



# NANO MEMBRANE TOILET BUSINESS EXPLOITATION PLAN

## OUTPUT 1 – BUSINESS MODEL CANVAS ANALYSIS OF THE NANO MEMBRANE TOILET

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## Abbreviations

<b>NMT</b>	Nano Membrane Toilet
<b>MURT</b>	Multi-units reinvented toilets
<b>SURT</b>	Single-units reinvented toilets
<b>CLTS</b>	Community Led Total Sanitation
<b>CapEx</b>	Capital expenditure
<b>OpEx</b>	Operational Expenditure
<b>CBS</b>	Container-Based Sanitation

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## Definitions

**Household toilets:** single household typically serving immediate to extended family.

**Shared toilets:** group of households in a single building. This could be shared by a large family, many different families in the building or even different families in the immediate compound.

**Communal toilets:** shared by a group of households in a community. Each household may have a key to the toilets and it can be owned by the community members (group of houses), one owner who is charging for usage (company or individual) or the developers who built the community

**Public toilets:** Open to anybody in residential or commercial areas. Usually payment for usage.

## Executive Summary

The aim of this study was to **advise on routes to commercialisation of the Nano Membrane Toilet (NMT) in low income urban residential areas**. Considering that the NMT is a new, high-tech product, a business modelling approach suited the aim to explore ways to understand the target customers, and characterise some potential distribution and sales models. This was completed by some basic financial modelling, based on a thorough review of existing literature and sanitation delivery models, as well as interviews with key players to support results. The long-term goal for the Cranfield University team would be to refine potential business models further, based on this preliminary analysis. The team conducted an initial market analysis using Kenya (and Nairobi) as a case study to test and verify assumptions on routes to commercialisation. This case study was done to illustrate how preliminary business model options could be developed for a potential outreach of this new toilet in a typical urban and peri-urban context, presenting similar prevalent sanitation access problems than South Africa, where the Cranfield University team had realised user testing.

The purpose of Output 1 was to review the value propositions of the NMT compared to existing improved sanitation alternatives on the market, and to analyse the barriers for a commercialisation of the NMT in an urban or peri-urban, Sub-Saharan context, targeting primarily low to medium income customers living in hard-to-reach areas (from an accessibility and from a sales and marketing perspective). This study acts as a starting point for any business or institution interested in developing a full-fledged business plan for the NMT commercialisation in any given geographies, and as such provides high-level recommendations and next steps to support the uptake of the business case in the future.

This study generated two outputs:

- **OUTPUT 1** (*this report*) presents a **qualitative analysis of the market potential** using the Business Model Canvas as a framework.
- **OUTPUT 2** is a suite of **basic financial modelling spreadsheet tools building on Output 1 findings**. These tools sought to understand the Nano Membrane Toilet's commercial prospective in 3 market segments identified in Output 1 report: (1) informal housing, (2) community and shared use (public toilets) and (3) non-sewerage connected new builds. The suite includes a template financial modelling tool for users to start a modelling process themselves. *These tools are available on request.*

### **OUTPUT 1 generated the following key insights and recommendations:**

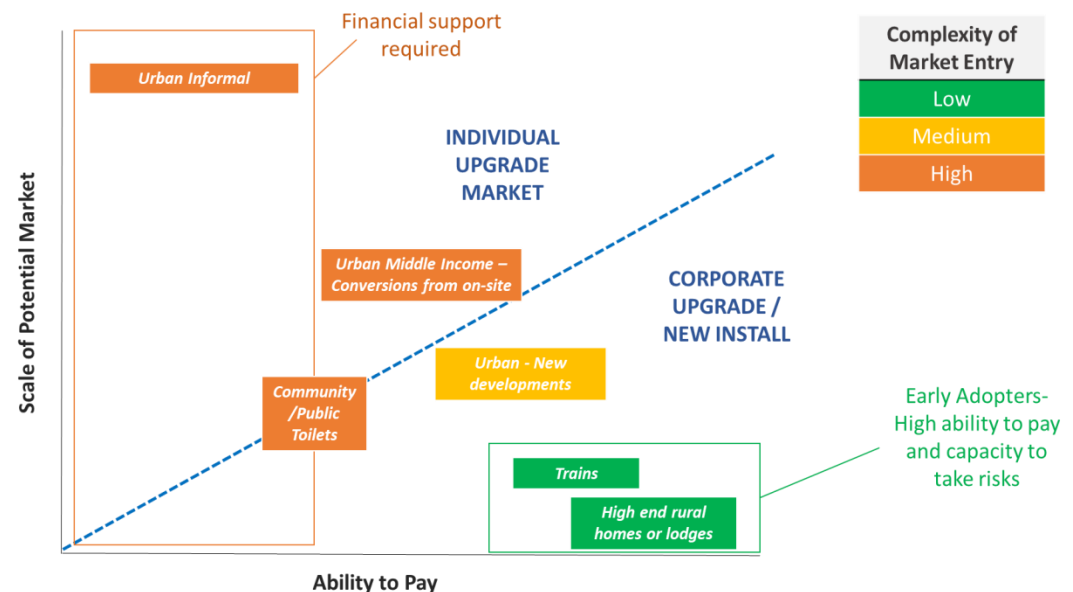
- This study analysed the NMT value proposition compared to other existing improved solutions in Kenya ([section 1](#)). The NMT is the only Reinvented Toilet aiming to serve individuals and functioning without any input (e.g. electricity, water) and presents some very tangible and attractive comparative advantages to other existing sanitation alternatives in non-sewered areas. While the NMT was initially developed for informal settlements in urban areas in Sub-Saharan Africa, we found that the NMT is likely to have a market in low to medium density urban areas, less so in densely populated urban areas where the lack of space in small dwellings may put off any uptake of an in-house toilet facility which, while reducing distance to access a toilet and reducing exposure to gender-based violence at night, still poses issues in terms of privacy, space and noises when set up in a small, communal, living space. The NMT is very

relevant for low-medium income households who are already sensitised to, and willing to have a toilet, but facing high connection fees to sewers or high costs related to poor sanitation alternatives. It was found that its commercialisation would require to be accompanied by some customer awareness, educational material, and training for target customers in low to middle income urban areas.

- While the NMT is being developed for low-income urban dwellers, we also found that in Kenya, and probably in a large number of developing countries in Sub-Saharan Africa, the NMT would also be very well targeted at medium-high income customers in non-sewered, low-density (peri-urban) areas. It would also be very well adapted for the hospitality sector, especially in remote areas, providing technical support and training are made available locally. This finding suggests that cross-subsidies between market segments may be a central idea to explore for those who may take the NMT to commercialisation.
- Using Kenya as an illustrative case study for Sub-Saharan Africa (and as a high potential market for Reinvented Toilet Technologies), 3 routes to market (or market segments) were rapidly identified (section 2):
  1. Individual households
  2. Community or shared use ('Public Toilets')
  3. Property developers

We found out that in Kenya, property developers involved in new builds represent a huge market entry point for the NMT (as in multi-storey buildings, the NMT may be a cheaper option than piped sewers).

The diagram below presents the various customer segments identified in this study, and shows the divide between the potential market for "individual upgrade" of existing sanitation options (or upgrade from the absence of any sanitation option) and the market for "corporate customers" looking at upgrading their sanitation options, and the "new housing" developments (for property developers looking at non-sewered and/or more cost-effective, solutions). While the NMT is developed for the 'Urban Informal' segment (with the highest potential market for scale, but with the lowest ability to pay), other segments such as the corporate, hospitality or new housing developments for medium to high income customers, or public uses (e.g. trains), which are not the main target for the NMT commercialisation, can present an easier market entry point. Early adopters with a high ability to pay should be considered as a way to cross-subsidise the 'Urban Informal' market segment.



- The study offers some insightful on the level of interaction that should be expected with NMT customers (section 3). It came across quite strongly that any business model and marketing strategy will have to be inclusive of a customer awareness and training feature to ensure long-term uptake and reduce maintenance issues. Flexible financing options will have to be available for the Urban Informal segment, served by suppliers who should have a local presence and initiated some demonstration sites and pilots. The way customer relationships will be managed will ultimately depend on whether the NMT is commercialised through a direct Business-to-Customer or a Business-to-Business model (which would involve a third party managing for example the maintenance and customer awareness service provision).
  - By reviewing some existing sanitation distribution models in East Africa and their resources, challenges and plans for the future, we were able to make recommendations on what distribution models should be considered for the NMT (section 4). While purchase outright should be excluded as a model (due to some prohibitive, high-capital, expenditure costs for the bottom of the pyramid), the study shows that models like Lease Agreements, “Rent-to-Buy” and Franchising for local suppliers are going to be much more adequate. BoP customer friendly payment options should be placed at the core of any future commercialisation plan, by offering a multi-service product package (including the toilet + Servicing/Maintenance + Financing + Customer awareness or training). The NMT could only be sold to low-income customers as an asset on microfinance or instalments. Such payment schemes can be part of a service contract, which will have to include maintenance and spare parts, for instance as part of the monthly charge.
  - This study also allowed the team to reliably list the essential resources (section 5) required in order to develop a reliable plan to commercialise the NMT in a given context, e.g. Sub-Saharan Africa. Physical resources provided by key suppliers and manufacturers in country, are crucial in any commercialisation model. For example, housing developers may present a strong market for the NMT investors (to reach to middle-high income households, and to pilot NMT in new-builds). In Kenya, existing manufacturing industries can offer competitive ways to distribute and manufacture the NMT. Institutional resources such as branding or licensing is going to be at the core of any commercialisation model, and existing distributors of products specialised in BoP and last-mile customers may offer advantageous partnerships.
- The study showed that if the NMT was to reach and convince low-income urban population, a high level of awareness building and community mobilisation would have to be accounted for in human resources terms. These are human resources that must be embedded in any future business plan, as trust building with potential users is a time and budget- consuming process. Financial resources such as sanitation loans and microfinance for customers and/or start-up incubation finance for the NMT providers, will have to be at the core of any business plan of the NMT.
- For the NMT business case to be viable, a series of preliminary activities (section 6) will have to be undertaken before a full-fledge business plan can be prepared. They involve a vast number of “market building” activities to engage with the key stakeholders of any given country where the NMT will be commercialised, as well as a review of all existing business models

in place for last-mile distribution there. It is expected that in any country, some strong customer awareness, education and training will be crucial (e.g. demo sites, post-sale servicing staff, social media promotion etc). The potential for local manufacturing will have to be explored, as some countries like Kenya already have a vibrant industry which could take up the production and retail of some core parts of the NMT. This product will also need to be embedded in a model offering a high Operation and Maintenance support available, especially for new customers. Key partners to have on board for any business planning process, and their involvement, are listed in this business model canvas analysis to support a business exploitation plan in a given country (section 7).

- Finally, the team worked on a simple cost-revenue analysis (sections 8 and 9) based on the preliminary figures provided by Cranfield University at this point in the NMT technology development. The adoption of the NMT among low to medium income customers as a potential core customer segment will always be primarily be cost-driven (affordability) rather than value-driven. This study therefore recommends in the section 4 of the business model canvas analysis to develop a NMT offer that will always include financing and customer awareness components as part of the product and servicing package marketed in any given geography. In section 8 and 9, the study also all the costs that any entity commercialising the NMT will have to consider to create a business model that can reach the last mile. The team achieved this by using several last-mile distribution business models in place in Kenya in the Energy and Sanitation sectors. This allowed us to start assessing what the willingness and ability-to-pay for the NMT may be, and how monthly charges linked to the use of the NMT would rank against

existing improved sanitation options. Information on revenue and cost structure laid in this section were used to produce the basic financial modelling (Output no.2) available upon request.

It is expected that any commercialisation model for the NMT will have to reflect on the payment models offered to targeted customer segments, and explore options for cross-subsidies between different customer segments to be able to reach the last mile for a maximum cost of USD 0.05 per user per day. This seems to be the only way the NMT can be offered as an affordable package, recommended to be inclusive of financing, customer awareness, training, maintenance and after-sales services.

# Introduction

The core research questions addressed in this assessment are:

- *Is there a market for the Nano Membrane Toilet in a Sub-Saharan, urban or peri-urban context, for low-income customers?*
- *How can this market be characterised, what customer segments does it entail, what market entry barriers should be considered?*
- *What initial steps should an investor be taking to explore the commercialisation of the NMT?*

This work took place over a period of 8 months, July 2018 – February 2019.

The study was based on several research methods and phases, including:

1. Literature Review ; Analysis of current container-based sanitation options and market analysis
2. Key Informant Interviews
3. Workshop and verification
4. Development of Business Model

The approach adopted by the research team presented the following characteristics and limitations:

Successes	Challenges
<ul style="list-style-type: none"> <li>- Response and interest from all interviewees contacted</li> <li>- Comparably high level of literature and data availability on core themes</li> </ul>	<ul style="list-style-type: none"> <li>- Absence of some stakeholders during time allocated for interviews (December -2018 – January 2019)</li> <li>- Reduced team mobility and delayed start date</li> <li>- Focus on unavailable financial data from interviewees</li> </ul>

The key stakeholders selected in the data collection phase included:

Key Informant	Type
Sanergy	Social Enterprise – selling sanitation services (in-home and public toilets)
Nairobi Water and Sewerage	Water Utility Company
Umande Trust	Non-Governmental Organisation, Based in Kenya, working on community projects in low-income areas.
GIZ	Development Agency
Water Services Trust Fund	Government Water and Sanitation Financing body
Bioliff Kenya/Davis and Shirtliff	Private sector – supplier of water and sanitation technology to African market

Sistema Biobolsa	Social Enterprise – selling sanitation services (biogas digestors)
Aquaya	Research Organisation – focused on WASH. Recently worked on willingness to pay and Sanitation Costing studies.
Property Developer	Private sector – construction of hotels and apartments

Nairobi, Kenya was chosen as an illustrative case study to address the study aims due to:

- Time and budget **constraints**
- **Familiarity** of consulting team – leading to quicker answers
- The prediction of it being one of the **most promising markets in Africa**, thus allowing for a more thorough market entry analysis

#### Strengths of the Nairobi market

1. Significant sanitation needs
2. High middle income population
3. Hub for sanitation innovations – demonstrated cultural acceptance of new sanitation tech
4. Presence of manufacturing industry
5. Relative ease of import

It was decided that at this research stage, it was not relevant to include households and toilet users in the interview process. Cranfield University have collected users’ feedback in Ghana and South Africa, and it would be expected to engage with users about business model options at a later stage when the NMT would be piloted in a certain area.

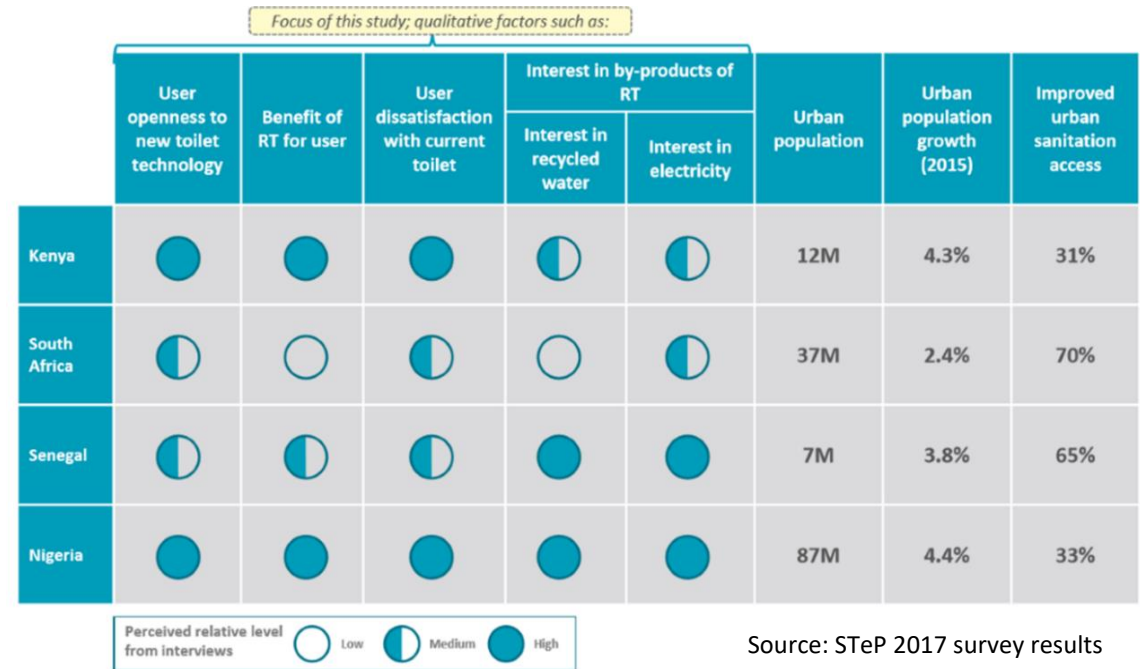
**The Gates Foundation has previously looked to Kenya as a promising market for emerging sanitation technologies.** Dalberg were contracted to complete a review on this market for the Reinvented Toilet in Kenya, as well as other promising African markets - South Africa, Senegal, and Nigeria. The lessons from this overarching study<sup>1</sup>, were that:

- In urban areas, Kenyans showed a high willingness to pay and openness to adopt new sanitation practices;
- The adaptability of Kenyans is evident in the influx of social enterprise and innovation-based sanitation actors in the past 10 years

<sup>1</sup> [Dalberg \(2017\), STeP Stakeholder Perspectives: Kenya, South Africa, Senegal and Nigeria](#)

- Overall, Kenyans were less reliant on the government for public sector-supplied sanitation solutions (compared with India and South Africa)
- Kenyans exhibited a moderate interest in recycled water and electricity as by-products of re-invented toilets – whereas in more countries with less access to public infrastructure (Senegal, Nigeria) these goods played a more attractive role;
- Kenyans showed a higher level of dissatisfaction with current services, making them strong candidates to upgrade sanitation systems;
- All countries were showing significant levels of urban population increase, but without a proportional expansion of sanitation services.

This figure presents the key characteristics of Kenya as an entry point for the NMT. Kenya is a strong market in the African context and chosen as a case study for its high level of potential – compared to markets with higher levels of instability, poorer ability to do business, and less educated populations e.g. Democratic Republic of Congo, Chad, Central African Republic etc.



**Methodology:** This assessment of the NMT’s marketability was framed around the “Business Model Canvas” as a methodology – as presented in the image below ([Strategyzer, 2019](#)).

A business model should describe the rationale of how an organisation or enterprise creates, captures and delivers value (economic, social or environmental). **The Business Model Canvas was chosen for this study based on its robust and tested methodology for the comprehensive assessment of new products and services.** It is used as a tool to capture insights about the customers to serve, what value propositions are offered through what channels, and how a company can money out of delivering a product or service. While the business model canvas offers a simplistic framework, the team also looked beyond the contemporary framework of the sanitation sector (e.g. financing models, and other sectors such as renewable energy services) which operate beyond a Kenya-only context.

**Due to the potential disruptiveness of the Nano Membrane Toilet, the scope to create value is vast and research was conducted to understand what the value would be for potential customers, whether they are already accessing a similar sanitation service based on competing technologies, or they are currently left without access to any form of improved sanitation.**

In the literature review conducted in the initial phase of the project, very little data was found to be available on other emerging sanitation businesses’ “Key resources”, “Cost structure” and “Revenue structure” in particular, were lacking in data. This is in fact the area with the most information gaps in the sanitation sector, as very few enterprises are known to have developed extensive business models.










# The Business Model Canvas

Designed for:

Designed by:

Date:

Version:

<h3>Key Partners</h3>  <p>Who are our Key Partners? Who are our key suppliers? Which Key Resources are we acquiring from partners? Which Key Activities do partners perform?</p> <p><b>MOTIVATIONS FOR PARTNERSHIPS</b> Optimization and economy Reduction of risk and uncertainty Acquisition of exclusive resources and activities</p>	<h3>Key Activities</h3>  <p>What Key Activities do our Value Propositions require? Our Distribution Channels? Customer Relationships? Revenue streams?</p> <p><b>CATEGORIES</b> Production Problem solving Platform/Network</p>	<h3>Value Propositions</h3>  <p>What value do we deliver to the customer? Which one of our customer's problems are we helping to solve? What bundles of products and services are we offering to each Customer Segment? Which customer needs are we satisfying?</p> <p><b>CHARACTERISTICS</b> Novelty Performance Customization "Getting the Job Done" Design Business status Price Cost reduction Risk Reduction Accessibility Convenience/Usability</p>	<h3>Customer Relationships</h3>  <p>What type of relationship does each of our Customer Segments expect us to establish and maintain with them? Which ones have we established? How are they integrated with the rest of our Business model? How costly are they?</p> <p><b>EXAMPLES</b> Personal assistance Dedicated Personal Assistance Self Service Automated Services Communities Co-Creation</p>	<h3>Customer Segments</h3>  <p>For whom are we creating value? Who are our most important customers?</p> <p><i>Mass Market</i> <i>Niche Market</i> <i>Segmented</i> <i>Community</i> <i>Multi-sided Platform</i></p>																								
<h3>Key Resources</h3>  <p>What Key Resources do our Value Propositions require? Our Distribution Channels? Customer Relationships? Revenue Streams?</p> <p><b>TYPES OF RESOURCES</b> Physical Intellectual (brand, patents, copyrights, data) Human Financial</p>		<h3>Channels</h3>  <p>Through which Channels do our Customer Segments want to be reached? How are we reaching them now? How are our Channels Integrated? Which ones work best? Which ones are most cost-efficient? How are we integrating them with customer routines?</p> <p><b>CHANNEL PHASES</b> 1. Awareness How do we raise awareness about our company's products and services? 2. Evaluation How do we help customers evaluate our organization's Value Proposition? 3. Purchase How do we allow customers to purchase specific products and services? 4. Delivery How do we deliver a Value Proposition to customers? 5. After sales How do we provide post-purchase customer support?</p>																										
<h3>Cost Structure</h3>  <p>What are the most important costs inherent in our business model? Which Key Resources are most expensive? Which Key Activities are most expensive?</p> <p><b>IS YOUR BUSINESS MORE</b> Cost Driven (leanest cost structure, low price value proposition, maximum automation, extensive outsourcing) Value Driven (focused on value creation, premium value proposition)</p> <p><b>SAMPLE CHARACTERISTICS</b> Fixed Costs (salaries, rent, salaries) Variable costs Economies of scale Economies of scope</p>			<h3>Revenue Streams</h3>  <p>For what value are our customers really willing to pay? For what do they currently pay? How are they currently paying? How would they prefer to pay? How much does each Revenue Stream contribute to overall revenues?</p> <table border="0"> <tr> <td><b>TYPES</b></td> <td><b>FIXED PRICING</b></td> <td><b>DYNAMIC PRICING</b></td> </tr> <tr> <td>Asset sale</td> <td>List Price</td> <td>Regulation (Dispensing)</td> </tr> <tr> <td>Usage fee</td> <td>Flat-rate (per use/subscription)</td> <td>Real Time Market</td> </tr> <tr> <td>Subscription Fees</td> <td>Customer segment dependent</td> <td></td> </tr> <tr> <td>Lending/Renting/Leasing</td> <td>Volume dependent</td> <td></td> </tr> <tr> <td>Licensing</td> <td></td> <td></td> </tr> <tr> <td>Brokers fees</td> <td></td> <td></td> </tr> <tr> <td>Advertising</td> <td></td> <td></td> </tr> </table>		<b>TYPES</b>	<b>FIXED PRICING</b>	<b>DYNAMIC PRICING</b>	Asset sale	List Price	Regulation (Dispensing)	Usage fee	Flat-rate (per use/subscription)	Real Time Market	Subscription Fees	Customer segment dependent		Lending/Renting/Leasing	Volume dependent		Licensing			Brokers fees			Advertising		
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## 1. Value Propositions

The value propositions of the NMT are the solutions (the “gain”) the product is presenting to address an existing problem (the “pain”) for potential customers in terms of sanitation access. In essence, if a product does not appeal to the values of its intended consumers, a market for the product will not manifest.

The NMT was developed to respond to a series of requirements from the Bill & Melinda Gates Foundation’s *Reinvent the Toilet Challenge*, with an emphasis on:

- **Affordability:** within a limit of US\$ 0.05 / day / user, inclusive of the Capital Expenditure (CapEx)
- **Safety** provided by an in-home toilet
- **Variety of options** for the enterprise or organisation commercialising a reinvented toilet, in terms of purchase, lease or shared ownership models
- **Waterless use:** Rotating, self-wiping, bowl with no flush
- **Low-cost maintenance:** NMT membranes can be cleaned and replaced

The value propositions of the NMT is the set of all the benefits (or “gains”) offered by the NMT to its potential new customers, in comparison to the existing products and services they have access to, or are willing to access in order to reduce the current constraints (or “pains) they face due to a lack of improved sanitation.

### 1.1. Financial value proposition against other sanitation options and practices

For many consumers in the African market, the value proposition of a product ultimately comes down to its cost. Decisions for purchase are often based on a **perceived financial value of the product**, which is at times placed at an even higher value than the function of the product itself. To understand the value of the NMT, it is first important to understand the cost of alternatives, and to understand at what level the NMT can be competitive from a cost point of view in this market.

Facility Type	Cost to Consumer
<b>NMT</b>	<b>USD 750 – (maximum cost still tbc, depending on distribution model)</b>
Unimproved sanitation options (e.g. unlined pit latrine with slab and superstructure)	CapEx: ~ USD60-400 in total OpEx (Emptying): between USD20-50 (or at times USD100)
Improved latrine	Total construction cost of ~USD 400+
Pour flush toilet	A connected to a septic tank costs ~ USD 460 (based on 2 toilet units sharing one septic tank) – per capita cost of USD 45 per person. Up to USD 1,000

UDDT (double vault single cabin) costs	~USD 575– per capita cost of 57 per person.
Sewer and cost of access <sup>2</sup>	Total average annual cost of USD 204 for connection to the closest sewer line, highly dependent on the distance (in urban Kenya), plus cost of seated toilet USD 50-150. 40% of the water bill is charged as an additional sewage charge – this is paid monthly.

In discussions with Kenyan stakeholders, the price of the NMT was a prevalent question and concern. **Many stakeholders felt that a sales price in the range of \$1,000-\$1,500 was acceptable**, as this would allow for an **outright purchase** for middle income households and developers, while **complementary financing or rental based models** would be necessary to access the lower income market.

### 1.2. Qualitative value proposition per customer segment

Potential customers reviewed the product highlighting their expectations and perceptions in regard to the NMT. These are ranked generally in order of perceived value according to the researchers; different customer segments demonstrated slightly different rankings of these values.

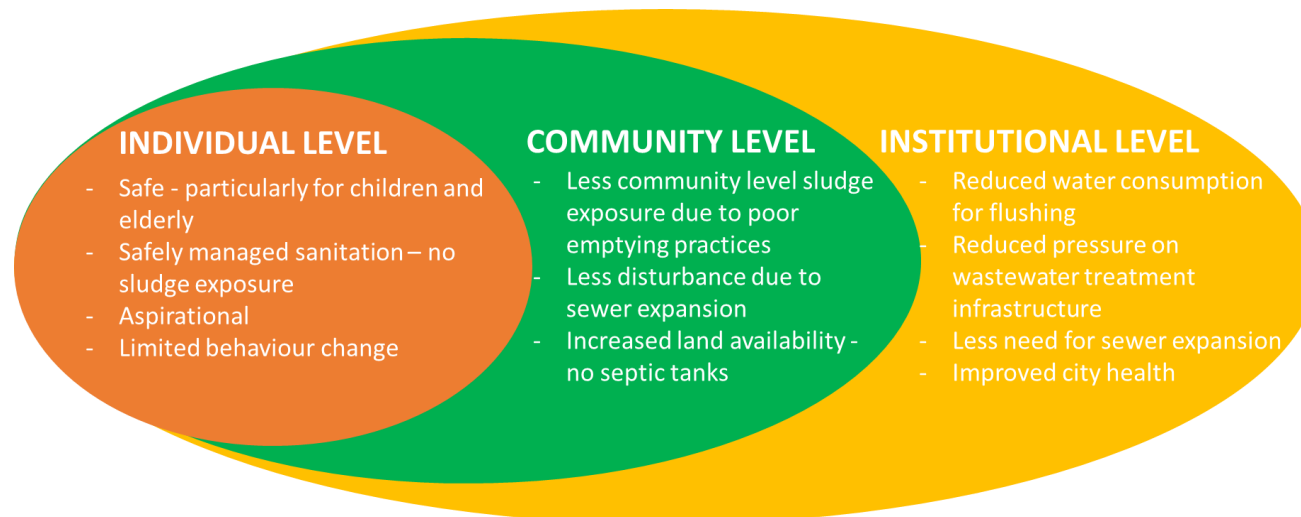
Value	For Higher Income Customer	For Low Income Customer	Relevance/Implication for NMT
<b>Water saving</b>	Save between on average 8L water per flush. A total of up to 3,000L for a 4 people household in a month. Decreases water bill significantly.	Saves paying for and collection of water for use in pit latrine.	<b>Interesting way to address water deficit for Water Utility Companies – saves investment in infrastructure for water delivery, sewers and waste treatment.</b> (e.g. NWSC have 200,000m3 deficit annually)
<b>Affordability</b>	Affordable @~\$1,000 but the need for multiple units per households increases CapEx	Need for tariff, leasing or rent-to buy model – the ‘kidogo’ economy – people like to pay ‘little by little’. Affordability is key for this group Question over whether payment is from landlord or household occupant.	- <b>Very relevant for low-medium income households willing to have a toilet, but facing high connection fees to sewers.</b> - <b>Issue of affordability could be addressed by involving landlords.</b>

<sup>2</sup> The value of the NMT is not so much for those living on the edge of the slum, near a sewer line, but more for those living at the heart of a slum or settlement. However this brings challenges around the issues of sufficient **space** and **density** of population (for a household toilet).

<b>Low maintenance</b>	<ul style="list-style-type: none"> <li>- Perceived as a key benefit by potential users.</li> <li>- Incurs a risk of self-maintenance by users.</li> <li>- High value proposition in low-density areas, where other in-house operators (e.g. Sanergy; Sanivation) do not have a strong business incentive (due to high costs of regular waste collection).</li> </ul>		
<b>Spare parts/ Servicing</b>	<ul style="list-style-type: none"> <li>- Need for servicing and spare parts is a huge concern to all potential customers.</li> <li>- Mistrust in follow up capacity from foreign companies distributing products in low-income areas</li> <li>- Lack of reliable availability of spares is a concern too.</li> <li>- Salt water (coastal areas) can erode parts of toilets thus users prefer ceramic over plastic toilets</li> </ul>		<ul style="list-style-type: none"> <li>- <b>Regardless of the location it is distributed, NMT should rely on a robust network of maintenance staff, and of membranes and other spare parts providers.</b></li> <li>- <b>Replacing plastic by some ceramic parts may decrease risk of erosion (coastal areas).</b></li> </ul>
<b>Placement</b>	<ul style="list-style-type: none"> <li>- Have space but unlikely to retrofit existing bathroom (better for new built housing)</li> <li>- NMT allows construction in areas without sewer access – places that previously came at high cost of development</li> </ul>	<p>Preference for toilet to remain outside of home in high density areas (cannot dedicate room at household level). Toilet could be moved inside for use only.</p>	<p><b>NMT likely to have the best value proposition in low-medium density urban areas, where availability of in-door space is not a challenge.</b></p>
<b>Security</b>	<p>No concerns</p>	<ul style="list-style-type: none"> <li>- In-house toilet would decrease risks of GBV and harassment at night</li> <li>- Theft concern highlighted repeatedly.</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Of interest for investors looking into solutions to reduce gender-based violence.</b></li> <li>- <b>Higher value proposition in areas where a high value asset will not generate high risk of theft.</b></li> </ul>
<b>Number of users</b>	<p>Low level of use – Need for multiple toilets – Therefore high CapEx expected</p>	<p>High level of sharing – unpredictable numbers of uses and users</p>	<ul style="list-style-type: none"> <li>- <b>70 uses a day (for a membrane replacement every 3 months) means average use by 10 users a day (~ up to 2 families).</b></li> <li>- <b>Relevant to pilot NMT in low to medium density areas, comparing number of uses in areas with shared and not-shared habits.</b></li> </ul>

<b>Cleanliness</b>	Concern over how clean flushing mechanism can really be – Increasing desire to use chemicals and toilet paper.	<ul style="list-style-type: none"> <li>- <b>Educational material and training</b> has to be part of the NMT ‘package’ when marketed to customers.</li> <li>- <b>Avoid marketing the NMT in areas where solid waste collection is a strong challenge.</b></li> </ul>		
<b>Comfort</b>	<ul style="list-style-type: none"> <li>- Seated option is not a preference (for hygiene related reasons) when shared use of toilets (common in low-income areas)</li> <li>- Muslim users may require water</li> <li>- Men, in particular, uncomfortable with sharing seated option</li> <li>- Good for children and elderly</li> </ul>	<ul style="list-style-type: none"> <li>- <b>NMT better adapted for households with a majority of women and children.</b></li> <li>- <b>Educational material and training</b> (e.g. prohibited use of water with the NMT) has to be part of the NMT ‘package’ when marketed to customers.</li> </ul>		
<b>Appearance</b>	<table border="1"> <tr> <td>Plastic may be disliked by higher income customers.</td> <td>Looks very modern for a basic household – May be too visible in a low-income area</td> </tr> </table>	Plastic may be disliked by higher income customers.	Looks very modern for a basic household – May be too visible in a low-income area	<ul style="list-style-type: none"> <li>- <b>Higher marketability of the NMT if external design and finishing adapted to each customer segment.</b></li> </ul>
Plastic may be disliked by higher income customers.	Looks very modern for a basic household – May be too visible in a low-income area			
<b>Function</b>	Concerns over misuse by guests, use of cleaning chemicals by cleaners, impact of vomiting, diarrhoea. For those who have access to alternatives this is seen as HIGH risk – would want warranty and ability to default to other sanitation systems.	<ul style="list-style-type: none"> <li>- <b>Recommended to incorporate a warranty system in any NMT package for maintenance and customer satisfaction.</b></li> <li>- <b>High value proposition of NMT as it is easily removable if household decides to change sanitation system.</b></li> </ul>		

This diagram summarises the distinct value proposition of the NMT for the 3 traditional customer types highlighted here.



### 1.3. Value proposition against alternative sanitation solutions in Kenya

We were able to accurately present a comparative analysis of the NMT's value propositions against its direct competitors in a country that counts a high number of **innovative container-based sanitation solutions led by private enterprises**. The NMT comes as a direct competitor for Sanergy's *FreshFit* (in-home) and Sanivation's *BlueBox* toilets, set up in two major urban areas (respectively Nairobi and Naivasha).

**Sanergy FreshLife:** urine diverting dry toilet (UDDT) housed within a prefabricated concrete structure, supplied and operated by Sanergy as a public toilet in low-income settlements of Nairobi. These toilets were initially sold to franchisees; the model has now shifted to renting the toilet only.

- Selling price to entrepreneurs: **USD 588** (incl. installation, painting and daily waste collection for one year)
- Fresh Life Operators (FLO) charge customers **USD 0.05 USD per use**.
- Monthly charge: **Ksh 850 (USD 8.50)** for the waste collection, upkeep and associated services.

**Sanergy FreshFit:** in-house toilet provided by Sanergy to meet households' needs of a sanitation solution in or near their home, for extra privacy and safety, especially at night. This product has been piloted and now marketed in Mukuru, an informal settlement of Nairobi.

- **Monthly charge of Ksh 850 (USD 8.50) since 2018. Collection can be arranged daily depending on the number of users.**
- **In-house toilet option: monthly charge of Ksh 950 (USD 9.50) for a daily waste collection (reducing odour inconvenience), Ksh 600 (USD 6) for a collection 3 times a week, and Ksh 200 (USD 2) for a collection twice a week.**

#### Learning from Sanergy's model include:

- ✓ **Customer referrals:** they represent a high proportion of new sales (~60% as of October 2017).
- ✓ **Integrated roles for costs reduction:** Costs incurred in the collection of waste have been reduced by combining the collection routes of both the FreshLife and FreshFit toilets in the first pilot. Today, the collectors' role has also been expanded to customer service and new sales after training.
- ✓ **Privacy:** Putting a curtain around the in-home toilet area doesn't work for all users, people not only need visual and sounds and smell privacy.
- ✓ **Importance of space:** often, toilet used into a private space indoors, then placed outside when households cannot dedicate a full-time space to a toilet
- ✓ **Prominence of family users:** Multiple adults are not taking up the in-home toilet, only families; often it is a landlord who is preventing his family from needing to share the toilet with all of the compound e.g. save his daughter from needing to use the same toilet as a casual labourer renting a room on the same seat.
- ✓ **Partnerships with public authorities:** Sanergy have no Kenyan Bureau of Standards Approval (KEBS) for the toilet itself. Ambition is to establish themselves as a go-to service provider, while they have very close relationships with Nairobi Water and the local chiefs and governance, indispensable to exist.
- ✓ **Security:** toilets need to be lockable to prevent neighbours from using them.

<p><b>Sanivation BlueBox toilet</b> (Naivasha and Kakuma refugee camp)</p> <ul style="list-style-type: none"> <li>• Users pay <b>monthly subscription fee (USD 3.50)</b> upon customer sign-up, <b>USD 3.50 upon installation</b>, and a monthly subscription of <b>USD 6 per month</b>.</li> <li>• Cost of Blue Box toilet manufacturing with labor: <b>USD 65</b></li> </ul>	<p><b>Enviro Loo</b> is a waterless, on-site, dry sanitation toilet system, with installation sites in Kenya</p> <ul style="list-style-type: none"> <li>• Selling price varies per model. 4 different models that cater to different usage rates ranging from <b>USD 500 to 800</b>. The A Domestic (D2010) unit for 10 users per day is on the lowest end of the range.</li> <li>• Enviro Loo aims to provide sanitation in line with the target set by the Bill and Melinda Gates Foundation of <b>0.05 cents (USD) per day</b>.</li> </ul>
<p><b>Kentainers Ltd:</b> National distributor and retailer for a wide range of household sanitation products:</p> <ul style="list-style-type: none"> <li>• <b>EkoLoo</b>, a complete hut and slab</li> <li>• <b>Mobilet</b> (mobile toilet), slab dry toilet. The Mobilet can be compared to standard pit latrines with superstructures built from local materials rather than prefabricated materials. Retailed price: 150 USD</li> <li>• <b>WonderLoo</b>, ecological household seat-toilet</li> <li>• <b>SatoPan</b>, a toilet pan targeting regions where squatting and pit latrines are fairly common practice</li> </ul>	<p><b>SavvyLoo</b>, urine diverting dry toilet designed for rural and temporary settlements in Africa (incl. Kenya)</p> <ul style="list-style-type: none"> <li>• Unknown pricing, product in development. Tested in South Africa, not commercialised at large scale yet. Kenya part of the target markets.</li> </ul>

#### 1.4. Value proposition against other emerging technologies

A new generation of toilets was developed to treat waste and kill pathogens without the need for sewer connections, treatment plants, water supply or electricity. How does NMT compare to others? What is its market compared to others?

The table below presents information on each Gates Foundation's *Reinvent The Toilet* technology as presented in the Technology Brochure for the November 2018 Toilet Fair held in Beijing, China. The NMT has the following advantages over its competitors:

- **Energy neutral**
- **Compact**
- **Adaptable to existing household structures**
- **Compact lends itself well to financing options since system can be removed if payment missed**

	Early prototype /advanced prototype /market <sup>33</sup>	Wipe/ Wash/ Both	Squat/ Pedestal /Both	Intended for community/ household/ both	Inputs needed	Outputs for disposal or reuse	Maintenance
<b>Nano Membrane Toilet (Cranfield University)</b>	Early prototype	Wipe	Pedestal	Household 10 uses/day	None	Water (domestic use) Ash	Water/ash emptied daily. Membranes changed 4x annually
Recycling Toilet (Clear Environment Technology)	Market (China)	Both	Both	Community 1000 uses/day	Electricity, water (rainwater harvesting)	None	Membranes replaced every 2 years
Empower Sanitation Platform (Duke Centre for WASH-AID)	Advanced prototype	Both	Both	Both 10-50 uses/day	Electricity	Water, sterilized dried solids	Dried solids emptied weekly
Blue Diversion Autarky (EAWAG)	Early prototype	Both	Pedestal	Household 10 uses/day	Electricity, calcium hydroxide	Water, nutrients (nitrogen, phosphorus and potassium)	Frequency of water refill/fertilizer harvest and supply of chemical?
Eco-San Toilet (Yixing Exo-Sanitary Manufacture Co.)	Market	Both	Both	Community 50-80 uses/day	Electricity	Water, fertiliser (1ton/year)	Solids maintained twice a year. Membrane replaced 4x annually
EToilet (Eram Scientific Solutions)	Early prototype	Both	Squat	Both 100 uses/day	Electricity	None	NA
HTClean Toilet (Helbling)	Early prototype	Both	Both	Household 10 uses/day	Electricity	20g filter cake	Cake to be disposed by user
Zyclone Cube (SCG Chemicals)	Advanced prototype	Both	Both	Community 130 uses/day	Electricity, water, media	Water, solids	Media and electrodes replaced every 3 years. Fertilizer monthly
NEWgenerator (University of South Florida)	Advanced prototype	Both	Both	Both <10-1000+ uses/day	Electricity, water, salt	Biogas, Nitrogen and phosphorus	Every 6 months
Toronto Toilet (University of Toronto)	Early prototype	Both	Both	Household	Electricity	Water, ash	Solids emptied monthly

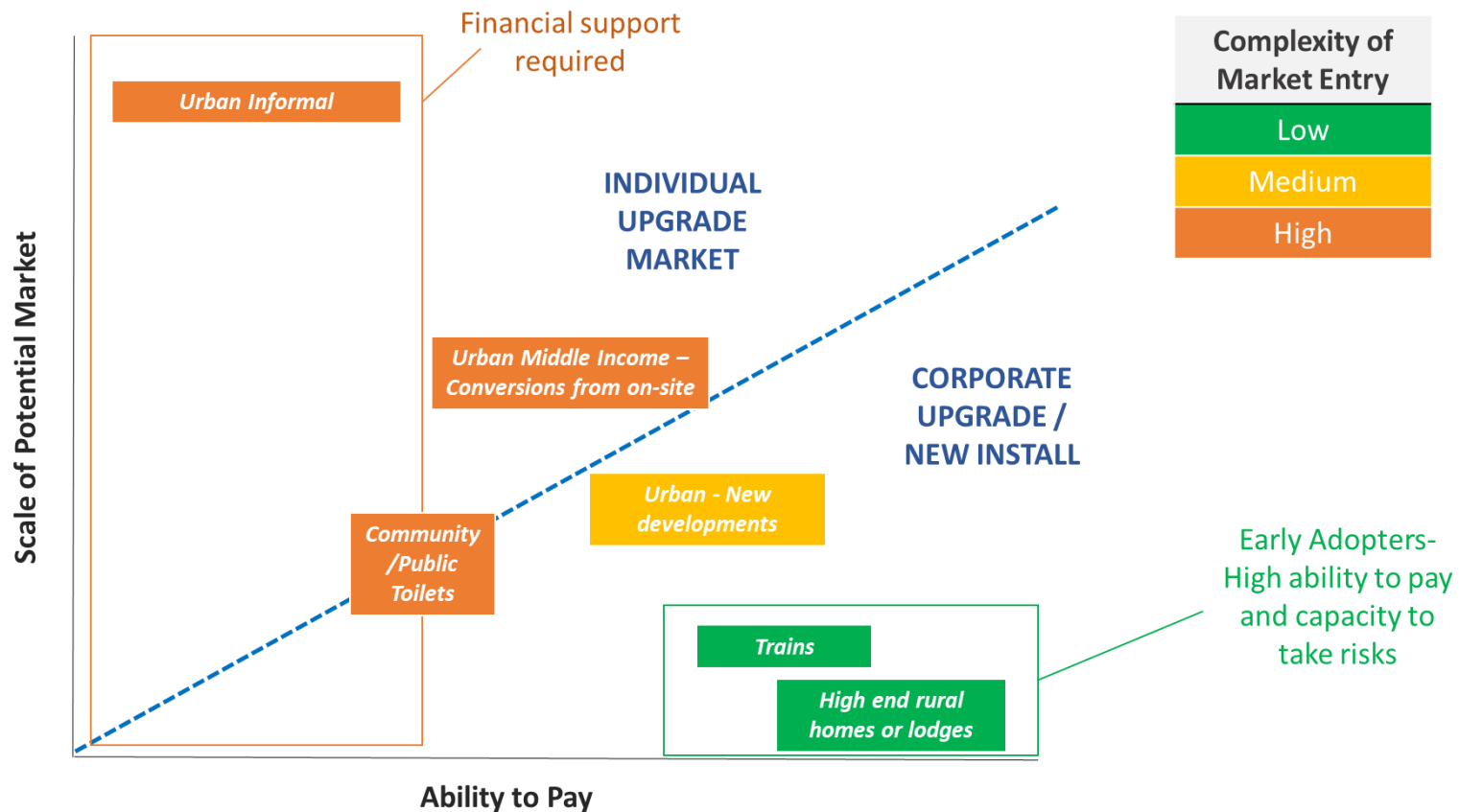
## 2. Customer Segments

Another part of the business model canvas analysis’s aim is to construct customer “archetypes” with defined groupings. Using desk-based willingness to pay and ability to pay studies, as well as face-to-face interviews, we analysed the “gains” (or value propositions) from the NMT for each customer segment to help a business model prioritising the right customers. This assessment highlighted 3 primary customer segments, which represent the most likely categories of customers for the NMT in Sub-Saharan Africa, taking Nairobi, Kenya as a case study. Based on primary and secondary data collection, the table below highlights the relevance of the NMT as a new product for each segment.

	Existing households		Community/ Shared	New builds
	Low income	High income		
Market Size	316,450 households in Nairobi using pit latrines, of which a latent market of ~280,000 households	Unknown / No data available	Unknown / No data available	e.g. Nairobi: - 10,000 new per year - latent market of 2,800 SURT and 5,000 MURT.
Opportunities	<ul style="list-style-type: none"> <li>- <b>Security:</b> Reduced risk of accessible public toilet at night</li> <li>- <b>Privacy/Dignity</b></li> <li>- <b>Affordability:</b> if similar or reduced expense on toilet</li> <li>- <b>Health:</b> End of open defecation and ‘flying toilet’</li> <li>- <b>Landlords</b> installing NMT to upgrade rent</li> </ul>	<ul style="list-style-type: none"> <li>- Enjoy the novelty of a new modern technology – good early adopter</li> </ul>	<ul style="list-style-type: none"> <li>- Wealthy landlords own large compounds and may arrange for sharing (instead of using and emptying a pit latrines)</li> </ul>	<ul style="list-style-type: none"> <li>- Allows developer to construct in area without prior sewer connection</li> <li>- Save space internal external to building dedicated to pipe work/septic/sewer connection</li> </ul>
Barriers	<ul style="list-style-type: none"> <li>- Affordability of one unit may overweight existing expenditure on public toilets</li> </ul>	<ul style="list-style-type: none"> <li>- Affordability of multiple units for the home</li> </ul>	<ul style="list-style-type: none"> <li>- Seat not appropriate for large scale sharing</li> <li>- More regular maintenance if &gt;10 uses per day.</li> </ul>	<ul style="list-style-type: none"> <li>- Seen as a very high risk to design a new build around an emerging type of toilet</li> </ul>
Summary	<p><b>Very relevant product for low-to-medium density areas, where there is either enough in-house space for toilet,</b></p> <ul style="list-style-type: none"> <li>- shared habit between up to 2 or 3 families, or</li> <li>- low-risk of theft</li> </ul>	<ul style="list-style-type: none"> <li>- Very well targeted at medium-high income customers in <b>non-sewered, low-density (peri-urban) areas</b></li> <li>- Very well adapted for <b>hospitality</b> sector or high-income households with rural accommodation to cross-subsidise access in low-income areas.</li> </ul>	<p><b>Other Gates toilets designed for large scale sharing but NMT may be suitable for smaller compound sharing.</b></p>	<ul style="list-style-type: none"> <li>- Property developers are a huge market entry point (in multi-storey buildings, the NMT may be cheaper than piped sewers).</li> <li>- Would require significant warranty and product testing but high potential</li> </ul>
<p><b>Attractive segment for companies – strong business incentive incurred by very low expenses on regular waste collection.</b></p>				

The diagram below presents the 3 primary customer segments, highlighting the divide between **the market for individual upgrade of existing sanitation options (or upgrade from the absence of any sanitation option)** and **the market for corporate customers looking at upgrading their sanitation options, and the new housing developments** (for property developers looking at non-sewered and/or more cost-effective, solutions).

The diagram also allows to visualise that the biggest customer segment (in terms of scale) is also the one that will need complex business models offering financial support or subsidies (in this case to reach the urban informal segment). This study also highlighted that, although **other segments such as the corporate, hospitality or new housing developments for medium to high income customers, or public uses** (e.g. trains) are not the main target for the NMT commercialisation, they can present an easier entry point. They also offer the possibility to design models where **revenue from the NMT sales to the “early-adopters”** can allow an enterprise to offer a subsidised sales model for the lowest-income customers.



Beyond the 3 primary customer segments, **5 supporting segments** can also be identified for the NMT. These include any non-individual customers, who may still represent a low-risk and high-impact pathway to reach potential urban low-income customers. Their incentives and potential challenges to be involved in a partnership for the commercialisation or piloting of the NMT are highlighted below.

	<b>Donors</b>	<b>Utilities</b>	<b>Sanitation Arm of Government</b>	<b>NGOs</b>	<b>Technology Distributors</b>
Opportunities	<ul style="list-style-type: none"> <li>- Refusing to invest in sewers (too expensive, not able to reach sanitation coverage soon enough)</li> <li>- Aligns with climate change, urban resilience and environment protection agendas</li> </ul>	<ul style="list-style-type: none"> <li>- Waiting for extremely large grants for sewers, prevents incremental growth in coverage</li> <li>- Reducing wasted use of water in water scarcity areas</li> <li>- Decreases need for investment in supporting infrastructure for toilets</li> </ul>	<ul style="list-style-type: none"> <li>- Can be seen to be innovative</li> <li>- Provide long term option with low level maintenance</li> <li>- Can provide high visibility if trial successful</li> <li>- Indispensable approval and promotion from the <b>County Governments for piloting</b></li> </ul>	<ul style="list-style-type: none"> <li>- In line with WASH programming in peri-urban and urban areas where FSM is a challenge</li> <li>- In line with GBV programming</li> </ul>	<ul style="list-style-type: none"> <li>- Chance to expand innovative product line</li> <li>- Long term income potential via servicing and spares</li> <li>- Sell to customer already purchasing solar, biogas etc. - adopters</li> </ul>
Barriers	High risk investment if piloted for the first time.	High risk investment if piloted for the first time.	Hardly likely that public authorities will take on a challenge alone.	<ul style="list-style-type: none"> <li>- High level of education and training required</li> <li>- High level of facilitation expected for maintenance, operational training and distribution channels</li> </ul>	<ul style="list-style-type: none"> <li>- High marketing cost to promote idea</li> <li>- High risk to promote unknown tech</li> </ul>
Summary	<b>A very good fit, as long as business case involves a minimum level of <b>subsidy</b> required, or a <b>private actor</b> involved.</b>	<b>Strong interest in piloting NMT as new model providing there is <b>support</b> (funding, users' training, business modelling)</b>	<b>Stronger business case to pilot it through an <b>investor</b>, under <b>supervision of public authorities</b></b>	<b>Well positioned to jointly pilot a <b>trial</b> in targeted area, and lead <b>community engagement</b></b>	<b>If supported with <b>marketing budget</b> and <b>warranty</b>, a good proposition</b>

### 3. Customer Relationship

Any business model for the NMT will have to work on understanding **the level of interaction customers want to have with the NMT**. In this study, we reviewed marketing strategies done by other sanitation enterprises (including in the solar products industry). This analysis brings the following highlights on **how to engage the public in wanting the NMT and feel ownership**.

As a follow up activity, it will be recommended for any organisation partnering in the commercialisation of the NMT to assess what interactions other industries (mobile, energy, food) have with their own target customers in a given country of operation, and how they retain customers.

Customer base management system features	Essential	Desirable	Reason/Comment
Educational materials	X		Avoid misuse and disposal of waste
Flexible financing	X		Extend range of potential customers. Consider pay-as-you-go, or payment in instalments.
Warranty (e.g. 10 years)		X	Equal to expected lifespan of product
Pricing inclusive of all after-sale maintenance and servicing		X	Transparent pricing system Incentivises users to limit self-maintenance if included automatically in payment plan.
Supplier with local presence	X		For fast-response and reduced costs of intervention
Develop detailed manual for maintenance workers and caretakers		X	Avoid misuse and disposal of waste Mitigate negative effects of possible self-maintenance by users
In-person fee collection weekly/monthly by NMT supplier or delegated operator		X	Allows in-person monitoring, although can present high labour cost.
Initial demonstration sites	X		Potential customers unlikely to desire product they have not seen.
Customer support, follow-up and satisfaction survey	X		NMT likely to build customer base through referrals (e.g. Sanergy: <80% sales attributable to referrals; <90% renewal rate from 3 <sup>rd</sup> month using service)
Map of low-medium density areas in target city - to prepare sales/marketing campaign <sup>3</sup>		X	Avoid targeting marketing to high density communities where no. users will be too high for NMT good O&M.

<sup>3</sup> (e.g. Sistema.bio, a biodigester company, organises customers by “hubs”. Each hub has an “area coordinator” in charge of managing staff dedicated to sales/marketing and maintenance technicians).

## 4. Distribution Channels

In this part of the business model canvas, the team reviewed the current sanitation distribution models in existing companies, their resources challenges plans for the future. The interviews we conducted with sanitation products/services distribution companies in Kenya, and local Water Utility company helped analyse the potential role a company could play in delivering the NMT to its targeted customers. By reviewing the **engagement of the target consumers (BoP) with other essential services**, and the **available/existing services for the servicing of the toilet in Kenya**, and by undertaking a qualitative assessment of the potential for working with current sanitation distributors and other services that have regular interaction with the BoP (including Municipalities and sanitation bi-products industries), we generated the following table. It summarises the various distribution models that can be used to sell the NMT and offer efficient servicing options.

	Distribution model options	Description	Key benefits	Key challenges
Physical asset acquisition / management	<b>Purchase outright</b>	<ul style="list-style-type: none"> <li>- Customer purchases good outright from shop</li> <li>- A servicing contract can be added for maintenance</li> </ul>	Straightforward interaction with ownership transferred to customer	<ul style="list-style-type: none"> <li>- Unlikely that a low-income household will be able to afford the full CapEx.</li> <li>- Low control over households' level of maintenance and upkeep</li> </ul>
	<b>Leasing Agreement</b>	<ul style="list-style-type: none"> <li>- Owner of the physical asset (e.g. NMT) agreeing to let someone else use it in exchange for a fee</li> </ul>	<ul style="list-style-type: none"> <li>- NMT remains property of the company</li> <li>- Higher control on maintenance levels of the toilet</li> </ul> e.g. Sanergy switched from selling the Fresh Life toilets to renting them out – offering them to take it back if someone was not offering the service to the expected standard)	<ul style="list-style-type: none"> <li>- Affordability: Monthly cost may be high if including the cost recovery of the toilet</li> <li>- No ownership as a result. Asset is returned to the company leasing it.</li> <li>- Complex service model that requires at least monthly interaction with the customer</li> </ul>
	<b>Franchising (or micro-franchising)</b>	Two types of franchise methods: <b>1. Business format franchising:</b> <ul style="list-style-type: none"> <li>- Owner of a business (the franchisor) grants a licence to another person or business (the franchisee) to use their business idea - often in a specific geographical area.</li> <li>- Franchisee sells the franchisor's product or services, trades under the franchisor's trade mark or trade name, and benefits from the franchisor's help and support. In return, the franchisee usually pays an initial fee to the franchisor and then a percentage of the sales revenue.</li> </ul>	<ul style="list-style-type: none"> <li>- Proven model to deliver basic products (e.g. solar home systems) to the Bottom of the Pyramid (BoP) customers</li> <li>- Offers recognised brand name and trade mark for franchisee to market NMT to customers</li> <li>- No prior experience needed for the franchisee as training received from the franchisor</li> <li>- Compared with an individual entrepreneur, the franchisor often has better negotiating power with suppliers and is able to reach economies of scale in other areas (e.g. product</li> </ul>	<ul style="list-style-type: none"> <li>- Low control over households' level of maintenance and upkeep</li> <li>- Relies on a business model that has been tested and proven to work. Franchisees can operate subsequent outlets at lower risk.</li> <li>- Costs can be high for the franchisee who pay continuing management service fees and may have to agree to buy products from the franchisor.</li> <li>- Franchising includes restrictions on how a franchisee can run the business to suit the local market.</li> </ul>

		<ul style="list-style-type: none"> <li>- <b>Product and trade name franchising:</b></li> <li>- Franchisor provides their product to a franchisee. The franchisee is required to purchase the product or range of products exclusively from the franchisor.</li> <li>- Franchisor also provides national marketing and advertising campaigns, logos and trademarks.</li> </ul>	design, use and development of new technologies, and supply chain development).	
	<b>Rent to Buy</b> ("M-Kopa Model")	Rent-to-own system*, providing new technology to the BOP through a microfinance system, tied bound payments until complete ownership.	Recover asset if payments missed	NMT is a large asset, too large for a tenant to necessarily want to own and take it to the next rental. Model more adapted to small assets (e.g. solar home system)
	<b>Delegated Management Model</b>	Traditionally used for water distribution, could be re-adapted for toilet distribution: Master operator (can be a franchisee) managing a portfolio of toilets in a given community.	<ul style="list-style-type: none"> <li>- Lean central company using existing distribution structures</li> <li>- Allows for decentralised maintenance contracting</li> <li>- Can incorporate incentives at this level for salesperson</li> <li>- Removes fear of customer about lack of local contact in case of system failure</li> </ul>	<ul style="list-style-type: none"> <li>- Building/training of distributors up front</li> <li>Keeping track of standard of service of all distributors</li> <li>- Toilets are difficult to sell, and are one time purchases compared with regular sales of water – water may distract and toilets get no attention</li> </ul>
<b>Maintenance</b>	<b>Service Contract</b> (i.e. Someone with a <b>skill/service</b> agreeing to use that skill for someone else in exchange for a fee.)	User could purchase the NMT outright and contract a maintenance technician through a service contract e.g. Sanitation: leasing agreement of the BlueBox Toilet, including a service contract for waste collection and bucket replacement.	<ul style="list-style-type: none"> <li>- Maintenance staff available at customer's request (especially if paired with customer service hotline service)</li> <li>- Low risk/likelihood for a customer to try repair or maintain NMT themselves and cause potential damage</li> </ul>	<ul style="list-style-type: none"> <li>- Regular replacement of Nano-Membrane may lead to people <i>trying to take shortcuts</i> and do it themselves.</li> <li>- Servicing contract needs to be thoroughly explained to customers new to this model to avoid self-repairs</li> </ul>
<b>Modes of distribution</b>	<b>Business-to-Business (B2B)</b>	Can rely on a Franchising system.	<ul style="list-style-type: none"> <li>- A locally known and well connected retailer can act as intermediary (e.g. Sanergy using local corner shop owners as intermediary franchisees to run community toilets)</li> <li>- Promotes local employment</li> </ul>	<ul style="list-style-type: none"> <li>- Low control over households' level of maintenance and upkeep</li> </ul>

	<b>Business-to-Customer (B2C)</b>	Can rely on "Atomised distribution" (e.g. last mile distribution of toilets through small or individual distributors)	Atomic distribution approach connects well to the Sanitation Marketing and CLTS approaches led by existing WASH programmes	<ul style="list-style-type: none"> <li>- Requires a lot of small or individual distributors in charge of reaching a dispersed customer base at the BoP</li> <li>- Need to rely on a large team of marketers</li> <li>- More adapted to small products (such as cook stoves or solar home systems, easily transportable)</li> </ul>
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The distribution model options will be crucial for reaching the key customer segments targeted for the NMT commercialisation. A key question for the commercialisation remains around the divide of responsibilities between **landlords and tenants**: While in Kenya for instance the provision of sanitation facilities is the responsibility of the landlord, most of them do not invest in their slum or informal settlement based properties. The tenants usually find themselves responsible de facto for their own sanitation. The NMT should therefore present delivery and payment options that can fit both parties.

**Recommendations for the most appropriate distribution models will be laid out in the Section 2 of this report.**

User friendly packages and payment schemes will be at the heart of any successful business model for the NMT. Payment schemes can include the following. We strongly recommend to consider **option 4**, which offers the best opportunities to build a long-lasting customer base.

#### Package offers

Option 1	Product-only ( <i>user-serviceable</i> )	NMT is distributed (through either of the model presented) but maintenance is the responsibility of the owner.
Option 2	Product + Service	NMT is distributed, inclusive of a maintenance or servicing contract (membrane replacement).
Option 3	Product + Service + Financing	NMT is sold as an asset on microfinance or instalments. Payments are inclusive of a service contract and possibly an interest rate.
Option 4	Product + Service + Financing + Education/Training	<b>NMT is sold as an asset on microfinance or instalments. The payment scheme is inclusive of a service contract (and possibly an interest rate) and offers regular training and follow-up on use of the NMT.</b>

#### Payment schemes can include:

- **Payment by instalments**, which includes **servicing** (e.g. M-KOPA), or **leasing with servicing** (e.g. Sanivation)
- **Pay-as-you-go (PAYGO)** system (e.g. MKOPA solar home systems fitted with a sim card) whereby there is a possibility to stop the use the toilet until the user pays

## 5. Key Resources

The business model canvas analysis helps us look at the resources required to commercialise the NMT in a given context, e.g. Sub-Saharan Africa. Using primary and secondary data collection in Kenya, we were able to list the following critical resources that an investor or company delivering the NMT would need to consider.

Type of resource	Implications for the NMT (Pros & Cons)
Physical	<ul style="list-style-type: none"> <li>✓ <b>Critical to identify key suppliers and manufacturers to design viable, financially efficient distribution channels<sup>4</sup></b> Note: these may not necessarily be ‘in country’ – many technologies of a similar level of complexity to the NMT are manufactured in Asia and imported, even when the market is at a significant scale</li> <li>✓ <b>Housing developers may present a strong market for the NMT investors (to reach to middle-high income households, and to pilot NMT in new-builds as an alternative to sewer connections or septic tanks and emptying costs)</b></li> <li>✓ <b>Depending on the country of operation, manufacturing industries may be very well equipped to assemble and distribute to selected retailers.</b></li> <li>✓ <b>The value proposition of the NMT for potential customers will strongly rely on the possibility for them to see and experience the product before considering investing.</b></li> <li>✓ <b>Existing distributors (e.g. African wide water and sanitation product supplier - Davis and Shirtliff) may adopt the NMT as a product, but are unlikely to invest in the initial marketing push. The upfront costs involved in gaining trust are expected to be significant in early markets.</b></li> </ul>
Intellectual / Institutional	<ul style="list-style-type: none"> <li>✓ <b>Recommended to associate a locally appropriate brand to the NMT offered on a national or regional market to maximise distribution and value proposition.</b></li> <li>✓ <b>The NMT could be a product offered by existing sanitation companies with a portfolio of branded products<sup>5</sup> who may already have the legal status and certifications needed to commercialise such product.</b></li> <li>✓ <b>Approaching energy products (e.g. MKopa) companies may be a strategic step to access an existing customer range<sup>6</sup></b></li> </ul>

<sup>4</sup> In Nairobi, Sanergy has concentrated their distribution channels through integrated roles: Costs incurred in the collection of waste have been reduced by combining the collection routes of both the *FreshLife* (community toilets) and *FreshFit* (in home) toilets in the first pilot. Today, the collectors’ role has also been expanded to customer service and new sales after training. This reduces dramatically the operating costs.

<sup>5</sup> E.g. “FreshLife” (Sanergy), “BlueBox” (Sanivation) or “WonderLoo” (Kentainers Ltd)

<sup>6</sup> Across Uganda and Kenya, as of January 2018, M-KOPA has connected over 600,000 homes to affordable solar power with 500 new homes being added everyday (primarily in rural and peri-urban areas) through a product-servicing-financing package which has been presented as a model of success in the international development and the renewable energy sector.

Human	<ul style="list-style-type: none"> <li>- Sales agents ; Customer support</li> <li>- Maintenance technicians</li> <li>- Community mobilisers – in charge of users’ training</li> <li>- Relationships with government and local sanitation partners</li> <li>- Relationships with donors</li> </ul>	<ul style="list-style-type: none"> <li>✓ <b>As demonstrated by successful models, resources availed for customer relationships are crucial (e.g. after-sales agents visiting households on a regular basis) to commercialise the NMT successfully)</b></li> <li>✓ <b>Existing models show that renewal rates for toilets leasing contracts heavily rely on strong presence of after-sale, community mobilisers and maintenance human resources in densely populated areas and in targeted community.<sup>7</sup></b></li> <li>✓ <b>Demo sites and training will be a key activity to demonstrate the value proposition of the NMT in a communities, e.g. to set up public/communal toilets first for usage before selling nearby households as test perhaps with the Water Utility Company.</b></li> <li>✓ <b>Sales agents from the targeted communities are likely to present a key human asset in any given business model.</b></li> <li>✓ <b>In some Sub-Saharan countries, sanitation goods can be imported duty free – this is a significant saving for the end customer.</b> Establishing the relationships that allow for such negotiations/lobbying to take place should begin well in advance of market entry.</li> <li>✓ <b>In some Sub-Saharan countries, sanitation coverage expansion is donor led – as such, relationships must be established with donors for emerging sanitation technology to be considered in shaping investment programs for areas of interest</b></li> <li>✓ <b>Necessary time to establish relationships and gain trust should not be underestimated – this process can be cost and staff intensive.</b></li> </ul>
Financial	<ul style="list-style-type: none"> <li>- Sanitation loans</li> <li>- Microfinancing system embedded in product offer (e.g. M-Kopa system). Can be paired with mobile money</li> <li>- Start-up and social enterprise grants, prizes, and loans</li> </ul>	<ul style="list-style-type: none"> <li>✓ <b>Financing for targeted customers: e.g. Micro-loan products for tenants or landlords willing to upgrade their sanitation facilities, can be offered as part of the company’s package.  e.g. the NMT could be delivered through a wider Sanitation loans programme (i.e. Community Total Led Sanitation; Sanitation Marketing) led by international development agencies or the national government<sup>8</sup>.</b></li> <li>✓ <b>Financing for the company distributing the NMT: Various new companies with a social impact mission have benefitted from loans and accelerator grants (e.g. Sanergy; Mkopa) which have considerably the scale of their customer segments and value proposition.</b></li> </ul>

<sup>7</sup> In 2017, Sanergy had a 83% renewal rate of their *FreshFit* (in home) toilet for the first 2 months, and a 93% renewal rate from the third month of using the service. Attrition is primarily due to movement out of community. The company also switched from selling the *FreshLife* (community) toilets to renting them out, hereby offering customers the option of taking the toilet back if they were satisfied with the expected standard of servicing.

<sup>8</sup> e.g. Kenya’s Up-scaling Basic Sanitation for the Urban Poor (UBSUP) programme (2011-2018) implemented by the Water Sector Trust Fund with support from GIZ and the Bill & Melinda Gates Foundation, focused on promoting toilet construction according to standards, with a financial incentive covering part of the costs.

## 6. Key Activities

For the NMT to be commercialised, key activities listed below have emerged from our research. They cover elements that are **crucial to develop most of the other elements of the business model canvas**, i.e. essential to design impactful value propositions, to set up strong distribution channels in-country and locally, and to propose a servicing and maintenance package, which demonstrates to be a central element to sustain customer relationships and sales over a long period of time. Ultimately, a thorough analysis of the key features of the company taking on the NMT commercialisation will help understand what its key features and core competencies should be in a given country of operation.

<p><b>Market building:</b> <i>Creating an enabling environment for the market to develop</i></p>	<ul style="list-style-type: none"> <li>✓ Engage a <b>multi-stakeholder mapping</b> of how to distribute the NMT in a given country. The mix of partners needed for a successful distribution model will vary from country to country</li> <li>✓ Consider <b>various business models</b>, which can include e.g. <i>mix of subsidy plus for-profit behaviours</i> to distribute the NMT to the last mile customers</li> <li>✓ Demonstrated by other sanitation or energy products business models that a key activity needs to be around <b>lowering up-front cost as much as possible</b></li> <li>✓ Demand for a new sanitation product is strongly influenced by <b>who the service is delivered by</b> (e.g. Commonly observed lack of trust in County Government; products and services are better received if offered by NGOs or Private Utility Companies)</li> </ul>
<p><b>Building consumers' awareness of the options:</b> <i>Conveying value proposition to new users</i></p>	<p>Learning from other sanitation businesses show a top list of critical demand generation activities :</p> <ul style="list-style-type: none"> <li>✓ Use <b>hygiene benefits</b> as a top motivator</li> <li>✓ Leverage <b>community social pressure</b> and <b>word of mouth</b> (or referrals) as a sales model</li> <li>✓ Customers believe in <b>what they see</b> (i.e. essential to set up demo sites among targeted communities)</li> <li>✓ Create <b>easier buying experience</b> (e.g. accessibility to support staff, customer service line, or spare parts)</li> <li>✓ Get <b>high profile users and promoters</b> to engage on social media to promote the NMT</li> </ul>
<p><b>Educational activities for new customers:</b> <i>Building customers' understanding of the features, limitations and key maintenance aspects of the NMT</i></p>	<p>The offer package may need an educational component:</p> <ul style="list-style-type: none"> <li>✓ To limit behaviours that may damage the NMT (e.g. disposal of sanitary pads, use of chemicals for cleaning)</li> <li>✓ To train customers on the disposal of the by-products (water and ash)</li> </ul>

<p><b>Production / Manufacturing:</b> <i>Finding the right model for production, manufacturing and assembling parts.</i></p>	<ul style="list-style-type: none"> <li>✓ Develop a product that can be very <b>robust</b> over time (due to weather conditions, dust, difficult and uneven terrain and access to some households)</li> <li>✓ Develop a <b>comparative analysis</b> on where membranes and other spare parts should be produced, manufactured and retailed for optimal cost-efficiency (dependant on country of distribution of the NMT)</li> <li>✓ Explore taxation and import tax regime for sanitation products and potential imported parts for assembling or servicing (dependant on country of distribution of the NMT)</li> </ul>
<p><b>Operation &amp; Maintenance</b></p>	<ul style="list-style-type: none"> <li>✓ Develop several options to pilot and test for O&amp;M (solutions should be as simple as possible), including both self-maintenance by NMT users, and externally contracted servicing technicians.</li> <li>✓ Include in O&amp;M options the <b>cost of providing maintenance services to hard-to-reach customers</b>, and how to potentially <b>integrate</b> this into an existing servicing offer for other household products<sup>9</sup></li> </ul>
<p><b>Lobbying Decision Makers</b></p>	<ul style="list-style-type: none"> <li>✓ Engage with main stakeholders at national and local levels to help them understand: <ul style="list-style-type: none"> <li>(i) how NMT facilitation <b>saves money in wider infrastructure budgets</b>;</li> <li>(ii) that NMT allows <b>‘temporary’ infrastructure development in informal settlements with insecure land tenure</b></li> </ul> </li> </ul>

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## 7. Key Partners

In the business models analysed, and throughout the interviews conducted by the team, we learnt that a successful commercialisation of a new product like the NMT, which presents an unusual features for most users (i.e. waterless, no flushing system) would heavily rely on **strategic partnerships** to ensure i) resources are optimised; ii) risk and uncertainty are reduced to a minimum for the ones investing; and iii) partners can bring a high level of credibility to a new product introduced to a market. Below is an initial partnerships mapping exercise which looks at the **key organisations, private sector and authorities likely to be involved in any business model option for the NMT.**

A key follow-on activity will be to **identify interests and potential benefits for partners to engage in the NMT commercialisation** and ways for them to benefit and be interested in maintaining the operations/partnership.

Key partners required by a company to commercialise the NMT for Low-Income / Bottom of the Pyramid customers	Expected involvement / role
Foundations, investors, development institutions	<ul style="list-style-type: none"> <li>✓ Funding (in particular for market entry)</li> <li>✓ Technical advice on product design</li> <li>✓ Market identification</li> <li>✓ Public endorsement</li> <li>✓ Allow use of NMT as part of grant spending</li> </ul>
Community groups	<ul style="list-style-type: none"> <li>✓ Awareness raising among new customers</li> </ul>
Universities, Non-profit and NGO	<ul style="list-style-type: none"> <li>✓ Research and development, technical advisory</li> <li>✓ Promotion of product via existing Sanitation Marketing supply chains, relationships and infrastructure</li> </ul>
Regulatory agencies (Environmental agency; Water sector regulators etc.)	<ul style="list-style-type: none"> <li>✓ Responsible for delivering certifications, licence, tax exemptions</li> <li>✓ Approval of NMT as safe sanitation option</li> </ul>
UNICEF	<ul style="list-style-type: none"> <li>✓ Involved in industry consultations in a number of countries, focusing on market-based solutions to sanitation. Likely to invest further in innovative solutions benefitting children in low-income areas.</li> </ul>
City or County Government (or equivalent)	<ul style="list-style-type: none"> <li>✓ Funding, subsidies</li> <li>✓ Public endorsement</li> </ul>
Bureau of standards (or equivalent)	<ul style="list-style-type: none"> <li>✓ Responsible for delivering certifications, licenses, labels</li> </ul>
Contractors and property developers	<ul style="list-style-type: none"> <li>✓ Large market presence</li> <li>✓ Potential business case in areas where alternative solutions for new-built are costly</li> <li>✓ Key partner to reach out to middle to high income customers</li> </ul>
Manufacturers	<ul style="list-style-type: none"> <li>✓ Production of parts of the NMT</li> </ul>
Distribution / Maintenance partners	<ul style="list-style-type: none"> <li>✓ Ensure consistent availability of spare parts</li> <li>✓ High service standards maintained</li> </ul>

## 8. Cost Structure

The adoption of the NMT among low to medium income customers will primarily be **cost-driven** (affordability) rather than value-driven. This research highlighted again<sup>10</sup> that there is very little literature on the long-term, ongoing costs of running a sanitation business (hence the focus on Kenya). Interviews with key market players in the container-based sanitation sector in Kenya allowed the team to compare the compile information on the cost structure of other toilets, similar to the NMT in size, scope, customer target, and price range.

Minimum costs expected for delivering the NMT	
<p><b>Fixed costs</b></p> <p>Company overheads:</p> <ul style="list-style-type: none"> <li>✓ Core staff salaries</li> <li>✓ Rents/Storage</li> <li>✓ Utilities</li> <li>✓ VAT</li> <li>✓ Legal – contract with users or stockists, warranty</li> <li>✓ Stocking manufacturing units before distribution</li> <li>✓ Local approvals and/or licenses</li> <li>✓ Import duty, Export duty</li> <li>✓ Profit</li> </ul> <p>Manufacturing costs:</p> <ul style="list-style-type: none"> <li>✓ Direct materials – product materials</li> <li>✓ Direct labour – man power</li> <li>✓ Direct expenses – any specific tooling etc. that needs to be developed to aid manufacture</li> <li>✓ Factory overhead</li> <li>✓ Packaging</li> </ul>	<p><b>Variable costs</b></p> <ul style="list-style-type: none"> <li>✓ Installation/Maintenance to existing customers</li> <li>✓ Financing costs</li> <li>✓ After-sale follow-up to existing customers</li> <li>✓ Marketing to new customers – promotional material, demonstrations</li> <li>✓ Taxation on parts of the product (or import taxes)</li> <li>✓ Workforce salary/commissions or distributor overhead</li> <li>✓ Clearing agent</li> <li>✓ In-country transport / freight</li> <li>✓ Servicing costs</li> <li>✓ Storage</li> <li>✓ Packing</li> </ul>
<p><b>Economies of scale:</b> e.g. Using field staff or existing service providers (e.g. water vendors, waste management)</p> <p><b>Economies of scope:</b> e.g. Other company producing similar parts (e.g. plastic toilet slabs<sup>11</sup>)</p>	

**Estimated costs for customers, based on similar toilet business models:**

<sup>10</sup> As a study undertook by some Cranfield University researchers had uncovered in Adams, R., (et al), “A scoping review of business model configurations for diffusion of high-tech innovations at the bottom of the pyramid”, British Academy of Management, 2018

<sup>11</sup> In Kenya the study identified three plastic toilet slabs manufacturers likely to see a business opportunity in partnering on the commercialisation of the NMT: Silafrica Kenya Ltd; Kentainers Ltd; TopTank

	Informal housing 'in-house'	Community / public toilets	New house apts.
Capex	< 250USD (equivalent to improved pit latrines/septic tanks)* potential for initial subsidies by WSTF	< 250 USD per toilet. Economies of scale in bulk? Subsidies by county/workers/WSTF/organisation	< 500 USD per toilet for areas being built unconnected to sewage lines
Maintenance	<30USD per year on maintenance. Either by maintenance worker or individuals	Taken care of by the worker. They must buy membranes.	<30USD per year on maintenance. Either by maintenance worker/apt. personnel or individuals
Payment collection	<ol style="list-style-type: none"> <li>1. Upon maintenance (enforcement problems, upfront payment)</li> <li>2. Monthly payments</li> </ol>	Monthly payments till cost is repaid.	<ol style="list-style-type: none"> <li>1. Upfront by housing developer/county</li> <li>2. Yearly maintenance costs given by housing developer</li> </ol>

	Informal housing 'in-house'	Community / public toilets
Existing cost models in urban Kenya	<p><b>Sanergy FreshFit Toilet:</b></p> <ul style="list-style-type: none"> <li>- Plot toilet: monthly charge of <b>Ksh 850 (USD 8.50)</b> - daily collection available</li> <li>- In-home toilet: monthly charge of <b>Ksh 950 (USD 9.50)</b> for a daily waste collection (reducing odour inconvenience), <b>Ksh 600 (USD 6)</b> for a collection 3 times a week, and <b>Ksh 200 (USD 2)</b> for a collection twice a week.</li> </ul> <p><b>Sanivation BlueBox Toilet:</b></p> <ul style="list-style-type: none"> <li>- Monthly subscription fee <b>Ksh 300 (USD 3)</b> upon customer sign-up, <b>Ksh 350 (USD 3.50)</b> upon installation</li> <li>- Monthly subscription <b>Ksh 600 (USD 6)</b>.</li> </ul> <p>Cost of manufacture with labor is currently about <b>KSh 6,500 (USD 65)</b>. Sanivation is aiming to drop this price point to around USD 35 at scale.</p>	<p><b>Sanergy FreshLife Toilet:</b></p> <ul style="list-style-type: none"> <li>- Toilets sold to Kenyan entrepreneurs for approximately <b>USD 588</b> and includes installation, painting and daily waste collection for one year.</li> <li>- Fresh Life toilets Operators (FLO), receive business management and operations training from Sanergy and can earn revenues by charging customers <b>USD 0.05 USD per use</b>.</li> <li>- Financing available through a partnership with <i>Kiva</i> (online micro-lending).</li> <li>- <b>1,691 active Fresh Life Toilets</b> in informal settlements. <b>50,000 daily uses from community members</b> now with access to affordable hygienic sanitation.</li> <li>- Monthly charge: <b>Ksh 850 (USD 8.50)</b> for the waste collection, upkeep and associated services.</li> </ul>

These models present low monthly charges for models that vary from leasing the toilet (based on service contracts for Sanergy and Sanivation) to purchasing the toilet outright (EnviroLoo). In the first two models, the capital expenditure (the cost of the toilet outright) is included in the monthly charges for the customers, who remain a user of the toilet but will not become the owner. This model is very well adapted to low-medium income customers, but not to the very bottom of the pyramid.

However these models give a very good indication of what the existing alternatives of the NMT propose and what currently seem to work in densely populated areas.

**Sanergy** can for instance offer low monthly charges to the customers because its model is based on densely populated target communities, and on low collection costs, as the collection routes are integrated with the solid waste collection operated as another activity of the company.

The **BlueBox toilet** remains a low cost sanitation option, as it relies on a very simple, low-cost, design (toilet seat fixated on a wooden box, containing a sealed bucket to collect the waste, emptied weekly). It gives however a good comparison point in terms of acceptable monthly charges for low income customers.

In urban Kenya, the three enterprises highlighted above present cost structure characteristics are as follows:

- **Monthly charges:** from USD 2 to USD 9.50 (depending on waste collection frequency, all inclusive)
- **Monthly subscription system** adopted by the 2 most successful Container-Based Sanitation companies
- **Upfront cost:** from USD 500 to USD 800 for a stand-alone product.

The NMT requirements in terms of cost for the customer (0.05 USD per day per user) is in line with cost of existing community toilets in Kenya (between 0.38-0.5 USD per month) and public toilets (between 0.04-0.18 USD daily).

In urban Kenya, the NMT target market spends USD 97-287 on toilet installation and USD 30 on maintenance a year (Dalberg). The market however offers improved pit latrine ranging from Ksh. 25,000-60,000 (USD 245 – 589), and septic tanks from USD 245-962 (usually connecting at least 2 toilet units).

This show that there is space for a new toilet, as long as the upfront cost or monthly charge for customers does not go above other alternatives.

**Information on cost structure laid in this section were used to produce the basic financial modelling in Output no.2.**

## 9. Revenue Streams

The last part of the business model canvas looks at the potential revenue streams for the organisation commercialising a product/service. In the case of the NMT, like for other container-based sanitation options offered in Kenya, this model could be a mix of Subsidies / For-profit approach, or be delivered by a social enterprise supported by external funds. Each revenue stream might have different pricing mechanisms which can be differentiated broadly into *Fixed* and *Dynamic* pricing:

- *Fixed pricing* would include price of asset sales, static fees collection at point of maintenance or periodically and by-product sales.
- *Dynamic pricing* would include fees collection based on usage, subsidies for area based deployment, licensing for different companies based on potential installation volumes and advertising based on area specific toilet walls.

The business model canvas can further help analyse for instance options for fee collection from the customer (e.g. is it best to collect money through an aggregator, analyse aggregator role and who is best for this).

### Fixed pricing will generate revenue:

1. **From asset sales** (on initial sale of toilet and/or clean membranes). Up-front payment from:
  - Local distributor or service provider
  - Direct to Household level customer
  - Property Developer
  - Donors
  - Utility
  - Government body
2. **From fees collection** (periodically, from households or from a common point of service usage i.e. public toilets; or at point of maintenance)
  - Low capital cost; but money made from recurring cost of membrane cleaning
3. **From governments/non-profits** (grants and/or government contracts)
4. **From by-products sales** (reuse of by-products, e.g. water, energy, fertilizer)
  - N/A for the NMT
5. **From licensing IP in exchange for fees** (licensing deals with companies in hotel/long-haul transportation/residential building industries)
6. **From advertising** (on public/community toilet block walls)

**Based on this study, a more in-depth commercialisation model can be tailored for a specific market (or country).** The cost and revenue model will be very dependent on all the other elements of the business model canvas (i.e. value propositions for target customers, existing distribution channels, resources and partners active in a certain context). However, **any commercialisation model will have to address the following questions:**

✓ **What is the shortlist of payment models that can be in place in this context (e.g. Pay-as-you-go ; Leasing ; etc) to collect revenue ?**

Note: No revenue stream will be available from by-products

✓ **Are the revenue streams ensuring enough cost recovery and profitability to maintain and expand the service and consistent with social and market objectives?**

✓ **Is it affordable for the consumer? (USD 0.05 cent /day /user)**

✓ **What are the existing players who can allow to combine marketing strategies with flexible subsidies, micro-credit schemes and payment by instalments**

✓ **Are there successful models of cross-subsidisation revenue model that could work in this context to make it viable to reach out to the lower-income customers, using revenue streams from the higher income customers?**

(e.g. WSUP and SWEEP in Bangladesh ; EnviroFit clean cookstoves)

✓ **Is there mobile money available (e.g. M-PESA) or any alternative, as an ideal way to collect revenues?**

✓ **Are all after-sales and services are covered in the cost of each unit and through the monthly charges (if any)?**

**Key first steps for setting up a business delivering the NMT:**

1. **Register a company and enter the market themselves** with full service support
2. **Register in one place and sell to local stockists** but with the promise of a hefty marketing budget and training.

Local stockists could be existing social enterprises focused on sanitation technology, water and sanitation technology stockists)

**OUTPUT 2** is a suite of **basic financial modelling spreadsheet tools building on Output 1 findings.**

These tools sought to understand the Nano Membrane Toilet's commercial prospective in 3 market segments identified in Output 1 report: (1) informal housing, (2) community and shared use (public toilets) and (3) non-sewerage connected new builds.

The suite includes a template financial modelling tool for users to start a modelling process themselves.

*These tools are available on request.*

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## NANO MEMBRANE TOILET BUSINESS EXPLOITATION PLAN

### OUTPUT 1 – BUSINESS MODEL CANVAS ANALYSIS OF THE NANO MEMBRANE TOILET

#### Annexes

#### Annex 1. Insights from stakeholders’ interviews (October 2018 – January 2019)

The market size is 3,500 – 7,000 single unit reinvented toilet (SURT) and 4,000 – 12,000 multi-units reinvented toilets (MURT) in Nairobi, according to the Dalberg study. If we take the average of both SURTs and MURTs market size, an average of 6 Nano Membrane Toilets per MURT (3 each per gender) and a total repaid cost per toilet of 750USD the total market comes to USD 39.94 million. 8,000 MURTs with on average 6 toilets each is a market of 48,000 toilets, 9 times bigger than the market for 5,250 SURTs based on the Dalberg study.

Source	Insight	Relevance/Implication for NMT
STEP study, Umande Trust, WSUP	Many throw foods, trash, pads into the current toilets	The NMT may require an educational component to limit these behaviours but would benefit greatly if the system could accommodate these features
STEP study. Umande Trust	Reservations about using water recycled by Reinvented Toilets	Do not consider water byproduct for drinking/washing. Limits usage to cleaning or industrial usage.
STEP study	Sit toilets perceived dirtier than squat toilets IF not cleaned regularly	Necessitates a custodian of the toilets if public and if shared between households then responsibility goes to homeowners who may prefer squat toilets
STEP study	Toilet doors often broken or missing in communal/public toilets	Necessitates a custodian of the toilets and maintenance costs
STEP study	Salt water can erode parts of the toilet	If looking at sales in coastal areas be wary of material used
Kenya Onsite Sanitation Demand Generation Strategies / Nairobi Water	Customers want to see and use the toilet before buying something more expensive than the alternative they have	Selling into households may prove difficult without marketing by testing. An idea could be to set up public/communal toilets first for usage before selling nearby households as test perhaps with Nairobi Water.
Selling sanitation (2012)	Not owning a toilet is something to be ashamed about and non-owners are perceived and lazy and unclean	Use social capital to pressure behaviour change. Utilise societal influencers to install the toilet and allow marketing through word of mouth

Sanergy, STEP study, Nairobi Water	Sewage connection costs are ~50USD for a residential user and ~17USD a month thereafter. A normal family of 5 in Ghana can pay up to 18USD month for sanitation, number less in Nairobi. Container based sanitation solutions charging around 8.50USD a month for collection and more to repay the cost of the toilet (~7.50USD).	Only able to charge around 10-20USD a month for repayment purposes
Sanergy	Constructing Improved pit latrines w/ septic tanks cost around 150-300USD and require faecal sludge removals few times a year. Sanergy FreshLife, working on an entrepreneur led franchising model of public toilets sell to entrepreneurs for \$588USD including installation, painting and daily waste collection for a year. This has switched to rental model	Have a CAPEX including installation of between 400-500USD per communal toilet (if the model has switched to rental and price is the reason that this should be adjusted lower). This is the price that entrepreneurs would be willing to pay without any subsidy on upfront costs from municipalities of government – the latter parties could subsidise this even by 20% greatly increasing the affordability for entrepreneurs. However, grouping toilets together, instead of individual toilets would increase upfront and the ideal mix should be understood.
Sanergy, Bioliff	Customer referrals represent a large % of sales	Ensure ease of use and functionality before approaching the market .
Sanergy	Privacy important for customers (not just visual but sound privacy as well). Often toilets are put at the back of the house, usually outside and houses can afford to dedicate rooms to toilets.	If selling to individual households in informal areas, take into account how many do not have functioning doors and spaces for toilet installation.
Sanergy, Nairobi Water	Household toilets will get used by different families if left unattended – needs security or locking device to prevent theft.	Consider security issues in household toilets. Toilets should be in an area that can be attended or locked at all times.
Government documents, Nairobi Water	Water Sector Trust Fund (WSTF) responsible for allocating ODA funding, Water Service Board (WSB) for regional implementation coordination and Water Service Providers (WSPs) for municipality level implementation.	Contact relevant authorities alongside local municipality leaders when targeting a specific area and obtain permits/subsidies for implementation.
Nairobi Water	Ensure right standard adherence	Contact Kenyan Bureau of Standards for correct certification

Government documents	Government to increase % of GDP allocation to sanitation sector	Contact government for subsidies.
WSUP	Communal tariffs range between 0.38 – 0.47 USD monthly and public toilet tariffs range between 0.04 – 0.19 USD per use	Charge between 0.04 – 0.1 USD per use for public toilets and 0.4 – 0.5 USD per month for communal usage.
Aquaya	From interviews having faeces in the house is perceived as negative	Have public or communal toilet blocks outside the house.
Aquaya	Maybe useful to target landlords instead of tenants as the latter do not have ownership and the former is supposed to have responsibility	Target landlords and new developers
Bioliff	Target main contractors/developers as they have the largest market presence	Target contractors/developers
Bioliff, Nairobi Water	Service and maintenance is the most important challenge that will need to be addressed properly to retain customers (almost as important as the product itself)	Ensure maintenance and replacement of Membranes when needed
Nairobi Water	The toilet must be able to wipe itself clean	Ensure wipe mechanism is functioning and use water discharged for cleaning if possible
Nairobi Water	Land issues in informal settlements is a big problem for even sewer expansion	Ensure applicability of the Nano Membrane Toilet in constrained areas and focus on communal/public toilets initially
Nairobi Water	Muslims would struggle with a waterless toilet as it may be culturally inappropriate	Interview Muslims or target areas without many Muslims initially
Nairobi Water	Topography (downhill from a trunk sewer, water shortage areas, sewer expansion plans, ground/soil conditions all key barriers in building sewers in specific areas	Build a map of Nairobi with key metrics to see where the Nano Membrane toilets are best fit and apply for subsidies to build in these areas which are not going to be serviced by alternative services
Sistema Biobolsa	Geographically focused sales with regional sales agents – adapt the market to the product and incentivise sales through agents	Narrow down key areas of sales and implement good commission protocol for sales
Umande Trust	If selling direct to households a pay-as-you-go system a locking system for toilets when customers don't pay could be used	Explore integrating this model and see how costs would increase

## Annex 2: Overview of Sanitation Sector in Urban Kenya

### A high urbanisation growth

**Kenya is a country of over 50 million people in which urbanization is occurring at a rapid rate. By 2030 more than 60 percent of Kenyans will be living in cities and towns (39.24 million in 2030 compared to 14.1 million in 2018)<sup>12</sup>.**

Based on the 2009 population census, half of the urban population resides in 11 major urban centres. Nairobi, the capital city, makes up about 25.9% of Kenya's urban population, with over 3.1 million residents in 2009, followed by Mombasa (7.7%), Kisumu (3.2%), Nakuru (3.1%), Eldoret (2.6%), Kikuyu (2.2%), Ruiru (2%), Kangundo-Tala (1.8%), Naivasha (1.4%), Thika (1.3%) and Machakos (1.3%).<sup>3</sup> Urban growth has been mostly fuelled by the high rate of migration from rural to urban areas in search of employment and better access to services. A lot of the new comers to urban areas find accommodation in growing informal areas. In 2017, it was estimated that already 56% of the urban population in Kenya are living in slums, an increase from 33 per cent in Nairobi 40 years ago.<sup>4</sup>

In a survey of 1,755 Nairobi slum households in 2004, Gulyani and Talukdar (2008) found that 92 per cent were rent-paying tenants and only 6 per cent owned both the land and structure.

### A deficient access to improved, safe, sanitation

According to the WHO-UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) in 2008, **only 27% of the urban population had access to private improved sanitation** – most of which consist of simple pit latrines providing varied degrees of safety, hygiene and privacy. In 2017 it was reported that 69% of urban areas lack adequate sanitation, **48% of urban population rely on shared toilets** and 2% of urban population defecate openly.<sup>5</sup>

**As of 2015, the sewerage coverage in Kenya was estimated at only about 12%** with 5% of the national sewerage effectively treated. An assessment report in 2009 showed that there were 43

<sup>1</sup> <https://www.euromonitor.com/kenya-in-2030-the-future-demographic/report>

<sup>2</sup> <http://www.worldometers.info/world-population/kenya-population/>

<sup>3</sup> Kenya National Bureau of Statistics (2009) Kenya Population and Housing Census: Analytical Report on Urbanization. Nairobi, Kenya

<sup>4</sup> Lall, S., Henderson, J. V., and Venables, A. J. (2017), Africa's Cities: Opening Doors to the World, Washington, DC, World Bank.

<sup>5</sup> STeP Stakeholder Perspectives: Kenya, South Africa, Senegal and Nigeria 2017

sewerage systems in Kenya and waste water treatment plants in 15 towns – serving 900,000 inhabitants. The operation capacity of these systems is only at 16% of design capacity, due to **inadequate operation and maintenance and low connection rates to sewerage systems**. Of the wastewater that enters the sewer network, only about 60% reaches treatment plants.

**The Kenyan Ministry of Health estimates that in 2010, almost half of rural Kenyans did not have access to even basic sanitation. In terms of improved sanitation<sup>6</sup>**, access has barely improved since 1990 with an increase from 25 percent in 1990 to 29 percent in 2013. The WHO-UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) estimated that in Kenya 31% of the urban population had access to improved on-site sanitation in 2015, up from 27% in 1990.<sup>7</sup>

**In poor urban settlements, less than 20% of the population has access to sanitation, and 80% of facilities are shallow pit latrines that contribute to pollution of the environment.** Unsafe water and sanitation (5.3%) is the second leading risk factor and contributor to all mortality (deaths) and morbidity burden (DALY) in Kenya.<sup>8</sup> Approximately 19,500 Kenyans, including 17,100 children under the age of 5 are dying each year from diarrhoea.

**In economic terms, Kenya loses an estimated KES 27 billion (USD 270 million) or 1% of national GDP annually due to poor sanitation.**<sup>9</sup> Sanitation services delivery in Kenya is similar to the pattern found in urban areas in developing cities elsewhere, where high-income households in the city centre have in-home water and sewer connections and the lower-income, peripherally located rely on alternative options including on-site sanitation.

In developing countries like Kenya, a variety of tariff, tax and transfer derived revenue streams are used to increase access to water and sanitation services. “Sanitation” components of water utility bills are commonly used to finance solid waste management (i.e. garbage collection), and the maintenance and expansion of sewerage infrastructure. Often these components are proportional to water tariffs, and the rates can vary between domestic and commercial customers. Such components may be presented as a sewerage tariffs or other tariffs or as an environmental/sanitation surcharge for some sort of community-level service; however, these components rarely benefit the poor.<sup>10</sup>

**African utilities and municipalities fund most investments in pro-poor sanitation from transfers (overseas development assistance) and from tariffs, i.e. direct charges to low income consumers for services received.**<sup>11</sup> Cross-subsidies from higher income to lower income citizens are not widely used, despite experience from countries including Burkina Faso and Zambia, indicating that cross-subsidies can be a sound and effective fiscal tool for expanding sanitation access in lower-income urban areas.

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<sup>6</sup> Improved sanitation is one that hygienically separates human excreta from human contact. The majority of improved sanitation facilities include: 1) flush/pour flush to piped sewer system, septic tank and pit latrine, 2) ventilated improved pit (VIP) latrine, 3) composting toilet, 4) urine diverting dry toilets (UDDT), 5) cartridge based toilets (CBT), 5) improved pit latrines that include raised latrine floor, cleanable slab, well-fitting lid, roof, should be at least 40m from water source.

<sup>7</sup> Acey, Charisma, et al. (2018)

<sup>8</sup> WHO (2009)

<sup>9</sup> Kenya Environment, Sanitation and Hygiene Policy 2016-2030

<sup>10</sup> Acey, Charisma, et al. (2018)

<sup>11</sup> Boex & Edwards (2014)

**In order to meet the 2030 Kenya Vision target of 100% improved sanitation in rural and urban areas in Kenya the nation will have to embrace new technologies and business models to extend sewer coverage but also deliver services to areas not traditionally viable for sewer construction.**

Low-income slum areas in cities is one such area that has not been the beneficiary of sewer connections due to conventional unsustainable financial models, informal housing plans, cramped areas for household toilets and stickiness of traditional methods.

### Implications of policy reforms and targets for the NMT

The policy section outlines the targets set by the Kenyan government for Nairobi, the proposed strategies to achieve the targets and key players and their roles. The overarching policy framework for urban sanitation is provided by:

- the Constitution,
- the Kenya Vision 2030
- the Kenya Environmental Sanitation and Hygiene Policy 2016-2030.

In 2016, Kenya introduced a series of sanitation and hygiene policies to be in line with the SDGS and Kenya’s other global and regional WASH commitments (see table below), which form a strong enabling environment for market-based solutions for onsite sanitation.

Policy / Regulation	Implications for the NMT
<p><b>The Water Act (2002)</b> introduced some important regulatory changes in the water and sanitation sector in Kenya. It separates:</p> <ul style="list-style-type: none"> <li>- on the one hand the responsibilities for asset ownership and</li> <li>- on the other hand the operation of water and sewerage infrastructure.</li> </ul> <p>The act led to the creation of autonomous water utility companies and WASREB (Water and Sanitation Regulation Board), an independent regulator, ring-fencing revenues within the sector, and establishing a framework for utilities and other Water Service Providers (WSPs) to move towards cost-reflective tariffs.</p>	<p><b>By recognising an enhanced role played by NGOs and other community based organizations in the sector, the Water Act led to increasing initiatives by the government allowing for public-private partnerships which could benefit a business model delivered through a PPP.</b></p>
<p><b>Kenya’s Constitution and Vision 2030</b> are the country’s long-term social and economic development blueprint and illustrate commitment to development and pro-poor services. The targets to improve access to water and sanitation by 2030 include<sup>12</sup>:</p>	<p><b>Priority given by the Government to increase the sewer coverage and the buy-in for non-sewered solutions in the 2016-2030 Sanitation Policy may or may not limit their interest in some of the</b></p>

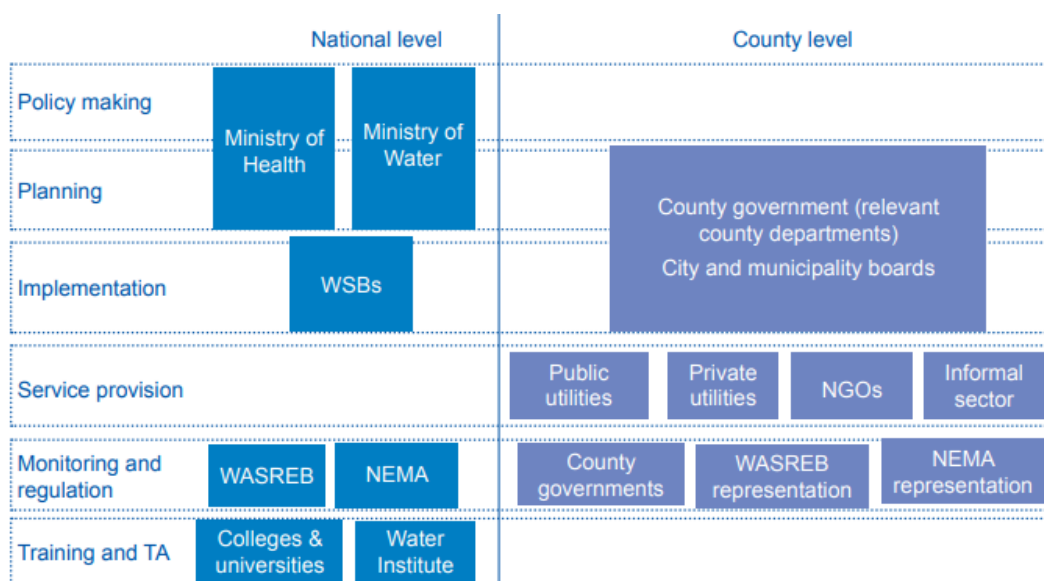
<sup>12</sup> Kenya Environment, Sanitation and Hygiene Policy 2016-2030

<ol style="list-style-type: none"> <li>1) Achieve and sustain 100% ODF Kenya by 2030 through a national campaign launched in 2016</li> <li>2) Achieve and sustain 100% access to improved sanitation in rural and urban areas by 2030</li> <li>3) Increase public investment in sanitation and hygiene from 0.2% to at least 0.5% of the GDP by 2020 and to 0.9% of the GDP by the year 2030.</li> </ol>	<p><b>“Reinvented Toilets”<sup>13</sup>. The issue remains around the proper policy implementation due to decentralisation.</b></p> <p><b>The slow expansion of sewers, especially into densely populated low-income areas, is likely to create more need for onsite sanitation options like the NMT.</b></p>
<p><b>The Kenya Environmental Sanitation Strategic Framework (KESSF) 2016-2020</b> provides a medium-term framework for the implementation of the KESHP 2016-2030. It aims to declare 100% of Kenya ODF by 2030, and to ensure that at least 55% of urban households have access to improved sanitation facilities.</p> <p><b>The Kenya Environment, Sanitation and Hygiene Policy 2016-2030</b> is the outcome of reviews to address limitations of the National Environmental Sanitation and Hygiene Policy published in 2007. The absence of a coherent legislative and regulatory framework for sanitation had led to a lack of normative principles reflecting current development objectives. The KESHP takes into consideration the devolution of most sanitation functions to the 47 County Governments. This policy requires that relevant regulatory agencies, including the <b>Water Services Regulatory Board (WASREB)</b>, provide guidelines for solid and liquid waste management. At the city level, therefore, the WSPs, which report to the Ministry of Water and Irrigation, are responsible for sanitation service provision (including managing sludge from the on-site).</p>	<p><b>Its key strategies could be relevant for the implementation of the NMT in Kenya:</b></p> <ol style="list-style-type: none"> <li>1) Scaling up access to improved rural and urban sanitation</li> <li>2) Assuring clean and healthy environment free from public nuisances</li> <li>3) Fostering private sector participation and investment in sanitation</li> <li>4) Building governance and leadership capacity for sanitation</li> <li>5) Sustainable financing and investment for sanitation</li> <li>6) Building enabling legal and regulatory environment</li> <li>7) Establishing an effective research and development framework for sanitation</li> <li>8) Strengthening monitoring and evaluation systems for the sanitation sector</li> </ol>
<p>A Prototype County Kenya Environmental Health and Sanitation Bill (2016) was developed by the Ministry of Health to assist the county governments in enacting county legislation for achieving the right to sanitation and a clean and healthy environment; ensuring effective execution of the sanitation functions and powers vested in the county governments; and enabling effective provision and regulation of sanitation services within the counties.</p>	

<sup>13</sup> Dalberg Study (2017)

SOURCE: WSUP, 2017

### Institutional set up for urban sanitation in Kenya



SOURCE: WSUP, 2017

It is expected that the NMT may be piloted as a private initiative in the testing and adoption phase. However, the institutional set-up for urban sanitation in Kenya means that any “Reinvented Toilet” piloted in Kenya would be involved with a variety of these stakeholders for the following reasons:

Stakeholder	Relevant role for the NMT
Water Services Boards and Water Service Providers	WSBs ensure the coordination of sector players on regional and local levels; they include pro-poor sanitation into investment planning; supervise and control the implementation and operation of sanitation infrastructure.  WSBs and WSPs (public or private utilities, private companies) are mainly involved in sewerage services (benefiting less than 20% of Kenyans) and may not be key stakeholders for piloting the NMT.
NGOs Colleges & universities Water Institute	Potential advocates and key partners in piloting trials for the NMT in sample communities. Indispensable to engage with local community based organisations.
Water and Sanitation Regulation Board	WASREB issues licenses to service providers, approves service provision agreements and develops tariff guidelines. WASREB is not currently involved in the regulation of small-scale sanitation service providers, o
National Environment Management Authority (NEMA)	NEMA manages hazardous waste levels in the sewerage system, including pesticides and toxic wastes. The Authority issues licenses for any activities raising any risk of potential environmental pollution, such as the transport of human and solid waste.

County Government, City and Municipality Boards	County governments are mainly involved in the construction and management of public toilets. They also issue licenses for sanitation facilities in schools.
Private service providers	<p>The private sector is dynamic but remains limited in terms of provision in low-income areas. Social enterprises represent the main concurrence to the NMT but also potential partners.</p> <p>Sanergy designs and manufactures in-home toilets and public toilets with sealable containers and rents the franchise to local residents. Sanivation offers a pay-as-you-go in-house toilet model in Naivasha and Kakuma Refugee camp.</p>

### Financing of sanitation in Kenya

This finance section first looks at the financing available for sanitation solutions from governmental and international transfers and subsequently customer tariffs.

The Kenyan Ministry of Health estimates that public funds for sanitation represent only 0.2% of country's GDP every year, despite the country's commitment to reach 0.5% of GDP by 2020. Most investment plans for the sanitation sector have focused on sewerage services, despite a recent acknowledgment of the need for more onsite sanitation solutions.

Despite a Sector Wide Approach (SWAp) was launched in 2006 to unify financing on specific sectors, there is a lack of coordinated financing for improving sanitation services. Overall, sanitation has remained a low investment priority area due to institutional fragmentation. Nearly all the funding allocated to pro-poor sanitation still comes from donors. Main funding streams are as followed<sup>14</sup>:

- **Central government funds** from the Treasury to the Health, Water and Environment ministries and national agencies (WSBs see Appendix F)
- **County funds**, from central government transfers or own revenues, have full discretion over the funds. As there are no earmarked funds only 11 counties (out of 47) referred to sanitation in their health, water or environmental budgets (2013/2014).
- **International transfers** from donors to the central government, WSBs and WSPs
- **International transfers** from donors (and international NGOs) for off-budget projects.

A Draft Water Sector Investment Program was prepared in 2011 which estimated that KSh 849 billion (USD 8 billion) would be needed to meet sanitation targets by 2030 with 42.5% of funds required specifically for urban sanitation.<sup>15</sup> The study predicted that 97% of investment would go into sewerage infrastructure.<sup>16</sup> With the required amount vastly higher than what is domestically available, a sharp increase in national and county budget allocations for investment in sanitation is

<sup>14</sup> <https://www.wsup.com/content/uploads/2017/09/Situation-analysis-of-the-urban-sanitation-sector-in-Kenya.pdf>

<sup>15</sup> <https://www.wsup.com/content/uploads/2017/09/Situation-analysis-of-the-urban-sanitation-sector-in-Kenya.pdf>

<sup>16</sup> Ibid

necessary. The World Bank suggests that institutional and absorptive capacity of urban sanitation authorities need to strengthen to avoid underutilisation of approved budget.<sup>17</sup>

Part of the Water Act 2002 a Water Services Trust Fund (WTSF) was established – renamed to Water Sector Trust Fund (2016). This is a basket fund used to channel funds for pro-poor water and sanitation projects. Funding is disbursed through three avenues: rural, urban and water resources. By the end of 2014, the WTSF has raised 7.8 billion KSh (USD 74 million) and disbursed KSh 5 billion (USD 47.2 million). At least 18.4 million USD was allocated to pro-poor urban sanitation as part of the Upscaling Basic Sanitation for the Urban Poor (UBSUP) programme funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) through the German Development Bank (KfW) and the Bill and Melinda Gates Foundation (BMGF).<sup>18</sup>

It is estimated that USD 1 billion has been granted as Official Development Assistance (ODA) for water and sanitation since 2000 (mostly from KfW, GIZ, the World Bank, the African Development Bank, Agence Française de Développement (AFD), the Swedish International Development Cooperation Agency (SIDA) and the Bill and Melinda Gates Foundation.<sup>19</sup>

**From an institutional perspective, the County governments' capacity is insufficient (staff numbers and skills) to meet the needs of the sector, and there is currently no strong government initiative to fill this gap. As pro-poor sanitation remains a lower priority, the planning and funding remains is left to donor projects, which also subsidise the few private sector-led initiatives. This means that there is potentially a gap to be filled by new, innovative and affordable onsite sanitation technologies that can by-pass an unrealistic target for sewers to reach the most marginalised population.**

**If piloted in Kenya, under any business model option, the NMT would have to be a public-private initiative that involves all the relevant regulators, and contribute to build an even more robust business case for waterless sanitation options.**

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<sup>17</sup> World Bank (2012) Devolution Without Disruption: Pathways to a successful new Kenya. Washington DC, USA: World Bank Group

<sup>18</sup> <https://www.wsup.com/content/uploads/2017/09/Situation-analysis-of-the-urban-sanitation-sector-in-Kenya.pdf>

<sup>19</sup> Ibid