

The potential for scaling up container-based sanitation in informal settlements in Kenya

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Abstract

Kenya has enshrined the right to sanitation in the 2010 constitution. Achieving this requires scaling up infrastructure and models of delivery beyond sewer networks that have previously been the focus. In Kenya, two enterprises, Sanergy and Sanivation, have been providing new forms of off-grid services with container-based sanitation (CBS). This paper uses a political economy analysis to understand the incentives, institutions and power dynamics that are enabling or constraining the potential for such off-grid sanitation models. The paper outlines six core problems to be addressed in the pursuit of scaling up: fragmented governance; sustainability of CBS enterprise models; service delivery planning in informal settlements; personal power rather than institutions in decision-making; vested local interests; and land tenure and political connection. It discusses how stakeholders might work collaboratively to progressively address or recognise these issues.

KEYWORDS

Kenya, political economy, sanitation, social enterprises

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1 | INTRODUCTION

Achieving Sustainable Development Goal (SDG) 6, universal access to sanitation (WHO and UNICEF, 2017), will require technical, social and political innovation to serve marginalised communities globally. In sub-Saharan Africa, only 7.6% of the total and 17% of the urban population are estimated to be connected to sewers (WHO and UNICEF, 2020). Expanding sewer coverage is often an expensive and technically difficult approach, particularly in informal settlements, due to either terrain or population density (Mikhael et al., 2017). On-site sanitation, where the excreta generated is stored on the plot such as pit latrines and septic tanks (Tilley et al., 2008), is a major component of sanitation in informal settlements (Peal et al., 2015; Tilmans et al., 2015).

Two sanitation enterprises in Kenya, Sanivation and Sanergy, are focusing on tackling sanitation challenges by introducing off-grid sanitation systems. It is suggested that off-grid sanitation provision for low-income areas might achieve access targets and further increase provision through new service delivery models and technical innovation (Diener et al., 2014; Graf et al., 2014). These models include technical innovation in toilet design, as seen with toilets developed under the Re-invent the Toilet Challenge (Bill and Melinda Gates Foundation, 2020) or with container-based sanitation (CBS) companies (Mikhael et al., 2017; Tilmans et al., 2015; World Bank, 2019a, 2019b). Such models also integrate the idea of the circular economy as a way of generating revenue to fund sanitation in urban areas (Diener et al., 2014; Toilet Board Coalition, 2016). The expectation of new business models to enable sanitation access can be seen as part of the neoliberal approach to service delivery, where businesses and user fees step in as a solution to the lack of state provision (Bayliss, 2003; Budds & McGranahan, 2003; Furlong, 2011). Private sector involvement in utilities has often come with the promise of investment and reduced pressure on public sector budgets (Remington et al., 2018), but empirical evidence in the water, sanitation and hygiene (WASH) sector has not lived up to the promise (Castro, 2008; Furlong, 2011; Mallory, Holm, & Parker, 2020).

An estimated 54% of the urban population in sub-Saharan Africa live in informal settlements (World Bank, 2019c). Sanitation in informal settlements faces technical challenges due to the dense populations limiting access for construction of sewer infrastructure for waste transport (Mara, 2018). Moreover, landownership may be unclear, leading to tenure issues and unwillingness to invest in services, both from households and local authorities (McConville, 2014; Silveti & Andersson, 2019). There is a slow response in infrastructure and services delivery in these areas, due to changing density and character of these communities, because they are often subject to multiple, at times overlapping, or even contradictory, governance systems—particularly where municipal and customary authorities coexist (Ekane et al., 2014; del Morales et al., 2014). This can cause tensions as governments or utilities do not want to provide infrastructure when settlements are considered illegal (McGranahan, 2015).

Subsidies and government funding for sanitation often focus on those who can access networked services, thus failing to reach the poorest residents (Andres et al., 2019). This also means investment in on-site sanitation often falls to households, who are likely to invest in the private benefits of sanitation such as privacy over the more collective gains of waste conveyance and treatment (Jenkins & Curtis, 2005).

In informal settlements where there are an array of different governance systems and overlapping providers, there is a need to recognise and understand the resulting hybrid systems of governance and legitimacy (Boege et al., 2009; Kapidžić, 2018). Such hybrid systems are often not well captured in official policy documents and include more hidden forms of power and control such as patronage networks, rent-seeking and service provision 'cartels' (Bercegol & Monstadt, 2018; Boege et al., 2009; D'Arcy & Cornell, 2016; Mallory et al., 2021; Reback, 2007; Thieme, 2010).

Kenya has two CBS enterprises and a newly evolving sanitation policy (both of which are described in detail later) which makes it a particularly interesting case to explore as it offers an insight into the challenges of scaling up CBS as means of extending non-sewered sanitation access. Previous research already recognises a need for major changes in policy and enabling environments to enable sanitation business models to operate (Mallory, Akrofi, et al., 2020; Mallory, Holm, & Parker, 2020) and that for long-term sustainability and scaling up of provision that additional public funding is required (Auerbach et al., 2020; Remington et al., 2018). In Kenya, the responsibilities

and mandates for sanitation provision are unclear and overlapping (Ekane et al., 2014; Mansour et al., 2017b; Mansour & Esseku, 2017; Simiyu et al., 2017). Sanitation services lack regulation and are provided by a complex mix of formal and informal actors (Mansour et al., 2017a). In such contexts, actually existing service delivery modes and governance are fragmented. Lines of accountability and responsibility for service provision and governance are blurred and therefore processes of sociotechnical change require local negotiation (Criqui, 2020).

This paper examines the potential for off-grid CBS to scale up and extend sanitation services in informal settlements in Kenya. It does so through an examination of infrastructure networks as 'sociotechnical systems that combine material, cognitive and political elements' (Criqui, 2020, p.161). Specifically, the paper focuses on two CBS enterprises operating in informal settlements. We analyse these enterprises as part of wider city-level infrastructural networks that are shaped by formal structures of policy and governance interacting with more informal and negotiated systems of service provision. We also explicitly consider the dynamics of institutions, finance and power which shape the political-economic context in which these infrastructure networks evolve.

1.1 | Research design

Guided by political economy approach to the analysis of services (Criqui, 2020), this study took an exploratory approach to examine how CBS enterprises fit into infrastructural networks and relate to wider dynamics of power and decision-making. This approach combined analysis of grey and published literature, semi-structured key informant interviews and participant observation. Such methods enable the triangulation of emerging narratives and the mapping of complex actor networks in contexts of fragmented service delivery (Mdee & Mushi, 2020).

The urbanisation dynamics of informal settlements in Kenya provide a rich opportunity to examine the extension of sanitation provision in rapidly growing cities, with low coverage of sewered networks. The extent to which CBS can extend coverage in these contexts requires further scrutiny. The broader political economy of governance in Kenya provides a particular environment in which CBS enterprises operate. The new Kenyan constitution in 2010, a significant response to post-election violence of 2007 and 2008, emphasises the decentralisation of power. This led to the creation of 47 county governments gaining significant powers and responsibilities including service delivery (Manji, 2014; Mansour et al., 2017b). Local and national politics are still often shaped by ethnic allegiances (Bedasso, 2017; D'Arcy & Cornell, 2016).

With an urban population growth rate of 4%/year (World Bank, 2020), the provision of urban services including sanitation faces many challenges (Corburn & Hildebrand, 2015; Schouten & Mathenge, 2010). At the national level, the Kenyan Government is attempting to implement targets of universal coverage of sanitation. The 2010 constitution specifically recognises the human right to sanitation (Government of Kenya, 2010). The Kenya Environmental Sanitation and Hygiene Policy (KESHP) aims to achieve 100% coverage of *improved* sanitation by 2030 (Republic of Kenya, 2016). An overview of the formal and informal actors related to sanitation provision is given in Table 1 to give an overview of the mandated roles and responsibilities of organisations and enterprises. An estimated 46% of the urban population live in informal settlements (World Bank, 2019c), which are densely populated and lack legal recognition and predominantly rely on pit latrines for sanitation provision (Seal et al., 2018; Thieme, 2010).

However, there is a relatively high level of activity by CBS enterprises, and this provides an opportunity to understand the material, cognitive and political challenges to expanding sanitation provision through CBS enterprise models.

The paper centres on two case studies of CBS enterprises, Sanergy and Sanivation in Nairobi (capital city) and Naivasha (a secondary city), respectively, and examines specifically how their operations are positioned in relation to other formal and informal actors in the sanitation service delivery chain. Such an analysis enables consideration of the barriers and potentials for scaling up service provision via CBS. The first author initially attended the first Kenya Sanitation Conference in November 2019 alongside enterprises, non-governmental organisations (NGOs) and utilities involved in Kenyan sanitation. This informed initial interviewee selections. Interviews were conducted with key informants from sanitation enterprises, water utilities, county government and national government employees,

TABLE 1 Institutions and responsibilities in sanitation provision in Kenya

| | Relation to Sanitation Provision |
|--|--|
| Ministry of Water and Sanitation | Set policies and planning strategies for sanitation, particularly in an urban context |
| National Environment Management Authority (NEMA) | License sanitation providers and enforce fines for disposal of waste |
| Ministry of Health | Responsible primarily for rural sanitation provision |
| Water Services Regulatory Board (WASREB) | WASREB sets the required standards in water and sanitation services and is licensing utilities that fulfil the requirements |
| Water Services Board (WSBs) | Responsible for ensuring implementation of sanitation services under 2002 Water Act, though now partially overlaps with county governments |
| County Governments | Responsible for ensuring implementation of sanitation services in line with constitutional decentralisation and 2016 water act but disputed with WSBs |
| Utilities | Responsible for water sanitation and wastewater services in cities/counties |
| NGOs | Often play a role in sanitation service provision |
| Informal Sector | Often responsible for sanitation service delivery, particularly in informal settlements where Utilities may not be providing services |
| Water Sector Trust Fund | Kenyan state corporation with the mandate to provide grants to counties and assist in financing the development and management of water and sanitation |
| Sanitation Enterprises | Provide sanitation services, usually in informal settlements |

TABLE 2 Interviewees

| Stakeholder | Number Interviewed |
|--|--------------------|
| Nairobi Water and Sewerage Company Employees | 3 |
| Sanitation Enterprise Employees | 6 |
| NGO Employees | 4 |
| Public Health Officers | 1 |
| Manual Pit Emptiers | 20 |
| Vacuum Truck Operators | 20 |
| Ministry of Water Employees | 1 |
| Nakuru County Employees | 2 |
| Naivasha sub-County Employees | 2 |

NGOs and civil society organisations (see Table 2). Interviews focused on the nature of power, finance and politics in sanitation service delivery networks in informal settlements. Interviews, focus groups and observations were conducted with two groups of eight pit emptiers in Naivasha and two groups of eight vacuum truck operators, one each in Nairobi and Naivasha, using snowball sampling until sampling reached saturation through finding the same operators. Documents were selected from policy documents and NGO project briefs and publications from sanitation enterprises operating in Kenya.

Interviews were recorded and transcribed in English. Those with pit emptiers and sanitation providers were translated from Swahili and transcribed. Consent for data collected including audio recordings and field notes and their use was obtained from all respondents before the commencement of the interviews. Respondents were informed of the purpose of the research and assured of confidentiality. The research received ethical approval from [removed for blind peer review] and National Commission for Science, Technology and Innovation (NACOSTI), Research Licence Number Blinded for review. Field notes were taken by researchers throughout the process and

analysed thematically using NVivo (QSR International Pty Ltd, 2014), according to guidelines set up by Robson and McCartan (2016). This process follows an iterative process of data familiarisation, code generation and integration. This process was done iteratively until the data were organised into a set of codes that were verified by the researchers involved in data collection.

1.2 | Note on limitations

The fieldwork for this study took place between January and March 2020 and was halted due to the Covid-19 outbreak. Many of the political situations and changes surrounding elections are now resolved or changed, and many of the priorities of the department for water and sanitation have changed due to the outbreak. This paper is a reflection of the dynamics and debates taking place at the time and forms part of a larger project investigating the political economy of sanitation in Kenya which will return to investigate the changes in more detail.

This research focuses on two NGOs practising combinations of CBS and circular economy approaches in Kenya: Sanergy and Sanivation.

Sanergy is a private company who provides CBS services in Mukuru settlements, situated in the eastern part of Nairobi. A typical CBS system captures waste in an easily removable container instead of pits or septic tanks (Tilmans et al., 2015). Sanergy's service provision model is divided into non-profit and for-profit arms. The non-profit arm is responsible for the sanitation provision in informal settlements, and responsible for the toilet service, emptying, transportation of the used containers to a transfer station at the edge of the settlement and their ultimate transportation to Sanergys' treatment site. The organisation converting waste to produce and sell compost and black soldier fly (BSF) larvae is a for-profit organisation. BSF are a species particularly suited to feeding on organic waste and can reduce waste volume by 58%–70% to produce a high-protein animal feed (Lalander et al., 2013). Currently, the subsidy required across both arms is estimated at around \$19/person/year, which they expect to reduce to less than \$10/person with heavy expansion (2000 more toilets a year for 7 years from their current 1200 in 2017) (World Bank, 2019a). They are looking to expand their services and be a 'competitive option for the government to provide affordable, accessible sanitation services to Nairobi's entire population' (Auerbach et al., 2020).

Sanivation operates in Naivasha town, situated in Nakuru County about 100 km north-west of Nairobi with a population of around 200 000. Their initial model provided CBS services and reuse and sale of briquettes, but they now provide decentralised faecal sludge treatment for waste collected from exhauster trucks. Nakuru is one of the earliest counties to implement a sanitation plan, a plan for the strategy and investments to achieve the goal of universal sanitation by 2030 (Nakuru County Sanitation Programme, 2018). In theory, this provides an interesting case of how decentralisation might enable individual counties to accelerate increasing sanitation coverage.

2 | REVEALING THE COMPLEX FRAGMENTATION OF SANITATION GOVERNANCE

Our analysis suggest a fragmented and complex governance context in which CBS services are attempting to operate. This creates a broad set of political-economic dynamics that will influence their potential for scaling up their service delivery.

2.1 | Fragmented governance

There is significant institutional and governance fragmentation as the roles and responsibilities of sanitation provision are shared among various government departments. As such, coordination of activities related to sanitation can

be limited, as seen in the Ministry of Water and Sanitation vision 'To ensure water resources availability and accessibility by all' neglecting sanitation (Ministry of Water and Sanitation and Irrigation, 2021). County governments have argued that the 2016 Water Act, which set out roles and responsibilities for sanitation, is not aligned with the constitutional reforms, and hence, it has not been implemented. Rather, the 2002 Water Act is often still the text that defines institutional roles (Mansour et al., 2017a).

In such contexts, lines of accountability and responsibility for service provision are unclear, as is illustrated by the following vignette.

On 28 October 2019, the Kenyatta International Conference Centre is filled with the utilities, ministries and NGOs involved in sanitation provision. It is opened with a speech from William Ruto, the Deputy President whose support enabled Uhuru Kenyatta to become president in 2013 (Kanyinga, 2020; Kiruga, 2020). Later in the day after presentations on commitments to increased sanitation coverage, sewer connections and project ideas, a plenary session is opened by a 'citizen speaker'. After many presentations talking about the progress being made, and the commitment to 'sanitation for all', she takes 10 min to cut through the usual progression of conference proceedings. Photos of her informal settlement provide a clear counterfactual to the talk of commitment to low-income areas and universal sanitation by 2030. 'Ruto, Kenyatta, everyone in this room. You have done nothing for me!' In the spell-bound silence, she eventually asks, 'who do I sue?' referring to the much-vaunted right to sanitation enshrined in the constitution. A quiet applause rolls out for this point about the lack of clear accountability for sanitation. But no answers emerge from the room. If the national conference for sanitation does not know who is responsible, what does the right to sanitation mean?

A new constitution for Kenya was agreed upon in 2010 (Manji, 2014). The right of sanitation in article 43 states that 'Every person has the right to accessible and adequate housing, and to reasonable standards of sanitation' (Government of Kenya, 2010). This created a new legal right to sanitation, but in 10 years, there was only one legal case where the right to sanitation was successfully raised in court (Government of Kenya, 2020). This case centred on the lack of sanitation services along the major roads in Kenya. One of the enabling aspects for the legal claim to sanitation here was that there was a clear responsibility of the highways authority to provide services. In this context, businesses and road users were able to clearly demand their constitutional right to sanitation, showing its potential power. In urban and rural households, the problem becomes more ambiguous, relating back to 'who do I sue' and if such citizen action could even reach a judgement or any enforcement. Otherwise, the right to sanitation is often part of demands under the constitutional right to housing, as seen in the case of Garissa, a town 370 km north-east of Nairobi, evictions of 2000 informal settlement residents (Waterlex, 2015). Here, the forcible eviction of residents was declared unconstitutional, and the right to water and sanitation formed part of the case as residents had been disconnected from their existing services. Where houses have not been removed or disconnected, and there is no suitable service in the first place, the demand becomes less clear. This is at least partly due to the lack of clear mandate and responsibility between government agencies at both a national and county level.

Further, we identify a range of factors operating at the level of the informal settlements which also critically shape the potential for scaling up CBS enterprise models.

2.2 | The problem of sustainability of CBS enterprises

In informal settlements, there are many NGOs with overlapping aims and objectives providing services. One of the results of this is that NGO projects often bring a resource base that local groups look to capture and co-opt to work with. In sanitation, this was seen with many previous projects in Kibera where groups had worked to manage transfer stations and sewer disposal points, but then they had become disused and abandoned over time. Projects like this that fail to understand the local power dynamics are always likely to struggle to provide a meaningful contribution to expanding sanitation coverage. At a national level, activists, utilities and government representatives often suggested that NGOs and enterprises play a large role in shaping and influencing policy directives.

Sanergy provides sanitation services in Kenya. Sanergy's service currently operates at a loss with revenues from fees and reuse recovering 19% of costs (World Bank, 2019a). Unfortunately, Sanivation's costs were not included by the World Bank (2019a) for comparison. It is clear that cost recovery and profit sustained service delivery have not been achieved. Their current status as an aid-funded NGO arguably enables them to provide superior services at a loss whilst expanding and scaling to reach the point where they hope to become a contractor of county governments. Whilst it is legitimate to expect that extending sanitation coverage will require subsidy, particularly in lower-income areas, the question for such enterprises is whether aid-funded NGOs provide a model for this transition.

These enterprises and NGOs play a role in policy formation, for example, KESHP, recognised the container-based toilets that Sanergy uses as a solution. These dynamics will influence whether sanitation enterprises can reach the intended point of being a government recognised and funded service. However, local interviewees expressed doubt about such enterprises, arguing that they would come and go in the same way NGO projects come and go in informal settlements and disappear without a trace. It is critical then to understand the inclination and incentives of other actors in the fragmented infrastructural networks to enable the scaling up of CBS enterprise models.

2.3 | The problem of planning service delivery in informal settlements

There has been an increased commitment to non-sewered sanitation and on-site systems in the governance and policy approaches of Kenya (Mansour et al., 2017). One of the major issues that is gradually changing is that the Water Services Regulatory Board (WASREB), the board responsible for regulation and monitoring of urban sanitation services, had no mechanism or goals in place for measuring access to on-site sanitation. In their own report, it was accepted that the goal of universal sanitation would not be achieved by expanding sewerage coverage, which was reported at 15%–17% since 2011. Entire informal settlements may be considered illegal, or individual residents may not have rights or tenure to properties where they live, and this removes a lot of the visibility and responsibility for service provision in areas.

WASREB will now have a KPI (Key performance indicator on on-site sanitation access) this year which will be introduced. If you are sitting in an exam what's a point in answering a question that has no marks. (Sanitation Enterprise Employee)

Nairobi provides the most extreme case for both the institutional lock-in to sewer systems and the large populations of slum dwellers. Sixty-one per cent of the sewerage coverage in the whole country is in Nairobi. Yet, it has 100 informal areas, and 60%–70% of its population are estimated to reside in these locations (APHRC, 2014). Residents in informal settlements often lack tenure, recognition or a stake in their development. This was most starkly demonstrated in the 2018 demolitions of homes of 2000 families to make space for a road to connect the central area of the city to a bypass along the southern perimeter of the city. Informal settlements in Nairobi were historically colonially assigned areas that were intended to not give the 'natives' the right to live in a city (Wanjiru & Matsubara, 2017). External perceptions of informal settlements can fail to understand the realities of life there, with an interviewee from a utility responsible for informal settlements suggesting that they in fact get services for free regardless.

They are government-owned land and people just find houses and move in and often it is where the sewer passes. So, they are enjoying more services than any other. (Utility Employee)

There is also uncertainty about population numbers in settlements in Nairobi. Kibera is the largest slum in Kenya and often claimed to be the largest slum in Africa, with NGO documents estimating population numbers in the millions whilst 2009 census data estimated the population around 170 000 (Desgroppes & Taupin, 2009).

Development organisations will want the numbers of slum dwellers of high for their impact, while government want to keep the numbers low. (NGO Employee)

Whilst population data remains so uncertain, there is potential for manipulation of numbers to either inflate the impact of projects from the point of NGOs or enterprises providing services or for governments to minimise the problem.

2.4 | The problem of personal rather than institutional power

One recurring theme of interviews in relation to sanitation and planning in government circles was that change was often dependent on individual agents and that institutional consistency was lacking.

There is the same thing at a national level. Building structures that do not rely on personalities. If looking for a boss then you go through the gatekeepers as when the boss goes the gatekeepers are still there. For that reason then it is important to build relationships with the gatekeepers. (Sanitation Enterprise Employee)

At the national level of sanitation, a lot of the progress in terms of hosting conferences and making policy communiques was attributed to the presence of the previous Chief Administrative Secretary (CAS) in the Ministry of Water and Sanitation. The CAS at the time of the sanitation conference (October 2019) was very effective especially with matters to do with sanitation. However, during the government restructuring/reshuffle, the CAS was moved to the State Law Office and Department of Justice. It was the feeling of the respondents that this was a blow to sanitation initiatives in the country and that a lot of the progress could either stall, slow or be reversed. The power of individual agents of changes was also seen in Nakuru, where the governor and his predecessor were 'sanitation champions', leading to Nakuru being the first county to implement a sanitation plan after devolution. This example demonstrates the potential for individuals to enable longer-lasting change through enabling and building institutions. At a national level, based on interviews with employees, it is still expected that sanitation will become a department within the Ministry of Water and Sanitation, which would enable sanitation to have an independently managed budget and remit, showing the potential institutional shifts.

There is now a new Chief Administrative Secretary as you know, and it seems he is now much more interested in irrigation. The previous CAS is now in the attorney general office as her background is in law. The work can often depend on good will from officers. (Ministry of Water Employee)

But after the next election will the governor be someone who is interested and excited? So for that the work we have put in, building capacity and building a framework. (Sanitation Enterprise Employee)

When motivated individuals are in roles of power, they can rapidly change and scale systems if they see sanitation as a priority. At the same time, it means that progress may abruptly halt if events or individuals change as observed with the reshuffles of the CAS. At a national level, it appears that sanitation is a low priority and the main government development agenda is the 'big four' of housing, manufacturing, health coverage and food security set out by President Uhuru Kenyatta.

My perspective is that it's not a priority. They concentrate on big 4 and you have to find where you can fit into that. (NGO Employee)

Therefore, it appears that institutional capability and political incentives are not aligned to promote the scaling up of CBS enterprise models.

2.5 | The problem of vested local interests

One of the emergent themes from interviews that were identified as a key challenge to expanding CBS enterprise models in Nairobi was that of 'cartels' and vested interests. These varied from groups who controlled space or land, or who already provided services and saw outside providers coming into settlements as unwelcome competition. Manual pit emptiers who transported sludge through settlements like Kibera or Mukuru often faced violence from cartels who claimed territory and would prevent them from carrying sludge through their areas or extort money from them.

You have to look tough to prevent the violence. When doing work I'm not scared. Sometimes I even face them as they want to pick the money I've taken. You will find out if they are a coward. If they are a coward you can solve. (Manual Pit Emptier, Kibera)

Sometimes we are forced to release our pay at gunpoint. (Manual Pit Emptier, Kibera)

These challenges are also faced by more formalised NGOs, enterprises and state utilities looking to provide services in Nairobi. There were multiple examples in Kibera where transfer stations or sewer disposal points have been opened for disposal, only for the groups managing them either to disintegrate or for the infrastructure itself to be sabotaged. Cartels make sure that the services they provide are preferred by residents. One cited example was them blocking sewer lines so residents could not dispose of waste there and thus required the services provided by the cartel.

So, when you are working there you are destabilising a resource base. We had to work with them and maintain the services with them so that we are not threatening their income. If you do not think about the economics of the informal settlement you are doomed. (NGO Employee)

There was a fight between the youth groups managing public toilets and the county as they thought that they were making loads of money. They are maybe run by people who campaigned for the government. (Ministry of Water Employee)

This can be used to demonstrate that a sitting politician is unable to bring positive change to sanitation or to ensure that no rival politician can enact positive change and use the results as a campaign strategy against him or her. This example shows that infrastructure projects in informal settlements often break down outside of the stated legal arrangement of responsibilities and providers in Kenya as stated in formal policies like the Water Act. There is a mix of landlords, land claimants, groups and NGOs who have many overlapping interests and stakes in sanitation and infrastructure in general.

2.6 | The problem of land and political connection

Tied into the issues of cartels and vested interests, landownership and tenure is often unclear and conflicted in informal settlements. Underneath the formal ownership of the land by the national government in informal settlements, often local and national politicians are the major owners of buildings as 'slumlords', making them an arena for

political mobilisation around election time. This has been particularly important in the rising of Raila Odinga, leader of the opposition, who has mobilised Kibera (where Sanergy work) as one of his key strongholds (Elfversson & Höglund, 2018). This can often lead to expanding populations and voters of tribal groups being moved into informal settlements in the run-up to elections. This would increase pressure on already contentious land, meaning that any attempt to place infrastructure such as transfer stations would struggle.

Even in 2022 we are expecting new villages. Politicians are trying to rebalance by bringing others for votes. Then they go to villages where there is labour. (Utility Employee)

The problem with providing in informal areas is that there is often no recognition of the land, but there is a part of the constitution that should allow people to claim the land if they have been there. In Kibera, there has been some upgrading. But it is still difficult even where the Nubians have had the land as they are often not the people who live there. (Ministry of Water Employee)

The political power attached to existing housing and landlord arrangements in informal settlements can undermine any efforts to provide services or infrastructure, due to contestations over ownership and responsibility. Landlords resist the provision of sanitation infrastructure as it means less space for paying tenants and responsibility for pit emptying. In one informal settlement, there is already a legal case resisting the provision of infrastructure, whilst in Kibera, government efforts to find land for transfer stations and infrastructure have so far been unsuccessful.

3 | DISCUSSION

There are a number of aspects of Kenya's political economy that are key to understanding the challenge of scaling up CBS enterprises, particularly in informal settlements. Our results suggest several problems with this intention. It is clear that CBS enterprises cannot scale up without subsidy or considerable formal institutional support.

Looking at the role of enterprises like Sanergy and Sanivation, there was some scepticism about whether their model and operations would be sustainable long term. They are both currently still reliant on donor funding to provide services but are looking to increasingly become a government contractor to break even. Eikenberry (2009) explains that it can take a lot more effort for a social enterprise to become reliant on market income than to cultivate donor funding. In Sanergy's own paper, they say that 'For the funding that Sanergy has received since 2011, and the learning on the part of our funders and ourselves, to have been worthwhile, we must cross this finish line' (Auerbach et al., 2020). Sanivation's model is to provide treatment plants that replace the municipality's infrastructure, even if the processes and regulations for public-private partnerships around sanitation are not yet established. As Roy et al. (2013) suggest, social enterprises addressing health issues work at the interface between the community and the state. Even if they receive subsidy, they need to maintain independent management and government contracts need to be specified in a way that recognises the value in local people doing local work. Eikenberry (2009) adds that social enterprises may do better to focus on their social mission and to contribute towards democracy than to pursue market-based strategies, which in this case would be advocating for better sanitation services for vulnerable populations.

These enterprises' success depends on whether the system will be able to change to recognise the right to sanitation in settlements and fund it sustainably and equitably. Until this shift happens then much like many venture capital firms, they are relying on a supply of capital to provide improved services at a loss during an expansion (Kenney & Zysman, 2019). Similarly, there is a risk that if the funding dries up, or does not scale up with Sanergy's expansion before governments step in and fund their service, then the business model could collapse. This has been seen with sanitation ventures before such as Pivot or Waste Enterprises, who tried to establish a variety of circular economy approaches to sanitation but have now ceased operation, and there is little evidence of their existence

beyond a record of \$1.5 million being awarded in grants for their operations in Ghana and Rwanda (C3E, n.d.; Bill and Melinda Gates Foundation, 2014). Other examples such as People, producers of compostable bags, have also come and gone in Kenya demonstrating the risk of enterprises (Fischer et al., 2021).

It is therefore vital to assess the political economy of sanitation infrastructure networks and how CBS enterprises relate to those. In Kenya, they operate in a context where there is a lack of clear mandate and fragmented responsibilities that have not been agreed upon since the constitutional devolution. This is common in cities across the global south (Mansour et al., 2017a). One of the consequences is that there is a limited ability for citizens to demand the right to sanitation through their courts, and hence, governments feel little pressure to serve poor and disconnected populations. This contrasts more starkly with South Africa where landmark cases have established the right to reasonable sanitation, particularly in informal settlements, and CBS technology forms a part of government-funded service delivery (Waterlex, 2015). Accountability for services is often idealised as a relationship of citizen action leading to government action, though these narratives are less clear in practice (Joshi, 2017). What often emerges is the 'blame-world' characterised by Hood (2011) where blame is often shifted sideways, down or upwards along lines of responsibility. In Tanzania, it was found that narratives of blame and responsibility did not align with the responsibilities stated in the policy that often could not be implemented in practice due to institutional capacity constraints (Mdee & Mushi, 2020). As the devolution of responsibilities is dynamic and contested, there is likely to be an ongoing debate over who is responsible for sanitation in policy and practice. Therefore, in the absence of a sustained national or local political will, there appears to be little likelihood of sustained investment in extending the activities of CBS enterprises.

Mapping and understanding this process will be necessary to understand where incentives to invest in sanitation lie within the government and where better services can be demanded or encouraged. Many examples of devolution of power in Africa have resulted in capture by the central government; however, Kenya's process has led to meaningful devolution of power and budgetary resources so far (D'Arcy & Cornell, 2016; Mbate, 2017). County governors are now able to distribute state resources to their networks of local power (D'Arcy & Cornell, 2016). In such circumstances, it may be that particular individual leaders will choose to make investments in sanitation through CBS enterprises.

The problem of tenure in informal settlements often leads to an unwillingness from governments and utilities to serve such areas. This has been seen with other utility services in Kenya with slum upgrading programmes or electricity connections recognising areas that are still seen as government land (Bercegol & Monstadt, 2018; McGranahan, 2015). The lack of recognition can often lead to uncertainty around population numbers that actually need to be served (Desgropes & Taupin, 2009; Jerven, 2014). If governments were to recognise and fund sanitation in such areas, this uncertainty could provide the potential for politicisation of numbers and funding distribution. There is still a need to recognise these services somehow as currently funds for subsidising access to sanitation simply miss populations who are not connected to sewers (Andres et al., 2019). The lack of legal recognition for informal settlements often also neglects informal providers and informal markets that are already operating. Policies framed by international expectations of good governance and formal institutional control can have 'isomorphic mimicry' if they appear strong but fail to account for the realities of local contexts. This can lead to 'capability traps', where the state is unable to govern and manage service delivery or activities of the population due to their lack of recognition and engagement with informal actors and dynamics (Mdee & Harrison, 2019; Mdee & Mushi, 2020). Whilst formalisation may offer utilities more ability to control and regulate such informal providers, in Kenya, it has previously also entrenched the power of 'cartels' in the water sector (Boakye-Ansah et al., 2019).

4 | CONCLUSION

CBS offers a potential technical solution to extending sanitation coverage to those living in informal settlements. Yet, the complex and contested terrain of informal settlements makes scaling up a complex economic and political

challenge. The paper set out to examine the sociotechnical challenge of scaling up CBS provision. This analysis used case studies of two CBS enterprises (Sanergy and Sanivation) operating in Kenya as a starting point and sought to understand the potential routes and barriers to scaling up their activities. We contextualised the activities of these enterprises in relation to the wider sanitation infrastructure and governance networks in Kenya.

The paper outlines six core problems to be addressed in the pursuit of scaling up: fragmented governance; sustainability of CBS enterprise models; service delivery planning in informal settlements; personal power in decision-making; vested local interests; and land tenure and political connection. Such problems are rooted in interlocking and dynamic history, economics, politics and power. Addressing these issues will require political will and resource allocation on the part of the Kenyan state and local country governments. Those working with and promoting CBS as a solution to technical sanitation challenges need to recognise the political and economic realities of the context and to work on building coalitions of action that begin to debate and clarify lines of responsibility and accountability for the provision of sanitation in informal settlements.

DATA AVAILABILITY STATEMENT

Data cannot be made publicly available; readers should contact the corresponding author for details.

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