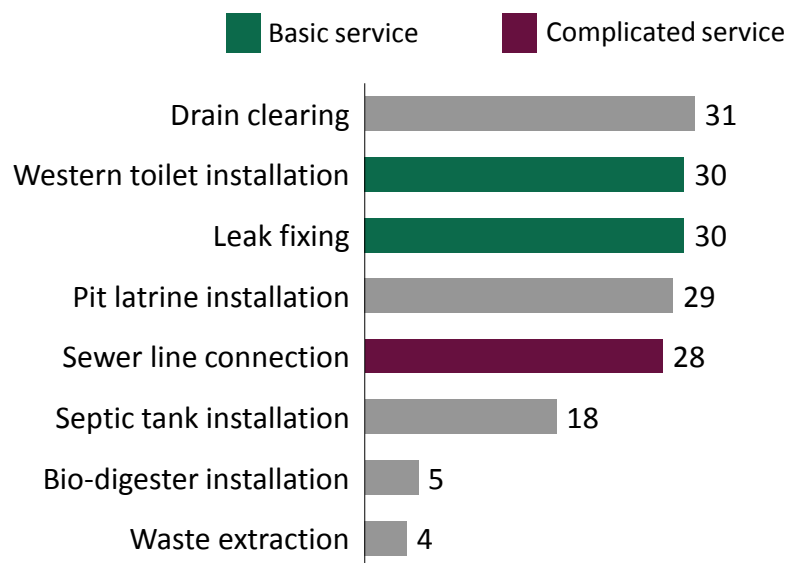
## 56% of interviewed plumbers had more than one year of training

- 56% of plumbers interviewed in Nairobi and Mombasa have more than one year of training; ; 21.9% have no formal training
- 44% of interviewed plumbers were trained at a technical college and 35% were trained through apprenticeships
- Only 21% of plumbers interviewed have had a follow up training, 75% of which received this training from shops that sell sanitation products and from other plumbers

## Plumbers interviewed claimed to be able to offer a wide variety of basic services

- 88% out of the Mombasa plumbers are able to install a septic tank, compared to 18% in Nairobi.
- Basic service costs range between KSH 500-7,000 (USD 5-70); with most services costing under KSH 2,500 (USD 2.5)
- Few stated that they encounter plumbing problem that they cannot tackle; those who do rely on other plumbers for help

## Of 32 plumbers, number who offer the following services:



Note: \*TACC: Tile and Carpet Center

Source: Stakeholder surveys; Dalberg analysis



**STeP**

Sanitation Technology  
Platform

# CHAPTER 4: NIGERIA COUNTRY REPORT

**Dalberg**

DESIGN  
**IMPACT**  
GROUP



## NIGERIA COUNTRY REPORT: CONTENTS

- **Nigeria sanitation landscape: stakeholders, challenges and opportunities**
- Residential market: priority segments and go-to-market approach
- Institutional market: priority segments and go-to-market approach
- Conclusion: Recommended paths to market entry
- Annex

# Executive summary (1/6): Context and as-is outlook for the Reinvented Toilet (RT) in Nigeria



## Sanitation gaps and opportunities in Nigeria

- **The percentage of the population with access to sanitation in Nigeria is declining, indicating the need to fill an access gap** - Nigeria ranks in top 10 countries with no access to safe, private toilets and urban-dwellers openly defecating
- **The national sanitation policy ecosystem is fragmented**, resulting in poor policy formulation and inadequate execution in most parts of the country. Sanitation is the shared responsibility of several ministries, with no clear line of sight and persistent under-investment
- **The infrastructure gaps indicate a potential market for RT.** Lagos state government has no plans to install a central sewage network and welcomes the concept of on-site treatment solutions. In Abuja, delay in roll out of urban development plan sees only 30% coverage of the sewage, presenting a gap that could be filled by the RT

## Nigeria target segments for the Reinvented Toilet (RT)

**The Nigeria go-to-market strategy for the RT considers three distinct categories of buyers and/or users:**

- 1) Existing residential constructions
- 2) New residential constructions
- 3) Institutional locations

No single go-to-market (G2M) approach will suit all three categories, as each will require either a business to consumer (B2C) or business to business (B2B) approach, or both. For existing residential constructions, buyers will be landlords, tenants and homeowners and this segment will likely require a B2C approach. In contrast, for formal new constructions, buyers will be housing developers, therefore requiring a B2B sales approach. Finally, the institutional segments will likely require B2B, B2C and B2G (business to government) approaches

## As-is-outlook for the RT

**There is a great need for improved sanitation in Nigeria and there are ways to improve RT uptake:**

- For technology partners, tweaking the product design to match user preferences and enhance the value proposition for these respective groups may boost target market propensity to adopt
- For commercial partners, establishing an on-the-ground presence to manage multiple aspects of the value chain (including sale, installation and maintenance) will boost the likelihood of success for the product

# Executive summary (2/6): Segment value proposition of the RT for existing residential construction priority segments in Nigeria



## Existing residential constructions: informal building and tenement building dwellers

**Within this category, low-income households in informal settlements and tenements in Lagos and Abuja are priority segments for the RT.** These are the largest market segments in both cities, estimated to have the highest propensity to adopt the RT

**For the 1.1 million households that make up these segments in both cities, depending on product pricing, there is an addressable market of 8,500 – 26,000 SURTs and 10,000 to 30,000 MURTs.** The latent market is far larger, indicating opportunity for scale if financing is available for households. The addressable market for MURTs and SURTs is equally large in Lagos and SURTs are a more attractive proposition in Abuja, where the space constraints are not as serious as in Lagos.

**The by-product value proposition of the RT is greater than the waste treatment / sanitation access value proposition for households in the target segments:** most households appear comfortable with their existing solutions, though in some cases dissatisfied with the frequency of evacuation (in tenements and informal dwellings with shared facilities). The by-product offerings, however, generated significantly more interest during our human-centered design sessions. The value proposition may therefore rest on these by-products, as many households are looking to either enhance the reliability or lower the costs of their basic services (i.e., electricity) and in some cases looking to commercialize by-products (i.e. sell soil conditioner/fertilizer or water by-products to third parties)

## Existing residential constructions: design recommendations

**A few design modifications will likely enhance the product-market fit:**

- **Electricity:** Electricity in Lagos and Abuja is not reliable. Therefore it is highly recommended that toilet not run on a user's existing power source. If it does need to, the power source should be off-grid.
- **Water:** The RT should not depend on a user's existing water supply as most households pay for water and like to keep costs low
- **Space:** There is no space to install a single toilet and piping in a one room household. Further, it would be difficult to retrofit a building that did not follow standard building codes. There may be opportunity to experiment with smaller portable toilets, as some players are doing
- **By-products:** The by-products most valued by the users were electricity and biogas. The by-product most valued by the users for entrepreneurial use was fertilizer.

# Executive summary (3/6): Go-to-market recommendations for existing residential construction priority segments in Nigeria



**To achieve widespread adoption of RT, there is a need to facilitate access to finance, to enhance users ability to pay.**

- There are no existing and reliable benchmarks for the willingness to pay for sanitation
- Willingness to pay was expressed as maximum of USD 200 but, as discussed in the report, these estimates are not reliable
- Most households may require financial assistance to acquire, since over 50% of respondents earn less than USD 100 per month and few households have access to bank accounts and credit (only 9 million households in all of Nigeria have bank accounts)

**After creating demonstration projects to test and generate interest in the RT, we recommend a product + service + finance model to bring the RT to Nigerian customers –**

- Product is purchased from local shops, with finance provided by a consortium of partners (state government, microfinance institutions) to fund the capex of the RT
- Installation and evacuation services are provided by bricklayers and plumbers associated with an existing sanitation company/shop
- A product + service + finance model would enhance product awareness, facilitate adoption by making the product affordable
- Note: business owner and associated artisans will be trained on installation and maintenance of RT and will likely become champions of the technology in the community

**If RT's commercial partners are unable to forge necessary local partnerships, pursuing a product-only model without any local presence may compromise RT's market penetration.**

**We recommend importing the RT initially and moving to a model where it is assembled locally** – Importing the RT in the early stages will secure customer trust due to association of imported products with the idea of “quality”. Since importation is subject to currency risks and local manufacturing industry is not competitive (expensive and lacking due to scarcity of quality materials), local assembly may be a viable compromise, presenting the opportunity to import RT parts and assemble in Nigeria

**The main buyers i.e. major target of distribution will be homeowners/landlords and tenants** (who jointly make decisions on repairs, enhancements or replacement of sanitation technology). They will likely need support for the Capex of the RT, through funding institutions such as MFIs, community savings groups, and donor programs

# Executive summary (4/6): Go-to-market recommendations for new residential construction in Lagos



## Formal new residential constructions

**The approach for new residential constructions differs significantly from that of existing constructions.** New constructions will require a business-to-business approach – as buyers would not be households but housing developers, and architects or mechanical engineers, who design the sanitation/plumbing system and recommend fittings

**This segment is slowly recovering from the recession and depending on the growth rate in the next five years, could reach ~23,000 – 37,000 units**

- Recession has led to an 80% decline in construction spend in recent years and slow recovery, with 5.39% - 22% annual growth predicted for the next 3 years
- The adoption of the RT within this segment may be further enhanced if it proves to be cost-saving relative to existing solutions and offers flexibility on plumbing fixtures

**The go-to-market approach for this segment requires closely engaging the professionals who influence the selection of sanitation technology.** Demonstrate RT at periodic meetings of architecture and mechanical engineering professional organizations. Once the concept is proven to these professionals, they may adopt the RT for their new building projects. STeP commercial partners should also solicit feedback from these professionals and make adjustments to product design or distribution strategy, where necessary

# Executive summary (5/6): Go-to-market recommendations for Nigerian institutional segments – state-sponsored housing and public toilets



In Nigeria, we recommend state sponsored and public toilets as target segments, with varied go-to-market implications. The institutional segments also present the opportunity to demonstrate RT's functionality and value proposition to the residential segment

## State sponsored housing

- There are several planned and ongoing state sponsored housing projects, with some presenting an opportunity to pilot the RT
- **Value proposition to the state governments is:**
  - The potential reduction in construction capex due to elimination of septic tank costs
  - Alternative water and electricity sources to supplement the current scarce supply
  - Alternative to centralized waste treatment plants, since reach of current infrastructure is not extensive in Abuja and not intended to be centralized in Lagos
- **Go-to-market strategy could involve partnering with one state government institution** (LASURA or LBIC\* in Lagos) for a pilot, demonstrating its success and extending the offering to the rest of the market

## Public toilets in market and transport hubs

- There is a proven market for public toilets, with location in busy transport hubs, community buy-in, management/maintenance by competent officials and appropriate toilet interface (both squat and seat) being identified success factors
- **Value proposition of the RT is that it could reduce operation costs for the public toilet operator.** The by-products of water and electricity will and elimination of evacuation costs will reduce overall operational costs
- **STeP commercial partners can enter the market directly or indirectly, with the indirect play being a faster option**
  - Directly: Develop new/own public toilets, which includes the arduous process of site and technology approval or take over renovating existing toilets
  - Indirectly: Enter the market by supplying existing players or partner with them to renovate existing public toilets
- In addition to partnership with private sector operators, there are potential opportunities to partner with civil society and state government programs to develop public toilets in Lagos and Abuja

\*LASURA: Lagos State Urban Renewal Agency; LBIC: Lagos Building Investment Company

# Executive summary (6/6): Recommended paths to market-entry for the 4 priority segments in Nigeria



Putting the recommendations across the four priority segments together, there are three potential paths to market-entry for priority segments in Nigeria –

## **Path 1: Demonstrate in public toilets to prove the concept to existing low-income residential segments**

### 1. Launch in state sponsored housing schemes and public toilets

Launch SURTs and MURTs in state sponsored housing and MURTs in public toilets

### 2. Engage community groups and local contractors to adopt the RT

Depending on market feedback, launch more communal MURTs and SURTs / household-level products using a neighborhood-saturation approach

The demonstration effect works only for existing low-income residential constructions and is unlikely to spill over to new constructions, as housing developers do not take market cues from the public toilets sector

## **Path 2: Validate the concept with a target developer and scale to new residential construction**

### 1. Validate and demonstrate the value proposition

### 2. Pilot with a housing developer

### 3. Market to other developers and to the industry

Dependent on validation from low-income housing developers (i.e., a compelling business case and match to customer preferences), pilot with a selected housing developer, market the results of the demonstration project to other developers, architects and surveyors and bring product to scale



- **Nigeria sanitation landscape: stakeholders, challenges and opportunities**
- Residential market: priority segments and go-to-market approach
- Institutional market: priority segments and go-to-market approach
- Conclusion: Recommended paths to market entry
- Annex

# The proportion of the population with access to sanitation in Nigeria is declining, indicating the need to fill an infrastructure gap



## Context

- Nigeria ranks in the top 10 of countries with no access to safe, private toilets, and as one of the top 10 countries with urban dwellers openly defecating
- **For every one urban-dweller reached with sanitation since 2000, two were added to the population living without access**
- Rapid urbanization and increase in population have not been accompanied by commensurate increase in government investment in water and sanitation service delivery and infrastructure
- Though improved water access has been on the rise (80.8% of urban population and 63.2% nationally), this has not impacted sanitation levels
- The government does not prioritize sanitation. Sewer coverage is limited, with the exception of Abuja (federal capital) and parts of Lagos (business capital), which have relatively better access to improved sanitation technology

## Persistent sanitation challenges in Nigeria

**21%**

urban-dwellers  
without  
improved  
sanitation

**3<sup>rd</sup>**

ranking for  
length of public  
toilet queues  
globally

**70%**

urban-dwellers  
without  
sewerage /  
septic tank

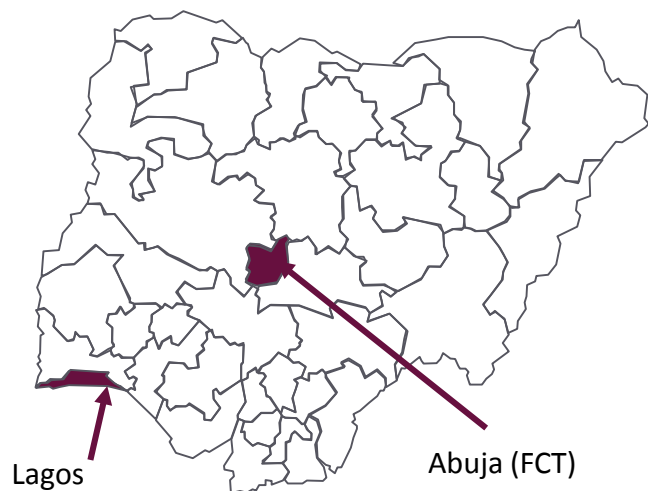
**21.4M**

HHs with pit  
latrines

# Our selected Nigerian cities, Lagos and Abuja, are the largest and most urbanized in the country but are unique in several ways

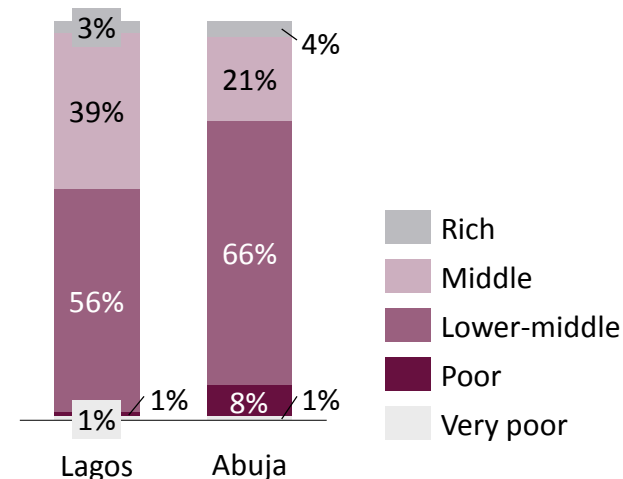


Location of selected sites In Nigeria



Lagos is poorer than Abuja

Socioeconomic distribution



## Selected attributes of Lagos and Abuja

<b>Population size</b>	Population of Abuja is 2.4 million and that of Lagos is 13.1 million
<b>Income levels</b>	23.5% of Abuja and 8.5% of Lagos live below the poverty line; both lower than the national average of 46.0
<b>Toilet type</b>	36% of households in Lagos share toilets, compared to 70% in Abuja
<b>Religious composition</b>	Nigeria has a nearly evenly split population between Christianity and Islam. Lagos conforms to this but Abuja has a larger relative Muslim population
<b>Housing type</b>	Dominant housing in Abuja is "Standalone House" (46.02%) while in Lagos it is tenements (53.51%)
<b>Home ownership</b>	75.8% of Lagos and 53.3% of Abuja are renters

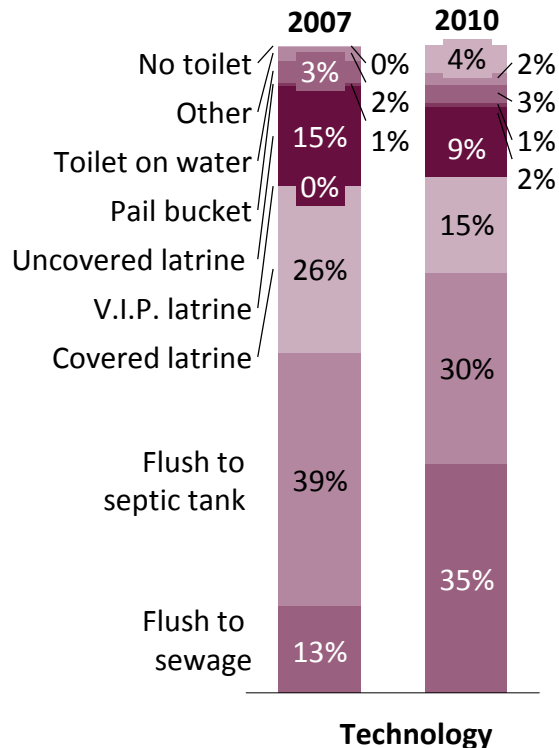
# In Lagos, access to improved sanitation and waste collection is low but improving; there are plans to expand treatment coverage



## Access

*Though the rate of access has increased over time, 10% of households (400,000) still do not have access to improved sanitation facilities\**

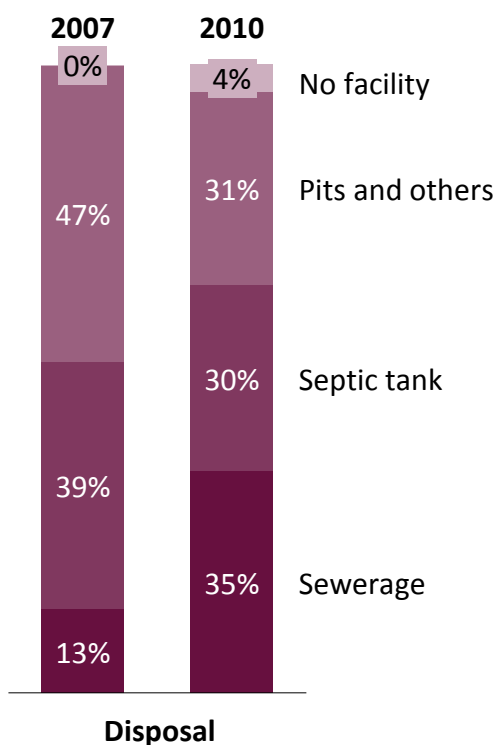
**Type of toilet – 2007 to 2010**  
(% of total households)



## Collection and conveyance

*Access is on the rise but four out of every 10 households (1 million) do not have access to sewerage or septic tank*

**Type of collection facility – 2007 to 2010**  
(% of total households)



## Treatment and reuse

*Lagos lacks proper sewage management and has expressed long term goals of treatment decentralization*

- Insufficient waste treatment infrastructure: just three functional official waste treatment plants service the 4 million households of Lagos
- Lagos state government plans to introduce 10 new plants to accommodate the expected increased use of formal waste treatment following the enforcement of the pit latrine ban
- Lagos state government however encourages decentralized waste treatment due to the high cost of building and maintaining a central sewer system
- The government also has long-term plan to phase out truck conveyance of waste to treatment plants; on-site biogas generation from human waste is a sector of interest

\* Improved sanitation is defined as sewage, septic tank, covered and VIP latrine

# In Abuja, development of several unplanned settlements has led to reduced access to improved sanitation



## Access

*Four out of every 10 households (160,000) do not have access to improved sanitation facilities*

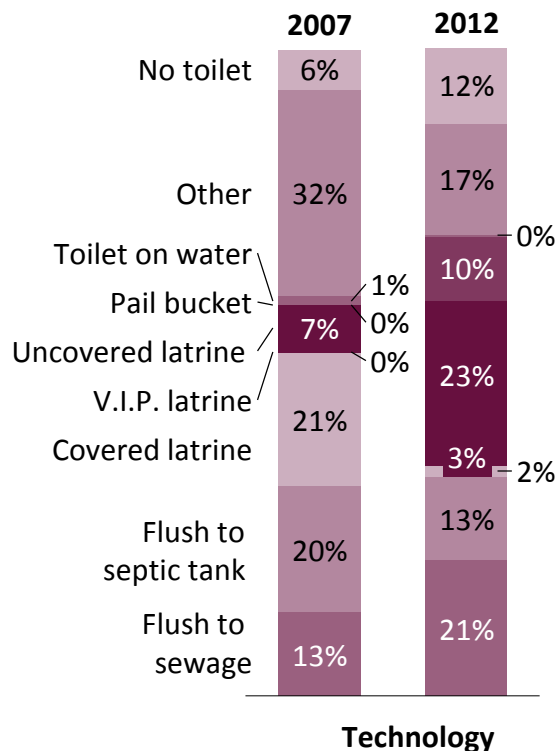
## Collection and conveyance

*Largely due to increased urban sprawl, seven out of every 10 households (280,000) do not have access to sewerage or septic tank*

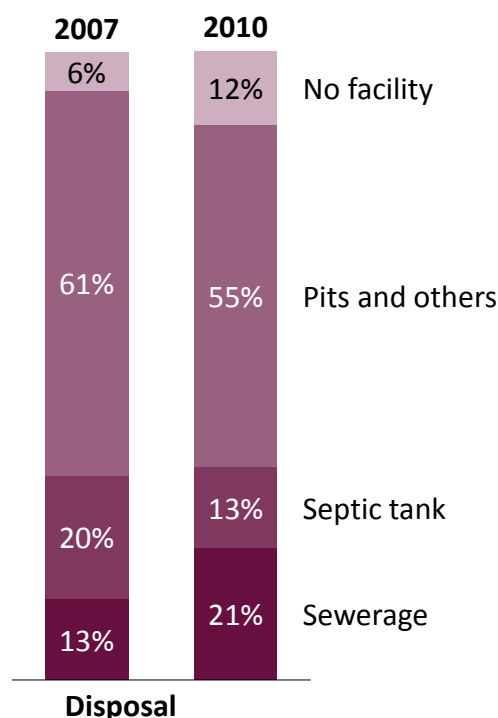
## Treatment and reuse

*Centralized waste water treatment in Abuja is underdeveloped*

**Type of toilet – 2007 to 2010**  
(% of total households)



**Type of collection facility – 2007 to 2010**  
(% of total households)

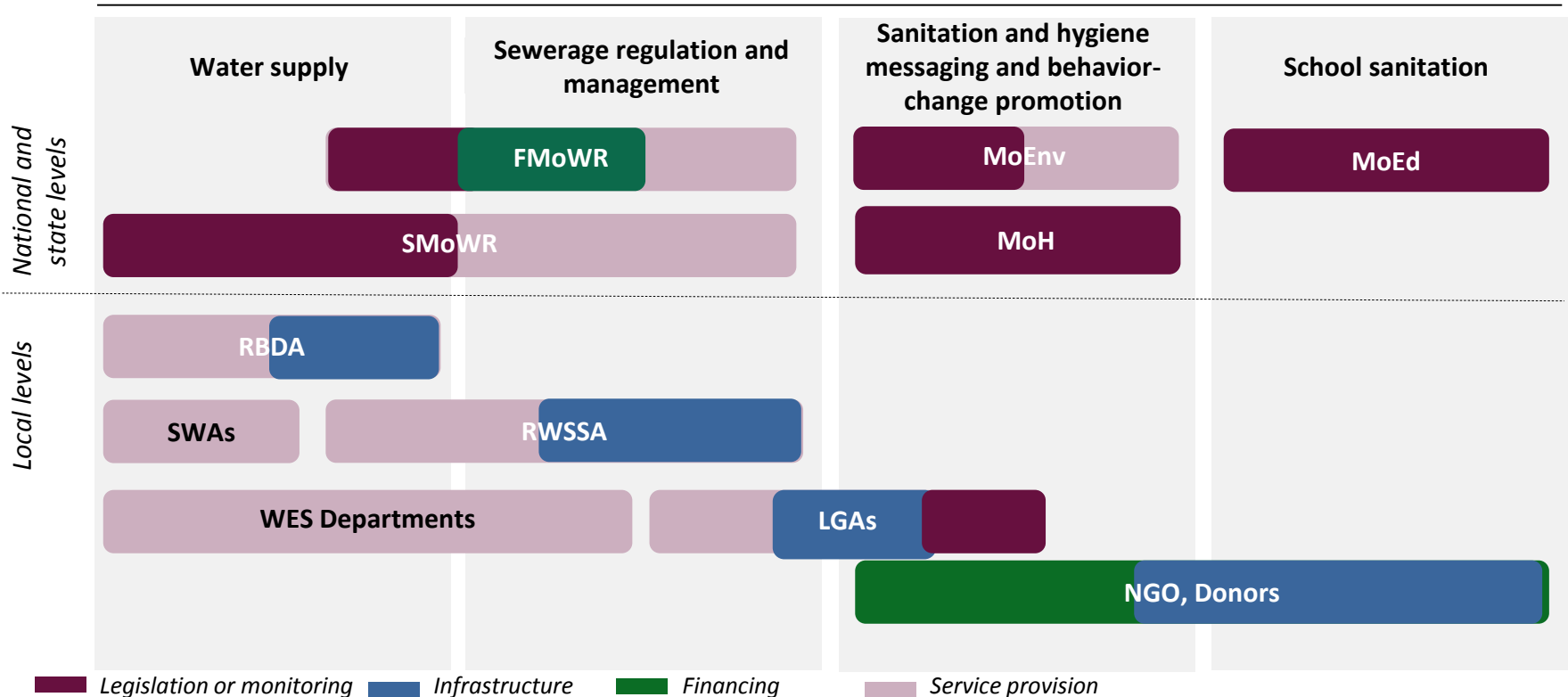


- Abuja operates a central sewage system with one line for residential waste and another for commercial
- It is restricted to one third of Abuja; unplanned settlements are not served
- The sewage infrastructure is fraught with challenges; leakages and blockages result in contamination of food and water in some peri-urban locations whose water bodies are a receptacle for the waste water outfall
- The central treatment plant has closed on occasion, citing non-payment of allowances
- Peri-urban settlements are particularly underserved, rarely having treatment plants

# The national policy ecosystem is fragmented, resulting in poor policy formulation and inadequate execution in most parts of the country



Sanitation policy ecosystem

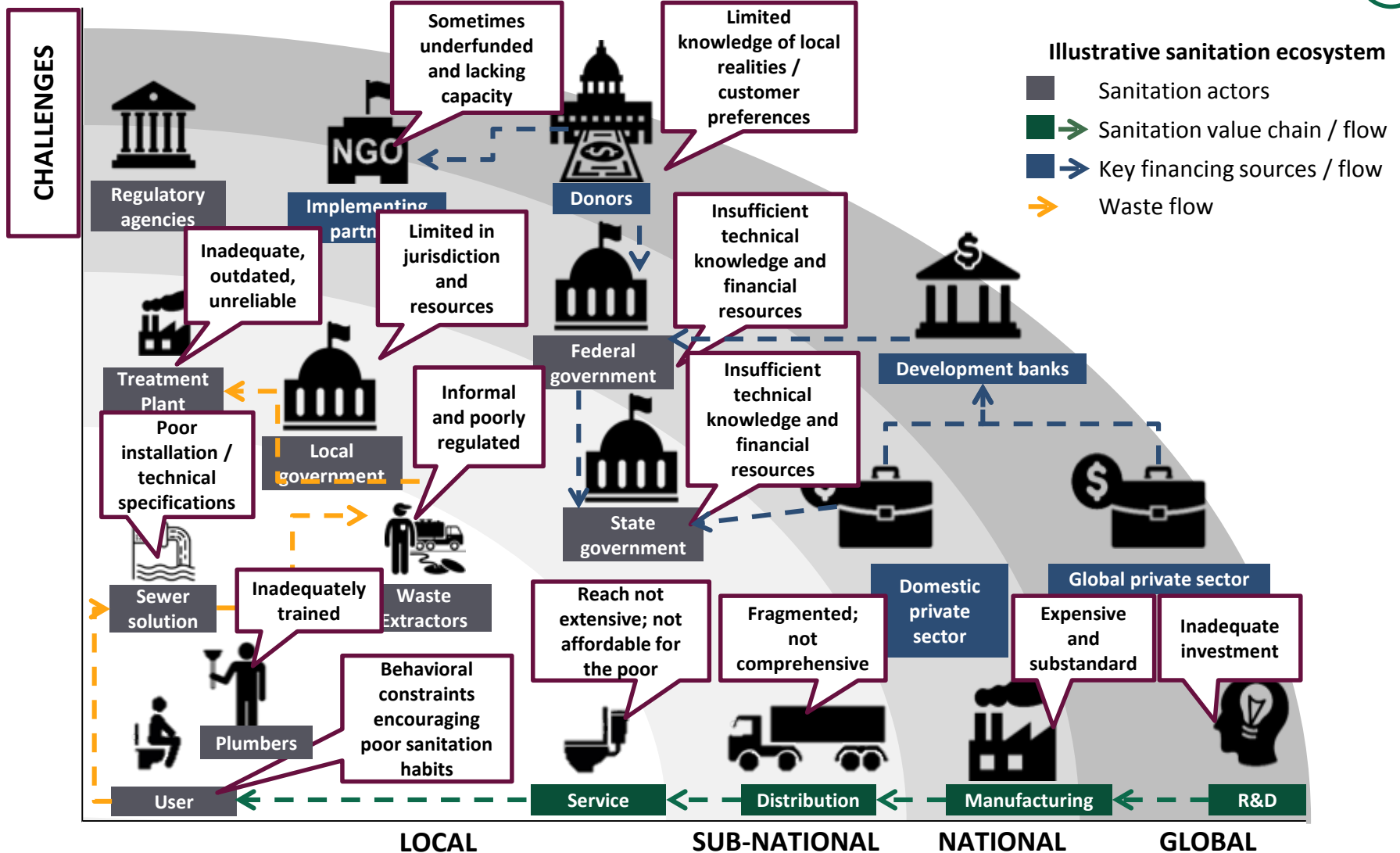


**Abbreviations:** NCRW – National Council on Water Resources; FMoWR – Federal Ministry of Water Resources; MoEnv – Ministry of Environment; MoH – Ministry of Health; MoEd – Ministry of Education; SMoWR – State Ministries Responsible for Water Resources; RBDA – River Basin Development Authority; SWAs – state water agencies; RWSSA – Rural Water Supply and Sanitation Agencies; WES Dept. – Water and Environmental Sanitation departments; LGAs – local government authorities

**Sanitation is the shared responsibility of several ministries, with poor coordination and inadequate investment.**

Source: Hofman, Lawanson (2017) Pathways out of Urban Poverty; Ibiyemi J. Ilesanmi (2006) Pre-Feasibility Assessment of Onsite and Decentralised Sanitation Systems for New Satellite Settlements in Abuja, Nigeria; Water Aid (2007) Water and Sanitation in Nigeria: A Briefing in National Policy; USAID (2010) Nigeria Water and Sanitation Profile; Dalberg analysis

# The broader sanitation ecosystem is affected by policy inadequacies and further constrained by financial and capacity limitations



# Recent national and state level policies seek to improve sanitation outcomes by increasing access and changing behaviors



Policy theme	Policy direction
<b>Behavioral change</b>	<ul style="list-style-type: none"><li>• The Roadmap to an Open-Defecation-Free Nigeria 2025 (by Federal Ministry of Water Resources and UNICEF) seeks to foster attitudinal change toward poor sanitation practices by promulgating the Community-Led Total Sanitation model (CLTS) in rural communities, sanitation marketing and media campaigns</li><li>• The Government of Nigeria is working with the WaterAid resource agency for CLTS programs across the country</li></ul>
<b>Technology improvement</b>	<ul style="list-style-type: none"><li>• The Roadmap proposes the development of technologies to suit different geo-physical conditions (such as topography and groundwater level), household preferences and ability to pay. It also suggests introduction of water-economic pour flush toilets as a low-cost option</li><li>• Lagos state government is looking in the long term to phase out operation of the waste evacuation trucks and achieve fully decentralized waste water treatment</li><li>• Lagos is also increasing the level of enforcement on the ban of pit latrines, which will require residents to adopt improved technologies and replacements</li></ul>
<b>Finance / budgeting</b>	<ul style="list-style-type: none"><li>• Budgets are decided at the federal level, with opex disbursed quarterly and capex disbursement determined on case-by-case bases</li><li>• State governments encourage PPPs for investment in water and sanitation infrastructure and delivery of related services</li><li>• Reaching the zero open defecation target will require an investment of USD 670 million—justifiable in the light of the USD 3.6 billion lost due to poor sanitation</li><li>• Despite the targets, there are no clear indications of how this money will be raised or provided to sanitation programs</li></ul>

**The policy direction presents an opportunity for the Reinvented Toilet, but the details on how the RT could support existing policy interventions still need to be explored.**

# Within this political and institutional landscape, many actors involved in the sanitation value chain may find value in the RT (1/2)



Actors	Involvement	Incentivized to promote / buy / use the RT	Rationale
<b>Government</b>	Policy-setting	●	<ul style="list-style-type: none"> <li>State government in Lagos has no plans to install centralized sewage system and encourages decentralized treatment. Abuja has limited sewer network coverage due to pace of urban development plan roll out. Both stand to benefit from RT on-site sanitation feature</li> </ul>
<b>Donors and NGOs</b>	Policy-influencing, service provision, financing	●	<ul style="list-style-type: none"> <li>The RT as a sanitation solution and water / energy generator addresses a range of development problems in the purview of NGOs' work</li> </ul>
<b>Waste treatment municipality</b>	Development and maintenance of sewer infrastructure; sludge treatment	●	<ul style="list-style-type: none"> <li>RT will reduce utilization rates of the waste treatment plants, which are often dysfunctional or out of order. Though revenue might be affected, there will also be cost savings to the government</li> </ul>
<b>Public health and sanitation officers</b>	Product and behavior-change promotion	●	<ul style="list-style-type: none"> <li>Public health and sanitation officers are key influencers in the sanitation ecosystem. If products align with their overall objectives, they can serve as product promoters, or at least as channels to connect to local communities</li> </ul>
<b>Alternative sanitation providers</b>	Design and sale of non-sewered solutions; occasionally treatment of waste	●	<ul style="list-style-type: none"> <li>There are not many such players in the market and the RT could be direct competition for their product. Some may embrace the opportunity to stock RT and install it for customers</li> </ul>

○ Low or no incentive   ● High incentive

# Within this political and institutional landscape, many actors involved in the sanitation value chain may find value in the RT (1/2)



Actors	Involvement	Incentivized to promote / buy / use the RT	Rationale
<b>Masons and contractors</b>	Construction across income segments	●	<ul style="list-style-type: none"> <li>Contractors could benefit from the reduced cost of construction (i.e. no septic tank) and masons can be contracted for installation, depending on RT installation requirements</li> </ul>
<b>Plumbers and informal laborers</b>	Installation and maintenance	●	<ul style="list-style-type: none"> <li>Plumbers may still find value if they are involved in the RT value chain - to provide repair and maintenance services, with training where necessary</li> </ul>
<b>Local hardware stores</b>	Distribution and sale of construction materials	●	<ul style="list-style-type: none"> <li>Local hardware stores can be found in neighborhoods across income levels. However, they are conscious of product selection, typically opting for faster-moving products, or those that are typically purchased in bulk (e.g., cement bags, etc.). They may or may not wish to stock the RT, given its size and space requirement</li> </ul>
<b>Fecal sludge extractors</b>	Sludge extraction and disposal	○	<ul style="list-style-type: none"> <li>Companies and individuals that currently provide extraction services are unlikely to find value in a purely on-site solution that requires no extraction – thereby competing with their core business</li> </ul>

○ Low or no incentive   ● High incentive

**Various state and local government departments, NGOs, donors in Nigeria are likely to find value in the RT**



## NIGERIA COUNTRY REPORT: CONTENTS

- Nigeria sanitation landscape: stakeholders, challenges and opportunities
- **Residential market: priority segments and go-to-market approach**
  - Go-to-market considerations for existing construction priority residential segments
    - **Overview, size, needs and preferences of priority segments**
    - Design considerations, commercial value chain considerations, and business models
  - Go-to-market considerations for new construction priority residential segment
- Institutional market: priority segments and go-to-market approach
- Conclusion: Recommended paths to market entry
- Annex

# Summary: Segment value proposition of the RT for existing residential construction priority segments in Nigeria



## **Existing residential constructions: informal building and tenement dwellers with pit latrines**

**Within this category, low-income households in informal settlements and tenements in Lagos and Abuja are priority segments for the RT.** These are the largest market segments in both cities, estimated to have the highest propensity to adopt the RT

**For the 1.1 million households that make up these segments in both cities, depending on product pricing, there is an addressable market of 8,500 – 26,000 SURTs and 10,000 to 30,000 MURTs.** The latent market is far larger, indicating opportunity for scale if financing is available for households. The addressable market for MURTs and SURTs is equally large in Lagos and SURTs are a more attractive proposition in Abuja, where the space constraints are not as serious as in Lagos.

**The by-product value proposition of the RT is greater than the waste treatment / sanitation access value proposition for households in the target segments:** most households appear comfortable with their existing solutions, though in some cases dissatisfied with the frequency of evacuation (in tenements and informal dwellings with shared facilities). The by-product offerings, however, generated significantly more interest during our human-centered design sessions. The value proposition may therefore rest on these by-products, as many households are looking to either enhance the reliability or lower the costs of their basic services (i.e., electricity) and in some cases looking to commercialize by-products (i.e. sell soil conditioner/fertilizer or water by-products to third parties)

# Process: We segmented the residential market in Lagos and Abuja to identify priority segments for the RT

RECAP

## Segmentation approach

- 1 Developed a long list of segmentation criteria—variables that could explain variation in adoption of the toilet—based on desk research and interviews
- 2 Shortlisted segmentation criteria based on variable relevance, data availability and actionability
- 3 Created a segmentation framework based on the shortlisted segmentation criteria
- 4 Evaluated each of these segments on their (i) propensity to adopt the Reinvented Toilet and (ii) relative market size
- 5 Selected two to three priority segments in each country and evaluated each for the ease of going to market (as defined by ease of reaching the market through a single entry point or an aggregator)

## Segmentation framework

Age of construction		Unbuilt / New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pit (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socioeconomic category	E	Light Blue	Yellow	Dark Grey	Dark Grey	Light Blue	Dark Grey	Dark Grey	Dark Grey	Light Blue	Yellow	Dark Grey	Dark Grey	Light Blue	Yellow	Dark Grey	Dark Grey
	D	Light Blue	Yellow	Yellow	Light Blue	Light Blue	Dark Grey	Dark Grey	Dark Grey	Light Blue	Yellow	Dark Grey	Light Blue	Light Blue	Yellow	Yellow	Light Blue
	A+B +C	Dark Grey	Dark Grey	Yellow	Light Blue	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Yellow	Light Blue

Light Blue Potential segments for SURT

Yellow Potential segments for MURT

Dark Grey Non-existent or negligible segment

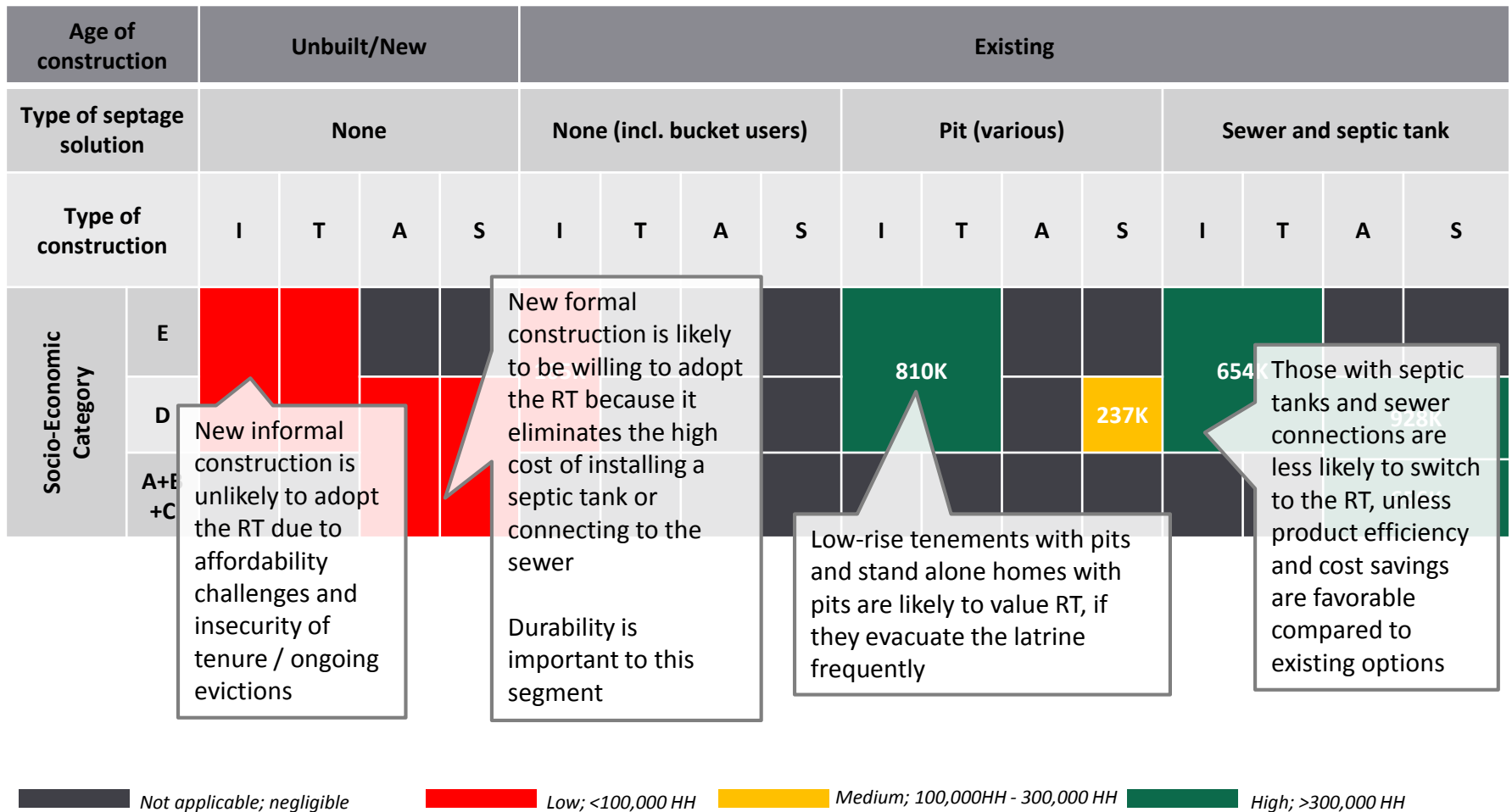
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Note: I = Informal settlement; T = Tenement; A = Formal apartment building; S = Standalone house

# In Lagos, we selected existing low-income tenements with pits and informal housing, and formal new constructions. Total size: ~820K HH



Segment total market sizes in Lagos



New informal construction is unlikely to adopt the RT due to affordability challenges and insecurity of tenure / ongoing evictions

New formal construction is likely to be willing to adopt the RT because it eliminates the high cost of installing a septic tank or connecting to the sewer

Durability is important to this segment

Low-rise tenements with pits and stand alone homes with pits are likely to value RT, if they evacuate the latrine frequently

Those with septic tanks and sewer connections are less likely to switch to the RT, unless product efficiency and cost savings are favorable compared to existing options

Note: I = Informal settlement; T = Tenement; A = Formal apartment building; S = Standalone house; See annex for detailed market sizing methodology and calculations

Source: Desk research; DHS (2013); stakeholder interviews

# In Abuja, we selected existing low-income informal housing and tenements with pits. Total size: ~270K HH



Segment total market sizes in Lagos

Age of construction		Unbuilt/New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pit (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E					64K				276K				117K			
	D												19K				
	A+B +C																66K

Currently unable to afford toilet and septic tank installation but aspires to own improved sanitation facility and may buy if product is affordable and the design is appropriate for the segment

Households connected to septic tanks/sewer are less likely to adopt a new technology due to sunk costs, unless RT is demonstrated to be significantly more efficient and cost effective

Not applicable; negligible
  Low; <50,000 HH
  Medium; 50,000HH - 100,000 HH
  High; >100,000 HH

Note: I = Informal settlement; T = Tenement; A = Formal apartment building; S = Standalone house; See annex for detailed market sizing methodology and calculations

Source: Desk research; DHS (2013); stakeholder interviews

# In Nigeria, combined, we selected existing low-income informal and tenement housing using pit latrines, and formal new constructions



Priority segment	Propensity to adopt and market size	Ease of targeting
<p><b>Lagos / Abuja</b></p> <p><b>Existing tenement dwellers in SEC D with pit latrines</b></p>	<ul style="list-style-type: none"> <li>Tenements house 40 – 50% of the population of Abuja and Lagos</li> <li>They typically offer shared sanitation facilities (mostly pit latrines) that present numerous challenges, such as long queues</li> <li>Users / landlords may be willing to switch to improved sanitation technology in the form of RT if product economics match preferences</li> </ul>	<ul style="list-style-type: none"> <li>This segment is difficult to reach as private landlords are often reluctant to be identified, since they may not be compliant with building codes or tenancy laws, or may owe land use charges</li> <li>Tenants might be able to jointly sponsor RT and can be more easily targeted through relevant marketing channels</li> </ul>
<p><b>Lagos / Abuja</b></p> <p><b>Existing informal building dwellers in SEC D with pit latrines</b></p>	<ul style="list-style-type: none"> <li>Some informal building dwellers aspire to own improved sanitation facilities but are hindered by the cost of installing septic tanks and purchasing a water closet</li> <li>Pit latrines, which cost less than USD 40, have shown uptake</li> <li>Interviewed stakeholders demonstrated a willingness to adopt the RT, as long as the costs are less than that of installing a pit latrine. That said, many respondents had strong mental models on receiving the RT for free</li> </ul>	<ul style="list-style-type: none"> <li>This segment is relatively disaggregated. However, there are many existing NGOs, social enterprises and slum upgrading programs that could offer an entry point</li> <li>Sanitation experts also recommend reaching this segment through local government authorities</li> </ul>

**As part of our surveys, we further segmented informal and tenement dwellers into homeowners, landlords and tenants to better grasp the decision-making strengths of these actors**

# 70% of Lagos lives in Tenements, also known as ‘Face-me-I-face-you’ to indicate dense living environments with communal toilet facilities



*There used to be a steady light here, at least [during the] day; we [would] have at least 10 hours of electricity per day... But now things have changed. There is no way we can move out because when there is no money there is nothing you can do but to manage what you have and prepare yourself to [have] your own place instead of moving around to search for a new house. – Tenant in Abuja*

## About tenements

- Over 2 million households are tenement dwellers in Lagos and Abuja
- Tenements are often referred to as “face-me-I-face-you” due to characteristic overcrowding in buildings that house several households, sharing sanitation facilities (bathroom and toilet) and sometimes cooking facilities too
- They can be single storied or multiple storied structures
- They house lower-middle-income blue collar workers (and their families) who are able to afford a small electricity generator, displaying a propensity to purchase household items that enhance living standards
- They are mostly privately owned and the landlord sometimes lives on the premises

## Drivers of adoption of the RT

- Given the severe electricity shortage in Nigeria, households could find value in the by-products of the RT
- Depending on product economics, the RT could present a relatively low-cost alternative to the pit latrines used by half of the tenement dwellers
- They could replace pit latrines has political and institutional support in light of the Lagos state government’s enforcement of the pit latrine ban
- In areas where’re there is a septic tank connection, frequent evacuation may inspire replacement with an alternative like RT, providing it is easy to maintain and doesn’t have the same problem

## Barriers to adoption of the RT

- It may be difficult to market the RT to the landlords—they are the principal decision makers, and like to keep costs low, particularly around installation. However, they are responsible for full or partial payment for extraction services and utilities, and the opex cost-saving value proposition could be strong as landlords sometimes pay for latrine evacuation

# Informal dwellings house the poorest of the poor who seek access to clean toilets but have severe space constraints within their units



*Even though Lagos state government has this megacity plan, it will probably see an increase in temporary housing structures because of the high cost of building materials and high demand for relatively affordable housing.  
– Staff at NGO with housing programs*

## About informal dwellings

- These house low-income households, are typically made of mud or unplastered materials and may have corrugated roofing sheets
- Some of these households are on the electricity grid but have erratic power supply. They are not connected to piped water supply and buy water on a daily basis or tap it to meet domestic and sanitary needs
- Abuja's urban plan implementation is unfolding in phases and will eventually reach areas with informal dwellings. The effect may not be demolition but rather the advancement of infrastructural development
- Lagos state government has plans to make Lagos a megacity; these include demolishing informal settlements, thereby reducing over time the stock of existing dwellings in this segment

## Drivers of adoption of the RT

- Some informal settlement communities invest in improving infrastructure as a tactic to prevent evictions (by demonstrating to the government that they have invested in their living environment)
- Poor electricity supply may make the electricity by-products of the RT attractive to this segment

## Barriers to adoption of the RT

- Depending on product economics, there might be affordability constraints
- Houses in this segment are small, with severe space constraints
- This market segment is disaggregated and difficult to access. There is potential, however, to gain market access by partnering with existing slum upgrading/urban renewal programs, NGOs, slum dwellers associations and other community-based organizations active within this segment

## Process: We used the findings from ~300 quantitative surveys to better understand the living and earning conditions of these segments

RECAP

We identified big-picture needs, preferences, and capacities, through a total of ~300 quantitative surveys with homeowners, landlords, tenants, and plumbers in each country and sampled as follows:

Respondent type	Nigeria	
	Lagos	Abuja
Homeowners	43	44
Landlords	20	24
Tenants	70	71
Plumbers	17	18
<b>Total interviews</b>	<b>307</b>	

### These surveys allowed us to understand:

- Common sanitation needs across selected user segments
- Existing living and household financial conditions (e.g., incomes, utilities spends, asset ownership)
- Expressed preferences for the RT and interest in by-products
- Ability and willingness to pay for SURTs and MURTs
- Ability and willingness to maintain the RT

# Survey findings: Tenement dwellers look fairly similar to informal dwellers in their incomes, rent and utilities expenditures (1/2)



## Household characteristics across informal settlements and tenements



- Average household sizes are comparable across housing type: 4-5 members

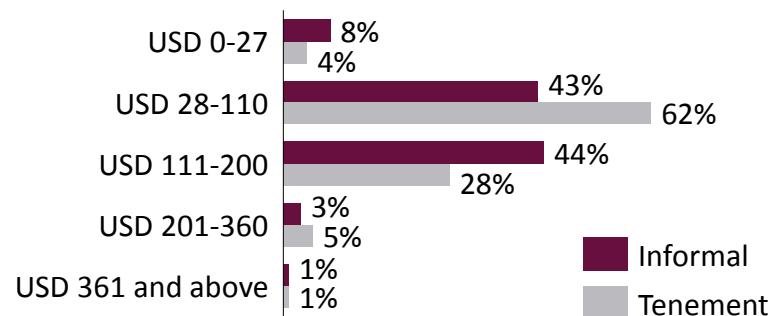


- Tenement dwellers and informal building dwellers have similar incomes, the difference in their income is not statistically significant:
  - 60% of tenants earn <USD 100 per month
  - 88% of tenants earn between USD 30-200 per month

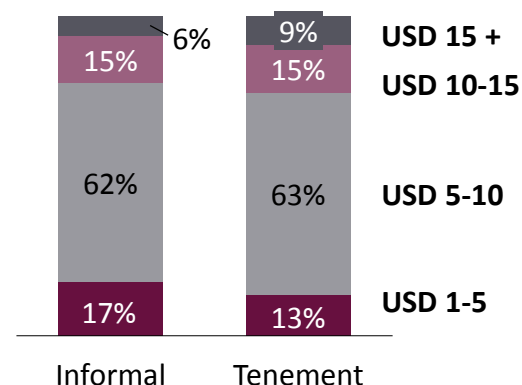


- Rent is comparable across housing type:
  - 65-70% of both segments pay between USD 10 and 25 per month in rent
  - Average rent of both samples is USD 10,
- Most renters have utilities partially included in their rent
- 80% of the sampled tenants shared a latrine

### Monthly income distribution (tenants)



### Average monthly rent (tenants)



If we compare them on household composition, income, and utilities spend, there is no major difference between the two priority segments

# Survey findings: Tenement dwellers look fairly similar to informal dwellers in their incomes, rent, and utilities expenditures (2/2)



## Household characteristics across informal settlements and tenements



- **Source of and average monthly spend on water is comparable:** 96% of the segment access water through boreholes and wells



- **Electricity is accessed through the municipality and spend does not vary across segments:**
  - The municipality is the main provider across segments and tenement and informal settlement dwellers pay USD 10-12 per month on average

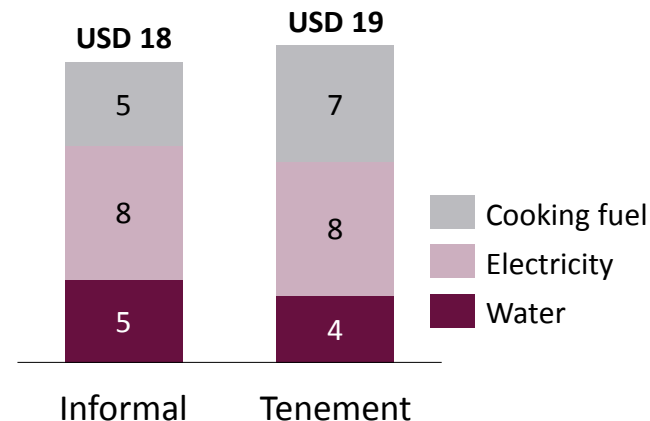


- **HH are mainly using unimproved cooking fuels and paying USD 7 per month on average**
  - Tenement dwellers use gas cookers and kerosene
  - Informal settlement dwellers use gas cookers, firewood and kerosene

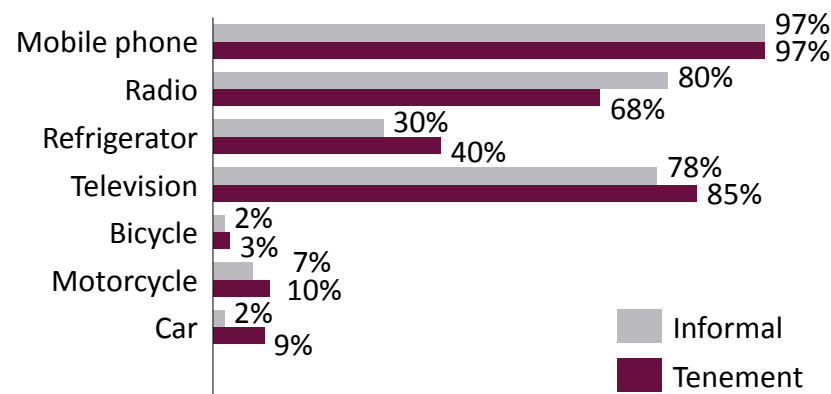


- **Three most common assets are: mobile phones, radios, and TVs. There is no variation across segments**
  - Most of the respondents purchased large assets (e.g., TV and refrigerators) in cash outright

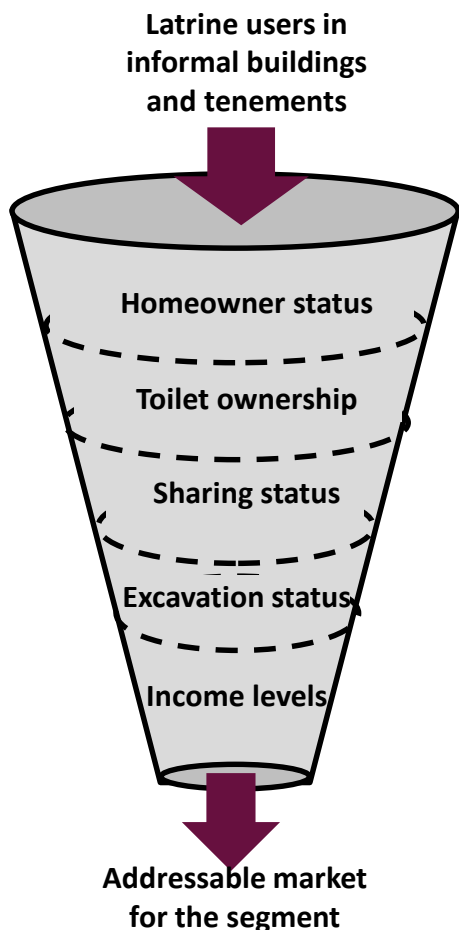
### Monthly spend on utilities (tenants + homeowners)



### Ownership of assets (tenants + homeowners)



## Process: The survey findings also helped arrive at the latent and addressable market size in priority segments in Lagos and Abuja



We identified the following criteria from the quantitative surveys and used them as follows:

**Latrine use:** There are a total of 810,000 and 274,000 households in informal buildings and tenements that use pit latrines in Lagos and Abuja, respectively. They form 21% of all households in the two cities, collectively.

**Homeowner status:** Used this as an initial filter to assess decision-making power; assuming that homeowners and tenants have different incentives, preferences and constraints to installing the RT.

**Toilet ownership:** Toilet ownership in priority segments help identify the number of households that do not have a toilet and could be a potential market for the SURT or MURT.

**Toilet sharing status:** Provided a benchmark for the number of households that currently use SURTs vs MURTs.

**Habit of latrine excavation:** Was used as a proxy for homeowners/landlords finding value in on-site sanitation from an opex cost-saving perspective.

**Household income levels:** Would help move from latent to addressable market by providing benchmarks of the % of households in the priority segments who could afford the product.

The addressable market size was only calculated for the priority segment and not for all the segments in Nigeria. Therefore, the addressable market presented here is considerably smaller than the total addressable market in Nigeria.

# Combining homeowner and tenant markets in the priority segments in Lagos, the addressable market for MURTs is larger than SURTs



## Homeowners in priority segments

**Lower-bound scenario**

=

**~5,000 MURTs**

**~5,000 SURTs**

**± 40%**

Assuming the RT requires household monthly income > USD 200 and 11 households share a MURT

**1,050 MURT units ± 20%**

**4,940 SURT units ± 20%**

**Upper-bound scenario**

=

**~ 17,000 MURTs**

**~13,000 SURTs**

**± 40%**

Assuming the RT requires household monthly income > USD 100 and 11 households share a MURT

**2,804 MURT units ± 40%**

**13,170 SURT units ± 40%**

## Tenants in priority segments

Assuming the RT requires household monthly income > USD 200; tenants will partially pay for RT and 11 households share a MURT

**3,710 MURT units ± 40%**

Assuming the RT requires household monthly income > USD 100; tenants will partially pay for RT and 11 households share a MURT

**13,250 MURT units ± 40%**

**Given space constraints and the extent of shared toilets in priority segments in Lagos, the market for MURTs is larger than SURTs. The addressable market for MURTs in the priority segments will be considerably smaller if the commercial partners do not factor homeowner and tenant income levels into price**

# Combining homeowner and tenant markets in the priority segments in Abuja, the addressable market for SURTs is larger than MURTs



## Homeowners in priority segments

**Lower-bound scenario**

=

**~1,200 MURTs**  
**~3,500 SURTs**  
**± 40%**

Assuming the RT requires household monthly income > USD 200 and 11 households share a MURT

**800 MURT units ± 40%**  
**3,500 SURT units ± 40%**

**Upper-bound scenario**

=

**~ 7,000 MURTs**  
**~13,000 SURTs**  
**± 40%**

Assuming the RT requires household monthly income > USD 100 and 11 households share a MURT

**3,000 MURT units ± 40%**  
**13,000 SURT units ± 40%**

## Tenants in priority segments

Assuming the RT requires household monthly income > USD 200; tenants will partially pay for RT and 11 households share a MURT

**370 MURT units ± 40%**

Assuming the RT requires household monthly income > USD 100; tenants will partially pay for RT and 11 households share a MURT

**4,100 MURT units ± 40%**

**Space constraints are not as acute in Abuja as they are in Lagos and therefore the market for SURTs is larger than that for MURTs**

# Combined, the priority segments have a modestly sized addressable market for SURTs and MURTs, providing the RT is priced affordably



## Lower and upper bound addressable market

Lower bound (RT affordable to HHs earning > USD 100 per month)

Upper bound (RT affordable to HHs earning > USD 200 per month)

	Lagos	Abuja
SURT	~5,000 – 13,000 ± 40%	~3,500 – 13,000 ± 40%
MURT	~ 5,000 – 17,000 ± 40%	~1,200 – 7,000 ± 40%

## Implications

- The addressable market for MURTs and SURTs is equally large in Lagos. Abuja has a larger market for SURTs than MURTs. This is likely because Abuja homeowners tend to have more space in their homes
- Lagos appears to have a larger addressable market than Abuja, particularly for MURTs
- If the RT is priced so that it is affordable to a household with a monthly income of USD 100, the addressable market for both SURTs and MURTs will increase 3-4x in both cities
- If income is not a binding constraint, the latent market for SURTs and MURTs in this segment is much larger

**It is important to note that this is the addressable market for the priority segments only. The addressable market for all segments in Lagos and Abuja will be much larger**

## Process: We complemented survey research with human centered design research to understand segment decision making and preferences

RECAP

To understand key stakeholders, map out the decision-making pathways and capture preferences and constraints, Our immersive research was aimed at understanding challenges, aspirations, needs, behaviours and preferences. We used a combination of research methods to engage a range of participants.



### Contextual interviews

Interviewing, observing and carefully documenting attitudes and behaviours.



### Participatory design sessions

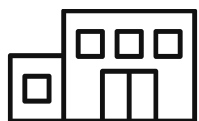
Engaging participants in a dialog around crafted prototypes to gauge preferences.



### Group Interviews

Leveraging groups of 3-5 participants for quick supplemental insights.

We conducted our research in Nigeria and Kenya and focused efforts on understanding insights from the following:



Tenements



Informal settlements

51

Participants interviewed

17

Landlords

34

Tenants



Lagos  
Nairobi  
Mombasa

# We identified 5 key personas within the informal shanty/tenement priority segment, each representing different needs and preferences



## About personas

Across the sanitation ecosystem, we have identified 5 personas – 3 tenant personas and 2 landlord personas – that represent behavioral segments with patterns of common preferences and needs. These personas are important influencers of demand for the RT, and serve as starting points for testing ideas and concepts throughout the design process. These personas also interact with other actors in the ecosystem.



### 3 Tenant Personas



The Fisherman  
(Lagos, Shanty)



The Influential Pastor  
(Lagos, Shanty)



The Shopkeeper  
(Lagos, Tenement)



### 2 Landlord Personas



The Respectful Community Member  
(Lagos, Tenement)



The Inheritor  
(Lagos, Tenement)

### Additional Ecosystem Actors

*Baales (i.e., chiefs)* are consulted – and paid – by landlords to approve development on land.

*Laborers* work closely with landlords to design homes and recommend sanitation solutions.

# The Fisherman (Shanty | Tenant, Lagos)



## Mr. Tunde

Married with 4 children

36 years old

Makoko – Lagos ([see film](#))

USD 40 per month

Mr. Tunde is a fisherman and his wife sells his fish in the market. He lives in a one roomed wooden and cardboard house on stilts above a lagoon with his family.

***“We have trouble with power, it’s expensive and inconsistent.”***

### Water: Access ● Reliability ● Payment to: Water Tank Owner

His family gets their water from a water tank, and spend USD 0.20 per day. They use the water for their daily chores, but cannot directly consume it because it often smells and looks dirty. When Mr. Tunde has extra money, he buys one package of pure water (i.e., 20 plastic sachets of drinking water that cost USD 0.55) for his family monthly drinking water supply. If he does not have the funds, his wife boils their collected water if there is enough cooking fuel.

#### Key needs:

- Access to clean drinking water at a cheap rate

### Sanitation: Access ● Reliability ● Payment to: Included in rent

Mr. Tunde uses the hanging toilet (i.e., a wooden slab with a hole that’s suspended over the lagoon) located outside his compound. The toilet doubles as a bathroom and is shared with 4 other households. The toilet is inaccessible during the night due to insecurity. His wife and the other women of the compound take turns cleaning the wooden slab. He is happy that water takes the waste away.

#### Key needs:

- Accessibility to a sanitation facility at night

### Energy: Access ● Reliability ● Payment to: Landlord

Mr. Tunde’s landlord has an agreement with the plot next door to tap their electricity supply so the landlord can provide it to his tenants. Mr. Tunde is very frustrated with his electricity service because it is unreliable, but he pays a monthly bill of USD 2.50 despite the quality of the service.

#### Key needs:

- Constant and reliable source of power

### Cooking fuel: Access ● Reliability ● Payment to: Vendor

Mr. Tunde's wife uses kerosene for cooking. She purchases small quantities of kerosene from the floating market (i.e., vendors who sell small household goods in a wooden canoe) at USD 0.20 every few days. His wife wants gets frustrated that it takes more fuel and time to cook beans.

#### Key needs:

- A faster and cheaper method to cook beans

Good ● Average ● Poor ●

Access - the ability to obtain the service  
Reliability - the performance of the service

# The Influential Pastor (Shanty | Tenant, Lagos)



## Mr. Egbowon

Married with 5 children  
46 years old  
Ijora – Lagos  
USD 65 per month

Mr. Egbowon is a influential pastor, and residents around the area attend his church service. He lives next to the waterfront and his shanty house is built on top of artificial land made out of trash and other recycled material.

*“Rain brings joy and sorrow.”*

### Water: Access ● Reliability ● Payment to: Well Owner

Mr. Egbowon’s family buys water from his neighbor’s well and, when he can afford it, pure water from the local vendor. His neighbor charges the family USD 0.15 per day, and Mr. Egbowon purchases the pure water once a month at USD 0.55. The well water is often dirty, but his wife boils the water if the family runs out of pure water.

#### Key needs:

- Access to cheap portable water

### Energy: Access ● Reliability ● Payment to: Landlord

Mr. Egbowon has mixed feeling about the rainy reason. On the one hand, he gets power for at least 5 hours out of the day. On the other, the risk of electrical fires increases and flooding occurs. During the dry season, he is without power for 3 consecutive days out of the week. Mr. Egbowon’s landlord shares the meter with another plot. The bill is split evenly amongst all tenants. Mr. Egbowon pays a monthly bill of USD 3.00.

#### Key needs:

- Access to cheap, reliable, and safe source of power

### Sanitation: Access ● Reliability ● Payment to: N/A

He does not have a toilet; he uses the shot put method (i.e., defecation in plastic bags and disposal into the lagoon). They have a bathroom made of wood, and the greywater drains directly into the environment. There are public toilets around that charge USD 0.08 per use, but he rarely uses them due to cost and poor maintenance. During the rainy season, flooding makes the bathroom and the public toilet inaccessible.

#### Key needs:

- Access to a clean sanitation facility that withstands the floods

### Cooking fuel: Access ● Reliability ● Payment to: Vendor

Mr. Egbowon’s wife uses a kerosene stove and firewood for cooking. His wife spends USD 0.20 on kerosene daily. Mr. Egbowon’s wife and neighbors collectively purchase and share firewood. His family contributes USD 1.50 per month to the firewood supply. Mr. Egbowon does not like the idea of cooking gas because he believes it is dangerous, especially around children.

Good ● Average ● Poor ●

Access - the ability to obtain the service  
Reliability - the performance of the service

# The Shopkeeper (Tenement | Tenant, Lagos)



## Mrs. Aoko

Married with 3 children  
32 years old  
Oworonshoki – Lagos  
USD 99 per month

Mrs. Aoko lives in a one roomed concrete house together with her husband and 3 children. Her husband drives a taxi and she manages a store that sells small household goods.

***“We have to do several evacuations during the raining season.”***

**Water:** Access ● Reliability ● **Payment to:** Included in rent

Mrs. Aoko gets her water from a well inside their compound which she uses for her chores, and buys pure water at a discounted rate (i.e., USD 0.40) from her shop. She has access to the well throughout the year, but during the dry season, it takes a longer time for her to fetch the water because the water level is low.

### Key needs:

- A faster and less strenuous way to collect water during the dry season

**Energy:** Access ● Reliability ● **Payment to:** Landlord

Mrs. Aoko building is connected to NEPA’s electrical grid, but the building only has one meter. The landlord receives the total bill and charges her a monthly fee based on the number of appliances she has in her home (i.e., USD 4.00). The power is unreliable with frequent blackouts, but she has to contribute to the electricity bill regardless of its stability. She has a small generator as a power backup that uses fuel which is an additional expense (i.e., USD 5.50 per week). She has to use the generator sparingly to save money.

### Key needs:

- Access to a cheap and reliable source of power that produces enough energy for all her appliances

**Sanitation:** Access ● Reliability ● **Payment to:** Landlord

Her 14-unit building has one squat toilet and a separate bathroom for them to share. Each tenant is responsible for collecting their water for the pour flush. The toilet is connected to a soak pit, which requires more evacuations during the rainy season. This frustrates Mrs. Aoko because she has to find extra money to contribute to the evacuations (i.e., USD 3.00). The residents at Mr. Aoko’s building collectively decided to hire a cleaner to clean common spaces so there would be fewer disputes. The cleaner comes three times a week and charges the building USD 15 per month.

### Key needs:

- A soak pit that does not require frequent evacuation
- An easier way to get water for the pour flush squat toilet

**Cooking fuel:** Access ● Reliability ● **Payment to:** Vendor

Mrs. Aoko cooks using a kerosene stove or a gas cooker. Cooking inside the house is not allowed, so she cooks in the shared kitchen. She uses the kerosene stove for her daily cooking and the gas stove for things that take a longer time to cook (e.g., beans). She pays USD 0.20 per day on kerosene and refills her gas cylinder every 2 months for USD 8.00.

Good ● Average ● Poor ●

Access - the ability to obtain the service  
Reliability - the performance of the service

# The Respectful Community Member (Shanty | Landlord, Lagos)



## Mr. Abayomi

Lives with his wife and 4 children

60 years old

Makoko – Lagos ([see film](#))

USD 85 per month

Mr. Abayomi's family bought land from the *baale* (i.e., chief) 15 years ago, and built a housing unit on it. Mr. Abayomi is a tailor who runs his shop from one of the units and rents the other units. He struggles to maintain the upkeep of the housing unit.

***“The tenants never have money to contribute to the housing issues.”***

## Background

Mr. Abayomi was born and raised in Makoko. Over the years, he saved small amounts of money from his business so he could invest in owning land and building rental units in Makoko. Mr. Abayomi's land is located on reclaimed land on the lagoon. He hired an experienced but uncertified local laborer to help him build a four single-room housing unit made out of wood that sat on stilts. Mr. Abayomi and his neighbors in his housing cluster agreed to build and share a hanging toilet amongst ten units.

## Key Needs

- **Decision-making** - To make any changes or improvements that may affect other buildings within the cluster (i.e., neighborhood), Mr. Abayomi must first consult the other landlords. If the landlords disagree with his request, Mr. Abayomi may need to give more money or buy more gifts to persuade them. This process can be time-consuming and costly.
- **Rent collection** – Most of the tenants have lived in the housing unit for a long period and have become good friends with Mr. Abayomi. It has become increasingly difficult to collect rent as tenants are either businessmen or casual labourers who do not have a steady source of income.
- **Flooding** – During the raining season, the whole cluster is prone to flooding. The wooden construction needs to be frequently changed as it starts to rot and lose structural integrity. Mr. Abayomi struggles to come up with the finances to make such repairs.

## Decision-making Process

Land ownership approval process:

- Mr. Abayomi approached and expressed his interest in owning land to the *baale* who resides in that particular region.
- The *baale* stated it was required to meet and bring gifts for all the Makoko *baales*.
- Mr. Abayomi met with the Makoko *baales* and stated his intent for wanting to own land.
- The *baales* agreed to his request, but stated if he wanted to expand beyond what they approved, he would need to go through another approval process (i.e., seek and be granted permission from landlords in his region, meet with *baales* and landlords to make a request and get approval for expansion).

The factors that determine what issues he addresses:

- **Cost** – In case of any improvements or repairs, he assess the cost. If it is minimal, he pays for the expense, but if it is large, he asks each tenant to contribute.
- **Urgency** - Issues that are a high priority are those that can potentially damage the structure of the building (e.g., stilts that hold up the housing unit).

# The Inheritor (Tenement | Landlord, Lagos)



## Mr. Odusanya

Lives with his wife and 2 children

34 years old

Bariga– Lagos

USD 143 per month

Mr. Odusanya is works at the local bottling company. He lives in two of the rentals which he inherited from his parents with his family.

*“I hold a bi-weekly meeting with the tenants to discuss plot issues.”*

## Background

Mr. Odusanya together with his 3 siblings inherited rental units built by his father 30 years ago. The plot has 10 single room units made of concrete, one squat toilet that is connected to a soak pit, one bathroom, and one kitchen.

Mr. Odusanya is responsible for ushering in new tenants, collecting rent and utility bills, and addressing tenant complaints. Mr. Odusanya and the head of each household hold bi-weekly meetings to discuss issues ranging from security, hygiene, maintenance, utilities, etc. He consults with his siblings before making major decisions about the building (e.g., building a new unit, increasing rent).

## Decision-making Process

The factors that determine what issues he addresses:

- **Cost** – In case of any improvements or repairs, he assesses the cost. If it is minimal, he pays for the expense, but if it is large, he asks each tenant to contribute.
- **Urgency** - Issues that are a high priority are those that can potentially damage the structure of the building or cause major health problems (e.g., failure to evacuate the soak pit).

## Key Needs

- **Decision-making** – His siblings sometimes fight and don't talk for months. This is an issue when a major decision needs to be made about the building.
- **Rent collection** – Most of the tenants are casual laborers who do not have a steady source of income, and struggle to come up with rent at the end of the month.
- **Maintenance cost** – The amount of rent that is charged is not sufficient to cater for regular maintenance, so he asks his tenants to contribute. The tenants comply whenever he asks them to contribute.
- **Flooding** – During the rainy season, the soak pit tank fills at a faster rate. It frustrates both Mr. Odusanya and the tenants that they have to pay for frequent evacuation during that time of year.

# For priority segments, the by-product value proposition of the RT is greater than the waste treatment / sanitation access value proposition

Users had other sanitation options (e.g., workplace, public toilets, etc.) beside their home sanitation unit. Sanitation was not a top priority issue, relative to others, because users did not use this basic service as frequent as others (i.e., electricity, cooking fuel, water). Users were excited that the RT could potentially produce a by-product that would address pain points of the basic services that they frequently use. The value proposition for the RT should be as follows:

## LANDLORDS

- **By-products:** The RT creates **electricity (Lagos)** that landlords can use for a variety of home and business needs, particularly if they live on the property. The RT also may allow landlords to charge higher rent due to the availability of by-products
- **Installation:** The RT is easy and cheap to install – it's flexible enough to fit into most residential configurations, it's straightforward to approve
- **Sanitation:** The RT is low maintenance – it's self-sustaining without the need for an existing power or a water supply, it's easy to clean and and it requires minimal evacuation
- **Price:** The RT is cost-competitive with existing sanitation solutions available on the market

## TENANTS

- **By-products:** The RT creates **electricity (Lagos)** that tenants can use for a variety of home needs, or as business business opportunities. This capability is differentiated from any other sanitation solution on the market
- **Sanitation:** The RT offers a relatively low maintenance solution– it's self-sustaining without the need for an existing power or a water supply, it's easy to clean and it requires minimal evacuation
- **Price:** The RT does not require any significant costs incurred by tenants associated with ongoing usage, maintenance or evacuation.

**Most respondents in priority segments were somewhat satisfied with their existing sanitation solutions. The value proposition of the RT may therefore rest on the by-products, as many households are looking to either enhance the reliability or lower the costs of their basic services (i.e., cooking fuel / electricity)**

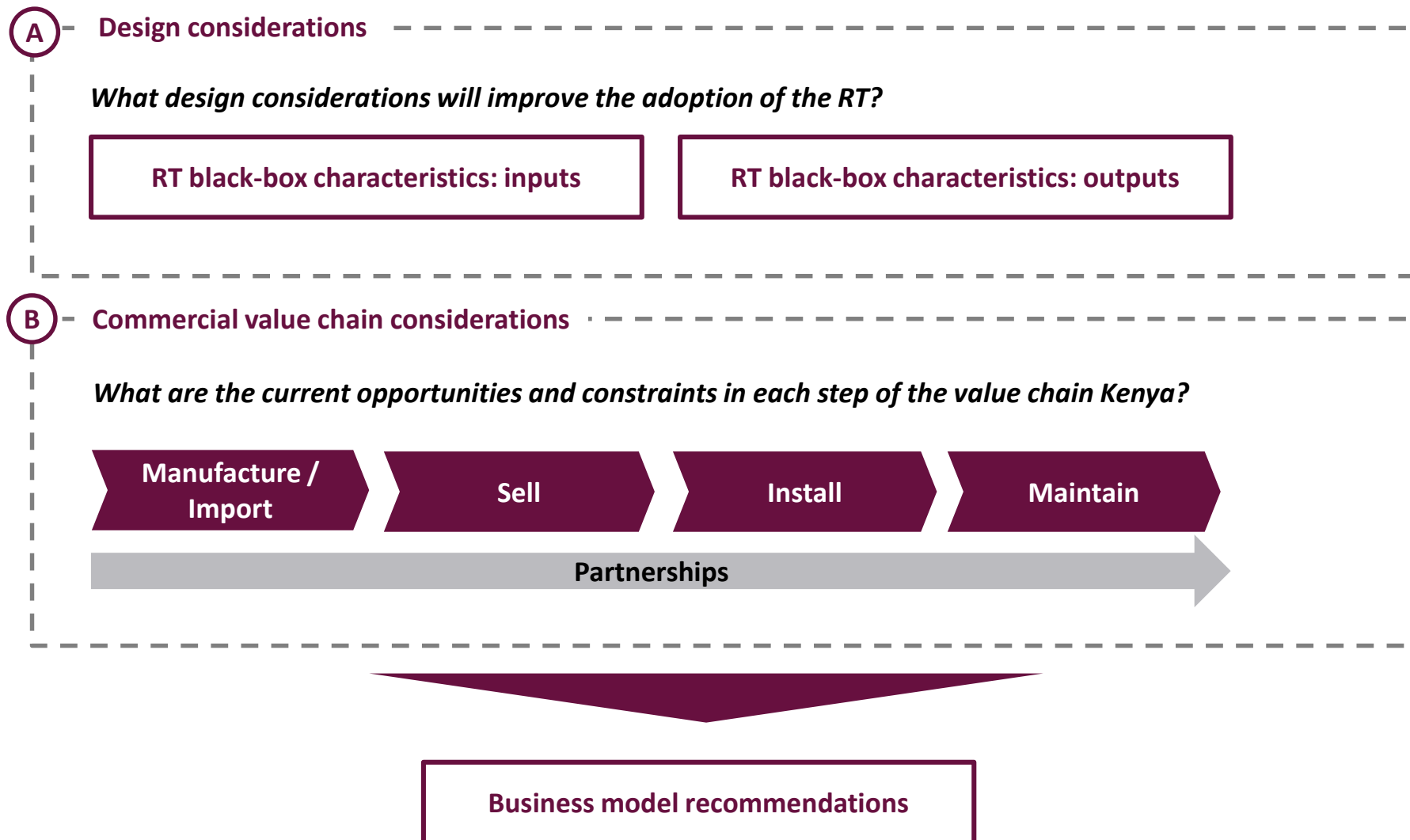


## NIGERIA COUNTRY REPORT: CONTENTS

- Nigeria sanitation landscape: stakeholders, challenges and opportunities
- **Residential market: priority segments and go-to-market approach**
  - Go-to-market considerations for existing construction priority residential segments
    - Overview, size, needs and preferences of priority segments
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  - Go-to-market considerations for new construction priority residential segment
- Institutional market: priority segments and go-to-market approach
- Conclusion: Recommended paths to market entry
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# Process: We uncovered the preferences of the target segments and identified design considerations to improve adoption of the RT

RECAP



## Process: In interviewing tenants and landlords, we developed design recommendations on the RT's black box parameters



The RT has 12 potential input parameters and 11 potential output parameters. These parameters are intended to describe ideal operating ranges for RT developers to consider when designing/modifying the RT. We used a variety of research methods with tenants and landlords to understand preferences, needs and behaviors related to the black box input and output parameters:

Potential input	Research method
Electricity	Interview questions and design activity
Water for initial charge	Interview questions and design activity
Urine & Feces	Interview questions
Footprint	Observations and interview questions
Weight	Attempted, but hard to conceptualize
Steps up platform	Observations and interview questions
Additives/consumables	Interview questions and design activity
Maintenance	Interview questions and design activity
Manual operation	Interview questions and visual card sort
3rd party servicing	Interview questions
Waste processed	Interview questions
Vent	Attempted, but hard to conceptualize

Potential output	Research method
Nothing	N/A
Electricity	Interview questions and visual card sort
Biogas	Interview questions and visual card sort
Liquid fertilizer	Interview questions and visual card sort
Ash	Interview questions
Non-potable water	Interview questions and visual card sort
Radiant heat	Attempted, but hard to conceptualize
Odor	Attempted, but hard to conceptualize
Noise	Attempted, but hard to conceptualize
Fire flame	Attempted, but hard to conceptualize
Potable water	Interview questions and visual card sort

## Black Box Parameter Insights – Input: Electricity (0-50 kWh)



### Current Experience in Lagos

Power Holding Company of Nigeria (locally known as NEPA) is the main electricity provider in Nigeria. NEPA's service is highly unreliable across all demographics in Lagos. Residents have frequent blackouts and sometimes go for days without electricity. It was common for tenements to have one meter for the entire building. Landlords of tenements divide and collect money from each household to pay for the electricity bill. For the few participants who had a generator, they stated that the high-cost of fuel limited their ability to operate the generator.

In the informal settlements, electricity was illegally tapped. Participants paid a shared fee for the use of the transformer. During the dry season, participants stated they would go for days without service, but during the rainy season, the quality of service was slightly better.

*"NEPA still charges us even though they do not bring us lights!"*

*– Mr. Emeka, Bariga, Lagos*

#### Common appliances:

Light bulb (~60W), Ceiling fan (~50W), CRT TV (~80W), Phone / charging port (~5.5W), iron (~1000W), small fridge (~100 W)

#### Cost (per month):

- Electricity
- Tenement: USD 2.40 – USD 5.50
- Shanty: USD 1.50 – USD 4.00
- Generator fuel: USD 22

#### Power usage range (per household):

1.03 – 3.61 kWh per day

### Design Considerations

Nigeria's electricity supply is extremely unstable. Therefore, **it is highly recommended that toilet not run on a user's electricity source. If a power supply is required, it should be derived off-grid and discreet.** However, an off-grid source would be another component of the RT that would require money, space, and maintenance. Also, it may be potentially misused, vandalized, or stolen if people see any value in it.

## Black Box Parameter Insights – Input: Water for Initial Charge (0-700 L)



### ***Current Experience in Lagos***

The majority of tenement participants accessed their water through a well that was either located on their or neighbors' plot. A few participants purchased water from an informal water delivery service. None of the participants had water directly piped to their sanitation system, and they were responsible for collecting their water for toilet use.

In informal settlements like Makoko or Ijora, where there is often little access to government-supplied water, most participants obtained their water from wells or water vendors. However, this water is often perceived to be relatively dirty and often colored, so most people avoid drinking and instead use it for chores. Participants did not require water to use their sanitation system.

***"Each tenant is responsible for collecting their own water to flush their waste."  
– Mrs. Adebola, Oworonshoki, Lagos***

### **Tenement usage:**

- Water used for pour flushing of waste in sitting or squat toilet
- Some toilets also served as a bathroom; greywater from bathing was used for flushing and cleaning
- Amount used: Unclear

### **Shanty usage:**

- No toilet
- Hanging toilet
- Wooden pit latrine

### ***Design Considerations***

**It is recommended that the RT not rely on users' water supply.** None of the participants had water directly piped to their sanitation system or other parts of their home (e.g., single room, kitchen, bathing area). **If water is required for the RT, it should be self-generating.**

# Black Box Parameter Insights – Input: Urine and feces (10-100 ppl)



*“There’s nobody around. Does that mean I have to use the toilet all the time to make this RT work?!”*

**- Mrs. Adeyinka–Makoko Lagos, Nigeria**

### Number of persons per toilet:

- Tenement: 40 – 64 people
- Shanty: 16 – 64 people (most did not have a toilet on their plot)

### Design Considerations

**For tenements, the RT needs to account for fluctuating urine and feces volumes.** Residents have other options besides their plot toilet. Adults can use a toilet at their workplace, or the market and children can use a toilet at their school. The input volume may be low during the week, but high during the weekends if residents are around or if there is a celebration.

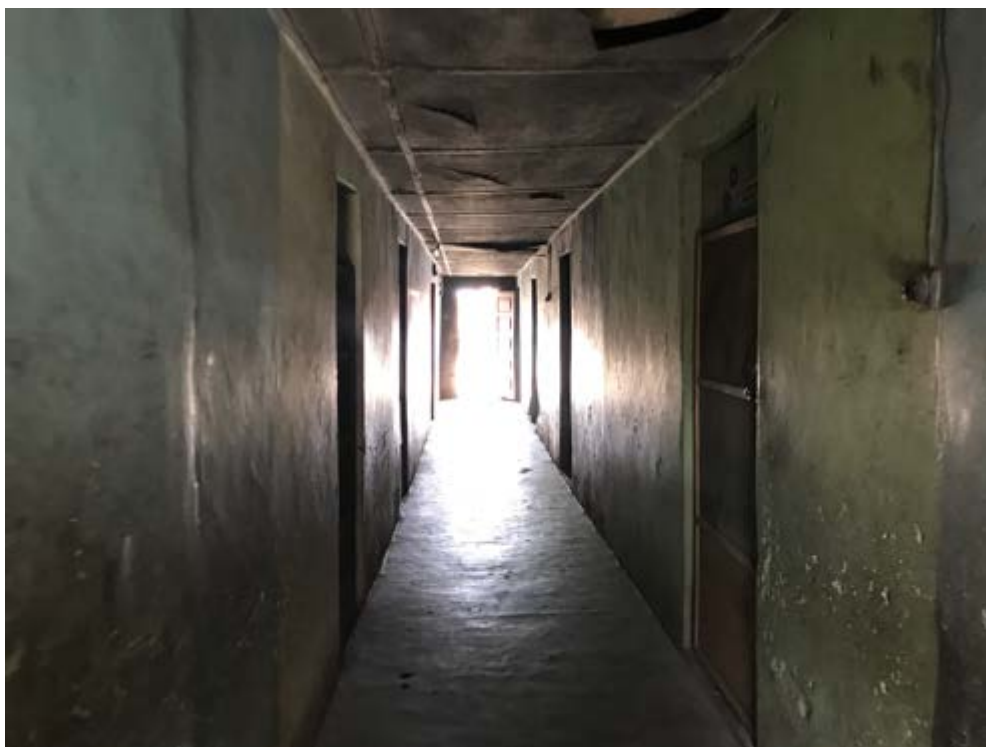
For shanties, the shot up method is convenient and free. For the hanging toilet, the waterbody transports the waste away from home, and the landlord does not have to pay for evacuation fees. **The RT would need to be conveniently located and produce a byproduct (i.e., electricity) that the segment wants for them to use a central toilet.**

### Current Experience in Lagos

Tenement participants did not have a toilet inside their home due to major space constraints. The majority plots had only one toilet for the entire compound, which was connected to a soak pit.

Due to both space and geographic limitations, shanty participants either did not have a toilet and used the shot up method (i.e., defecation in plastic bags and it is disposed into the lagoon) or used a hanging toilet (i.e., wooden pit slab hanging over the lagoon).

## Black Box Parameter Insights – Input: Footprint (1mx1mx1m- 2.5mx6.5m/20' container)



### **Current Experience in Lagos**

Tenements, locally known as Face -Me – I –Face- You, are residential buildings located in tightly densely populated areas. They consist of multiple small single room units and one toilet, bathroom, and kitchen that is shared amongst all tenants.

The homes of participants living in shanties / informal settlements were precariously situated on a lagoon and often prone to flooding. Flooding was one of the reasons why they did not construct an on-ground sanitation system.

*“The toilet should be located outside as there’s no space inside my house.”*

– Mr. Aoko, Oworonshoki , Lagos

### **Design Considerations**

For the tenement segment, it would not be feasible to install individual toilets, which connects to a central on-site sanitation system, in single room units. **There is a possibility of changing the existing sanitation system (e.g., soak pit) with an RT system, but the value proposition would need to be very strong for landlord/s to spend money and time to replace their system. An aboveground RT treatment system is a possibility, but it is dependent on the availability of space and flooding conditions.**

Individual toilets that are connected to an on-site treatment system is also not feasible for the shanty segment. **We recommend exploring sanitation providers’ (e.g., Sanivation, Sanergy, Pivot) waste collection and transport approaches. Determine and test approaches that could work for the shanty segment.**

## Black Box Parameter Insights – Input: Steps up platform (0-4 steps)



*“We don’t allow children to use the toilet as they leave it messy.”*

– Mr. Asa– Bariga, Lagos

### *Design Considerations*

**It is recommended that the RT not have steps.**

Children (< 7 years) were not allowed to use the toilet because it was stated that they could not keep the toilet clean. Steps would further limit this demographic and others (e.g., the elderly) from accessing the toilet. Also, limited space and geographic constraints (e.g., lagoons) won’t allow for steps.

### *Current Experience in Lagos*

For the majority of the toilets we saw, there were no steps. We only observed two toilets that were slightly raised from the ground.

## Black Box Parameter Insights – Input: Additive/consumables (*none-monthly purchase/weekly additions*)



### **Current Experience in Lagos**

Some tenement participants stated that their building hired a cleaner to clean the common spaces (i.e., toilet, bathroom, kitchen). The cleaner was responsible for bringing and using her products. Participants stated that the cleaner would need to purchase whatever additive the RT required. Others who cleaned their facility used greywater from bathing and toilet brushes. They were concerned about the potential added cost to purchase RT additives.

***“The tenants collectively pay for a cleaning lady. She comes with her own detergents.”***  
– Mr. Adiche, Oworonshoki Lagos - Nigeria

Common household cleaning products in the grocery store:

- Bleach (brands: Sumo, Astonish, Hypo, Sunshine)
- Toilet cleaning gel (brands: Harpic, Sumo, Mr. Muscle)
- All-purpose cleaners (brands: Dettol, AJAX, Morning Fresh)
- Bathroom cleaners (brand: Astonish)

### **Design Considerations**

**If additives/consumables are required, they should be cheap and easy enough for anybody (e.g., tenants, cleaning lady) to use and purchase.**

## Black Box Parameter Insights – Input: Maintenance (*annual to monthly*)



### **Current Experience in Lagos**

For tenement participants, maintenance of the toilet consisted of cleaning of the front interface and fecal sludge evacuation. Some participants had a cleaning schedule for the toilet, while others stated that their building hired a cleaner to clean common spaces. All participants stated that their building used fecal sludge evacuation trucks for waste collection.

For shanty participants who used a hanging toilet, maintenance consisted of the replacement rotten/fragile wooden planks. For the few participants that used a pit latrine, evacuation consisted of hiring informal labor to rake and dispose of waste into a nearby waterbody.

***“The ladies take turns cleaning the toilet.”***  
– Mr. Babatunde, Bariga, Lagos

### **Tenement:**

- Total cost for fecal sludge evacuation: USD 24 – USD 60 per session
- Cost per household: USD 2.15 – USD 4.50
- Cleaning service: USD 13 – 18 per month

### **Shanty:**

- Total cost for fecal sludge evacuation: USD 0.56- USD 0.85 per session
- Cost per household: USD 0.11+
- Wooden plank: N/A

### **Design Considerations**

**The RT should require minimal maintenance, and it should be simple enough for residents to perform the required tasks.** Using a professional is another expense, and people will most likely address an issue themselves so they can save money. **If local professionals are required, they should be trained and provided with a grounded understanding of the RT’s internal workings. Also, they should be readily available.**

## Black Box Parameter Insights – Input: Manual operation (*flush toilet to user technical input*)



### **Current Experience in Lagos**

The majority of participants preferred a squat over a seated toilet because they perceived it as more hygienic. They feared of contracting diseases from sharing a toilet seat with multiple households but stated it was okay to share a toilet seat if it was only shared amongst one family. Also, participants were concerned about using a water closet toilet (also associated with a seated toilet) because they stated it would use more water which would increase fecal sludge evacuations. Participants preferred a pour flush so they could manage the water that entered in the soak pit. Others preferred automatic flush because they said it would reduce the fetching of water. No participants had water directly piped to their sanitation system.

***“Seat toilets requires too much water to flush.  
It will fill up the soakway quickly.”***  
– Mrs. Chioma, Oworonshoki , Lagos

### **Tenement:**

- Majority used a squat toilet
- Pour flush was the common flush mechanism

### **Shanty:**

- Plastic bag for the shot put method
- Wooden slab

### **Design Considerations**

Participants ideal toilet for a shared environment was a squat toilet with automatic flush. **As previously mentioned, the RT should not depend on users' water supply. The RT value proposition improves if it can generate its water for flushing.**

## Black Box Parameter Insights – Input: Third party servicing (*annual to monthly*)



### Current Experience in Lagos

Tenement participants stated that fecal sludge evacuation trucks were used to collect the waste from soak pits. Depending on the rainy seasons and quality of construction of the sanitation system (e.g., soak pit, septic tank), participants stated that evacuation occurred between one to three times a year. Frequent evacuations was a pain point for these participants. Fecal sludge trucks are known for improperly disposing of waste in a region called Iddo.

Shanty participants without toilets disposed of their waste in nearby water bodies. For those who had a pit, informal services (e.g., local youth) were used to rake waste into a waterbody.

*"We call those trucks (fecal sludge evacuation) to take the waste away."*

– Mr. Olufemi, Bariga, Lagos

#### Tenement:

- Total cost for fecal sludge evacuation: USD 24 – USD 60 per session
- Cost per household: USD 2.15 – USD 4.50

#### Shanty:

- Total cost for fecal sludge evacuation: USD 0.56- USD 0.85 per session
- Cost per household: USD 0.11+

#### Design Considerations

Fecal sludge vacuum trucks are heavily utilized in the tenement segment. Participants mentioned that they would call the trucks if the RT required disposal of waste. **It is recommended to explore integrating fecal sludge vacuum trucks into the RT ecosystem.**

In the shanty segment, for those who had a pit used informal services (e.g., youth) for evacuation. **The RT ecosystem should explore utilizing and training these informal service providers.**

## Black Box Parameter Insights – Input: Waste processed (*human waste to bio waste*)



*“I don’t allow the tenants to throw trash because it will fill up the pit quickly.”*

– Mr. Adebola, Makoko Lagos

### *Design Considerations*

**The RT should be able to process more forms of waste**, given the unpredictability and diversity of waste put in toilets.

### ***Current Experience in Lagos***

The majority of participants stated that only human waste, toilet paper, and water from anal cleaning or bathing went into the toilet. Landlords were against putting any other forms of waste in the toilet because it would increase frequent evacuations.

# Black Box Parameter Insights – Output: Electricity (0-10 kWh)



## Current Experience in Lagos Participant's First Choice

The RT electricity by-product was the top preference for the majority of participants. They were excited about the possibility of having a stable and reliable source of electricity. They were most interested in using electricity to power their fan, phone, and TV.

\*Low Usage: Fan (2 hr), phone charging (15 min), TV (2hr)  
High Usage: Fan (8 hr), phone charging (2 hr), TV (8 hr)

*"This is what Nigeria's needs! If this toilet comes into reality to produce electricity, I would be very happy."*

– Mr. Adeyemi, Bariga, Lagos

### Common use cases:

1 Fan, 1 phone charging, 1 - 19in CRT TV :

\*Low Usage: 0.221 kWh – High Usage: 1.05 kWh

### \*Electrical power demand (per day):

- For 10 households (~40 ppl): 2.21- 10.5 kWh
- For 16 households (~64 ppl): 3.54– 16.8 kWh

### Design Considerations

For the electricity by-product to be appealing, it would need to generate enough power to meet all households demands.

The homes in the shanty segment were poorly constructed. **It is recommended to explore safe electricity delivery methods to shanty type homes.**

Tenements' infrastructure seemed to be more stable, and the majority of them had a soak pit. The soak pits were underground and had a concrete foundation, so **the logistics and approval process of retrofitting an existing structure needs to be explored.**

## Black Box Parameter Insights – Output: Biogas (0 to 70 kWh (10 families))



**Current Experience in Lagos**  
*Participant's Third Choice*

There was a mixed reaction for the biogas byproduct. Some participants stated that the use of biogas would not be safe around their children. Others preferred it because they used cooking gas and wanted to use a free or cheaper alternative. The majority of tenement residents had a shared kitchen. The delivery of the biogas from the RT would be easier compared to those who lived in shanties who cooked inside their single room home.

**“I don’t like cooking gas, I have small children who might cause accidents.”**  
– Ms. Oluchi – Oworoshonki, Lagos

### Costs (shanties | tenements)

- Kerosene: USD 5.00 - 6.00 per month | USD 5.30 - 6.50 per month
- Firewood: USD 1.30 per month | N/A
- \*Gas (6 kg cylinder): N/A | USD 3-5 per month  
(\*purchased once every 2 months)

### Design Considerations

The biogas value proposition is not as strong as that of electricity. Since there were concerns about the biogas by-product, **it is recommended to install a demonstration RT in a community so that people can experience the product.** A potential demonstration partner is Justice Empower & Initiative (JEI). JEI is a non-profit organization working with communities in the informal settlement. Currently, they are in the process of developing their first community BioFil toilet in Daramola. Their goal is to setup 35 community toilets in low-income areas, and they are looking to partner with sanitation experts.

## Black Box Parameter Insights – Output: Liquid fertilizer (0-150 L/day)



**“There’s no space for farming here, maybe I will sell it (fertilizer).”**

**– Mr. Abayomi, Makoko, Lagos**

### *Design Considerations*

**It is recommended to explore Nigeria’s agricultural ecosystem and determine if the RT’s fertilizer by-product would address any of their pain points.**

### ***Current Experience in Lagos***

#### *Participant’s Second Choice*

Farming is not a big practice in Lagos, and so participants did not find value in using the RT fertilizer by-product. Nonetheless, many saw the potential economic value and proposed selling the by-product to farmers. However, when probed about how they would transport the fertilizer from their plot to the farm, participants questioned their selection because they did not consider the costs and logistics of transporting the fertilizer.

## Black Box Parameter Insights – Output: Non-potable water (60 L/day to 600 L/day)



### Current Experience in Lagos

Participants felt that there was not a need for non-potable water because they were surrounded by it. Lagos's shallow aquifer allowed some participants to access water via a well or borehole. However, people who used wells felt it was strenuous to fetch water due to lower water levels during the dry season. Participants were not excited about this by-product and expressed more negative than positive sentiment. However, they did express interest in an automatic flush toilet because it would reduce the burden of fetching water.

*“Water is plenty. There is no need for the RT’s non-potable water.”*

- Mr. Udo, Bariga, Lagos

#### Common use cases:

Cleaning, laundry, toilet

#### Tenement -

*Well water:*  
USD 0.05 per day

**Shanty - Well Water:** USD 0.15 per day,  
**Vendor:** USD 0.20 per day

#### Amount used:

- Tenement: 20-60 L per day
- Shanty: 20-50 L per day

### Design Considerations

Non-potable water is appealing for flushing waste. **For the RT to be appealing, it should combine non-potable water for flushing with the respondent's top by-product preference.**

# Black Box Parameter Insights – Output:

## Potable water (25-250 L/day)



***“Nigerians won’t accept this! Cannot drink the RT water. That’s like eating shit.”***  
 – Mr. Tunde, Oworonshoki, Lagos

### Common use cases:

Cooking, drinking (buys pure water if water quality is poor), cleaning, laundry, bathing, toilet (i.e., pour flush)

### Tenement -

*Well water:*  
USD 0.05 per day

**Shanty - Well Water:** USD 0.15 per day,  
*Vendor:* USD 0.20 per day

### Amount used:

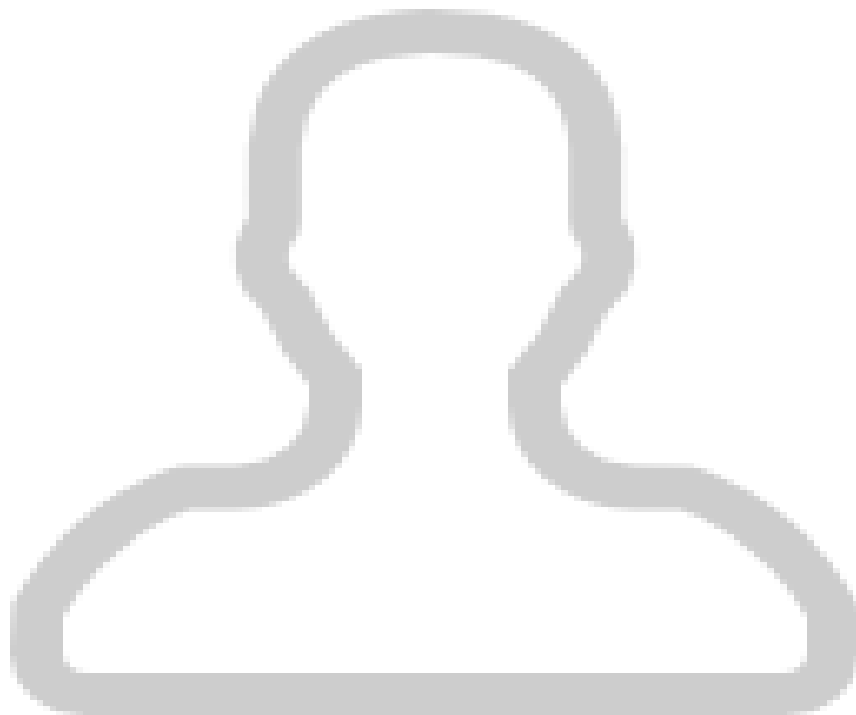
- Tenement - 60 - 120 L per day
- Shanty - 90 - 140 L per day

### Drinking water:

Pure Water brand, USD 0.55 per bag, 1 bag contains 20 500 mL sachets, purchased once a week

### Design Considerations

**It is strongly recommended that the potable water by-product is only used for non-human consumption purposes (e.g., flushing of toilet waste, cleaning). Also, the potable water should be combined with users’ top by-product preference for the RT to have a strong appeal.**



### Current Experience in Lagos

Despite informal settlements having severe water quality issues and tenements occasionally dealing with water quality issues, none of the participants entertained the idea of potable water by-product. They laughed at the notion of drinking water being produced from their waste. As they shared a toilet, it was difficult for them to conceptualize that a shared toilet, which tends to have hygiene issues, could produce potable water.

The potable water by-product was not an aspirational product. Consuming treated water from a sanitation unit could be stigmatic, and people that live in tenements and informal settlements already have to deal with much stigma.

## Black Box Parameter Insights – Output: Ash (*annually to quarterly*)



*“I will certainly dispose it (ash) into the lagoon.”*

– Mrs. Adunni, Ijora, Lagos

### *Design Considerations*

**The RT ecosystem needs to consider a third-party service or a proper disposal mechanism that is easy to use, convenient, and accessible.** If not, users will most likely use their current practice to dispose of the waste, which could lead to health and environmental consequences.

### ***Current Experience in Lagos***

Participants were willing to deal with ash if the RT had an appealing value proposition (i.e., electricity). When asked about how they would dispose of the waste from the RT, they stated they would use their current fecal sludge evacuation method (i.e., call fecal sludge truck or dispose of in a water body)

# Black Box Parameter Insights – Output: Noise



*“It is okay that it makes the sound of a small generator, but not a big generator.”*

– Mr. Uzoma, Bariga, Lagos,

### *Design Considerations*

**The RT should be as quiet as possible.**

### ***Current Experience in Lagos***

Participants who valued an RT by-product stated that they were willing to tolerate the RT making the sound of a small generator. In Lagos, there is a constant background of generator noise as many people use them as their backup source of energy when the electricity goes out. People expressed concerns about the generator running at night, as they were concerned they would not hear if their plot were broken into.

## Summary: Black-box input parameter insights



POTENTIAL INPUT	DESIGN CONSIDERATIONS
<b>ESSENTIAL DESIGN PARAMETERS TO CONSIDER</b>	
Electricity	It is highly recommended that toilet not run on a user's electricity source. If a power supply is required, it should be derived off-grid and discreet.
Water for initial charge	It is recommended that the RT not rely on users' water supply. If water is required for the RT, it should be self-generating.
Footprint	For the tenement segment, there is a possibility of changing the existing sanitation system (e.g., soak pit), but the value proposition would need to be very strong for landlord/s to spend money and time to replace their system. An aboveground RT treatment system is a possibility, but it is dependent on the availability of space and flooding conditions. For the shanty segment, we recommend exploring sanitation providers' (e.g., Sanivation, Sanergy, Pivot) waste collection and transport approaches. Determine and test approaches that could work for this segment.
Maintenance	The RT should require minimal maintenance, and it should be simple enough for residents to perform the required tasks. If local professionals are required, they should be trained and provided with a grounded understanding of the RT's internal workings. Also, they should be readily available.
Urine & Feces	For tenements, the RT needs to account for fluctuating urine and feces volumes. For shanties, The RT would need to be conveniently located and produce a byproduct (i.e., electricity) that the segment wants for them to be motivated to use a central toilet.
3rd party servicing	The RT ecosystem should incorporate and train informal service providers.
<b>IMPORTANT DESIGN PARAMETERS TO CONSIDER</b>	
Steps up platform	Steps are not recommended because they will further limit certain demographics (i.e., children and elderly) from accessing the toilet.
Manual operation	A squat toilet with automatic flush, which is not dependent on the user's water supply is the ideal shared toilet interface. The RT should be a self-sustaining system that produces its water supply for flushing.
<b>ADDITIONAL DESIGN PARAMETERS TO CONSIDER</b>	
Additives/consumables	If additives/consumables are required, they should be cheap and easy enough for anybody (e.g., tenants, cleaning lady) to use and purchase.
Waste processed	The RT should be able to process more forms of waste.

## Summary: Black-box output parameter insights



POTENTIAL OUTPUT	DESIGN CONSIDERATIONS
<b>ESSENTIAL DESIGN PARAMETERS TO CONSIDER</b>	
Electricity <i>(Top choice)</i>	The electricity by-product should be reliable and meet users' daily demands. It is recommended to explore safe electricity delivery methods to shanty type homes. For the tenement segment, the logistics and approval process of retrofitting an existing structure needs to be explored.
<b>IMPORTANT DESIGN PARAMETERS TO CONSIDER</b>	
Biogas <i>(3<sup>rd</sup> choice)</i>	It is recommended to install a demonstration RT in a community so that people can experience the product.
Ash	The RT ecosystem needs to consider a third-party service or a proper disposal mechanism that is easy to use, convenient, and accessible. The RT needs to investigate the health and environmental impacts of its outputs.
Non-potable water	It is recommended to use the non-potable water by-product for the flushing of waste. Also, non-potable water should be combined with the users' top by-product preference so that RT has a stronger value proposition.
<b>ADDITIONAL DESIGN PARAMETERS TO CONSIDER</b>	
Liquid fertilizer <i>(2<sup>nd</sup> choice)</i>	It is recommended to explore Nigeria's agricultural ecosystem and determine if the RT's fertilizer by-product would address any of their pain points.
Potable water	It is strongly recommended that the potable water by-product is only used for non-human consumption purposes (e.g., flushing of toilet waste, cleaning). Also, the potable water should be combined with users' top by-product preference for the RT to have a strong appeal.
Noise	The RT should be as quiet as possible.

# Process: We scoped the business landscape and identified commercial considerations for RT's partners



## A - Design considerations

*What design considerations will improve the adoption of the RT?*

RT black-box characteristics: inputs

RT black-box characteristics: outputs

## B - Commercial value chain considerations

*What are the current opportunities and constraints in each step of the value chain in Nigeria?*

Manufacture /  
Import

Sell

Install

Maintain

Partnerships

Business model recommendations

## Summary: Go-to-market recommendations for existing residential construction

RECAP

**To achieve widespread adoption of RT, there is a need to facilitate access to finance, to enhance users ability to pay.**

- There are no existing and reliable benchmarks for the willingness to pay for sanitation
- Willingness to pay was expressed as maximum of USD 200 but, as discussed in the report, these estimates are not reliable
- Most households may require financial assistance to acquire, since over 50% of respondents earn less than USD 100 per month and few households have access to bank accounts and credit (only 9 million households in all of Nigeria have bank accounts)

**After creating demonstration projects to test and generate interest in the RT, we recommend a product + service + finance model to bring the RT to Nigerian customers –**

- Product is purchased from local shops, with finance provided by a consortium of partners (state government, microfinance institutions) to fund the capex of the RT
- Installation and evacuation services are provided by bricklayers and plumbers associated with an existing sanitation company/shop
- A product + service + finance model would enhance product awareness, facilitate adoption by making the product affordable
- Note: business owner and associated artisans will be trained on installation and maintenance of RT and will likely become champions of the technology in the community

**If RT's commercial partners are unable to forge necessary local partnerships, pursuing a product-only model without any local presence may compromise RT's market penetration.**

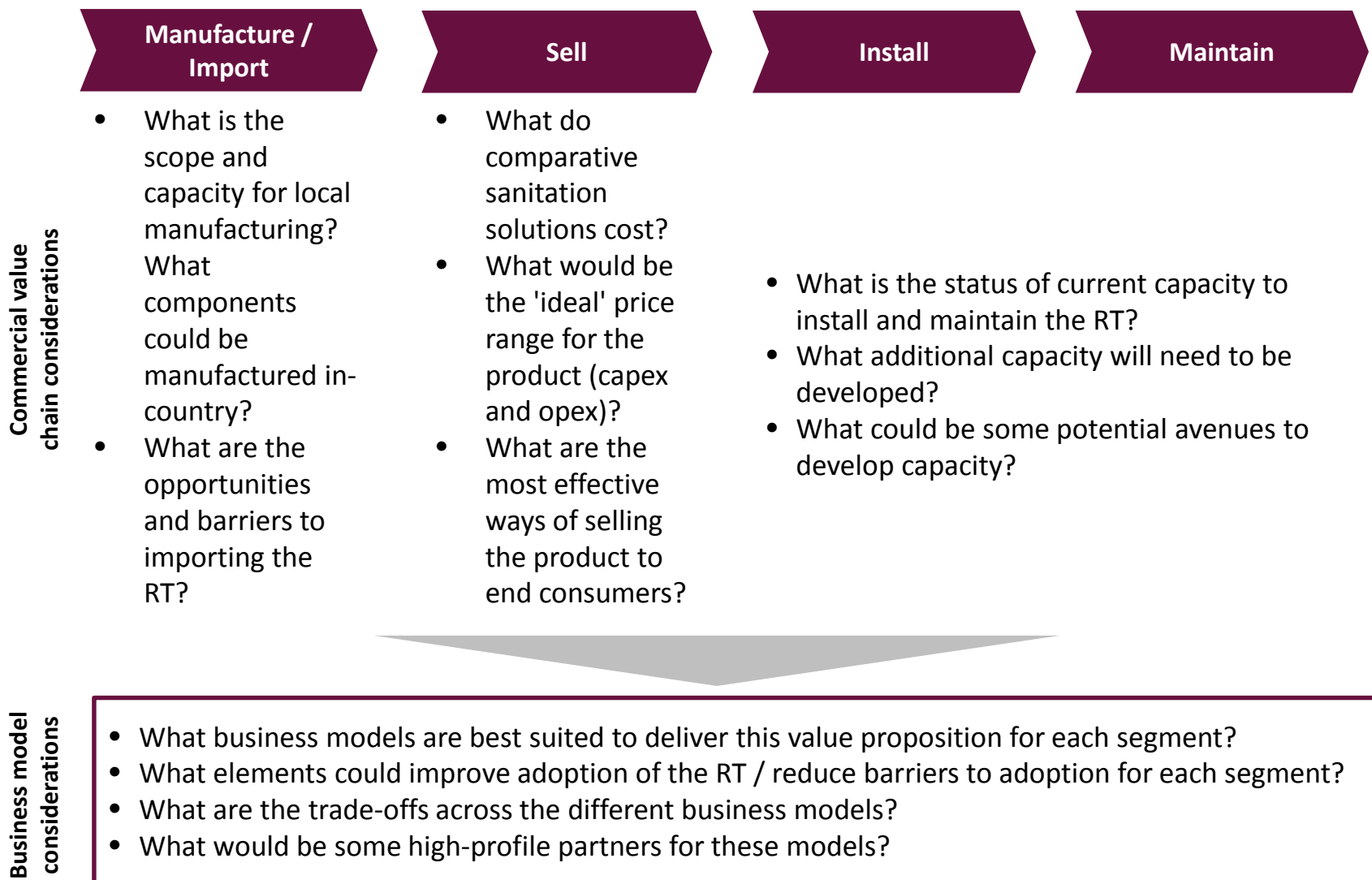
**We recommend importing the RT initially and moving to a model where it is assembled locally** – Importing the RT in the early stages will secure customer trust due to association of imported products with the idea of “quality”. Since importation is subject to currency risks and local manufacturing industry is not competitive (expensive and lacking due to scarcity of quality materials), local assembly may be a viable compromise, presenting the opportunity to import RT parts and assemble in Nigeria

**The main buyers i.e. major target of distribution will be homeowners/landlords and tenants** (who jointly make decisions on repairs, enhancements or replacement of sanitation technology). They will likely need support for the Capex of the RT, through funding institutions such as MFIs, community savings groups, and donor programs

# Process: Our key questions explored opportunities and constraints along four links of a commercial value chain



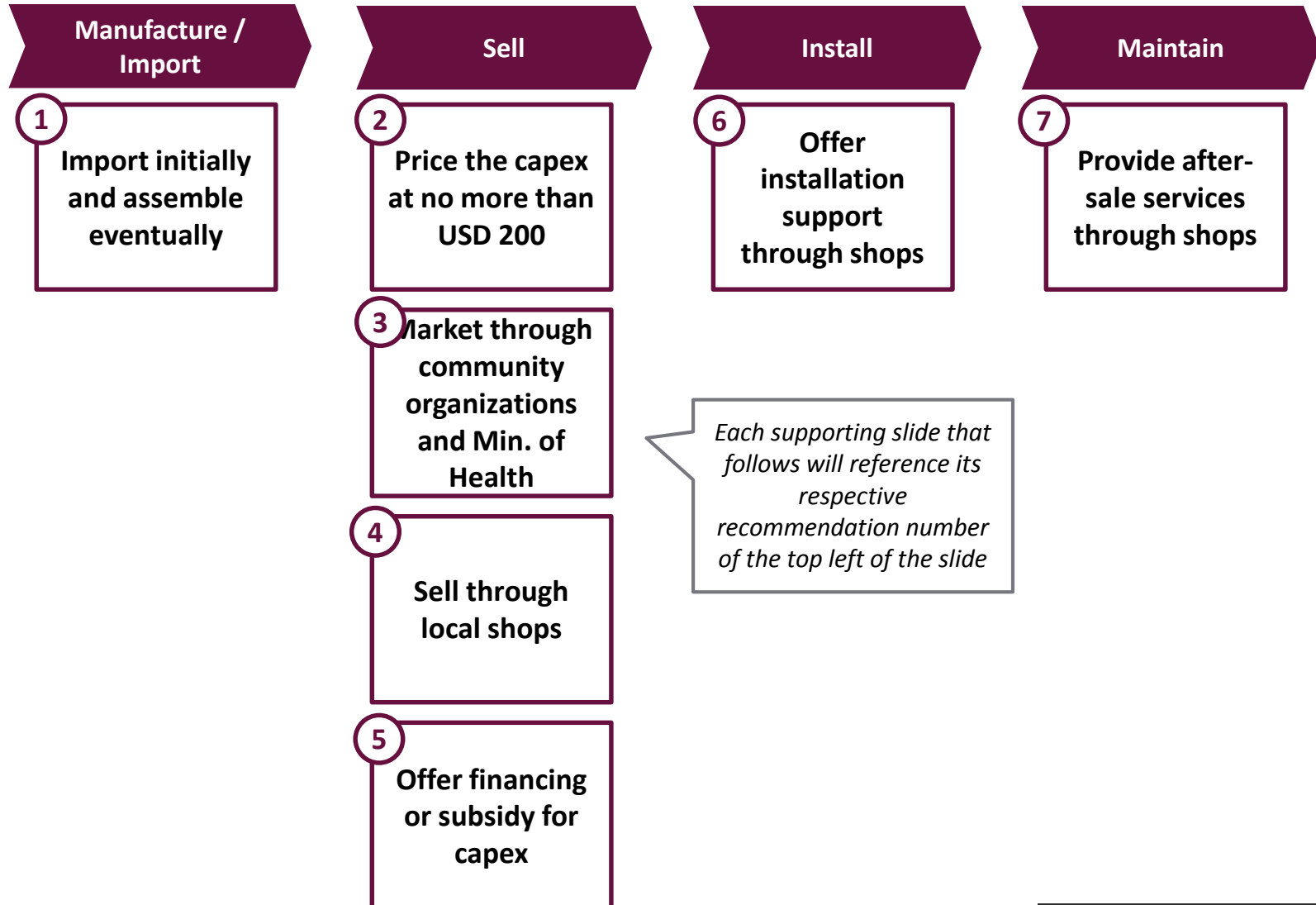
## Key questions explored



# Along four links of the commercial value chain, the recommended commercial considerations are as follows:



## Snapshot of possible commercial considerations



# Summary: Specific business model considerations for RT's partners to operate in target markets in Nigeria include



## Business model considerations for the target segments in Nigeria

- 1 Import initially and assemble eventually**

We recommend importing the RT initially to secure customers' trust in the quality of the product. Thereafter, begin to import parts not available locally and assemble RT in a local factory
- 2 Market through Min. of Health and community organizations**

There will be great value in demonstrating the RT at the community level to generate buy-in. We recommend involving the Ministry of Health and community organizations/ leaders in early marketing efforts.
- 3 Distribute through local shops**

HHs usually buy toilets and their spare parts from local shops, that are usually associated with an average of 5 plumbers/bricklayers. RT partners could sell through these shops
- 4 Price the capex at USD 200 maximum**

Based on homeowners and landlords responses to willingness to pay questions, price above USD 200 will be considered too expensive. This proposition needs to be tested further as expressed willingness to pay surveys are often unreliable
- 5 Offer financing or subsidy for capex**

Financing support or a subsidy will help open up the addressable market by rendering the product more affordable to cash-strapped households in lower-income categories
- 6 Offer installation support through shops**

To ensure the RT is installed properly, trained bricklayers/plumbers associated with existing sanitation businesses/shops could install the RT
- 7 Offer after-sales service through shops**

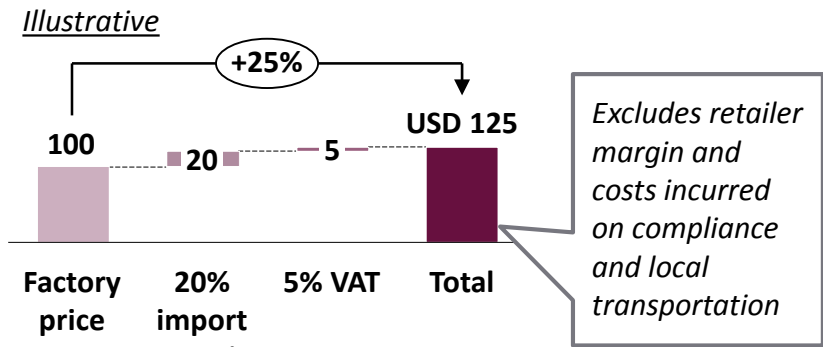
To ensure household concerns around maintenance are addressed and that the RT is seen as a reliable product, plumbers attached to local sanitation shops may provide periodic maintenance services



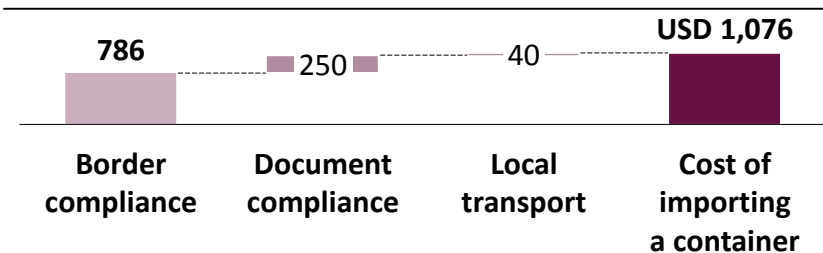
# ① Imports face more than 20% duty and are at risk of price volatility due to exchange rate risks



Importation costs on a USD 100 product



Importation costs for 20-ft x 8-ft container



Considerations

- **Imported products are expensive and prices fluctuate** due to the high volatility of the naira
- **In addition, there are several associated import costs:**
  - An average of 21% is charged in import duties and VAT on all imports categories
  - There are also costs associated with document and border compliance, i.e., the costs of compliance with customs regulations, inspection, handling and documentation required by originating and transit countries as well as Nigeria
- **The shipment clearing process is notoriously arduous**—up to 40% of companies pay bribes in order to speedily secure import licenses
- **The Naira devalued ~100% relative to the US dollar between 2012 and 2017**

**Experts advise against importing as a long-term strategy for sourcing RT, due to currency risks as well as the delays and high costs associated with the process**

Note: \*Unclear under which category the RT would fall. This assumes RT fall under “Sanitary ware and parts thereof, of iro.. Other(Baths)

Source: Customs Common External Tariff; Doing Business 2016 (World Bank); Stakeholder interviews; Dalberg analysis

# 1 Recommendation: Since imports are risky and local manufacturing industry is weak, consider local assembly, using some local materials



## Manufacture / Import

*Local manufacturing is expensive and there is no clear manufacturing industry in components relevant to the RT*

- **Infrastructure inadequacy is the most problematic factor of doing business.** In particular, Nigeria's electricity supply is poor, rating as low as 1.4 out of 7 points in the Global Competitiveness Index. Power from alternative sources accounts for 40% of production costs
- **Manufacturers depend heavily on imported raw materials.** Local raw materials are of inferior quality and available in inadequate quantities, deterring patronage from local manufacturing companies particular about quality and efficiency
- **Companies of Indian and Lebanese origin dominate the USD 222 million plastics and rubber products manufacturing sector,** mostly producing polythene and plastic products (e.g., OK Plast)

## Sell

## Install

## Maintain

*Assembly resolves the quality and cost issues of local manufacturing and provides several benefits*

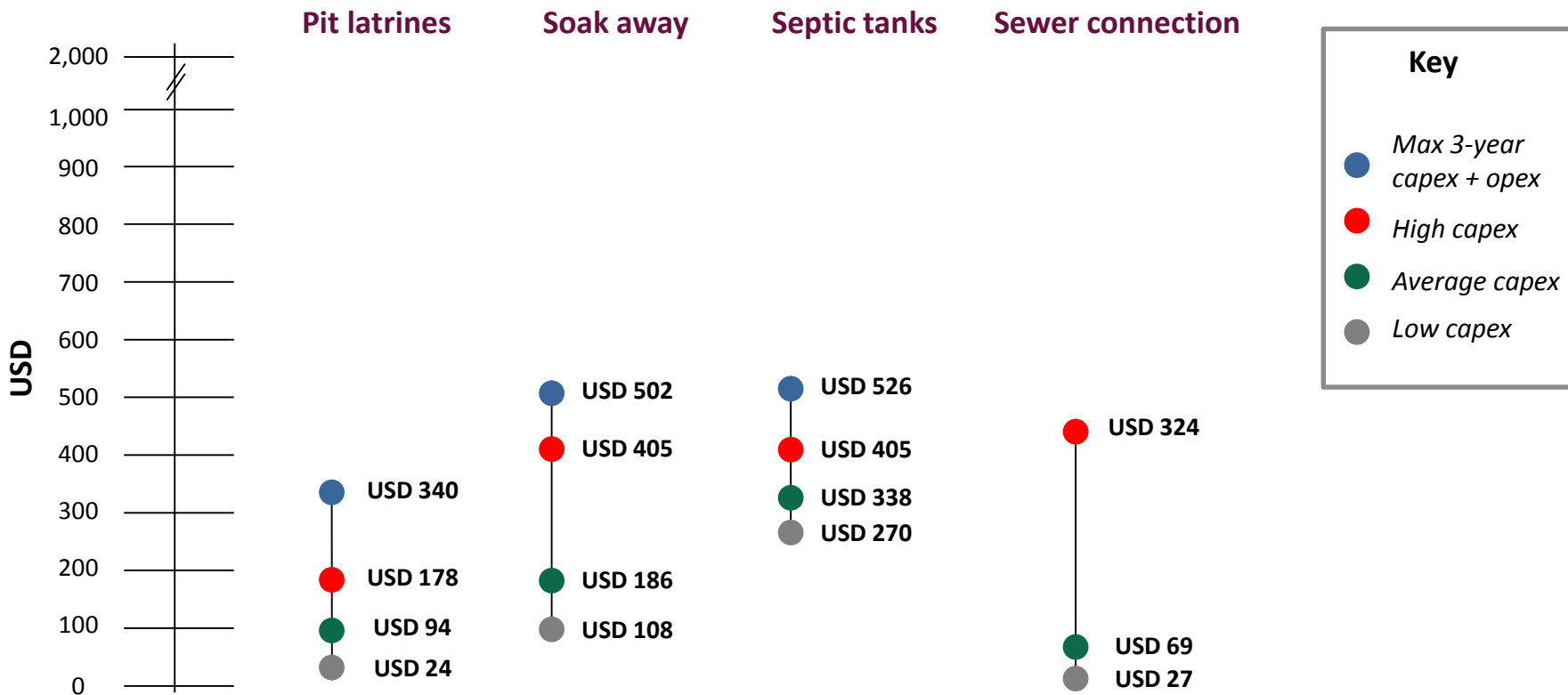
- **Nigeria has a USD 38 million assembly industry—** predominantly the assembly of vehicles / automobiles. In addition, local and foreign investments support the local assembly of mobile phones and laptops
- **Assembly allows for the utilization of locally available materials** while importing elements not available locally at the right quality / quantity
- **Potential benefits of building a local assembly plant include:**
  - **Fostering government partnership** by securing land for the assembly plant through Office for Overseas Affairs and Investments
  - **Cost savings—local assembly is less costly than importation** in the long run by saving on duties and import-related compliance procedures
  - **Further cost saving due to pioneer status,** i.e. tax exemption for two years, with a possible extension. “Waste treatment, disposal and material recovery” is one of the 27 industries recently granted this status, as announced by the National Investment Promotion Council
  - **Local assembly builds local maintenance competence** and ensures availability of spare parts for repair



# ② In deciding how to price the RT: priority segments currently spend USD 24-178 on installation of latrines and ~USD 0-54 annually on excavation



Installation and annual maintenance costs per septage solution (USD) – each serving 4 households on average\*



Expected lifetime	5-10 years	10 years +	10 years +	Indefinite
Annual expenses	~USD 0-54	~USD15-32	~USD32-41	Not estimable

Note: \*average household size is 4 in Lagos and 5 in Abuja

Source: Stakeholder interviews; Landlord Surveys; National Bureau of Statistics; Dalberg analysis

## 2 Process: To arrive at possible price points for the RT, we ran willingness-to-pay surveys; there are a few things to know about the methodology



Manufacture /  
Import

Sell

Install

Maintain

### Background and methodology

- **Van Westendorp's Price Sensitivity Meter** is one of a number of **direct** techniques to research pricing. Direct techniques assume that people have some understanding of what a product or service is worth, and therefore that it makes sense to ask explicitly about price
- **Lack of knowledge presents challenges for radically new products.** This aspect is one reason why pricing research should be treated as providing an input into pricing decisions, not a complete or absolute answer

**Sample survey question:** *"For a toilet that produces biogas for 5 hours for cooking for 10 families daily: at what price would you think the toilet is a bargain?"*

### Limitations of willingness-to-pay (WTP) surveys

- 1 **Studies show that expressed willingness to pay is somewhat unreliable, especially when target customers have not interacted with the product**
- 2 **WTP can increase if people experience the product;** This has been noted in the case of solar lanterns, where the willingness to pay increased three-fold after households were able to use the product for three nights
- 3 **WTP can decrease if the product does not meet the observer's expectations;** In this research, there were differences in willingness to purchase and pay for the RT in the quantitative survey and the human centered design research. The latter walked users through the product in more detail

Given these challenges there can be differences between demonstrated ability to pay (according to income levels and competitor pricing) and expressed willingness to pay



# 2 Recommendation: RT should aim for maximum capex of USD 200 and annual opex of USD 54, according to various pricing benchmarks used



## Potential price points

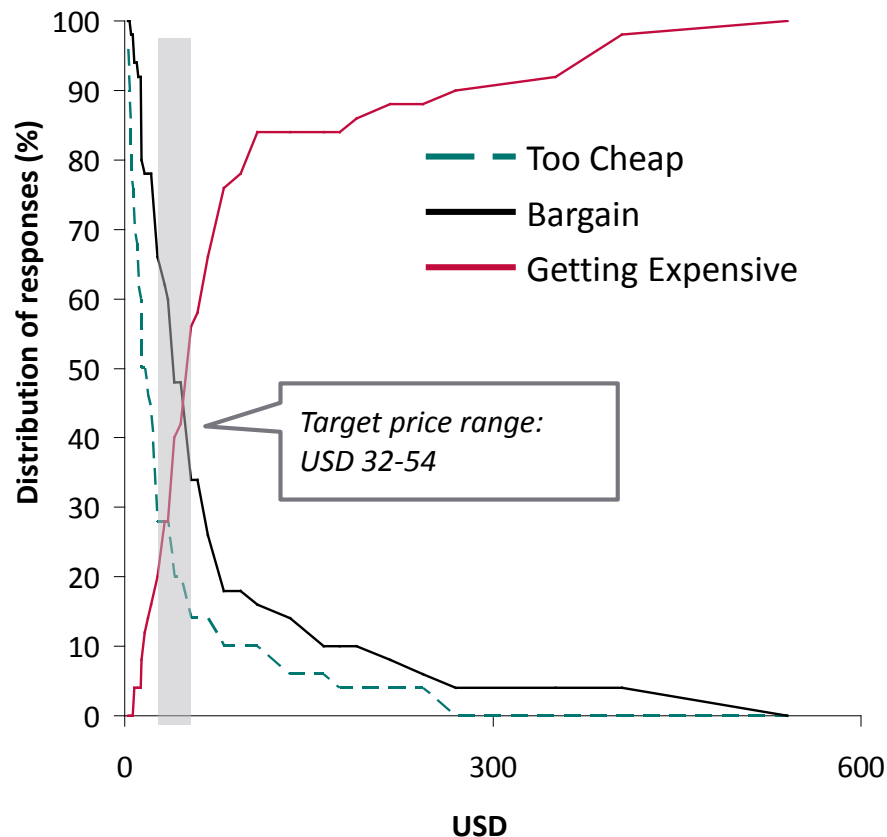
CAPEX

- **Reported willingness to pay (WTP)\*:** According to our surveys to homeowners and landlords, a SURT should cost USD 27-54; a MURT should cost USD 14-108. It is important to note that surveyed respondents had strong view that such products should be provided for free
- **Relative to competitors (without subsidy):** There are few products on the market, limiting the ability to benchmark. The Smart Toilet - pour flush system with pit latrine - costs between USD 81- 216 per unit and is provided with financing from MFIs

OPEX

- **Relative to annual maintenance cost of existing solutions:** Annual cost of maintaining (excavating) existing sanitation solutions ranges from no cost to USD 54 per annum

## Illustrative WTP\* graph (for electricity by-product)



Note: \*We used the [Van Westendorp Price Sensitivity Meter](#) to determine WTP and asked questions such as: "For a toilet that produces biogas for 5 hours for cooking for 10 families daily: at what price would you think the toilet is a bargain?"

Source: Household surveys; stakeholder interviews; "The world can't wait for sewers." 2017. Ernst & Young;

Dalberg analysis

# 5 Given low demonstrated ability to pay in the target segments, various payment models exist but may complicate the business model (1/2)



Manufacture /  
Import

Sell

Install

Maintain

## Models that have been used to sell sanitation products to the priority segment market

#	Model	Who pays CapEx	Who pays OpEx	Payment channel for OpEx	When would this work?	Example org.	Appropriate for the RT
1	<b>Pay-as-you-go</b>	Minor capex paid by user or absorbed in opex	User	Direct (monthly)	Works when there is a service or product (e.g., collection) which can be stopped / turned off if the HH misses a payment, as well as the ability to monitor HH usage and payment history		
2	<b>Pay-as-you-go with asset financing</b>	User (on credit)	User	Direct (monthly)	Requires asset financing, either in-house or through third-party. Works when there are institutions, such as MFIs, willing to provide toilet loans, for which payment can be collected by officers. May require loan collateral	<i>Smart Toilet (users take loans from MFIs and community savings groups)</i>	
3	<b>Standard sale, lease or layaway model</b>	User or landlord (varies)	User	Direct or indirect (e.g., through rent)	Works when the upfront investment is low enough for the HH, or when an entity (e.g., a women's group) holds on to the product as the user makes incremental payments, in a layaway model		

Least appropriate

Most appropriate

284



5

# Given low demonstrated ability to pay in the target segments, various payment models exist but may complicate the business model (2/2)



Models that have been used to sell sanitation products to the priority segment market

#	Model	Who pays CapEx	Who pays OpEx	Payment channel for OpEx	When would this work?	Example org.	Appropriate for the RT
4	<b>Partial subsidy</b>	Landlord and / or user + Subsidy	Landlord and / or user	Indirect (through rent)	Works when (i) the cost post-subsidy is equivalent or less than that of unimproved sanitation solutions, or (ii) there are bundled incentives (e.g., reduced water installation fee), or (iii) adoption is required (e.g., product mandated by law)		
5	<b>Full subsidy</b>	NGO	User	Direct (per use)	Works when NGO or donor builds or helps acquire product/building, with no expectation of repayment. Requires identifying, vetting, and training youth groups on business practices		

Least appropriate Most appropriate

**The appropriateness of the payment models may change depending on the technical modifications brought to the RT and on the business model selected (e.g., if there is a service component to the RT, then payment model #1 would now lean towards “more appropriate”)**

Note: \*Community-Led Total Sanitation

Source: Desk research; stakeholder interviews; Dalberg analysis



### 3 Recommendation: Market the RT through promoters in public sector

### 4 and civil society and sell the RT in local third-party shops



#### Do-it-yourself

Use channels such as radio, social media and community meetings / demonstrations to generate demand

#### Use existing promoters

Potential parties that could be leveraged as promoters:

- **Utilities services providers** (e.g., Lagos State Waste Water Management office)
- **Community-based organizations** (e.g., women's groups sponsored by institutions)
- **NGOs** that provide related services
- **Faith-based organizations** with community development projects
- **Ministry of Health:** In Nigeria, users expressed preference for validation of the new technology by the Ministry of Health, which has a hygiene and sanitation portfolio and credibility with the community

#### Option 1: Place the product at local third-party shops

**Ease of implementation: MED-HIGH.** Sales through local third-party shops is a common model for many household items. In the sanitation space, both WaterAid/LIXIL and newly introduced Smart Toilet have used this model successfully and have recommended the same for RT. It is a proven model that is relatively easy to implement and requires no significant capex investment. RT can also benefit from the established goodwill of local businesses

**Potential impact: HIGH**

#### Option 2: Build your own community-level shops

**Ease of implementation: LOW-MED.** In Nigeria, some companies build their own shops / stalls in target communities, which also serve as customer service / information centers for users. Examples of such models are solar energy products like Total's Awango. Given the size of the RT, the size of the community shops would be relatively larger than the small stalls for solar products but still feasible to implement. Availability of on-the-ground support will also positively impact the user experience and encourage / facilitate word-of-mouth marketing

**Potential impact: MED-HIGH**

**Local sanitation businesses typically have five artisans attached to them who can install / maintain the sanitation technology—presenting an additional benefit to third-party distribution**

## 6 Recommendation: Consider offering installation support through artisans that are associated with existing sanitation retailers



Manufacture / Import

Sell

Install

Maintain

### Potential installation and maintenance models

Model	Description	Considerations	Level of effort & risk
<b>1. DIY / no support</b>	Only the product is provided. The buyer is responsible for finding his own installer	<ul style="list-style-type: none"> <li>Typical for standard toilet types. For alternative solutions, there is no example that we know of. However, a sanitation company in Southeast Asia learned that when it did not provide installation support, households purchased but did not install the product for another nine months</li> <li>That company then integrated existing artisans into the value chain to reduce the installation lag</li> </ul>	<b>LOE: LOW. Risk: HIGH.</b> Given the complexity of the product, this would require a strong ecosystem of possible maintainers, which may not be available
<b>2. Outsourced installation / maintenance</b>	The company links the buyer to affiliated, pre-trained installers	<ul style="list-style-type: none"> <li>There is evidence that plumbers and artisans can be upskilled: Smart Toilet has worked with sanitation business owners and their associated workmen, training them to install and maintain the Smart Toilet</li> <li>Large luxury sanitary ware stores like Il Bagno also have formal training courses that are widely recognized</li> </ul>	<b>LOE: MED. Risk: MED.</b> For the target segments, it may be difficult, though not impossible, to find aggregated maintainers
<b>3. In-house installation / maintenance support</b>	The company dispatches its own group of installers once a product is purchased	<ul style="list-style-type: none"> <li>Mobisol, a solar company in East Africa, runs Mobisol Academy to train solar installation and maintenance officers</li> <li>For products requiring no formal installation, company agents train customers on proper use once the product is delivered</li> </ul>	<b>LOE: MED-HIGH. Risk: LOW.</b> This model offers control over the quality of the service provided by maintainers but requires significant oversight

**Model 2 is a viable option in Nigeria as many hardware / plumbing shops have associated artisans / plumbers. However, if they are not sufficiently trained and incentivized, the RT could suffer reputational risks**

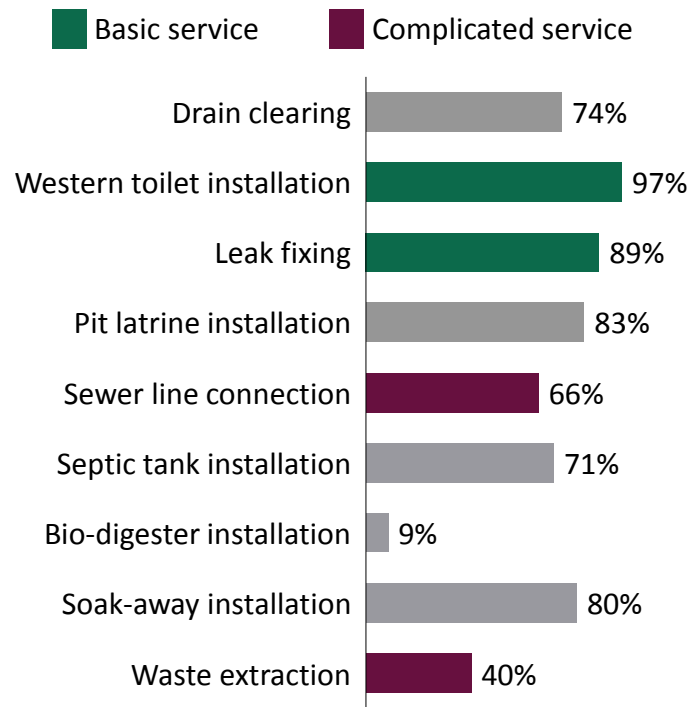
# 7 Plumbers are a key part of the value chain and would need additional training to perform the maintenance requirements of the RT



**Potential maintainers** | **Overview of current capacity** | **Of 35 plumbers surveyed in Nigeria, % who offer the following services**



- **85% of plumbers surveyed are trained through apprenticeship programs**, while a few received training at technical colleges
- 56% of sampled plumbers received training that lasted for more than one year; they seldom receive follow-on training
- **Plumbers receive new information from shops and plumbers groups/informal networks**
- Evacuators are truck drivers or “frogmen” who evacuate manually; they are largely untrained / informally trained and may or may not dump waste in designated areas / treatment plants
- Community youth are often hired to clear blockages or manually excavate pit latrines. However, there is no formal system of training or engaging them in the sanitation value chain. Some may have reservations due to community perception of those who handle human waste

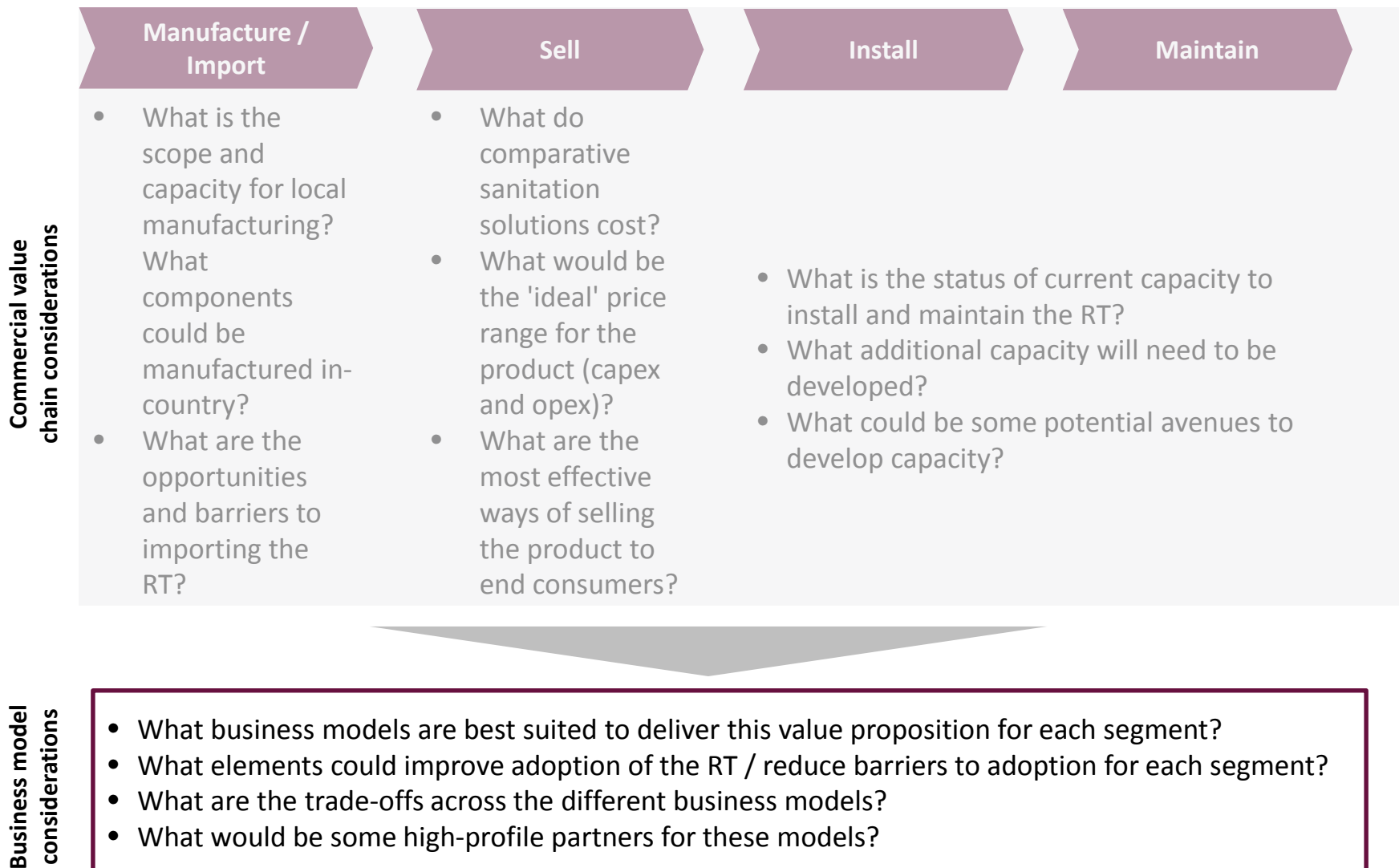


**Plumbers can be upskilled and engaged for RT maintenance, with training either provided directly by the RT’s commercial partner through local shops or through existing institutions, e.g., Yaba College of Technology**

# Process: Our key questions explored opportunities and constraints along four links of a commercial value chain

RECAP

## Key questions explored



# The complexities of the RT, novelty of the product, need to establish trust, and affordability should inform the model RT's partners choose



STeP partners should choose a model that addresses the following:

	Installation and maintenance	Usage	Use of by-products
<b>The inherent complexities of the RT</b>	RT installation /maintenance is considered complex, especially evacuation. Plumbers will need training for RT maintenance. They are mostly under trained - only 56% received >1 year training, mostly without follow-up. Concern for electrocution risk, due to water exposure in toilet	Given that the RT technology will be different from what they are accustomed to, there is a need to educate users particularly on usage (i.e. seat vs. squat) cleaning, evacuation and other maintenance related issues that might differ from their pit/squat toilet or regular WC usage	Many households did not express interest in adopting the RT because they could not fathom the by-products generation process. There is a need to communicate to the households in a manner that normalizes the concept of by-product generation, and usage
<b>The need of establishing trust</b>	Users expressed higher willingness to adopt the RT if the technology had been proven in the community or they were assured of its working. For this reason, there might be a need to run demonstration pilots to prove the tech		
<b>Customer preferences</b>	Customers in priority segments seek toilets that are easy and cheap to maintain and fix. They expressed preference to be able to fix the toilet themselves, if possible. Yet, they would prefer if any untreated waste is dealt with by third parties		

"Seeing is believing... I would want to test the technology for one month before paying for it"

*Landlord in Lagos*

**The market and supporting ecosystem is unfamiliar with the technology, as such it is important to train resources for installation and maintenance, and potentially provide financing until concept is proven and customers will willingly pay out of pocket**

# Recommendation: We recommend a product + service + finance model for the priority segments in Nigeria to boost adoption of the RT



## Awareness

To ensure that less-exposed households have the knowledge necessary to effectively use and extract value from the RT



Product  
+  
service  
+  
funding

## Trust

To convey to customers that the product is reliable and that there is a company/shop within reach for maintenance challenges



## Affordability

To ensure that the product is affordable to low-income segments, who, by and large, do not have access to credit



The slides that follow will build a case for the product + service + funding model, in addition to presenting relevant information for each component of the go-to-market pathway

# For Nigeria's low-income segments few players offer just the product; and others are experimenting with service and financing models



## Current business models utilized in Nigeria

Model	Example org.	Product offering	Target beneficiary	Trade-offs
<b>1. Product only</b>	WaterAid/LIXIL; UNO Waste to Biogas Green Technology .	<ul style="list-style-type: none"> <li>LIXIL – interface</li> <li>UNO – bio digester (with bio gas by product)</li> </ul>	LIXIL targets low income UNO services both low and middle income households/ estates	<ul style="list-style-type: none"> <li>Requires establishing own sales channel or a finding reputable distributor willing to do product promotion</li> </ul>
<b>2. Product lease + service</b>	DMT Mobile Toilets	<ul style="list-style-type: none"> <li>Toilet in plastic portable cabins, available for purchase or rent</li> <li>The toilet contains waste temporarily onsite and transports offsite, along with toilet at the end of the lease period</li> </ul>	Medium to low income households and state government (used as public toilets and also rented for outdoor events or indoor event centers without any/adequate toilets)	<ul style="list-style-type: none"> <li>Wear and tear of hardware, given constant transportation, installation and uninstallation at site</li> </ul>
<b>3. Product + service + financing</b>	Smart Toilet	<ul style="list-style-type: none"> <li>Provides interface solution (price USD 80 to 200), 4,000 units have been sold</li> <li>Trains sanitation business owners and associated workmen for installation</li> <li>Created instruments to fund acquisition, partnering with microfinance institutions to deploy funds by state govt. and partners</li> </ul>	Low income households	<ul style="list-style-type: none"> <li>Financing provided may be used for purposes other than sanitation technology</li> <li>May distort market for other products if they do not also begin offering financing</li> </ul>

**There are other models such as installing for free, to prove concept before selling for profit at scale but product + service + financing has more proven success as seen in Smart Toilet model**

# There are multiple permutations of product + service + financing model; the high-effort example will significant on-ground presence



What would a product + service + financing model look like for the RT?

Service options	Product + finance options		Possible combinations*
	RT only	RT + capex subsidy / financing	
Installation and customer education	✓	✓	<p><b>Low-effort example 1: Product + installation</b> Customer purchases RT from third party shop and artisan associated with that shop installs RT and maintains it periodically</p> <p><b>High-effort example 2: Product + capex financing + maintenance</b> Commercial partners of the RT could partner with select financial institutions / donors to deliver dedicated loan products / subsidies for purchase of RT. The financial partner could be a microfinance institution with presence in the user communities, or a state or federal government agency/ministry with specific interest in facilitating access to improved sanitation technology. In addition to these, customer pays periodic service fee to cover disposal of unwanted by-products and other maintenance required</p>
Periodic maintenance	✓	✓	
Disposal of unwanted by-products		✓	
Cleaning services		✓	

# To successfully roll out this business model, STeP partners would need to consider the following partnerships, activities and resources



## Key partnerships

- State sanitation ministries/departments - for permits/approval and also for marketing RT
- Local governments (LG) and local council development areas (LCDAs)
- Local small scale sanitation technology business owners
- Professional business organizations - Architects Registration Council of Nigeria (ARCON); Council for the Regulation of Engineering in Nigeria (COREN)
- Microfinance institutions (MFIs) e.g. LAPO microfinance bank

## Key activities

- Have the RT tested and approved for use by Lagos State Waste Water Management office and Federal Capital Territory Authority
- Engage local government and local council development areas to facilitate relationship with local business owners and community leaders, to facilitate access to local business owners
- Establish relationships with Ministry of Health and professional organizations, as promoters
- Develop financial instrument with state government, MFIs and other partners
- Engage local sanitation business owners and train their associated artisans on installation and maintenance
- Organize (individually or with partners) community events to test and use the RT
- Set up feedback collection mechanism

## Key resources

- Partnerships with relevant government ministries/agencies
- Financial instrument to fund RT purchase
- Relationships with architects and engineer professional organizations
- Knowledgeable sales force
- Well trained artisans – for installation and maintenance
- A strong supplier relationship (delivers quality and is reliable)
- A process for monitoring customer experience

**The slides that follow should provide some guidance on who the priority partnerships should be, based on their stake in the sanitation ecosystem, potential roles and likely disposition towards the RT concept**

# On-site sanitation provides a strong value proposition for the State government, but it is unclear how receptive they will be to the RT



1

## Given no or limited sewage network, on-site sanitation offers value to State governments

- **Lagos has no central sewage system** – it is too expensive for the government to install and they have no plans to. They have instead begun to encourage decentralize waste treatment, recommending that independent estates deploy on-site/off-grid treatment systems such as biogas or plant membrane systems
- **Abuja’s central sewage network has been deployed to only 30%** of the city. The Master Plan provides for centralized reticulation networks which have not been fully deployed. The rest of the state relies on none or privately provided off-grid solutions

2

## State governments do not want a technology to be imposed; they have expectations/preferences

- **Lagos state government is aware of on-site sanitation solutions** – A delegation from the government visited India and were introduced to a system of trucks extracting waste and treating onsite. They think this technology will work in Lagos
- **“Do not impose a technology on Lagos”** – the Lagos state government wants a technology that is locally relevant, similar to what they have observed in India and have cautioned against “imposition” of predetermined solutions. Going forward it will be important for RT’s commercial partner to involve government officials right in early stages of market entry

**Partnering with state governments is imperative for successful introduction of RT to the Nigerian market, and the process of securing the partnership must begin early, due to the high likelihood of delays**

# There are three potential roles various government departments and agencies can play; historically they play non-funding roles



## Evaluation of potential roles for the state government waste treatment and sanitation authorities

Role	Description	Pros	Cons	Feasibility
<b>Promoter</b>	Ministry of Environment and Ministry of Health, as part of their general sanitation and hygiene promotion activities can encourage individuals and household adoption of RT, using existing community touch points with through health programmes and verify hygiene levels of the water by-product	Extensive (national) reach through existing Ministry of Health/Environment WASH networks/programs and validation through association with the Ministry of Health	This may not significantly influence uptake, as acceptance of government associated initiatives is sometimes limited - believed to be politically motivated	<b>MED-HIGH</b> <i>Requires establishment of relationship with the ministries which can be arduous</i>
<b>Distributor (facilitator)</b>	Local governments (LGs) and Local community development authorities (LCDAs) can serve as a channel to local sanitation business owners via existing touch points due to licensing and other relationships. LGs and LCDAs can also stock	Facilitates community level access which experts claim is necessary to penetrate the market	Still operationally complex: would require distributor salesforce	<b>MED</b> <i>If local govt. sees the benefit, they would be willing to facilitate distribution though adoption not guaranteed</i>
<b>Lender (to user)</b>	Develop financing instrument, with microfinance institutions, to disburse loans specifically for funding sanitation technology purchase	Facilitates adoption by providing funding to users unable to afford RT	Not sufficient, in itself to drive adoption	<b>MED</b> <i>Govt. financial constraints may be a barrier to feasibility</i>



## NIGERIA COUNTRY REPORT: CONTENTS

- Nigeria sanitation landscape: stakeholders, challenges and opportunities
- **Residential market: priority segments and go-to-market approach**
  - Go-to-market considerations for existing construction priority residential segments
  - **Go-to-market considerations for new construction priority residential segment**
- Institutional market: priority segments and go-to-market approach
- Conclusion: Recommended paths to market entry
- Annex

# Summary: Go-to-market recommendations for new residential construction

RECAP

## Formal new residential constructions

**The approach for new residential constructions differs significantly from that of existing constructions.** New constructions will require a business-to-business approach – as buyers would not be households but housing developers, and architects or mechanical engineers, who design the sanitation/plumbing system and recommend fittings

**This segment is slowly recovering from the recession and depending on the growth rate in the next five years, could reach ~23,000 – 37,000 units**

- Recession has led to an 80% decline in construction spend in recent years and slow recovery, with 5.39% - 22% annual growth predicted for the next 3 years
- The adoption of the RT within this segment may be further enhanced if it proves to be cost-saving relative to existing solutions and offers flexibility on plumbing fixtures

**The go-to-market approach for this segment requires closely engaging the professionals who influence the selection of sanitation technology.** Demonstrate RT at periodic meetings of architecture and mechanical engineering professional organizations. Once the concept is proven to these professionals, they may adopt the RT for their new building projects. STeP commercial partners should also solicit feedback from these professionals and make adjustments to product design or distribution strategy, where necessary

# Formal new construction could be an attractive market for the RT, if real-estate growth recovers and RT meets cost and quality preferences



1

## Construction industry projected to slowly recover...



- As a result of the recession, national spend on construction decreased significantly, by 80% in 2016
- Slow recovery is projected at an average of 5.39% over the next 3 years
- Residential new construction is a potential market for the RT, with an average of 4,000 formal new units being built per annum in Lagos

2

## ...with preference for cost effective technology



- Developers are looking to keep cost to the barest minimum, while maintaining quality standards
- RT present the opportunity to save cost on septic tank construction or connecting to a sewer line

3

## ...influenced by architects and mechanical engineers

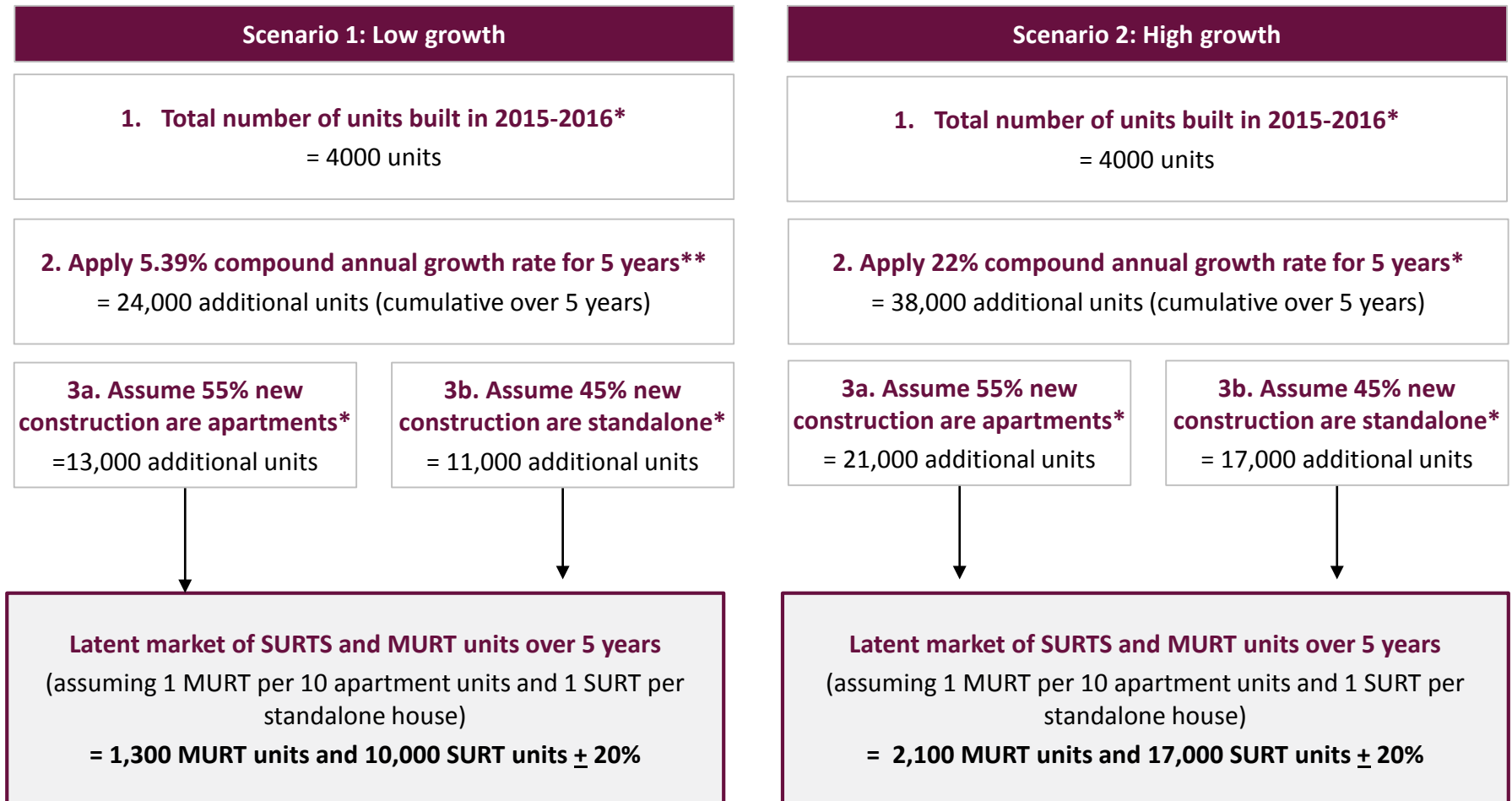


- Architects and mechanical engineers have strong influence on the choice of sanitary fittings and design of plumbing system, for new formal building projects or renovations
- They typically recommend fittings they are familiar with, can vouch for quality, and in some cases designs that match preferred aesthetic (in other cases, cost is the deciding factor and not aesthetic)

# If Lagos recovers from the current recession, formal new construction could offer a market of 1,300-2,100 MURTs and 10,000-17,000 SURTs



Latent market in two scenarios: Low-growth scenario assumes current growth rates and High-growth scenario assumes predicted growth rates



Note: MURT units are likely to be underestimates

Source: \*[RAC Lagos Housing outlook 2016](#); Real estate industry outlook 2017; National annual abstract 2010; Dalberg analysis

# STeP partners will need to address developer concerns around market perception, reputation and compliance



## Theme

## Housing developer concerns

### Market perception

- Developers are concerned that potential customers may not be willing to buy or purchase units that use alternative, or unconventional materials
- It is recommended that front-facing interface design of RT should not be a departure from what customers are accustomed to or ordinarily aspire to
- Many households still aspire to own “ideal” sanitation technology, even when the water closet + septic tank is financially out of reach

“Come to the market with something not too different, in terms of looks”

*Middle-income housing developer*

### Reputation

- If they overcome the first challenge, developers are further concerned with the assurance that the product would have few breakdowns, produce no smell, and be easily maintainable in the long run
- This is crucial to their ability to maintain their reputation in the professional community and with clients

### Legal compliance

- Developers claim the Planning Authority buy-in is necessary for adoption of the RT
- Building code requires installation of septic tanks in each new construction and building code recommends septic tank size, based on size of building
- The local planning authority (in Lagos – Lagos State Physical Planning and Urban Development; in Abuja Urban and Regional Planning Department of the FCTDA\*) approves the mechanical drawings, which include the septic plan/dimensions
- If mechanical drawings with RT are approved, the chances of adoption increase

“Planning authority has to see what the product is - they are the ones who approve the mechanical drawings, which has the plumbing plan”

*Architect*

\*FCTDA – Federal Capital Territory Development Authority

Source: Stakeholder interviews; Nigeria Building Code

# In order to secure this market, there is a need to engage developers and the architects/mechanical engineers early in the building process

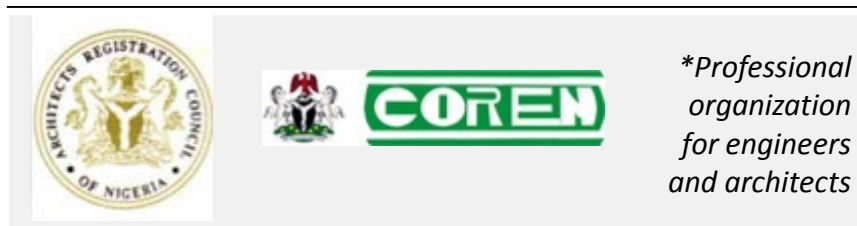


## Overview of the new construction process

### Stakeholders involved



### Key influencers



### Steps and roles in construction process

- 0** **Developer** finalizes plan for development, and communicates to architect/master planner/contractor
- 1** **Architect, mechanical engineer** create architectural, structural and mechanical drawings
- 2** **City planning authority** receives drawings for approval
- 3** **Architect / mechanical engineer** begins supervising construction and installations
- 4** **Architect / mechanical engineer** advise plumber on sanitary fittings to purchase
- 5** **Bricklayer/mason** builds septic tank, with supervision of quantity surveyor
- 6** **Plumber** installs sanitary fittings and plumbing with supervision by architect or mechanical engineer

■ Best time to engage
 ■ Opportunity closing
 ■ Too late

# A G2M strategy for formal new construction would require demonstrating value to building professionals



## 1. Validate and demonstrate the value proposition

## 2. Develop installation and maintenance system

## 3. Establish distribution channel and feedback loop

Description	1. Validate and demonstrate the value proposition	2. Develop installation and maintenance system	3. Establish distribution channel and feedback loop
Potential Partners	<ul style="list-style-type: none"> <li>Engage the professional organizations, making demonstrations during their periodic meetings, to understand preferences</li> </ul>	<ul style="list-style-type: none"> <li>Based on feedback from the key influencers, align design and installation process with market preferences</li> </ul>	<ul style="list-style-type: none"> <li>Determine training needs and create program for plumbers /masons associated with target sanitation business owners</li> </ul>
Risks	<ul style="list-style-type: none"> <li>Establish or leverage existing distribution channel through sanitation business owners in large open markets and at local government level</li> <li>For continuous improvement and to ensure customer satisfaction, establish a feedback loop with key influencers, to understand user experience</li> </ul>		
Mitigation	<ul style="list-style-type: none"> <li><b>ARCON and COREN*</b>: If convinced of the functionality of RT, will recommend for installation in new builds</li> <li><b>Lagos State Association of Plumbing Contractors</b> (and equivalent in Abuja or other target city) will facilitate connection with plumber who should be trained to install and maintain RT</li> <li>The RT may not be able to compete on price relative to other solutions available in the market in Nigeria (e.g., cement septic tanks, etc.)</li> <li>Demonstrating the value proposition for this market may require a complex sales process, for which various types of expertise would need to be sought (i.e., engineering knowledge to validate the value proposition, support for implementation, providing maintenance to ensure full realization of the value, etc.)</li> <li>STeP commercial partners should assess the willingness and capability and resources necessary to target this market segment</li> <li>Once the price of the RT is determined, assess its competitiveness against the solutions available in the Nigerian market</li> <li>In addition to engaging key influencers and installers, engage all other stakeholders in the construction process : master-planners, quantity surveyors etc., to ensure understanding of user preferences is comprehensive</li> </ul>		

\*ARCON: Architects Registration Council of Nigeria; COREN: Council for the Regulation of Engineering in Nigeria

Source: Stakeholder interviews; Dalberg analysis



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# Summary: Go-to-market recommendations for institutional segments – state-sponsored housing and public toilets

In Nigeria, we recommend state sponsored and public toilets as target segments, with varied go-to-market implications. The institutional segments also present the opportunity to demonstrate RT's functionality and value proposition to the residential segment

## State sponsored housing

- There are several planned and ongoing state sponsored housing projects, with some presenting an opportunity to pilot the RT
- **Value proposition to the state governments is:**
  - The potential reduction in construction capex due to elimination of septic tank costs
  - Alternative water and electricity sources to supplement the current scarce supply
  - Alternative to centralized waste treatment plants, since reach of current infrastructure is not extensive in Abuja and not intended to be centralized in Lagos
- **Go-to-market strategy could involve partnering with one state government institution** (LASURA or LBIC\* in Lagos) for a pilot, demonstrating its success and extending the offering to the rest of the market

## Public toilets in market and transport hubs

- There is a proven market for public toilets, with location in busy transport hubs, community buy-in, management/maintenance by competent officials and appropriate toilet interface (both squat and seat) being identified success factors
- **Value proposition of the RT is that it could reduce operation costs for the operator.** The by-products of water and electricity will and elimination of evacuation costs will reduce overall operational costs
- **STeP commercial partners can enter the market directly or indirectly, with the indirect play being a faster option**
  - Directly: Develop new/own public toilets, which includes the arduous process of site and technology approval or take over renovating existing toilets
  - Indirectly: Enter the market by supplying existing players or partner with them to renovate existing public toilets
- In addition to partnership with private sector operators, there are potential opportunities to partner with civil society and state government programs to develop public toilets in Lagos and Abuja

\*LASURA: Lagos State Urban Renewal Agency; LBIC: Lagos Building Investment Company

# Institutional segment (1/3): Despite budgetary and institutional barriers, state-sponsored housing and public toilets could be an RT opportunity



## Institution



### State-sponsored housing

- Federal and state governments are investing in affordable housing schemes in an effort to address the deficit of 2.5 million units
- **Planned housing schemes:**
  - In June 2017, the Buhari administration commenced the pilot phase of the National Housing Program (NHP) with the sum of NGN 35 billion (USD 111 million) as part of an effort to boost the supply of affordable housing units across the country
  - Lagos state government is investing up to USD 500 million in PPPs to redesign and complete peri-urban housing schemes
  - Federal government and local councils are investing in affordable housing units for government staff and citizens in order to fill a gap of 600,000 housing units; a recent USD 15 million bond will go to refinance affordable housing debts and federal government plans to build 6,000 units to house National Assembly staff

## Potential opportunities

## Potential barriers

- **Bureaucracy / red tape:** Experts have warned about potential difficulty in closing a deal with the government
- **Budgetary constraints:** Although the government has pledged investments in housing, budgetary constraints may prevent expansion



### Public toilets in markets and transport hubs

- There are fewer than 600 public toilets in all of Lagos
- Public toilets are typically operated by the private sector, in collaboration with the government or at least with government approval. State government rarely provides funding and may even charge a monthly fee for land use
- Market places and bus stops have a high foot traffic from commuters and those who work in the market. One public toilet of 6 toilet cubicles at a bus stop in Lagos gets up to 500 users daily, paying USD 0.07 – 0.23 (PPP) per use

- **Government approval:** Government permission is required in order to operate public toilets in Lagos, which could potentially result in long delays in installation or expansion. Approval is needed for the technology as well as the site
- **Community buy-in:** Without prior community engagement, toilets may face initial backlash from local community / landlords in markets and bus stops where land is valuable for parking or erecting another retail stall

## Institutional opportunity (2/3): Healthcare institutions and public schools could be RT opportunities but have limited budget and authority



### Institution

### Potential opportunities

### Potential barriers



#### Healthcare institutions

- Many health institution sanitation facilities are poorly maintained or inadequate (pit latrines)
- The Minister for Health has called for budget increases in state and local government health sectors to aid the federal government in revitalizing primary healthcare centers. In particular, there is a strong drive to build more primary healthcare centers around the country
- WHO reports that several federal government ministries have committed to targets for improved water, sanitation and health services in schools and healthcare institutions
- Lagos' primary healthcare board has 200 facilities under its ambit and periodically upgrades these facilities

- **Limited budget:** Public hospitals' spending is limited to budgetary allocation from the government, though they are able to divert funds from other line items as they deem fit. Limited funding is a potential barrier to adoption of the RT



#### Educational institutions

- **Public schools** (both state and federal) have poorly maintained or unimproved sanitation facilities, which are insufficient for the student population (e.g., 1 toilet catering to 1000 students)
- School toilets are often exclusively used by teachers, while students are forced to defecate in the open or go home
- WHO reports that several federal government ministries have committed to targets for improved water, sanitation and health services in schools and healthcare institutions, implying a posture toward investing in sanitation facilities

- **No decision-making power:** Public schools do not have authority or budget to replace the sanitation facilities. The authority (and budget) lie with the federal and state governments. This could be a potential hurdle to getting approval for RT

# Institutional opportunity (3/3): NYSC orientation camps and religious institutions present a mid-size opportunity for the RT



## Institution

## Potential opportunities

## Potential barriers



### NYSC orientation camps

- All Nigerian university graduates are mandated to participate in National Youth Service Corps (NYSC), which begins with a three-week orientation camp. There are 39 NYSC camps in the country serving roughly 400,000 students across four batches per year
- Both the number of students and the state of sanitation facilities vary greatly depending on the camp—conditions include camps with one toilet per 30 people, camps where toilets are available but people choose to defecate openly due to hygiene concerns, or camps with no toilets whatsoever
- Stakeholders claim the camps could benefit from the RT and electricity and water byproducts

- **Government approval:** The Ministry of Youth Development must approve the installation of the RT at the orientation camps
- **Budgetary restriction:** The Ministry might be unable to afford RT. Private sector companies could potentially be invited to fund the installation of the RT






### Religious institutions

- Lagos has 10,000 registered worship centers that experts claim are not all well fitted with sanitation facilities
- Abuja also thousands of places of worship, not all adequately fitted with sanitation facilities
- In addition to weekly worship services, large-scale rallies—for which alternative sanitation facilities would be required—present a potential market for Reinvented Toilets
- **Disaggregated market:** Though experts have recommended this as a potential market segment, decisions will be made by individual religious institutions. Therefore, reaching scale may be difficult

# We evaluated each of the commercial / institutional segments on its propensity to adopt the Reinvented Toilet (1/2)






Commercial / institutional segment	Propensity to adopt the RT				
	Needs new sanitation	Is a decision maker	Values the RT	Willing to maintain the RT	Able to afford the RT
 <b>State-sponsored housing</b>	Expected new construction in peri-urban areas	Housing provider / government has decision-making power over sanitation technology	Cost savings on septic tank installation; electricity and water byproducts**	Responsibility of tenants, not provider. Unclear what tenants' preferences will be*	Government pledged funds to housing schemes but there have been recent budgetary restrictions
 <b>Public toilets in markets and transport hubs</b>	There are fewer than 600 public toilets in all of Lagos; Abuja public toilet infrastructure is not extensive	Government approves site and technology, leading to approval in principle for installation	Players show strong interest in a system that eliminates the need for a septic tank and generates water	Toilet operators currently maintain public toilets with varied levels of effectiveness. Cleanliness is a key driver of use	Private sector players have displayed relatively high ability and willingness to pay
 <b>Healthcare institutions</b>	Many health institution sanitation facilities are poorly maintained or inadequate (pit latrines)	Purchase decisions are the responsibility of the federal and state Ministries of Health, not the hospitals	Electricity and water byproducts maybe attractive for reducing operating costs*	Currently (poorly) maintained by the health facility. No data on willingness to maintain*	If government budget is restricted, might be able to secure private sector funds through CSR initiatives

Note: \*To be confirmed in upcoming interviews, if needed. \*\* Depends on product economics.

# We evaluated each of the commercial / institutional segments on its propensity to adopt the Reinvented Toilet (2/2)



Commercial / institutional segment	Propensity to adopt the RT				
	Needs new sanitation	Is a decision maker	Values the RT	Willing to maintain the RT	Able to afford the RT
 <p><b>Educational institutions</b></p>	Toilets mostly dilapidated, unimproved or insufficient (e.g., one per 100 students)	Purchase decisions are the responsibility of the federal and state Ministries of education, not the schools	Electricity and water byproducts may reduce operating costs**	Currently (poorly) maintained by school and students. No data on willingness to maintain* (differs from Kenya)	If government budget is restricted, might be able to secure private sector funds through CSR initiatives
 <p><b>NYSC orientation camps</b></p>	Camps are overcrowded with one toilet per 30 people. Toilets are poorly maintained or not available	Ministry of Youth Development must grant approval to install / upgrade toilets / septage solution at camps	Stakeholders claim the camps could benefit from the RT and electricity and water byproducts	Unclear who maintains but potentially poor attitude towards maintenance given status quo*	Dependent on government budget or private sector CSR
 <p><b>Religious institutions</b></p>	Experts claims strong need for supplementary sanitation facilities for indoor / outdoor events	Each institution's leadership mostly has decision-making authority	May value ability to add unit without making larger septic tank; access to electricity byproduct*	Currently self-maintain own sanitation facilities or contract cleaning companies	Potentially able to afford*

Note: \*To be confirmed in upcoming interviews, if needed.

# Recommendation: state-sponsored housing and public toilets in markets / transport hubs are high potential institutional segments



← Propensity to adopt the RT →

	Potential opportunity	Needs new sanitation	Is a decision maker	Values the RT	Willing to maintain the RT	Able to afford the RT
State-sponsored housing	Federal and state governments plan to build houses to fill 17 million unit deficit. Expected new construction for different income groups, with projects offering pilot opportunities for RT	◐	●	◐	◑	◐
Educational institutions	High need due to acute shortage of sanitation solutions. Several federal and state targets to improve school sanitation	◑	◐	◐	◑	◑
Healthcare institutions	High need due to poor state of onsite facilities. Potential opportunity to install RT in projected new construction primary health clinics	◑	◐	◐	◑	◑
Public toilets in markets and transport hubs	Acute shortage of public toilets in markets and transport hubs. Proven business case for private operators but requires government approval of site and technology	●	◑	◑	◐	◐
NYSC orientation camps	Opportunity to install RT facilities in 39 camps nationwide. Limited government budget but private sector investment opportunity exists	◑	●	◐	◐	◑
Religious institutions	Experts recommend this segment given high number of registered churches and mosques and weekly human traffic. Could also purchase and install RT as part of charity projects	◐	◑	◐	◐	◐

**If there is interest in developing a partnership with the government, we recommend taking a portfolio approach that includes state-sponsored housing and public toilets in markets and transport hubs.**



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# State-sponsored housing schemes have expansion plans and are looking for cost-saving, decentralized sanitation solutions



## Current challenges of state-sponsored housing

## Value proposition of the RT



### Budgetary restrictions

- Lagos has an estimated housing deficit of 2.5 million units and has budgeted USD 138 million for housing and community amenities
- The state government has a total budget deficit of over USD 450 million, indicating substantial challenges in financing housing goals
- In Abuja, sanitation costs such as extension of sewer lines are sizeable project expenses for housing development

Government housing departments / parastatals will benefit from technologies that will reduce installation and maintenance costs of sanitation. If installing the RT amounts to cost savings, state governments will see value in the product



### Water and electricity shortages

- Water and electricity are in scarce supply across Nigeria
- Lagos has planned water infrastructure capital projects to increase government pipeline coverage
- The government recently urged residents to embrace alternative power sources

RT waste byproducts—water and energy—provide alternative sources to supplement existing supply. The volume of these byproducts will determine the extent to which the RT is valued for this particular purpose



### Inadequate sanitation infrastructure

- Lagos state government aims to decentralize the waste management system and seeks to phase out evacuation trucks due to the environmental hazards they present
- Only 30% of Abuja / FCT is covered by the sewer network due to the slow pace of urban development plan implementation

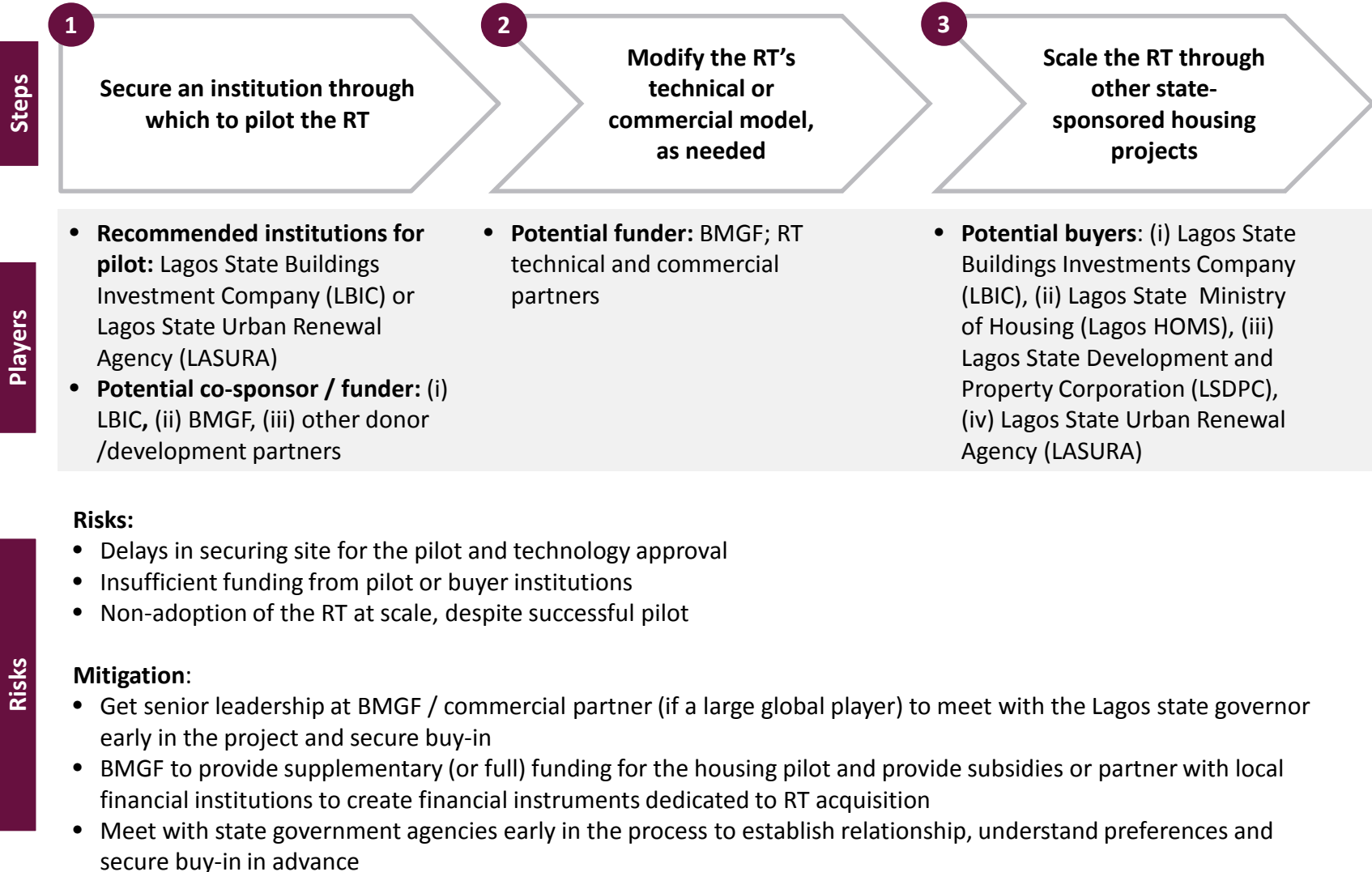
RT provides an alternative to the centralized system, and is needed as either a stopgap or permanent solution

# State-sponsored housing: there is opportunity for RT uptake in nearly 50,000 new construction / rehabilitated / upgraded units



Institution	Role	Target income	Stock
Lagos State Ministry of Housing	<ul style="list-style-type: none"> <li>Policies, facilitations, development and management of housing</li> <li>The Lagos Homes Ownership Mortgage Scheme (Lagos HOMS), which is planning to build 20,000 homes by 2020, is still in the conceptual stage; design preferences could be influenced to include the RT</li> </ul>	High / middle	<b>Current:</b> 10,000 units <b>Planned:</b> 20,000 units by 2020
Lagos State Development and Property Corporation	<ul style="list-style-type: none"> <li>Responsible for direct construction of market-oriented housing and indirect construction (through PPPs)</li> <li>Focused on higher-value property, not affordable housing; preferences for toilet interface may anchor on high-end models</li> </ul>	High	<b>Current:</b> 22,659 units <b>Planned:</b> 258 units (ongoing)
Lagos Building Investments Company (LBIC)	<ul style="list-style-type: none"> <li>Reports to the Lagos State Ministry of Physical Planning</li> <li>In charge of 20 government estates, included blighted ones, which it is in the process of upgrading</li> </ul>	High / middle	<b>Current:</b> 39,000* <b>Planned:</b> 39,000* <i>*Existing stock of govt. units to be renovated</i>
Lagos State Urban Renewal Agency	<ul style="list-style-type: none"> <li>Reports to the Lagos State Ministry of Physical Planning and is responsible for upgrading 42 notified slums</li> <li>Recently began USD 100 million project with AFD (French Development Agency) improve services at two sites. Currently does not have a sanitation component but this could be explored in the next phase</li> </ul>	Low	<i>Could improve public toilets (install MURTs) in 42 slums</i>

# State-sponsored housing: Entering this market requires buy-in from senior leadership in Lagos state government throughout the process



# Public toilets: The RT may potentially remedy several challenges related to operations, user habits and preferences



## Challenges for public toilet operators

## Value proposition of the RT

### Operation Costs

- **High energy costs** – Utilization of generator to power water pumps and lighting costs up to USD 100 / month. Interviewed public toilet operators expressed strong preferences for the RT that produces electricity (which they would use for lighting and charging phones)
- **Frequent evacuation** – Evacuation takes place once every four months at USD 60 per evacuation

- RT provides **cost saving opportunities** by:
  - Providing electricity byproduct for lighting
  - Eliminating / minimizing the need for evacuation

### User habits

- **Poor user habits** – Some users do not know how to use a seating toilet and stand on the seat or are heavy handed when flushing, causing damage to the interface

- Unclear whether the RT can address this challenge. If RT is **durable** and can withstand poor user habits, it will be highly valued by operators

### User preferences

- **Cleanliness** – Cleanliness is important to public toilet users and drives patronage, but public toilets operators often struggle to keep their toilets clean. Interviewed users expressed willingness to pay NGN 100 – 200 (USD 0.27 – 0.54) per use (up to twice current fee) for a clean toilet

- If RT is relatively easy to maintain and keep clean, it could be very valuable to the operators and users. RT by-products such as water and electricity could help improve the user experience of the public toilet

“If the toilet is clean, I will pay for it.”  
- Public toilet user

“God bless Gates. This is exactly what we are looking for [referring to the RT].”  
- Public toilet operator

# Public toilets: An established market already exists for privately owned public toilets with clear success factors and viable operational models



## Case study: Metamorphosis Nigeria / MN Environmental Services Ltd.

### Drivers of success for the company

#### Location

- **Transport hubs (bus stops) and markets** see high foot traffic—approximately 500 users per day for three cubicles
- Taxi parks are relatively quiet, seeing between 80 and 100 users a day for a block of 8 toilets

#### Community buy-in

- **Community members** are champions of the business and are themselves **regular patrons**, despite initial resistance

#### Management

- **Trained officials must manage the toilets**
- When MN (and others) transferred toilet maintenance to the community, the toilets became dilapidated

#### Toilet interface

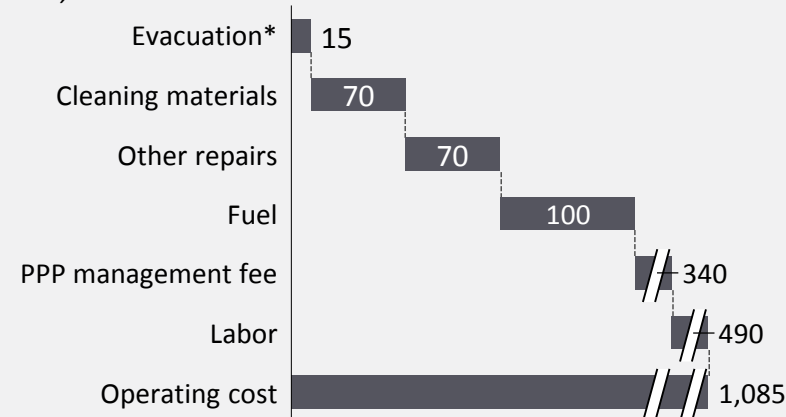
- **Interface matches user preferences**
- MN has both squat and seating interfaces with pour flush facilities

**Capex\*: USD 36,000**

*\*for 6 cubicles (3 showers, 3 toilets), generator, septic tank*

### Monthly opex for six cubicles

USD, 2017



**REVENUE\*: USD 2,400**

(Avg. fee per use: USD 0.16) x (users per day: 500) x (days worked per month: 30) or *six cubicles (three showers, three toilets), generator, septic tank*

Break even point: 2-3 years

# Public toilets in markets: The commercial partner can reach the market for public toilets directly or indirectly



**Direct play** – Enter the market as a public toilet operator and (A) develop new public toilets or (B) or take over and renovate an existing public toilet

A

## Develop new public toilets

- 1 Write letter of proposal to the Commissioner or Permanent Secretary of the Ministry of Environment
- 2 Letter will be forwarded to the Public Sanitation Utility Division
- 3 The Lagos Urban and Physical Planning department will be consulted, to determine if the site selection fits into the development plan for the location
- 4 Joint concession visit (to site) between the Public Sanitation Utility Division and the Lagos Urban and Physical Planning Department, for site and technology inspection
- 5 Approval in principle to be granted
- 6 Approval for technology is also to be sought in writing

**Risk: Process of site approval can take many years**

B

## Renovate existing public toilet

Partner with existing community-held / managed, dilapidated public toilets (e.g., in Ijora Badia community in Lagos) and renovate the facilities by installing RT

C







## Sell to operators

Engage private business owners like MN Environmental Services to convince them to adopt the RT

**Renovating an existing public toilet or selling to operators are the fastest paths to market, given the bureaucratic processes that can delay government approval of site**

# Public toilets: In addition to the private sector, there are opportunities for the public and civil society sectors to introduce RT public toilets



Institution	Target	Opportunity
 <p>Lagos State Urban Renewal Agency</p>	Low-income groups	<ul style="list-style-type: none"> <li>LASURA was created to implement government slum upgrading programs for 42 communities.</li> <li>Slum upgrading programs so far have not included a sanitation aspect but there is potentially an opportunity to do so—and to introduce RT as a sanitation solution</li> </ul>
 <p>AFD Agence Francaise de Developpement</p>	Low-income groups	<ul style="list-style-type: none"> <li>AFD has an urban development investment focus in Nigeria. A USD 100 million slum renewal program with the Lagos state government, focusing on Ifelodun and Bariga in Lagos, currently has no sanitation element. The next phase presents an opportunity to include and potentially install RTs</li> </ul>
 <p>UN-HABITAT FOR A BETTER URBAN FUTURE</p>  <p>jei</p>	Low-income groups	<ul style="list-style-type: none"> <li>UN-Habitat has deployed several urban development programs in Nigeria; in collaboration with state governments, it will be installing public toilets as part of planned urban renewal programs</li> <li>Justice Empower &amp; Initiative (JEI) is a non-profit organization working with communities in the informal settlement. Currently, they are in the process of developing their first community BioFil toilet in Daramola. Their goal is to setup 35 community toilets in low-income areas, and they are looking to partner with sanitation experts.</li> </ul>
  <p>Faith-based organizations</p>	Low- / middle-income groups	<ul style="list-style-type: none"> <li>Christian Association of Nigerians and NASFAT are umbrella associations for faith-based organizations. Their members routinely conduct charity programs. Experts claim their projects have more community acceptance than do government programs.</li> <li>There may be an opportunity to engage faith-based organizations, through their umbrella associations, to encourage installation of RT as part of charity community development projects</li> </ul>



## NIGERIA COUNTRY REPORT: CONTENTS

- Nigeria sanitation landscape: stakeholders, challenges and opportunities
- Residential market: priority segments and go-to-market approach
- Institutional market: priority segments and go-to-market approach
- **Conclusion: Recommended paths to market entry**
- Annex

# Summary: Recommended paths to market-entry for Nigeria



Putting the recommendations across the four priority segments together, there are three potential paths to market-entry for priority segments in Nigeria –

## **Path 1: Demonstrate in institutional segments to prove the concept to existing low-income residential segments**

**1. Launch in state sponsored housing schemes and/or public toilets**

Launch SURTs and MURTs in state sponsored housing and MURTs in public toilets

**2. Engage community groups and local contractors to adopt the RT**

Depending on market feedback, launch more communal MURTs and SURTs / household-level products using a neighborhood-saturation approach

The demonstration effect works only for existing low-income residential constructions and is unlikely to spill over to new constructions, as housing developers do not take market cues from the public toilets sector

## **Path 2: Validate the concept with a target developer and scale to new residential construction**

**1. Validate and demonstrate the value proposition**

**2. Pilot with a housing developer**

**3. Market to other developers and to the industry**

Dependent on validation from low-income housing developers (i.e., a compelling business case and match to customer preferences), pilot with a selected housing developer, market the results of the demonstration project to other developers, architects and surveyors and bring product to scale

# We recommend demonstration through institutional segment to prove the RT concept and encourage adoption by residential segment



Demonstration through early adoption by institutional segments...

...proving concept to residential segment

**STATE SPONSORED HOUSING**

Lagos State Ministry of Housing	Lagos Building Investments Company	Abuja Management Company	
Lagos State Development and Property Corporation	Lagos State Urban Renewal Agency	Abuja Environment Management board	

**PUBLIC TOILETS**

MH Environmental Services Ltd.	DMT Mobile Toilet	Sangrouse Public Toilet and Shower	
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*...and other public toilet players*

**NGO/DONOR /FBO programs**

"We need to see it to believe it"

# A path to market-entry for formal new construction would require RT's commercial partner demonstrating value to building professionals

RECAP

## 1. Validate and demonstrate the value proposition

## 2. Develop installation and maintenance system

## 3. Establish distribution channel and feedback loop

	1. Validate and demonstrate the value proposition	2. Develop installation and maintenance system	3. Establish distribution channel and feedback loop	
Description	<ul style="list-style-type: none"> <li>Engage the professional organizations, making demonstrations during their periodic meetings, to understand preferences</li> </ul>	<ul style="list-style-type: none"> <li>Based on feedback from the key influencers, align design and installation process with market preferences</li> </ul>	<ul style="list-style-type: none"> <li>Determine training needs and create program for plumbers /masons associated with target sanitation business owners</li> </ul>	<ul style="list-style-type: none"> <li>Establish or leverage existing distribution channel through sanitation business owners in large open markets and at local government level</li> <li>For continuous improvement and to ensure customer satisfaction, establish a feedback loop with key influencers, to understand user experience</li> </ul>
Potential Partners	<ul style="list-style-type: none"> <li><b>ARCON and COREN*</b>: If convinced of the functionality of RT, will recommend for installation in new builds</li> <li><b>Lagos State Association of Plumbing Contractors</b> (and equivalent in Abuja or other target city) will facilitate connection with plumber who should be trained to install and maintain RT</li> </ul>			
Risks	<ul style="list-style-type: none"> <li>The RT may not be able to compete on price relative to other solutions available in the market in Nigeria (e.g., cement septic tanks, etc.)</li> <li>Demonstrating the value proposition for this market may require a complex sales process, for which various types of expertise would need to be sought (i.e., engineering knowledge to validate the value proposition, support for implementation, providing maintenance to ensure full realization of the value, etc.)</li> </ul>			
Mitigation	<ul style="list-style-type: none"> <li>STeP commercial partners should assess the willingness and capability and resources necessary to target this market segment</li> <li>Once the price of the RT is determined, assess its competitiveness against the solutions available in the Nigerian market</li> <li>In addition to engaging key influencers and installers, engage all other stakeholders in the construction process : master-planners, quantity surveyors etc., to ensure understanding of user preferences is comprehensive</li> </ul>			

\*ARCON: Architects Registration Council of Nigeria; COREN: Council for the Regulation of Engineering in Nigeria

Source: Stakeholder interviews; Dalberg analysis



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# Of the many residential segments in Lagos and Abuja, we estimated the market size of two priority segments



*Segmentation framework and size of residential segments in Lagos and Abuja*

Age of construction		New construction				Existing construction											
Type of septage solution		None				None (incl. bucket users)				Pit (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E	Up to 75K				230K				1,080K				770K			
	D			4K								260K		770K		1,650K	
	A+B+C																
		← Annual flow →				← Existing stock in 2016 →											

## Priority segment in Lagos

### *New formal construction*

- The total segment size of new formal construction taking place annually in Lagos is 4,000 households
- At 5.3-22% annual growth rate, this amounts to 24,000-38,000 additional units built over a 5 years
- The latent market for this segment over 5 years is **10,000-17,100 SURTs and 1,000-2,000 MURTs**

\* Data for Abuja are unavailable

## Priority segment in Lagos and Abuja

### *Existing construction - Informal building and tenement dwellers accessing pit latrines*

- The total segment size of households in informal buildings and tenements using pit latrines is 810,000 and 270,000 households in Lagos and Abuja, respectively. This segment forms 21% of all existing households
- The latent market within this segment is 720,000 and 181,000 households in Lagos and Abuja, respectively
- The addressable market for this segment, after accounting for space constraints, propensity to adopt the RT, and income levels **8,500-26,000 SURTs and 6,000-24,000 MURTs ± 40%**, depending on product pricing

# Annex: Lagos residential market sizing methodology (1/2)



Age of construction		Unbuilt/New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pit (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E	<b>FLOW</b> Total HH/units of new, builds = 75,000 annual flow				Total HH with no sanitation = 165,800				<b>STOCK</b> Total HH with pit sanitation = 1.04 million				Total HH with access to sewer and septic tank = 2.2 million			
	D																
	A+B+C																

## Source: Real Estate Industry Outlook 2017

We estimated 4,000 formal units, based on projected 5.39% growth in real estate sector over the next 3 years. This may improve if there is a turnaround in the real estate market.

For informal units, we applied 4.4 annual urban growth rate to the total households that live in informal settlements and tenements

*Confidence in calculation: Low*

## Source: National annual abstract 2010; EIU CANBACK 2016

We applied % access to different types of septage solutions to 3.45 million HH in Lagos to calculate no of HH in each category:

- 4.8% have no septage solution (including bucket)
- 30.3% use different types of pits as a septage solution
- 64.9% use sewer and septic tanks

*Confidence in calculation: high; % triangulated with DSH 2013*

# Annex: Lagos residential market sizing methodology (2/2)



Age of construction		Unbuilt/New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pit (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E	Collectively 75,000 HHs annual flow	165K	810K	237K	654K	928K	656K									
	D																
	A+B+C																

**Assume all 165,000 HH who have no sanitation access live in informal housing**

*Confidence in calculation: medium; have not been able to triangulate with another source*

**Source: DHS 2013; EIU CANBACK 2016**

Apply the following % to the total 1.04 million HH that have pit septage solution:

- 0% of houses with pit latrines are apartments
- DHS 2013 shows that 77.4% HH with pits use a shared toilets and 22.6% have their own pit toilets. Assume those who live in informal settlements and tenements use shared toilets, and lower-middle income HH use single HH toilets to calculate HH in each segment

*Confidence in calculation: medium; shared toilet use is an imperfect proxy for type of construction*

**Source: DHS 2013; CANBACK 2016**

Apply the following % to the total 2.2 million HH that access sewers or septic tanks:

- Of all HH that have sewer or septic tank access, 29.21% HH share toilets and 70.71% do not (DHS 2013)
- SEC A+B+C = 656,000 HH (EIU CANBACK 206)

*Confidence in calculation: low; shared toilet use is an imperfect proxy for type of construction, there could be apartments and stand alone houses in SEC D with shared facilities*

# A total of ~162,000 homeowners in priority segments in Lagos could be latent markets for SURTs and MURTs, depending on product economics



There are a total of 810,000 households in informal buildings and tenements that access pit latrines in Lagos, and they can be split into homeowners and tenants. For homeowners, the addressable market is:

## 1. Segment size of homeowners with pit latrines

Of the 810,000 households in this segment, 20% are homeowners\*  
= 161,944 HH

### 2a. % of sub-segment (1) that does not own a toilet\*\*

23% of sub-segment (1)  
= 37,247 HH

### 2b. % of sub-segment (1) that owns a toilet\*\*

76% of sub segment (1)  
= 124,697 HH

### 3a. % of sub-segment (2a) that does not have space for a toilet\*\*

60% of sub segment (2a)  
= 22,348 HH

### 3b. % of sub-segment (2a) that has space for a toilet\*\*

40% of sub segment (2a)  
= 32,919 HH

### 4. % of sub-segment (2b) that excavates their latrine (and will therefore value the RT)\*\*

66% of sub segment (2b)  
= 82,300 HH

### 5a. % of sub-segment (4) that shares their toilet\*\*

90% of sub segment (4)  
= 74,070 HH

### 5b. % of sub-segment (4) that does not share their toilet\*\*

10% of sub segment (4)  
= 8,230 HH

## Latent market of homeowner HH (MURT)

= 96,418 HH  $\pm$  20%

## Latent market of homeowner HH (SURT)

= 41,150 HH  $\pm$  20%

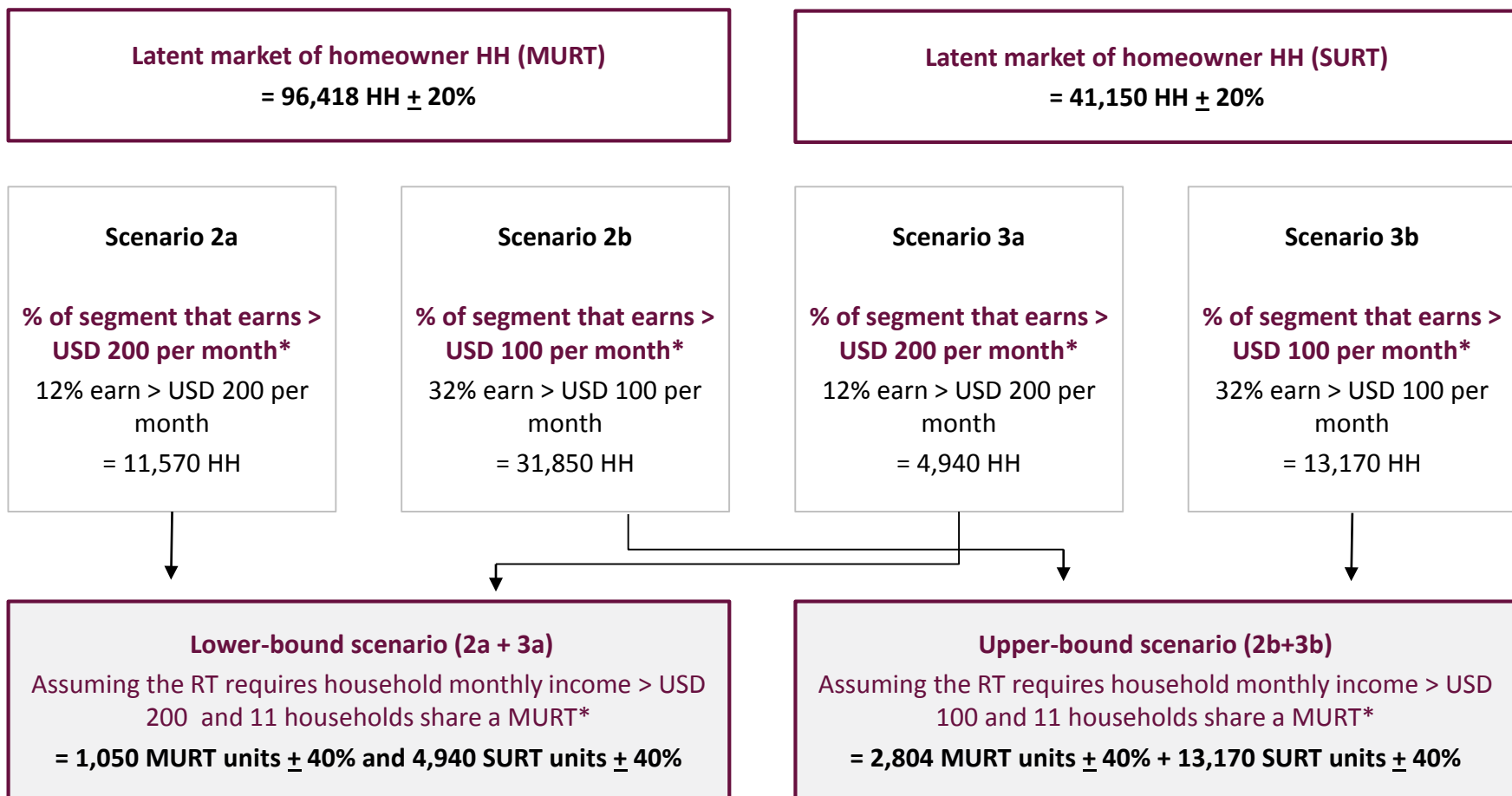
Note: margin of error gets larger as you moved down the steps because of the decrease in sample size

Source: \*DHS (2014);\*\*Assumptions and values based on survey data of 81 homeowners

# The addressable market size for homeowners in priority segments in Lagos is 250 –1300 MURTs and 700 – 3800 SURTs



Homeowners' ability to pay for the RT may restrict the total addressable market for MURTs and SURTs



\*Note: margin of error gets larger as you move down the steps because of the decrease in sample size  
 Assumptions and data based on survey of 81 homeowners

# The addressable market size for tenants in priority segments in Lagos is 3,500 – 18,500 MURTs, depending on product pricing



There are a total of 809,718 households in informal buildings and tenements that access pit latrines in Lagos, and they can be split into homeowners and tenants. For tenants, the addressable market is:

## 1. Segment size of tenants with pit latrines

Of the 809,718 households, 80% are tenants  
= 647,774

## 2. % that excavates the latrine more than once every 2 years (i.e., landlord will value the RT)\*

90% of sampled tenants and landlords in Lagos report that the latrine is excavated more than once every 2 years  
= 583,000 HH

### Scenario 3a

#### % of sub-segment (2) that earns > USD 200 per month\*

7% earn > USD 200 per month  
= 40,000 HH



### Lower-bound scenario

Assuming the RT requires household monthly income > USD 200; tenants will partially pay for RT and 11 households share a MURT  
= **3,710 MURT units ± 40%**

### Scenario 3b

#### % of sub-segment (2) that earns > USD 100 per month\*

25% earn > USD 100 per month  
= 147,800 HH



### Upper-bound scenario

Assuming the RT requires household monthly income > USD 100; tenants will partially pay for RT and 11 households share a MURT  
= **13,250 MURT units ± 40%**

Note: margin of error gets larger as you move down the steps because of the decrease in sample size

Source: \*Assumptions and values based on survey data of 81 homeowners

# Combining homeowner and tenant markets in the priority segments in Lagos, the addressable market for MURTs is larger than SURTs



## Homeowners in priority segments

**Lower-bound scenario**  
=  
**~5,000 MURTs**  
**~5,000 SURTs**  
**± 40%**

Assuming the RT requires household monthly income > USD 200 and 11 households share a MURT

**1,050 MURT units ± 20%**  
**4,940 SURT units ± 20%**

**Upper-bound scenario**  
=  
**~ 17,000 MURTs**  
**~13,000 SURTs**  
**± 40%**

Assuming the RT requires household monthly income > USD 100 and 11 households share a MURT

**2,804 MURT units ± 40%**  
**13,170 SURT units ± 40%**

## Tenants in priority segments

Assuming the RT requires household monthly income > USD 200; tenants will partially pay for RT and 11 households share a MURT

**3,710 MURT units ± 40%**

Assuming the RT requires household monthly income > USD 100; tenants will partially pay for RT and 11 households share a MURT

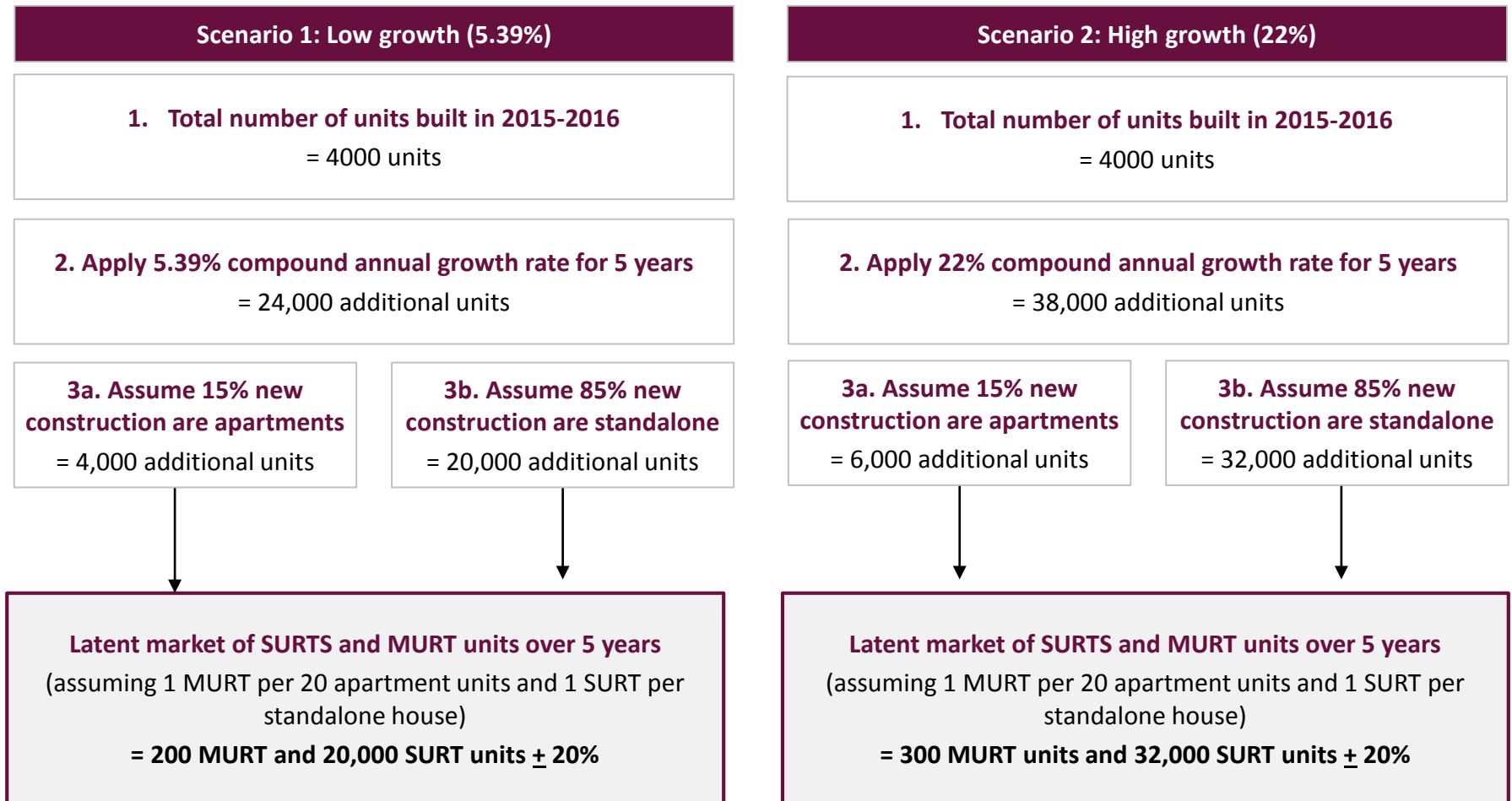
**13,250 MURT units ± 40%**

**Given space constraints and the extent of shared toilets in priority segments in Lagos, the market for MURTs is larger than SURTs. The addressable market for MURTs in the priority segments will be considerably smaller if the commercial partners do not factor homeowner and tenant income levels into price**

# If Lagos' real estate market recovers from the recession, formal new construction could present a robust latent market for SURTs



Given the current recession in Nigeria, the real estate sector has slowed down. There are different projected growth rates in the medium-run:



Note: Apartment numbers are likely to be underestimates

Source: \*Real estate industry outlook 2017; [RAC Lagos Housing outlook 2016](#); National annual abstract 2010; Dalberg analysis

# Annex: Abuja residential market sizing methodology (1/2)



Age of construction		Unbuilt/New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pit (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E	<b>FLOW</b> Total HH/units of new builds = 29,000 annual flow				<b>STOCK</b> Total HH with no sanitation = 64,542				<b>STOCK</b> Total HH with pit sanitation = 294,969				Total HH with access to sewer and septic tank = 183,271			
	D																
	A+B +C																

**Source: Real Estate Industry Outlook 2017**  
 We estimated 29,000 HHs, annual flow, based on projected 5.39% increase in National real estate sector over the next 3 years. This is likely an overestimate given the 90% downturn in construction due to the recession.

*Confidence in calculation: Low*

**Source: National Annual Abstract 2010; EIU CANBACK 2016**  
 We applied % access to different types of septage solutions to 542,222 HHs in Abuja to calculate no of HH in each category:

- 12% have no septage solution (including bucket)
- 54%% use different types of pits as a septage solution
- 64.9% use sewer and septic tanks

*Confidence in calculation: high, % triangulated with DHS 2013*

# Annex: Abuja residential market sizing methodology (2/2)



Age of construction		Unbuilt/New				Existing											
Type of septage solution		None				None (incl. bucket users)				Pit (various)				Sewer and septic tank			
Type of construction		I	T	A	S	I	T	A	S	I	T	A	S	I	T	A	S
Socio-Economic Category	E					64K				276K							
	D													19K			
	A+B +C																66K

Collectively 24,000 HHs annual flow

**Assume all 64,000 HH who have no sanitation access live in informal housing**

*Confidence in calculation: medium; have not been able to triangulate with another source*

**Source: DHS 2013; EIU CANBACK 2016**

Apply the following % to the total 294,969 HH that have pit septage solution:

- 0% of houses with pit latrines are apartments
- DHS 2013 shows that 93.5% HH with pits use a shared toilets and 6.5% have their own pit toilets. Assume those who live in informal settlements and tenements use shared toilets, and lower-middle income HH use single HH toilets to calculate HH in each segment

*Confidence in calculation: medium; shared toilet use is an imperfect proxy for type of construction*

**Source: DHS 2013; CANBACK 2016**

Apply the following % to the total 183,271 HH that access sewers or septic tanks:

- Of all HH that have sewer or septic tank access, 63.82% HH share toilets and 36.18% do not (DHS 2013)

*Confidence in calculation: low; shared toilet use is an imperfect proxy for type of construction, there could be apartments and stand alone houses in SEC D with shared facilities*

# A total of ~110,000 homeowners in priority segments in Abuja could be latent markets for SURTs and MURTs, depending on product economics



There are a total of 273,800 households in informal buildings and tenements that access pit latrines in Abuja, and they can be split into homeowners and tenants. For homeowners, the addressable market is:

## 1. Segment size of homeowners with pit latrines

Of the 273,800 households in this segment, 40% are homeowners\*  
= 109,500 HH

### 2a. % of sub-segment (1) that does not own a toilet\*\*

5% of sub-segment (1)  
=5,500 HH

### 2b. % of sub-segment (1) that owns a toilet\*\*

95% of sub segment (1)  
=104,000 HH

### 3a. % of sub-segment (2a) that does not have space for a toilet\*\*

23% of sub segment (2a)  
= 1,300 HH

### 3b. % of sub-segment (2a) that has space for a toilet\*\*

77% of sub segment (2a)  
= 4,200 HH

### 4. % of sub-segment (2b) that excavates their latrine (and will therefore value the RT)\*\*

90% of sub segment (2b)  
= 94,000 HH

### 5a. % of sub-segment (4) that shares their toilet\*\*

74% of sub segment (4)  
=69,000 HH

### 5b. % of sub-segment (4) that does not share their toilet\*\*

26% of sub segment (4)  
= 25,000 HH

## Latent market of homeowner HH (MURT)

=70,300 HH ± 20%

## Latent market of homeowner HH (SURT)

= 29,200 HH ± 20%

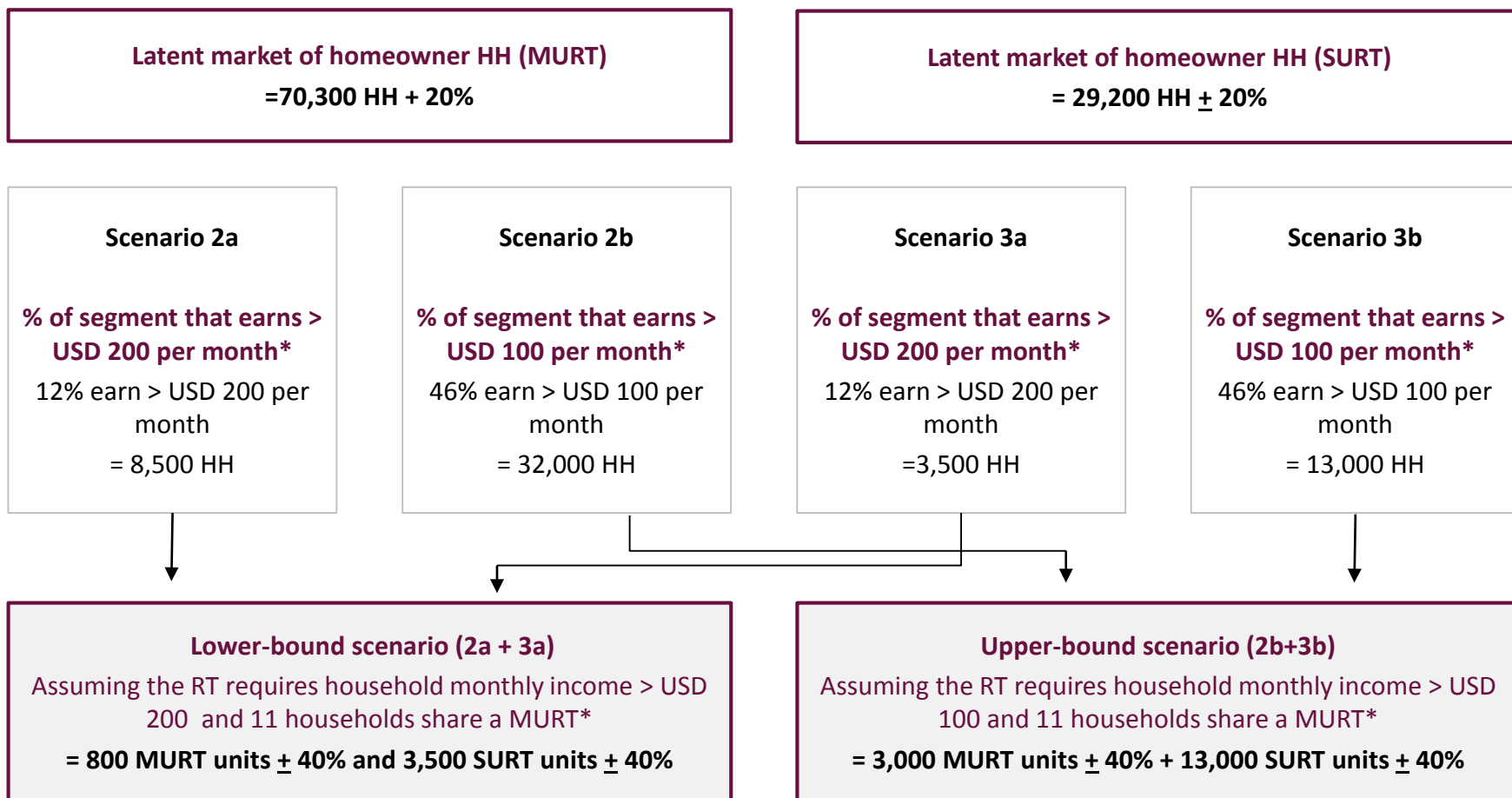
Note: margin of error gets larger as you moved down the steps because of the decrease in sample size

Source: \*DHS (2014);\*\*Assumptions and values based on survey data of 81 homeowners

# The addressable market size for homeowners in priority segments in Abuja is 800–3,000 MURTs and 3,500 – 13,000 SURTs



Homeowners' ability to pay for the RT may restrict the total addressable market for MURTs and SURTs



\*Note: margin of error gets larger as you move down the steps because of the decrease in sample size  
 Assumptions and data based on survey of 81 homeowners

# The addressable market size for tenants in priority segments in Abuja is 300 – 6,000 MURTs, depending on product pricing



There are a total of 273,800 households in informal buildings and tenements that access pit latrines in Lagos, and they can be split into homeowners and tenants. For tenants, the addressable market is:

## 1. Segment size of tenants with pit latrines

Of the 273,800 households, 60% are tenants  
= = 164,000

## 2. % that excavates the latrine more than once every 2 years (i.e., landlord will value the RT)\*

50% of sampled tenants and landlords in Abuja report that the latrine is excavated more than once every 2 years  
= 82,000 HH

### Scenario 3a

#### % of sub-segment (2) that earns > USD 200 per month\*

5% earn > USD 200 per month  
= 4,000 HH



### Lower-bound scenario

Assuming the RT requires household monthly income > USD 200; tenants will partially pay for RT and 11 households share a MURT  
= 370 MURT units  $\pm$  40%

### Scenario 3b

#### % of sub-segment (2) that earns > USD 100 per month\*

55% earn > USD 100 per month  
= 45,000 HH



### Upper-bound scenario

Assuming the RT requires household monthly income > USD 100; tenants will partially pay for RT and 11 households share a MURT  
= 4,100 MURT units  $\pm$  40%

Note: margin of error gets larger as you move down the steps because of the decrease in sample size

Source: \*Assumptions and values based on survey data of 81 homeowners

# Combining homeowner and tenant markets in the priority segments in Abuja, the addressable market for SURTs is larger than MURTs



## Homeowners in priority segments

Assuming the RT requires household monthly income > USD 200 and 11 households share a MURT

**800 MURT units ± 40%**  
**3,500 SURT units ± 40%**

Assuming the RT requires household monthly income > USD 100 and 11 households share a MURT

**3,000 MURT units ± 40%**  
**13,000 SURT units ± 40%**

## Tenants in priority segments

Assuming the RT requires household monthly income > USD 200; tenants will partially pay for RT and 11 households share a MURT

**370 MURT units ± 40%**

Assuming the RT requires household monthly income > USD 100; tenants will partially pay for RT and 11 households share a MURT

**4,100 MURT units ± 40%**

**Lower-bound scenario**  
=  
**~1,200 MURTs**  
**~3,500 SURTs**  
**± 40%**

**Upper-bound scenario**  
=  
**~ 7,000 MURTs**  
**~13,000 SURTs**  
**± 40%**

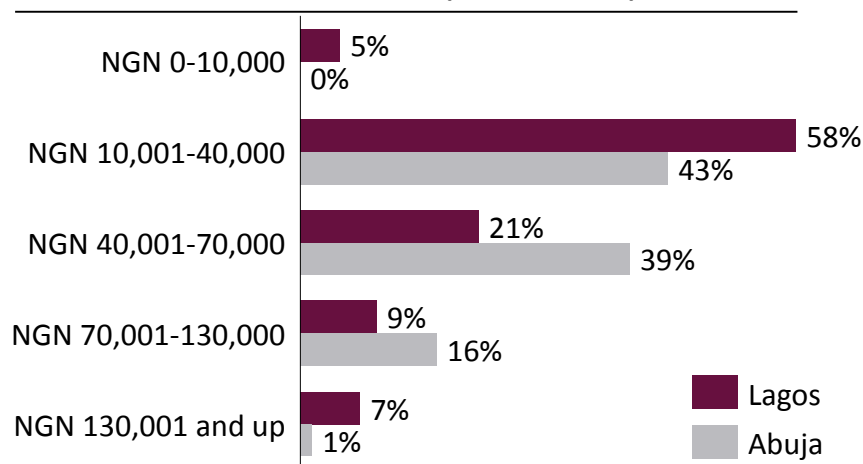
**Space constraints are not as acute in Abuja as they are in Lagos and therefore the market for SURTs is larger than that of MURTs**

# Nigeria: Surveyed homeowners in target segments earn between USD 20 and 190 per month and some are able to access credit

81% of the homeowners surveyed in Nigeria have a monthly income between USD 20 and 190

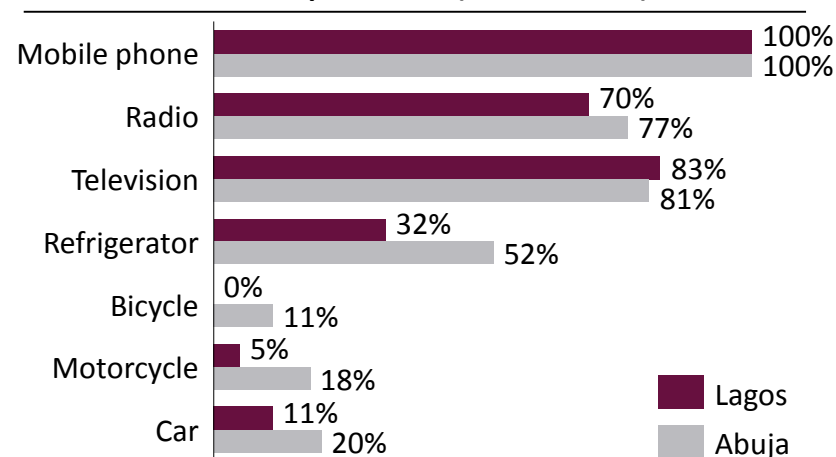
Homeowners and tenants in Nigeria are able to purchase assets and have access to credit through banks and savings groups

Income distribution (homeowners)



- Sampled tenants had similar income distribution as homeowners; 89% of tenants have a monthly income in between USD 20 and 190
- Average monthly rent in Lagos and Abuja is NGN 3,700 (USD 10) (Range: NGN 2,000-12,000 (USD 6-33)) and includes partial payment of utilities such as electricity, water, garbage collection, and waste extraction

Ownership of assets (homeowners)



- 81% of the homeowners with televisions, purchased this asset outright with cash
- 65% and 61% of homeowners in Lagos and Abuja, respectively, have access to bank accounts; 18% and 25% of tenants in Lagos and Abuja, respectively, have access to bank accounts; 90% and 54% of homeowners in Lagos and Abuja, respectively, have access to credit through banks and savings groups. and Few tenants have access to credit

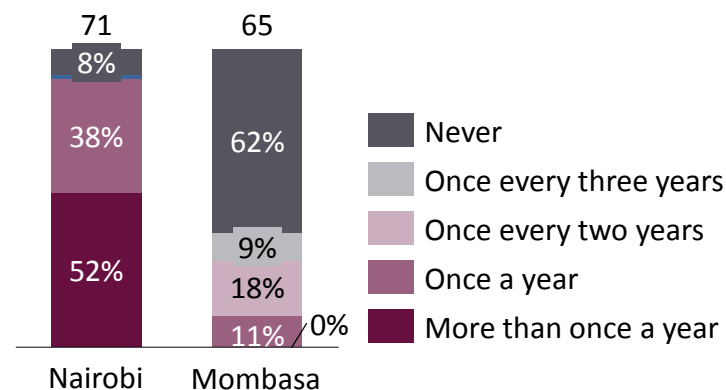
# Nigeria: Most landlords include utilities in rent and also pay for excavation of pit latrines, which takes place at varying intervals

## Majority of surveyed landlords lived in the same plot as their tenants, pay for utilities and excavation

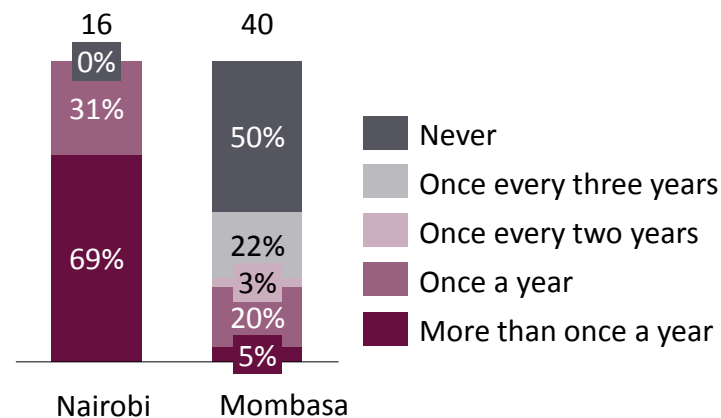
- 95% of the surveyed landlords in Lagos and 100% of landlords in Mombasa live in the same plot as their tenants
- Rent and utilities:** Average monthly rent in Lagos and Abuja is NGN 3,700 (USD 10) (Range: NGN 2,000-12,000 (USD 6-33)) and includes partial payment of utilities such as electricity, water, garbage collection, and waste extraction
- Water cost:** Homeowner average monthly household expenditure on water is NGN 1,719 (USD 4.7) in Lagos and NGN 2,272 (USD 6.2) in Abuja
- Excavation frequency:** 60% and 100% of landlords excavate soakaways and septic tanks once a year. Pit latrine excavation frequency varies significantly by city
- Excavation responsibility:** 88% landlords and tenants jointly pay for excavation of pit latrines
- Excavation cost:** Excavation which costs NGN 7,000-30,000 (USD 20-82), depending on the size of the latrine. Costs are similar in Lagos and Abuja

## Pit latrines are excavated more frequently in Lagos than in Abuja

### Reported frequency of pit-latrine excavation (tenants)



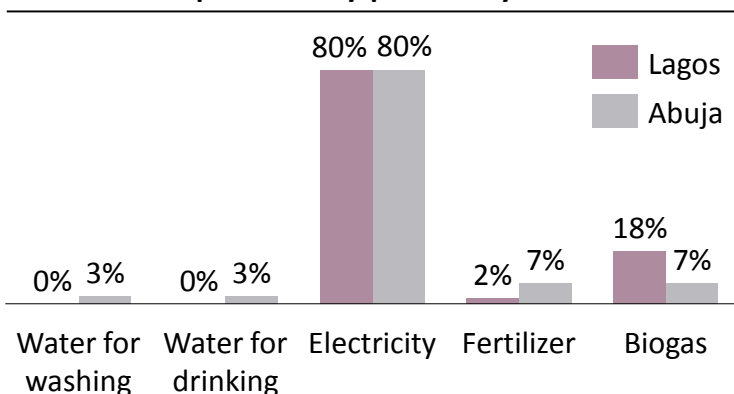
### Reported frequency of pit-latrine excavation (homeowners)



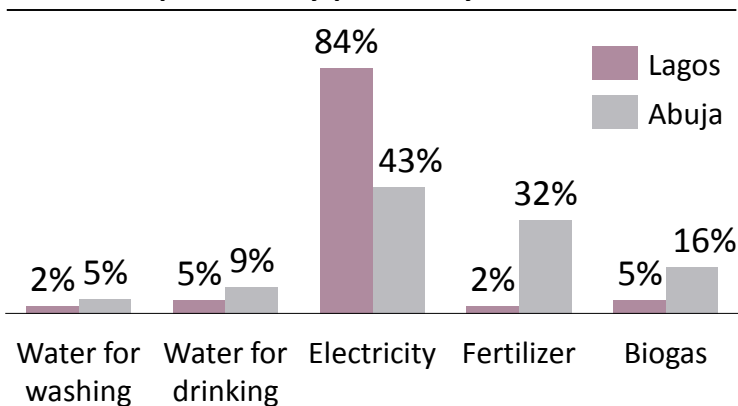
# Nigeria: Homeowners, landlords, and tenants expressed preference for electricity by-product and indicated some willingness to adopt the RT

Of the by-products, Nigerian homeowners and tenants expressed highest preference for electricity

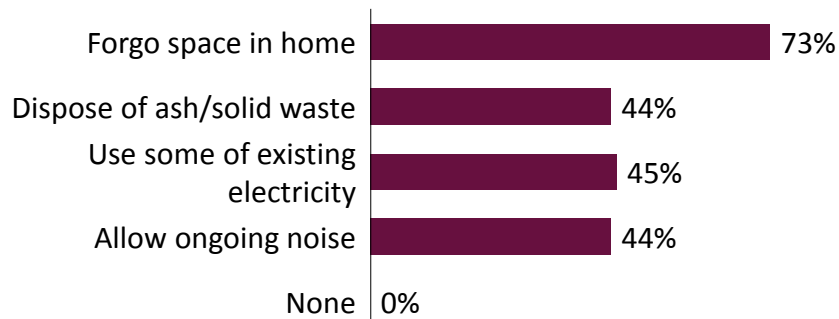
Most preferred by-product by tenants



Most preferred by-product by homeowners



Of the actions they would be willing to undertake to accommodate an RT, 73% of homeowners stated they would be willing to forgo some space in their home\*



Landlords would need to pay to install the RT and it could allow them to charge more rent

- 75% of the surveyed landlords stated that they would have to pay for installing the RT, and 13% felt that it should be paid for jointly by landlords and tenants
- 93% of the landlords felt that installing the RT would result in them being able to charge more rent; tenants indicated a willingness to pay additional rent if the toilet was in their unit
- Lack of space, permission from landlord, and price are the three most commonly cited barriers to installing a toilet within the unit

Source: Stakeholder surveys; Dalberg analysis

\*Note: this question allowed respondents to enter multiple answers

# Nigeria: Surveyed plumbers were largely informal, and offer more complicated plumbing services than their Kenyan counterparts

## Most plumbers in informal settlements and tenements work informally

- Plumbers interviewed provided services to informal areas, tenements, apartments and standalone houses
- 91% were informal, not affiliated with a company

## 56% of interviewed plumbers had more than one year of training

- All plumbers reported having received training for more than 1 year
- 85% of interviewed plumbers were trained through apprenticeships and 11% received training at technical colleges
- Only 9% of plumbers interviewed have had a follow up training
- Plumbers receive information about new products from shops selling sanitation products and other plumbers

## Plumbers interviewed claimed to be able to offer a wide variety of basic services

- Median basic service costs is NGN 5000 (USD 14); with most services costing under NGN 7000 (USD 19); median complicated service costs is NGN 10,000 (US 28); with most services costing under NGN 30000 (US 82)
- 30% of plumbers in Lagos stated that they have encountered plumbing problem that they cannot tackle; when they do, they refer to other plumbers or create make-shift solutions

### Of 35 plumbers, % who offer the following services

