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Tenuous Wires, Covert Excreta Flows, and a Formal/Informal Interface:
Uncovering New Facets of Informality in Nairobi
By
Alice M. Sverdlik

A dissertation submitted in partial satisfaction of the
requirements for the degree of
Doctor of Philosophy
in City and Regional Planning
Designated Emphasis in Global Metropolitan Studies
in the Graduate Division of the
University of California, Berkeley

Committee in Charge:
Professor Jason Corburn, Chair
Professor Charisma Acey
Professor Alison Post

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Abstract
Tenuous Wires, Covert Excreta Flows, and a Formal/Informal Interface:
Uncovering New Facets of Informality in Nairobi
by Alice M. Sverdlik
Doctor of Philosophy in City and Regional Planning
Designated Emphasis in Global Metropolitan Studies
University of California, Berkeley
Professor Jason Corburn, Chair

Utilizing qualitative research in Nairobi's informal settlement of Mukuru, this dissertation will explore the multiple roles of informal service providers, unravel their ties to formal actors, and develop new tools for analyzing informal service delivery. 'Informal' typically denotes activities that fail to comply with government regulations, and urban informality is always changing, contextually-determined and cross-cutting across multiple domains. I seek to fill multiple gaps in the literature on informality and service provision for low-income urban residents. Past studies rarely examine informal electricity providers or narrowly analyze 'electricity theft,' while my analysis of electricity providers will reveal the groups' multiple facets and changes over time. In my sanitation case study, I analyze seasonal and spatial variations as well as proposing a new approach for studying slums' waste flows. Although there is ample research of formal/informal linkages between firms or in a single sector like water, there is only limited comparative research of formal/informal ties in urban service provision. I develop a new typology of how informal water, electricity, and sanitation providers in Nairobi's slums relate to formal actors; my analysis of a 'formal/informal interface' can also encourage further research into these ties. Taken together, my chapters can foster rigorous comparative analyses and promote more appropriate initiatives in African informal settlements where informal providers play a central (though sometimes problematic) role in serving the poor.

Mukuru's heterogeneous informal providers and their diverse ties to formal actors make this slum a fitting site for uncovering new facets of informality in urban service provision. Located on private lands in Nairobi's industrial area, Mukuru has rarely featured in past studies or benefited from upgrading projects. Although Mukuru is undergoing electrification, the project has yet to displace well-established informal electricity providers and the slum's sanitation has been largely neglected by state or donor projects. Given its diversity of sanitation solutions, Mukuru is unusually well-placed to reveal how excreta are disposed in informal settlements and in turn to develop new methods for addressing these hazardous practices. Along with informal electricity and sanitation providers, Mukuru has active water vendors with their own modes of relating to government officials. With few donor- or government-led infrastructure interventions to date, Mukuru offers an appropriate study setting for analyzing a profusion of non-state service providers and for comparing formal/informal ties in urban service delivery. Based upon over a year of fieldwork in Mukuru, my dissertation draws upon semi-structured interviews, observations, and focus groups with residents and service providers as well as interviews with experienced practitioners in Nairobi.

In Chapter 2, I argue that electricity cartels simultaneously resemble gangs, electricity thieves, and informal workers, and these multiple facets create a corrupt, entrenched system that still provides an accessible service. Power cartels are comprised of youths who usually live in Mukuru, and they offer a range of benefits to customers like payment extensions and low-cost connections, even if the services undoubtedly remain hazardous. Although they initially clashed over customers and were ethnically divided, providers are now mixed and not primarily violent actors. I explain how cartels regularly collude with Kenya Power and the police; cooperate and compete amongst

themselves; and provide flexible services that are quite socially-embedded. While not downplaying the unsafe or collusive aspects, I aim to provide a nuanced understanding of these shadowy figures' multiple roles and to inform future electricity interventions. I also seek to enrich the literature on non-state providers (NSPs) by showing the mutability and complex motives of cartels while challenging a static classification of providers' profit orientation or sectarian ties.

Chapter 3 analyzes how excreta are disposed in Mukuru and develops a mixed-methods approach that can be replicated by local organizations. While analyses of the 'sanitation chain' (from user to ultimate disposal) helpfully recognize the need for comprehensive approaches, I suggest that this discrete sequence is misleading for informal settlements. Instead, Mukuru's wastes are disposed via non-linear, often improvised strategies that can vary by season, residents' age, gender, and other factors. I also critique past studies of excreta flows that typically utilize epidemiological methods that are too technical for local organizations, or miss fine-grained practices and variations in informal settlements. I develop a feasible mixed-methods approach for understanding slums' waste flows that could be subsequently utilized by sanitation advocates, urban poor federations or other local practitioners. Furthermore, I underscore the importance of ongoing maintenance by male latrine-emptiers and (largely female) caretakers who clean shared latrines. I argue for gender- and age-sensitive strategies as well as multi-sectoral initiatives combining fecal sludge management (FSM) with adequate drainage, menstrual hygiene facilities, and solid waste management. Finally, I argue the 'sanitation chain' in Mukuru is best understood as an emergent co-creation of households, caretakers, and service providers who regularly shift in their interactions with (at times filthy) shared latrines and tenuous networks like open drains or brittle water pipes.

Chapter 4 analyzes how Mukuru's informal providers interact with formal actors, and my typology can encourage further comparative research. Although there are related literatures on hybrid security governance and informal institutions, past studies rarely offer a comparative framework on urban informal service providers or focus on broader scales than informal settlements. In my exploration of a 'formal/informal interface,' I argue that these interactions represent a continuum ranging from latrine-emptiers (usually ignored by police and relevant officials) to electricity cartels that regularly bribe and periodically clash with state actors. Additionally, I offer a new typology of informal providers as invisibly parallel (latrine-emptiers), invisibly parasitic and collusive (sewer hook-ups), visibly parasitic (water), and visibly parasitic and collusive (electricity). I also offer a detailed comparison of water and electricity cartels, who differ in their levels of conflict, salience of ethnicity, and competitive vs. cooperative pressures. Lastly, I discuss how water and electricity providers can deploy 'trappings of formality,' including a strategic display of official meters to avoid paying fines. Understanding the interface not only helps to uncover the deep-seated, complex roots of informal provision but may also develop more appropriate interventions, such as tackling the collusive ties that contributed to the rise of cartels.

I conclude with policy lessons and methodological reflections, as well as analyzing ways to emulate informal providers' accessible, flexible services. Based on past slum electrification projects, I identify key challenges and mechanisms that may facilitate the transition to formal power; I also briefly discuss experiences with Nairobi's ongoing electrification project. I propose a research agenda into (sometimes unsavory) informal providers and suggest that future slum upgrading initiatives may benefit from a nuanced analysis of informal providers and their ties to official actors. After acknowledging the challenges of studying informal providers, I discuss the implications for implementing the Sustainable Development Goals (SDGs) and argue for holistic slum upgrading projects rooted in a thoroughgoing analysis of dynamic, multifaceted informal providers.

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Acknowledgements

Dedicated to my parents and grandparents, with love and deepest gratitude

Chapter 1
Introduction and Study Setting

<u>Overview</u>

When seeking to improve infrastructure in informal settlements, the design and implementation of initiatives may benefit from a deeper understanding informal providers as well as their ties to official actors. 'Informal' typically denotes activities that fail to comply with government regulations, and urban informality is always changing, contextually-determined and cross-cutting across multiple domains.[1] My three-article dissertation will use findings from Nairobi's slum of Mukuru to explore the multiple facets of informal providers and analyze their complex links to utilities, police, and other government officials. One case study will examine how electricity cartels both undercut and collude with Kenya Power, while also offering some unexpected benefits to the slum-dwellers they serve. Another case study will analyze the improvised, often insalubrious ways of disposing fecal waste such as manual emptying, covertly tapping into sewers, and releasing waste into drainage or watercourses in Mukuru. Such disposal methods are usually missed in the World Bank's recent Shit-Flow Diagrams (SFDs)[2] or the broader literature on fecal sludge management (SFM), requiring more detailed spatial and qualitative analyses of slums' sanitation practices. Finally, I will analyze a spectrum of relations between formal officials and informal providers in Nairobi as well as arguing for additional research into this 'interface.' My conclusion will discuss policy lessons, including ways of working with informal providers but also reducing their hazardous or extractive aspects in informal settlements.

This introductory chapter will analyze my study setting of Mukuru while placing it in the context of Kenya's rapid urbanization, inequitable access to infrastructure, and decentralization reforms. I synthesize recent socioeconomic and health data from Mukuru from secondary literature as well as findings from Berkeley's ongoing partnership in Nairobi. Since 2012, Berkeley has supported action-research in Mukuru by the Kenyan slum-dweller federation *Muungano wa Wanavijiji,* Akiba Mashinani Trust (AMT, Muungano's financial support organization), and researchers at the University of Nairobi, Strathmore University, and Katiba Institute. In February 2017, these partners successfully advocated for declaring Mukuru part of a 'Special Planning Area', which may pave the way for much-needed upgrading initiatives.[3] Below I analyze the overlapping challenges facing many Mukuru residents such as poverty, informal livelihoods, meager infrastructure, and unresponsive local governance, but I also note the heterogeneities within and between informal settlements. My case studies utilize largely qualitative methods and are based upon over a year of fieldwork conducted in Mukuru, as explained below and in my three case studies. After introducing Mukuru alongside Kenya's ongoing urban transformations, I close with a more detailed overview of my chapters and their intended contributions.

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[1] A seminal text by Castells and Portes (1989, pp. 12-5) defined the informal economy as "unregulated by institutions of society" but with deep historical roots, constantly changing processes that "cut across the whole social structure," and "systematic linkages" to formal enterprises. See Chapter 4 for discussion in the context of service delivery in urban areas.

[2] See sfd.susana.org/ and further discussion in sanitation case study.

[3] See 'County Government Freezes Development in Mukuru Settlement,' *Daily Nation,* Feb 17th, 2017, available at www.nation.co.ke/counties/nairobi/county-government-freezes-development-in-mukuru-settlement/1954174-3817274-fh0lxd/index.html. Plans for upgrading Mukuru and the adjoining Viwandani settlement are still being developed.

I. Urbanization Trends, Rising Inequalities, and Infrastructure Provision in Nairobi's Slums

Established in 1899 as a transportation and administrative center for the Kenya-Uganda Railway, Nairobi is still grappling with legacies of segregation and paltry shelter in its informal settlements. The city was quickly segregated as Europeans settled in higher-elevated western areas, while Asian (mainly Indian) railway workers and African workers were confined to low-lying, flood-prone eastern lands (Hake 1977). Medical and public health justifications for Nairobi's segregation were utilized since the early 1900s, much as in other colonial African cities (Corburn and Makau 2016, also see Freund 2007). This stark socio-spatial divide continues to define Nairobi's informal settlements, many of which are concentrated in the same areas as imperial-era African zones. British colonial authorities largely neglected urban planning, and Nairobi's first Master Plan was completed in 1948 but never fully adopted. Instead, resources were overwhelmingly devoted to creating "the image of a European 'city in the sun' [to attract] international corporate investment" (Anderson 2001: 154). Like other African cities, Nairobi has more recently aspired to 'world-class' city status while striving to erase legacies of colonial planning that contributed to its inequitable shelter and infrastructure provision (Myers 2015, Watson 2014). Presently, Nairobi has as many as 200 informal settlements, and the city's total population is projected to jump from 4 million today to 6 million by 2030 (World Bank 2016, p. 18).

Although Kenya is now classified as a lower middle-income nation, most urban residents live in dense, unsanitary informal settlements and rapid urban growth has been extremely inequitable. Kenya is urbanizing by 4.3% per annum but was just 27% urban in 2015; only in 2050 will half of Kenya's population reside in urban areas (World Bank 2016, pp. 17, 38-9). Kenya's GNI per capita was US$1280 in 2014 but urban job creation remains overwhelmingly informal and often precarious (*ibid.,* pp. 38 and 42, also below). Informal settlements continue to house the bulk of Kenyan city-dwellers, where housing and infrastructure provision are usually minimal. In 1990, almost 55% of Kenyan city-dwellers lived in slums; by 2014, 56% of Kenya's urban residents lived in slums, or 6.4m people (UN-Habitat 2016, p. 204)[4]. While informal settlements vary widely, the UN definition has focused upon overcrowded or impermanent housing, tenure insecurity, and inadequate access to water and sanitation (UN-Habitat 2016). Trends in Kenyan cities also vary by the infrastructure sector in question, suggesting the need for disaggregated analyses. Kenyan urban electricity access increased markedly from 42.5% to 65.6% between 1990-2008 (*ibid.*), and by 2016, 85% of Mukuru households had electricity, usually from informal providers (Strathmore 2016, p. 22, also below). By contrast, urban access to water has stagnated (55.8% in 1993 and 56% in 2008) and urban sewerage access fell from 44.8% to 34% (UN-Habitat 2016, p. 215, also below for urban disparities in water and sanitation). Exclusionary urbanization trends, as indicated by inequitable infrastructure access and burgeoning informal settlements alongside rising incomes, underscore the need to transform Kenya's urban development patterns.

Meager infrastructure is a defining characteristic of informal settlements, yet few studies examine the providers offering sanitation or electricity in African slums. Instead, recent electricity literature has uncovered low access levels amongst the urban poor, which is often obscured in aggregated data and the policy focus upon rural electrification (Singh *et al.* 2014). For instance, household surveys by the World Bank found that just 33% of urban poor households in 22 African nations had electricity (Kojima *et al.* 2016, p. 13). Other relevant research has explored electricity

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[4] In 2014, an estimated 56% of African city-dwellers lived in slums, far above corresponding levels of 31% in South Asia, 28% in Southeast Asia, and 21% in Latin America (UN-Habitat 2016, p. 203).

theft (Smith 2004, Lewis 2015) and the high costs of Africa's electricity connections (Golumbeanu and Barnes 2013). In sanitation, sobering studies have explored the health and socioeconomic impacts of inadequate provision; World Bank analyses suggest that in Kenya, $324 million is lost annually due to poor sanitation (WSP 2012). There is also ample literature on the need to increase available funding in these sectors, such as Eberhard *et al.* (2011) for expanding funds for African electricity provision and Hutton and Varughese (2016) for the funds needed to meet the Sustainable Development Goals (SDGs) in water and sanitation. Although informal water and transport providers are regularly featured (e.g., Kjellén and McGranahan 2006, Cervero and Golub 2007, Ahlers *et al.* 2014), there is far less consideration of their counterparts in electricity and sanitation. Informal electricity providers in Africa are almost completely ignored, although there are exceptions in South Asia (see Hossain 2012 for Dhaka and others discussed in my case study). A rapidly-expanding sanitation literature has focused upon fecal sludge enterprises in African cities (e.g., Chowdhury and Kone 2012, Murungi and van Dijk 2014), but usually overlooks the myriad other ways of managing excreta like manual latrine-emptying or improvised behaviors (see my case study).

II. Study Setting: Hazardous Living Conditions and Lack of State Interventions in Mukuru

Mukuru is a large informal settlement in Nairobi's industrial area, where residents face multiple environmental health hazards and severe threats to their well-being. The settlement is located about 7km southeast of Nairobi's CBD and covers over 450 acres of land (Mutinda and Otieno 2015). Mukuru was built upon private land parcels originally intended for light industries, but residents currently face elevated eviction risks of stemming from rising land values and tenure insecurity (Weru *et al.* 2015). Over the last 10 years, land values in Kenya's industrial areas have more than tripled (Mutinda and Otieno 2015, p. 51). Presently, there are an estimated 326,832 residents of Mukuru kwa Reuben and kwa Njenga (see Figure 1 and Table 1 below) and over 90% of Mukuru residents are tenants, in keeping with tenure patterns for other Nairobi slums (Strathmore University 2016, Gulyani *et al.* 2014). Similar to other slum-dwellers, Mukuru residents typically rent single-roomed dwellings built of iron sheets with minimal or unsafe infrastructure. But unlike Nairobi's well-known informal settlement of Kibera, Mukuru has rarely benefited from upgrading interventions (Weru *et al.* 2015).[5] Its prime location on private lands in the industrial area has contributed to the special challenges of upgrading Mukuru, though many of its other features are common to other informal settlements in Nairobi.

Table 1: Population Estimates in Mukuru[6] from Muungano's Enumeration (2015)

Area of Mukuru	Number of Households	Population (no. households x 3 people per household)
Mukuru kwa Njenga	63,952	191,856
Mukuru kwa Reuben	44,992	134,976
Total	108,944	326,832

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[5] For more discussion of the World Bank, Kenyan Government, and community-led upgrading initiatives in Nairobi, see Weru (204) and Corburn and Makau (2016).

[6] Population estimates for slums are uncertain and highly contested in Nairobi (and elsewhere in the Global South). See discussion in Lines and Makau (2017) for Muungano's community-led efforts to enumerate and map slum-dwellers in Kenyan cities.
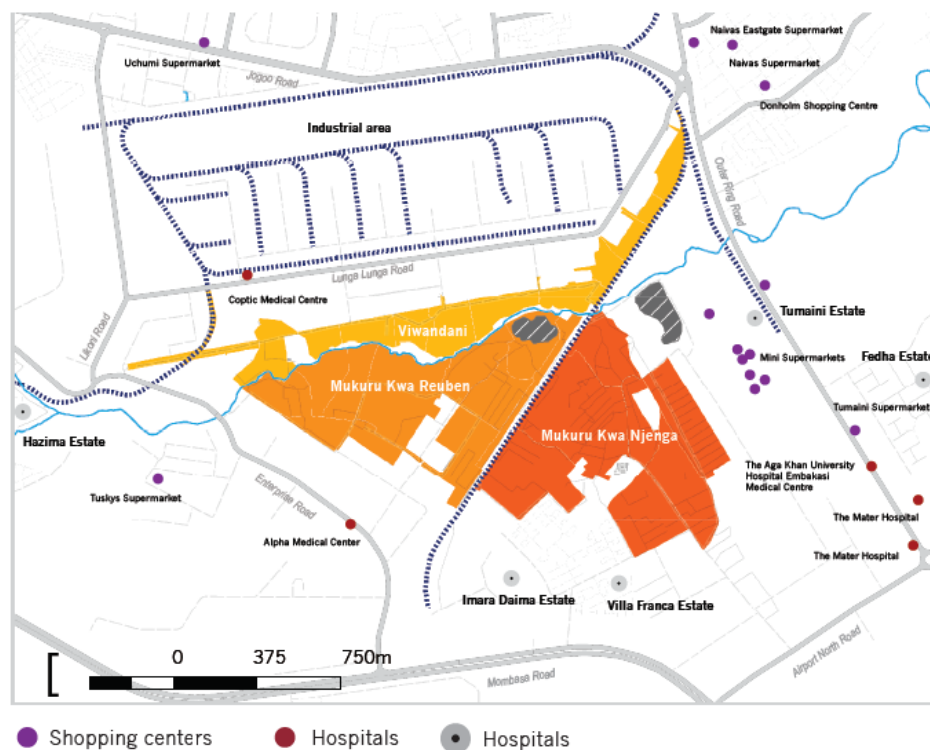
Figure 1: Mukuru, factories, and nearby settlement of Viwandani (Source: UC Berkeley *et al.* 2016, p. 25). I conducted fieldwork in Mukuru kwa Njenga, not the adjacent settlement of Reuben.

Mukuru's highly inadequate infrastructure and services, combined with its periodic floods as well as proximity to factories, have generated multiple health hazards and social risks for residents. Mukuru has meager drainage provision and is situated on land sloping towards the Ngong River, which can produce severe floods during Nairobi's rainy season. After heavy downpours, the settlement's paltry drainage usually results in flooded internal paths and roads paralyzed by thick mud (see Figure 2 below). Not only do inadequate roads and drainage significantly curtail local businesses and internal mobility, but they can also generate major difficulties when disposing human waste along rocky, flooded paths (see Figure 2 below and also my sanitation chapter). Residents' health is further imperiled by smoke, soot, and industrial effluents from the adjacent factories, with air pollution only heightening the risks from regular combustion of solid waste within the slum (UC Berkeley *et al.* 2016). Furthermore, fires are common in Mukuru as well as other slums due to low-quality informal electricity provision, and conflagrations can spread rapidly due to high housing densities combined with poor road access by emergency vehicles.[7]

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[7] For fires in Mukuru kwa Njenga in April 2016 see http://www.the-star.co.ke/news/2016/04/27/several-left-homeless-in-mukuru-kwa-njenga-fire_c1340073 and more recently in Mathare, where again electricity faults were the suspected cause of a fatal blaze http://www.nation.co.ke/video/1951480-3504558-3njtwmz/ (Jan 2, 2017).

Figure 2: Manual Latrine-Emptying in Mukuru (Source: author)
<u>Left</u>*:* a flooded internal path and metal shacks in Mukuru; <u>Right:</u> manual latrine-emptiers struggle to push an excreta-filled drum across rocky path with poor drainage

As a large, centrally-sited informal settlement that has not benefited from past upgrading projects, Mukuru presents both challenges and opportunities to its residents. For instance, its proximity to Nairobi's city center has allowed some households to work in the industrial area but also places them at heightened risk of eviction in the future. Additionally, Mukuru suffers from minimal water and sanitation, which has imposed considerable health and socioeconomic burdens with gender-inequitable impacts (Corburn and Hildebrand 2015, also below). Surveys with over 800 households in Mukuru found that only 3.6% had access to adequate bathrooms, 7% had adequate toilets, and 29% had adequate water (AMT *et al.* 2014). At the same time, Mukuru's density and proximity to trunk infrastructure can facilitate upgrading that may finally reach these marginalized residents. Finally, as in another informal settlement called Huruma, Mukuru is increasingly the site of illegal, shoddily-constructed high- and medium-rise buildings. As starkly reflected in the May 2016 building collapse in Huruma, unlawful development of high-rise structures in Nairobi's slums can pose major threats to health and well-being.[8] Mukuru residents usually live in dense shacks rather than tenements, but the building collapse in Huruma and ongoing spread of tenements all underscore the imperative to develop safe, affordable shelter in Nairobi.

Non-state providers dominate multiple sectors of Mukuru's service delivery, but I will explore how they still engage with public utilities, police, or other state actors. Government agencies offer "*next to no municipal services in Mukuru*", with "little to no access to sewage services [and] latrines are emptied manually" (Weru *et al,* 2015, p. 236, emphasis added). Sewers are regularly blocked or clandestinely tapped, and manual emptying is widespread (see sanitation chapter). Just 1% of residents enjoy water in their dwelling and 6% have piped water into the plot, leaving **<u>80%</u>** to pay a

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[8] See Mwiti, L., "Blame Game Continues for Years as Buildings Keep Tumbling Down," *The Standard*, 5 May 2016. An audit of 2,601 Nairobi buildings discovered that as many as 226 were unsafe. Dense tenements in Nairobi may reach ten stories in height, and each floor has at least 10 households occupying a single, poorly-built room (Huchzermeyer 2011a).

private provider such as an NGO, water cartel, or community group (Strathmore University 2016, p. 21).[9] Once again, electricity provision is overwhelmingly informal: about **93%** of residents in Mukuru and nearby Viwandani pay a private provider for electricity as compared to just 7% with a formal electricity meter (*ibid.,* p. 22, Figure 3 below for informal wiring). Finally, with just 3% of respondents having toilets inside their dwelling, most toilets in Mukuru are located on the plot and almost half of toilets are shared by over 20 households (*ibid.,* p. 21, also below). My formal/informal chapter will explore the diverse ways that non-state actors interact with formal officials, such as bribing the police and colluding with Kenya Power engineers in order to access transformers.

Figure 3: Multiple Types of Informal Electricity Wiring in Mukuru
Typically, electricity providers in Mukuru utilize naked aluminum wires outside since coated copper wires are easily stolen, but use safer, coated wires inside the plot. Left*:* naked aluminum wires (courtesy of an informal provider in Mukuru) and right: coated wires on the plot (photo by author)

Below I continue analyzing the area's possibilities and also explore the overlapping health, environmental, and infrastructure concerns for Mukuru residents. Although I note intra-slum variations, common challenges in Mukuru include poverty, ill-health, food insecurity, and inadequate infrastructure provision. As discussed below, Kenya is also implementing significant decentralization reforms that unfortunately have failed to translate into increased expenditures in Nairobi's slums.

III. Ill-health, Poverty Penalty, and Meager Water and Sanitation Provision in Mukuru

Mukuru residents use low-quality, high-cost services that impose a 'poverty penalty' (compared to formal service delivery) and are also linked to poor health outcomes. A Mukuru resident declared, "I have never seen latrines or toilets where I live. The water that is brought to us is so dirty that it is green in color. We just survive by the grace of God" (quoted in AMT *et al.* 2014, p. 106). Given such insalubrious, undignified living conditions, it is hardly surprising that Mukuru residents regularly suffer from ill-health and multiple threats to well-being. Recent surveys found

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[9] In spring 2016, researchers from Strathmore University surveyed a total of 1,720 residents in Mukuru kwa Reuben and kwa Njenga alongside residents of other slums and formal areas in Nairobi. The following findings are taken from a working paper draft shared with UC Berkeley (Strathmore University 2016). Water expenditures average Ksh. 507 per month, or an estimated three 20-liter jerricans per day per household (*ibid.*).

that the under-5 mortality rate in Makadara division (where Mukuru is located) reached 83 per 1000, exceeding Nairobi's slum average of 80 per 1000 and the city's average of 52 per 1000 (APHRC 2014, p. 95). Residents of Mukuru also suffer a significant 'Poverty Penalty,' where households can only access higher-cost yet lower-quality services than in Nairobi's formal estates. The average structure in Mukuru—a 10-by-10-ft rented room without amenities—is 10% to 26% more expensive per square-foot than formal estates in nearby Imara Daima with all services provided (AMT *et al.* 2014, pp. 74-76). For water, the poverty penalty is especially deplorable as slum-dwellers typically consume lower-quality water than residents with formal provision, but pay tariffs per m^3 that reach 172% the rates of formal water customers (*ibid.*). Not only is Mukuru's water and shelter of extremely low quality, but households also must bear the inequitable burden of higher unit costs than their wealthier neighbors.

Sanitation in Nairobi's slums is extremely inadequate and may impose gender-inequitable burdens upon women and girls. Surveys in Mukuru, Kibera, and Kampala found several different sanitation options (see Figure 4 below), but they are often unaffordable, poorly-maintained, or inaccessible such as public toilets that close at night due to insecurity. About 35% of Mukuru's toilets are provided by the social enterprise Sanergy, typically in Mukuru kwa Reuben (O'Keefe *et al.,* 2015, Strathmore University 2016).[10] Although these eco-toilets can safely capture and reuse waste, at 5 shillings per use these may be too expensive for the poor. Another 30% of Mukuru's toilets are on-site latrines, which are typically emptied in local water-courses, and the remainder are public or shared facilities connected to sewers (although these piped networks are often blocked, as discussed in my sanitation chapter). The challenge of accessing sanitation can disproportionately affect women and girls, who are at risk of sexual violence if they venture outside at night in Nairobi's insecure slums (Corburn and Hildebrand 2015). According to a focus group of 15 women in Mukuru kwa Njenga, 'Over half of us take 5 to 10 minutes to get to the toilet…If you go out at night you will get raped and assaulted' (quoted in Amnesty International 2010, p. 21). Although Mukuru has multiple sanitation options, they are overwhelmingly unhygienic, unaffordable, or inaccessible with deleterious impacts on the well-being of women and girls in particular.
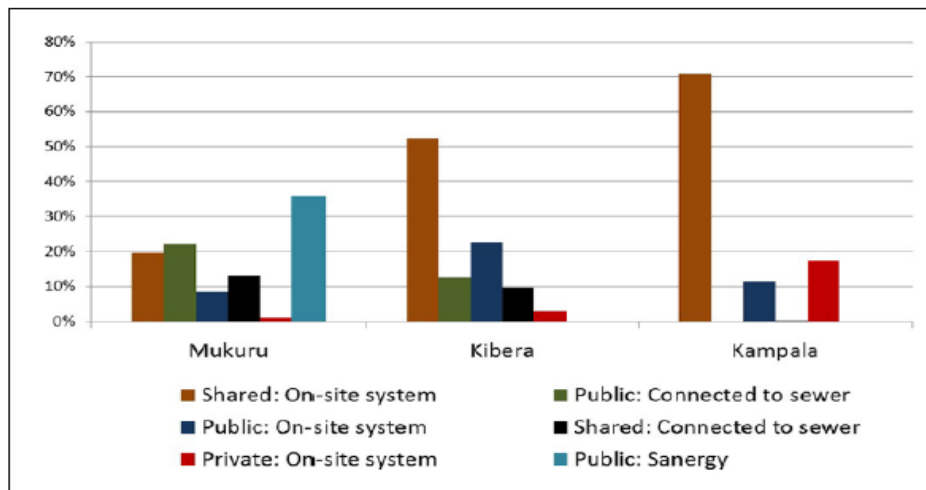
Figure 4: Sanitation Provision in Nairobi's Informal Settlements of Mukuru and Kibera and Kampala's Informal Settlements (Source: O'Keefe *et al.* 2015, p. 431)

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[10] My fieldwork was conducted in Mukuru kwa Njenga, where Sanergy toilets are less widespread.

Water provision is again a significant (and gendered) concern in Mukuru, and like other informal settlements Mukuru has endured periodic cholera outbreaks. In Nairobi and other cities of the Global South, women and girls overwhelmingly bear the brunt of inadequate water provision, as they usually wait for water and thereby lose vital opportunities for education or income-generation (Ray 2007, Crow and Odaba 2010). Furthermore, Mukuru's poor sanitation may heighten the risks of water contamination since thin 'spaghetti' water-pipes highly prone to breakage usually pass through open drains or next to sewers (see Figure 5 below). Water treatment remains rare: for instance, of nearly 200 Mukuru households surveyed recently, just 35% had treated their water on the day of the study and 38% received water treatment in the previous year (Blanton *et al.* 2015). Such concerns regarding water quality reflect the broader trend of declining access to piped provision among Kenya's urban poor. Although Kenya's overall coverage of piped drinking water improved from 1990-2015, in urban areas it fell sharply from 55% to 45% and provision is especially inadequate among the urban poor (JMP 2015). For Kenya's poorest urban quintiles, water access deteriorated markedly from 1995-2012 with piped water on premises falling *from 23% to 17%* and unimproved provision *rising from 19% to 29%* (see Table 2 below). In an especially distressing pattern, Nairobi's slums experience regular cholera outbreaks that are likely due to contaminated water connections and poor sanitation (as illustrated in Figure 5 below). During the 2009 cholera outbreak, the overall case-fatality rate of 8.6% in Nairobi far exceeded Kenya's national average of 3.9% (Mutonga *et al.,* 2013). Moreover, in 2015, Mukuru had 6 fatalities due to cholera and almost 40 cases in kwa Reuben over just 2 weeks (Ndunda 2015).

JMP - estimated trends of drinking water coverage by wealth quintile

Kenya		Rural		Urban	
		1995	2012	1995	2012
Poorest	Piped on premises	2	2	23	17
	Other improved	18	39	58	54
	Unimproved	80	59	19	29
Second	Piped on premises	3	7	42	40
	Other improved	26	41	44	44
	Unimproved	71	52	14	16
Middle	Piped on premises	9	12	52	57
	Other improved	25	38	34	31
	Unimproved	66	50	14	12
Fourth	Piped on premises	15	16	69	75
	Other improved	26	40	22	17
	Unimproved	59	44	9	8
Richest	Piped on premises	27	33	94	78
	Other improved	34	40	5	12
	Unimproved	39	27	1	10

Source: WHO/UNICEF JMP, 2015

Figure 5: 'Spaghetti' water pipes passing through open drainage in Mukuru (by author)
Table 2: Kenya's Urban Water Coverage by Wealth Quintile, 1995-2012[11]

Similar to the shortfalls in water provision noted above, access to sanitation in Kenyan cities has remained highly inequitable and increasingly inadequate for the urban poor**.** Shared facilities remained Kenya's most common form of urban sanitation in both 1990 and 2015, with levels of

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[11] Figures available from JMP at https://www.wssinfo.org/documents/?tx_displaycontroller[type]=wealth_quintiles

shared provision increasing from 41% to 48%, while improved provision only inched up from 27% to 31% (JMP 2015). Amongst the poorest Kenyan city-dwellers, *just 7% had improved sanitation* in 2012 and from 1995 to 2012 shared provision rose from 41% to 57% (see Table 3 below). Thus, Kenya's urban poor in settlements like Mukuru have consistently been denied access to improved sanitation, with few gains recorded in the past decades.

JMP - estimated trends of sanitation coverage by wealth quintile

Kenya		Rural		Urban	
		1995	2012	1995	2012
Poorest	Improved	4	7	5	7
	Shared	4	7	41	57
	Unimproved	47	31	47	29
	Open defecation	45	55	7	7
Second	Improved	7	12	7	8
	Shared	5	9	57	67
	Unimproved	57	63	33	25
	Open defecation	31	16	3	0
Middle	Improved	12	18	17	18
	Shared	8	12	63	69
	Unimproved	68	64	19	13
	Open defecation	12	6	1	0
Fourth	Improved	20	26	24	26
	Shared	13	17	65	69
	Unimproved	60	52	10	5
	Open defecation	7	5	1	0
Richest	Improved	44	48	59	60
	Shared	23	24	35	35
	Unimproved	30	28	6	5
	Open defecation	3	0	0	0

Source: WHO/UNICEF JMP, 2015

Table 3: Kenya's Urban Sanitation Coverage by Wealth Quintile, 1995-2012[12]

IV. Informal Employment, Household Incomes, and Food Insecurity in Mukuru

Reflecting Mukuru's location in the industrial area, residents typically work in the nearby factories or, alternatively, engage in various informal livelihoods. Overall, Kenya's economy generated 800,000 jobs in 2014, 80% of which were in the informal economy (World Bank 2016, p. x). From 2012-2014, an average of 22,000 jobs were created in Kenya's industrial sector, where many Mukuru residents work (*ibid.*). Official data indicate that manufacturing continues to contribute to Kenyan GDP growth, including 10.9% and 7.1% in 2013 and 2014 (KNBS 2015). Nevertheless, most households in Mukuru and other Kenyan slums are overwhelmingly employed informally. Recent Strathmore's surveys in Mukuru suggest that the leading occupations are casual labor, industrial worker, and businesspeople (Strathmore 2016, p. 30, full results not reported). Based on large-scale surveys in Nairobi's informal settlements by the African Population Health and Research Center (APHRC), about 62% of residents are "engaged in casual work, petty trade or are unemployed" (Buigut *et al.* 2015, p. 6). In Africa more generally, 9 in 10 new jobs are created in the informal sector, but over 70% of these workers are in vulnerable employment lacking social protections while enduring long hours and hazardous working conditions (ILO 2016, pp. 33-4).

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[12] Figures available from JMP at https://www.wssinfo.org/documents/?tx_displaycontroller[type]=wealth_quintiles

Although earnings vary markedly within the settlement, Mukuru residents often have low earnings and food remains the largest household expenditure. A typical Mukuru household has an average monthly expenditure of Ksh. 7,773 (about $78) with food and rent representing as much as 51% and 34%, respectively, of these expenses (AMT *et al.* 2015, p. 49). Similarly, in APHRC's surveys with over 3,400 households in Mukuru and 3 other slums, residents typically devoted most of their incomes on food but regularly go hungry. For residents of these 4 settlements, food expenditures absorbed as much as 52% of total household incomes and 42% of total expenditures (Amendah *et al.* 2014, p. 4). Levels of food insecurity can also vary over time, reflecting multilevel factors such as household-level poverty or illness, macroeconomic trends, and food prices.[13] In Nairobi and elsewhere in the Global South, the urban poor are highly vulnerable to price increases due to their dependence on purchased food (Cohen and Garrett 2010). Additionally, it is important to note that monthly household incomes in Mukuru range widely from Ksh. 4,000 ($40) to Ksh. 10,000 ($100) and above (Strathmore 2016). According to another 2014 survey in Mukuru and 2 other settlements, researchers again found intra-settlement variations in incomes and significant gendered inequalities, as female breadwinners earned just 62% of their male counterparts in Nairobi's slums (Beyer *et al.* 2016, p. 14). But surprisingly, the survey in Mukuru from 2016 found no correlation between ownership of household durables and level of education or occupation (Strathmore 2016, p. 34). Such findings suggest the need for further research into the causes of socioeconomic variation in slums and ways of promoting more secure livelihoods.

V. Decentralization in Kenya and Nairobi County Government's Expenditure

Kenya has initiated an ambitious set of devolution reforms, yet inadequate fiscal autonomy and local-level corruption may hamper the transformative potential of decentralization. Following Kenya's devastating post-election violence of 2007-8, a new Constitution was approved in 2010 creating elected governorships and 47 County Governments that are now responsible for service provision (see Cheeseman *et al.* 2016). Kenya's decentralization is comprehensive (i.e., political, fiscal, and administrative) and seeks to reduce inequalities between regions as well as to promote greater responsiveness and citizen participation at the local level (D'Arcy and Connell 2016, 2014). The 2013 gubernatorial elections were peaceful and Kenya's implementation of decentralization has been more extensive than many other nations in the Global South (*ibid.*). However, results to date suggest there are newfound opportunities for corruption, particularly among politicians representing ethnic majorities at the expense of ethnic minorities in their constituencies (*ibid.*). Furthermore, unclear responsibilities between local/national authorities and inadequate revenue-raising capacities at the County level have only heightened the challenges of implementing decentralization (World Bank 2016). These concerns are especially salient to my sanitation case study: as analyzed in my chapter, urban sanitation is characterized by sectoral fragmentation and unclear responsibilities that have spawned highly insanitary conditions in Mukuru.

Despite recently improving its revenue collection, there is still a pressing need to increase Nairobi County Government's expenditure on development and other services to benefit the poor. Nairobi's government collects over 60% of the annual target, comfortably exceeding the national average of 43.1% (World Bank 2016, p. 34). But nearly 58% of the County's spending went towards wages in 2013-4 (*ibid.,* p. 15) and Nairobi County has yet to spend the required 30% of its total budget on development (World Bank 2014, p. 15). In 2013-4, just 10.7% of Nairobi County's budget went towards development, and the County has inherited a crippling debt of nearly US $500 million,

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[13] For instance, from August 2012-February 2013, severe food insecurity among Mukuru's children aged 6-59 months steeply rose from 44% to 55% although fell to 34% by Feb 2014 (Beyer *et al.* 2016, p. 11).

largely arrears (WB 2016, p. 149). Similarly, in 2015-6, wages comprised 56% of Nairobi County's expenditures, O&M was 26%, and development was still low at 18% of spending (Nairobi City/County 2016, p. 13). The County boasts of collecting 800 tons of solid waste per day and constructing 2 km of sewer extensions (*ibid.,* p. 17), but tellingly, no information is provided on these sectors' activities in informal settlements. Since County funds are mainly consumed by debts or wages, it is hardly surprising that infrastructure and services in Nairobi's informal settlements have stagnated. My concluding chapter will discuss ways that local government may work with informal providers to improve infrastructure delivery or perhaps emulate some of their benefits.

VI. Summary on Study Setting and Case Selection

With its strategic location and minimal state intervention, Mukuru is home to profound challenges as well as offering opportunities to help overcome residents' exclusion and deprivation. These households are constantly exposed to industrial pollutants and effluents but, by the same token, many are employed in nearby industries or may sell to factory workers in their own informal enterprises (AMT *et al.* 2014). Additionally, Mukuru's central location may heighten the threat of eviction and the spread of speculative, poorly-built buildings as in Huruma and other slums across Nairobi (Huchzermeyer 2011). Mukuru residents must cope with hazardous shelter, while projected population growth will exert increasing strains on already-inadequate infrastructure and services. Residents suffer from recurrent diarrhea and cholera outbreaks, particularly during the rainy season that can also sweep their fragile homes away or grind their livelihoods to a halt (Blanton *et al.* 2015). Furthermore, malnutrition and food insecurity are rampant in Mukuru, with households sometimes skipping meals, removing children from school, or other desperate strategies in the face of rising food prices (Amendah *et al.* 2014, Beguy *et al.* 2015). Not only do residents rely upon unsafe, undignified services, they can even pay a 'poverty penalty' for lower-quality, higher-cost provision compared to nearby formal areas (Strathmore University 2016, AMT *et al.* 2014).

Mukuru residents thus grapple with multiple burdens affecting their health and well-being, but multi-sectoral upgrading initiatives may help to ensure that these areas fulfil their potential. Upgrading projects can significantly advance several objectives established by Nairobi County's Integrated Development Plan (CIDP) (see World Bank 2016, pp. 138-9 for analysis of CIDPs in Kenya). Nairobi's 2014 CIDP has identified key cross-cutting issues such as profound income and gender inequalities; insecurity; rising youth population; and environmental degradation (Nairobi City/County 2014, pp. 41-53). Furthermore, the Plan highlighted multiple concerns that particularly affect slum-dwellers including acute poverty, shortfalls in water and sanitation, and lack of jobs (especially for youth). In response, the CIDP recommended fast-tracking slum upgrading (by 2017); providing housing and environmental protection (e.g., water, sanitation, and solid waste collection); enhancing public works, roads, and transport; and developing policies to support youth, children, and social services, including efforts to reduce poverty in slums (*ibid.*). If such strategies are successfully implemented, it would signal a much-needed shift towards inclusive planning in Nairobi's informal settlements. With the recent declaration of a Special Planning Area in Mukuru, the area's latent possibilities may finally be realized and my case studies seek to inform more nuanced upgrading strategies. My conclusion will also offer policy lessons for future slum electrification projects and other interventions in settlements with widespread informal providers.

Mukuru's heterogeneous informal providers and their diverse ties to formal actors make the settlement a fitting site for uncovering new facets of informality in urban service provision. Although Mukuru is undergoing electrification with prepaid meters, the project is still incomplete and has yet to displace well-established informal electricity providers (see Chapter 5). The settlement

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is known for having powerful electricity cartels (according to a World Bank official advising the electrification project) and thus a case study of Mukuru may provide useful lessons for other electricity initiatives seeking to dislodge entrenched informal providers. Furthermore, Mukuru's electricity cartels have undergone several changes over time that may help reveal the complex dynamics of informal energy providers (Chapter 2). Meanwhile, Mukuru's sanitation has been largely neglected by state or donor projects; ecosan models like Sanergy and Umande Trust have made some inroads but still struggle to reach many residents (see Chapter 3). Given its diversity of sanitation solutions, Mukuru is unusually well-placed to reveal how excreta are disposed in informal settlements and in turn as a site for developing new methods to address these hazardous practices. Along with informal electricity and sanitation providers, Mukuru has active water providers with their own modes of relating to government officials (see Chapter 4). With few donor- or government-led infrastructure interventions to date, Mukuru offers an appropriate study setting to explore a profusion of non-state service providers and formal/informal ties in water, sanitation, and electricity. Below I offer a more detailed overview of my case studies and contributions.

VII. Dissertation Structure, Methods, and Intended Contribution

My dissertation will offer case studies of excreta disposal methods and of electricity providers in Mukuru, before analyzing formal/informal relations in water, sanitation, and electricity provision. I focus mainly upon informal providers (reflecting my difficulties in reaching formal officials), but my research can still help to fill key gaps in the literature. In particular, I uncover the roles of often-overlooked informal electricity and sanitation providers; encourage comparative analyses of slums' formal/informal service providers; and develop methods as well as conceptual tools that can spark future research. Past studies rarely examine informal electricity providers (for exceptions, see Hossain 2012 and Iqbal 2016), and I offer a novel synthesis of several literatures to analyze Mukuru's multi-faceted electricity cartels.[14] In my sanitation case study, I contribute to recent research on the 'sanitation chain' (Figure 6 below) by offering a detailed analysis of slums' excreta disposal patterns and an alternative method to study these practices. Extensive literature has examined formal/informal linkages between firms (Meagher 2013) or in a single sector like water (Ahlers *et al.* 2014), but few comparative studies consider relations between formal/informal providers in urban service provision (although see Post *et al.* 2017). My case study will explore how Mukuru's water, electricity, and sanitation providers relate to formal actors, and my discussion of the 'formal/informal interface' can motivate further studies into these ties. In my conclusion, I discuss lessons from slum electrification projects and reflect on ways of working with informal providers, alongside a research agenda into (sometimes unsavory) informal providers like electricity cartels.

I conducted over a year of (largely qualitative) fieldwork in Mukuru kwa Njenga, as well as interviewing local practitioners and officials experienced in urban sanitation, water, and electricity. Informal electricity in Nairobi is highly sensitive as well as hazardous; providers only complete their hook-ups and maintenance activities at night, when they risk electrocution or police harassment. As a result, I was unable to observe cartels and did not record my semi-structured interviews with cartels or Kenya Power officials (see below). My formal/informal chapter similarly relies on unrecorded interviews with utilities officials and experienced informal providers in water, sanitation, and electricity. Sensitive topics such as the often collusive, extractive formal/informal ties would have been poorly-captured in a survey or a structured interview, but can be adequately explored in

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[14] Recent studies have analyzed the rise of prepaid meters in Southern Africa (Baptista 2015, von Schnitzler 2013) and urban energy transitions in the context of climate change (Silver and Marvin 2016). See Chapter 2 for additional discussion of literature on electricity theft (e.g. Lewis 2015) and other relevant research.

semi-structured interviews. By contrast, my sanitation case study utilizes observations of manual latrine-emptiers, photographs of local sanitation solutions, and focus groups discussions (FGDs) with multiple stakeholders in Mukuru. These FGDs were vital to analyze seasonal variations, covert strategies such as flooding-out latrines, and sensitive topics like open defecation. Additional spatial analysis would have undoubtedly complemented my discussion of excreta flows, but my time and resource constraints made this impractical. Furthermore, as argued below, my mainly qualitative approach to studying excreta flows may be more readily replicable for local organizations than existing highly technical methods.

I worked with two research assistants in Mukuru to conduct my interviews and FGDs as well as translate them from Swahili to English, and this dissertation received IRB approval with CPHS protocol 2014-10-6827. Both of the research assistants were trained in key principles of human subjects research (using materials provided by CPHS) and never retained access to my notes or FGD recordings. One research assistant was a middle-aged woman who resides in Mukuru; she provided translation assistance and also helped to recruit participants for the FGDs. Interviews with informal service providers were conducted in a primary school conveniently-located for residents and where privacy was assured. Meanwhile, an experienced sanitation practitioner conducted the FGDs in a community hall within Mukuru. These FGDs were recorded after we explained the purpose of research and participants gave oral consent (due to low levels of literacy in Mukuru). However, the interviews with informal providers were not recorded, reflecting the sensitive subject of the research. We explained the purpose and topics of the research as well as assuring the participants of confidentiality and anonymity; it soon became clear that their candor was greater if the interviews were not recorded. Similarly, my interviews with Nairobi Water officials were not recorded since they explored sensitive issues such as collusion and corruption. In the following chapters, no service provider or resident in Mukuru will be identified by name. I will indicate the *village* (particular neighborhood of Mukuru) where the participant lives, such as Sisal, Wape Wape, and Zone 48, and these areas may differ markedly in their services or infrastructure access (see Chapter 3 for discussion in context of sanitation).

In my **sanitation chapter**, I analyze the plethora of strategies for managing Mukuru's excreta and I develop a mixed-methods approach that can be replicated by local organizations. While recent analyses of the 'sanitation chain' recognize the need for comprehensive approaches (see Figure 6 below), I suggest that this discrete sequence is unhelpful and misleading for informal settlements. Instead, my findings indicate that Mukuru's wastes are disposed using a wide array of non-linear, often improvised strategies that can vary by season, residents' age, gender, and other factors. I also critique past studies of excreta flows that typically utilize epidemiological data that are too technical for local organizations (Gretsch *et al.* 2016), or miss fine-grained practices and variations in informal settlements (see World Bank's citywide 'shit-flow diagrams' in Peal *et al.* 2014). By contrast, I develop a mixed-methods approach for understanding slums' waste flows that local organizations can easily replicate. I utilized *photos and observations* of disposal methods (e.g., pipes to an open drain or emptying in a river), a *short survey* with manual emptiers, and *5 focus groups* that included simple *mapping exercises* and discussion with toilet caretakers, latrine emptiers, and community health volunteers. Furthermore, I underscore the importance of ongoing maintenance by male latrine-emptiers and (largely female) caretakers who clean shared latrines; I suggest that both groups offer key entry-points for future interventions. I argue for developing gender- and age-sensitive sanitation strategies as well as multi-sectoral initiatives combining fecal sludge management (FSM) with adequate drainage, menstrual hygiene facilities, and solid waste management.

Figure 6: Urban 'Sanitation Chain' (see Ross *et al.* 2016, p. 2)

I argue that **electricity cartels** simultaneously resemble gangs, electricity thieves, and informal workers; their multiple facets have created a corrupt, entrenched system that still provides an accessible service. Power cartels are comprised of youths who usually live in Mukuru, and they offer several benefits to customers (such as payment extensions, affordable connection costs, and regular maintenance) even if the services undoubtedly remain hazardous. Although they initially clashed over customers and were ethnically divided, my findings indicate they are now mixed and not primarily violent actors. My multi-pronged discussion will elucidate how cartels regularly collude with Kenya Power and the police; cooperate and compete amongst themselves; and provide flexible services that are quite socially-embedded. Additionally, providers vary in their levels of education and scale of provision, making some of these youths more vulnerable and potentially more aggrieved by slum electrification projects. While not downplaying the unsafe or collusive aspects, I aim to provide a nuanced understanding of these shadowy figures' multiple roles and to inform future electricity interventions. My interdisciplinary analysis has incorporated several literatures on 'electricity theft,' informal labor, and urban gangs/militias, in hopes of creating a fuller portrait of these complicated providers. Furthermore, I seek to enrich the literature on non-state providers (NSPs) by showing the mutability and complex motives of cartels, arguing against a static classification of NSPs focused more narrowly upon their profit orientation or sectarian ties (cf. Cammett and MacLean 2014).

My **interface** chapter investigates how Mukuru's informal water, sanitation, and electricity providers interact with formal actors, and my typology can motivate further comparative work. There are several related literatures on hybrid security governance (e.g. Meagher 2012, Lund 2006), 'areas of limited statehood' (e.g, Risse and Krasner 2014), and informal institutions (Levitsky and Helmke 2004). Yet past studies rarely offer a comparative framework on urban informal service providers, and I differ from Post *et al.* (2017) by focusing narrowly upon formal/informal ties amongst providers in informal settlements, rather than formal/informal ties at the citywide scale. While my fieldwork centered upon informal latrine-emptiers and electricity cartels, I offer illustrative comparisons to water cartels and sewer hook-ups in Mukuru as well. I argue that Mukuru's formal/informal interface is a continuum ranging from latrine-emptiers (usually ignored by police, Nairobi Water, and relevant ministries) to electricity cartels that regularly bribe and periodically clash with police or Kenya Power officials. Furthermore, I offer a new typology of informal providers as *invisibly parallel* (latrine-emptiers), *invisibly parasitic and collusive* (sewer hook-ups), *visibly parasitic* (water), and *visibly parasitic and collusive* (electricity). I also offer a detailed comparison of water and electricity cartels, who differ in their levels of conflict, salience of ethnicity, and competitive vs. cooperative pressures. Finally, I argue that formal/informal distinctions are still relevant and discuss how water and electricity providers can strategically deploy 'trappings of formality' (e.g., displaying official meters to avoid fines or bribes for their informal connections).

In sum, my chapters explore informal providers' complex roles, unravel their ties to formal actors, and propose tools or methods that can inspire future initiatives and research in other slums. My sanitation chapter develops a feasible method to analyze informal settlements' excreta flows; building upon these approaches can offer much-needed data and perhaps spur collaborations to enhance sanitation planning. Similarly, the concept of an 'interface' can generate further research,

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such as refining my typology or analyzing additional relations between other cities' formal/informal providers. Power cartels have been largely overlooked in past literature, while my findings can encourage further investigations into these intermediaries and explore the multiple facets of other non-state service providers. Understanding the interface not only helps to reveal the complex roots of informal provision but may also develop more appropriate interventions (such as tackling the utilities' collusion that has contributed to the emergence and well-entrenched role of cartels). Additional research with formal actors may complement my findings, thereby revealing how their knotty relations with informal providers are created and transformed. Moreover, my conclusion will discuss lessons from past partnerships with informal providers as well as innovative ways of emulating their accessible and flexible services. My dissertation thus strives to promote rigorous comparative research, enhance recognition of the complexities of informal service delivery, and support more appropriate interventions in African informal settlements.

Chapter 2
Illuminating Non-State Providers: A Portrait of Informal Electricity Cartels

<u>Introduction: Urban Energy Access and Informal Electricity Providers in Africa</u>

With rising attention to climate change and inequitable access to clean fuels, energy has gained in salience yet electricity for Africa's urban poor is still overlooked in policy and academic research. Globally, 1.2 billion people lack electricity, including 632 million people in Africa or 65% of the continent's population (IEA 2016, pp. 57 and 93). Per-capita electricity consumption in Africa is just 6% of the global average, excluding the outlier of South Africa (*ibid.,* p. 94). But in one promising trend, these shortfalls in energy access are increasingly recognized at the national or international development level. Although the MDGs lacked a target on energy, the Sustainable Development Goals seek "to ensure universal access to affordable, reliable and modern energy services" (SDG 7.1). Additionally, USAID's Power Africa and the UN's Sustainable Energy for All (SEA4ALL) initiatives have prioritized equitable access to modern energy in Africa and elsewhere in the Global South (IEA and World Bank 2015, USAID 2016). However, the focus is usually upon enhancing *rural* residents' access to electricity or solar power, rather than energy access in urban areas.[15] For their part, urban theorists and planners have explored ongoing energy transitions, with recent consideration for electricity networks in the Global South (Silver and Marvin 2016, also below). Yet urbanists largely neglect energy access or provision amongst Africa's urban poor, and informal electricity providers are almost entirely ignored.[16] In the following case study of informal electricity providers in a Nairobi slum, I explore how these groups not only distribute (often hazardous) electricity but also offer unexpected benefits to consumers, develop collusive relations with the state, and combine both market- and non-market motives.

In the utilities literature, informal provision is analyzed as part of 'electricity theft,' a complex concern linked to corruption and exclusionary electricity policies, but most responses are narrowly technical. Electricity theft can occur via several distinct pathways, including *fraud* (e.g. meter-tampering by consumers), *stealing power* (e.g., bypassing a meter, hooking a line illegally), *billing irregularities* (often in collusion with utility staff), or *unpaid bills* (Lewis 2015, Smith 2004). For instance, in Jamaica, 187,000 informal hook-ups were removed in 2014 alone; this modality of electricity theft was most common in Kingston's poor inner-city areas (Lewis 2015, pp. 133-4). Although wealthy households and commercial clients also steal power, electricity theft may reflect slum-dwellers' poverty and prohibitively-high connection costs, as well as corrupt or poorly-motivated utility staff (Mimmi 2014, Sharma *et al.* 2016). Corruption in the electricity sector is a well-known problem in the Global South, ranging "from petty corruption at the level of meter readers and linemen to grand larceny by the political executives...*But it is at the consumer interface that corruption is most blatant and widespread*" (Gulati and Rao 2007, pp. 117 and 125, emphasis added). Based on patchy evidence, electricity connections in the Global South frequently require bribes, while maintenance and repairs can again necessitate informal payments (*ibid.*).[17] For example, in Indian cities, slum-dwellers may bribe and collude with politicians, power officials, and/or police to access to

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[15] For exceptions, see Singh *et al.* (2014) and Butera *et al.* (2016). The latter desk review of energy access in Latin American and African informal settlements noted that existing data are either very old or missing altogether (p. 2094).
[16] Although overlooking informal electricity providers in African cities, see Silver (2015) for electricity access in Accra, Baptista (2015) for prepaid electricity meters in Maputo, and Von Schnitzler (2013) for meters in Johannesburg.
[17] According to the World Bank's household surveys in Nigeria, over 50% of urban residents (from all income quintiles) reported paying a bribe to receive a formal electricity connection (Kojima *et al.* 2016, p. 33).

electricity.[18] But to date, electricity theft literature has focused upon technical solutions like smart meters (e.g. Depuru *et al.* 2011) and rarely gives detailed accounts of how slum-dwellers collude with power officials, police, or politicians (see below for limited evidence).

Informal electricity connections have spread in Nairobi's slums, with organized groups sometimes becoming key providers. As a covert, sensitive topic, informal electricity is usually obscured in official statistics, but scattered surveys in Nairobi suggest it has increased in prevalence. According to World Bank research from 2004, just 22% of 1,700 households surveyed in Nairobi's slums had electricity (Gulyani *et al.*, 2010).[19] Among 113 households surveyed in Kibera in 2004, 42% had electricity (usually illegal), 55% used kerosene for lighting, and the rest utilized candles or lacked electricity (Karekezi *et al.* 2008). Subsequently, slum-dwellers seem to have gained electricity access often via informal means. In the settlement of Mathare, household surveys from 2011 found just 9% of residents had formal metered electricity, 68% had an informal connection, and 22% still lacked electricity (UCB *et al.* 2012, p. 34). Finally, based on a survey with over 2,600 households in Mukuru and Viwandani in 2016, 85% of households had electricity (Strathmore 2016, p. 22). But just 7% had a meter from Kenya Power (KPLC) and as many as 93% used a private service provider, with monthly payments to the latter averaging Ksh. 428.[20] Although this smattering of findings cannot definitively reveal trends, informal electricity seems ever more common for Nairobi's slum-dwellers; recent surveys in Mukuru and Viwandani indicate that informal private providers are the overwhelming majority.

Below I argue that Mukuru's informal electricity providers are socially-embedded and provide a flexible, accessible service that is often unsafe, but can also offer surprising benefits to poor households. I utilize interviews with over 50 informal providers that were unrecorded to explore sensitive topics such as recurrent bribes to police and utilities officials (see Section III on methods). Today's providers are usually young male residents who are ethnically heterogeneous and have established clear territorial divisions; initially, the groups clashed over territories and were more ethnically homogeneous. Contemporary providers vary in their scale of provision, levels of education, and other livelihoods, so that some vulnerable youths may lack other sources of income after electricity formalization. I also highlight the groups' unexpected benefits to residents, including very low connection costs, free security lights, and payment extensions during crises or income fluctuations. Providers usually live in Mukuru, and they are locally called 'cartels' who distribute 'stima' (from *steamer*) or 'sambaza' (for *spreading* in Swahili). Many *sambaza* providers take steps to foster adequate maintenance and safety, such as using fuses and coated wires on the plot (see Section IV below). Of course, fires and electrocutions are still distressingly common in Mukuru as well as other informal settlements.[21] Nevertheless, I highlight these benefits so that slum electrification campaigns can smooth the transition to formal power and perhaps replicate the cartels' positive aspects (see Chapter 5).

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[18] In Indian cities, "power companies refuse to give official connections to residents of slums...[but] they unofficially allow slum residents to tap into power lines. *Politicians, police, and bureaucrats are all complicit* in this lawbreaking, going so far as to collect rent from residents for unauthorized access to electricity. For their part, residents do not pay for the electricity they use, even if they pay an equivalent amount in bribes" (Gupta 2015 p. 561, emphasis added).

[19] Such low rates may reflect under-reporting of (presumably informal) electricity provision; alternatively, electrification may have occurred after this survey was conducted in 2004.

[20] For Mukuru's rare KPLC customers, the average payment was higher, at Ksh. 527 monthly (Strathmore 2016, p. 22).

[21] For a recent fatal fire caused by an electric fault in Mukuru, see "Toddler Burns to Death in Mukuru Slum Fire," *Daily Nation,* http://nairobinews.nation.co.ke/news/toddler-burns-to-death-in-mukuru-slum-fire (Feb 7, 2017).

I also argue that studies of non-state service providers (NSPs) cannot explain cartels' complex roles in their settlements; instead, cartels combine aspects of gangs, informal workers, and electricity thieves. Recent studies explore the profusion of African NSPs in housing, healthcare, and other vital sectors, and these actors are found to have ambiguous or negative impacts upon government accountability and equitable access to services (Kushner and MacLean 2015, also below). Although such contributions rightly underscore the diversity of African NSPs, I critique their rigid typology (non-profit, for-profit, religious, etc.) for failing to capture the dynamics of multifaceted electricity providers. In my alternative framework, I synthesize past research on electricity theft, urban gangs/militias, and informal labor that I suggest can better explain Mukuru's chameleonic power cartels. Literature on 'electricity theft' is highly relevant (e.g., Lewis 2015), but typically assumes that individual customers collude with utility officials and thus has missed *intermediaries* like cartels. Cartels may also resemble gangs and other non-state armed groups, such as in Rio de Janeiro where *milícias* again utilize electricity as a source of illicit income (Arias and Barnes 2013). In a further parallel to gangs, many electricity providers began as ethnically-divided but grew more diverse over time and typically alternate between conflictual and collaborative relations with the state (Rogers and Hazen 2014). But unlike gangs, my findings suggest that *sambaza* providers are only rarely violent or conflictual, and I argue that they offer a flexible, not solely profit-driven service that is tailored to poor customers, much like informal workers.

I begin with background on urban energy networks and electricity access in African informal settlements (Section I) before offering a framework that incorporates interdisciplinary literature on gangs/militias, electricity theft, and informal workers (Section II). Combining insights from these literatures, I suggest, may offer more helpful explanations of electricity cartels than past studies of NSPs. In Section III, my methods are explained and my interviews are analyzed in Section IV, including a brief overview that draws upon my alternative framework to highlight key findings. I then explore cartels' benefits to consumers (such as flexibility, affordability, and accessibility), the groups' changes over time, and collusive ties with police and Kenya Power. I also identify some differences within electricity providers, although such findings should be validated in surveys or through more extensive interviews. My analysis of consumer benefits again requires validation in household surveys or focus groups, as acknowledged in Section V on my limitations. I conclude by discussing why electricity cartels are so difficult to eradicate and identifying several areas for comparative research.

I. Urban Energy Networks, Connection Costs, and Access in African Informal Settlements
City planners, urban theorists, and geographers usually overlook urban energy systems or informal providers, even as energy systems are increasingly recognized as key to addressing climate change. An *Urban Studies* special issue on energy (2014) critiqued urbanists and planners for viewing energy as only a national policy concern, thus overlooking the mutual co-constitution of cities and energy systems (Rutherford and Coutard 2014). But these articles were focused upon the Global North except for a Cape Town study, which did not consider informal providers or energy access among low-income households (Jaglin 2014). A recent edited volume on urban electricity networks includes cases from the Global North and South, but has again limited consideration of informal providers (Silver and Luque-Ayala 2016).[22] Meanwhile, in his discussion of Accra's electricity, Silver (2015) analyzes the historical roots and inequitable impacts of interrupted provision, using insights

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[22] The volume includes studies of prepaid meters in Maputo as well as electrification in Rio's favelas and in Delhi's slums, which I will discuss in Chapter 5.

from urban political ecology (UPE).[23] In their useful article on African urban energy transitions, Silver and Marvin (2016, p. 11) call for analyzing informal/formal relations in Africa's urban energy systems and everyday interactions with the energy system in African cities, as well as additional attention to energy intermediaries (especially international organizations). Finally, a relevant edited volume *Beyond the Networked City* recently explores the "logics, contradictions, and tensions present…at the margins of, in the interstices of, in combination with, or simply in the place [of] centralized infrastructure networks" (Coutard and Rutherford 2015, p. 9). In the following case study, I explore such tensions and alternative logics of hybrid provision but with a focus upon the informal electricity cartels often missed in past literature.

Within the electricity sector, few studies or statistics consider the challenges in African slums, though patchy findings suggest widespread electricity theft in East Africa. Due to rapid population growth and rising demand in Africa, the pace of electricity expansion is usually glacial or nonexistent. For African nations from 2010-2012, the average annual growth in electricity access was a minuscule 0.03% (SEA4ALL 2015, p. 48). Even more concerning, Kenya's annual rate of change in electricity access was negative, declining by about 2.75% from 2010-2012 (*ibid.,* p. 45). And while inequities in rural/urban electricity access are widely-recognized, there are limited data on the shortfalls in informal settlements. Based on the latest figures from the International Energy Agency (IEA), rural electrification averaged just 19% in African nations, far below 63% in urban areas.[24] For Kenya, the IEA again reported major rural-urban disparities, with rural electrification rates of just 7% as compared to 60% in Kenyan cities (*ibid.*).[25] But these statistics are not based on household-level surveys, and only national-level data are available on transmission and distribution (T&D) losses, the common proxy for electricity theft. T&D losses over 6% are considered problematic (Lewis 2015) and Kenya's T&D losses reached 18% in 2013, only slightly better than the corresponding figures of 19% in Ethiopia and 20% in Tanzania.[26] Such findings hint at widespread electricity theft in East Africa, while Kenya's sluggish electrification rates and rapid urbanization underscore the vital need to increase access to power in urban areas.

Legal electricity connections are often extremely costly in Africa, posing major obstacles for urban poor, and legal or policy obstacles to slum electrification may also be significant. As a World Bank paper noted, exorbitant connection fees for electricity "can constitute a powerful disincentive…no matter how much [households] might desire the service" (Golumbeanu and Barnes 2013). Kenya Power's connection costs are as high as $460 (GPOBA 2016a) while the average monthly income was just $120 for residents of Mukuru and Viwandani (Strathmore 2016, p. 31). Additional barriers may include land tenure requirements (difficult to fulfill in many informal settlements), poorly-aligned energy and city planning policies, and inadequate incentives to electrify low-income urban households (for Kenya, see Karekezi *et al.* 2013, also review by Singh *et al.* 2014). Such obstacles are increasingly recognized, and recent initiatives seek to overcome them via prepaid meters and/or lower connection costs (GPOBA 2016b).[27] Meanwhile, electricity access for the urban poor remains a major concern, as confirmed by the World Bank's recent household surveys in

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[23] Silver (2015, p. 987) notes that UPE studies have focused on water but rarely upon electricity and most urban energy studies use a socio-technical transitions approach (e.g., Jaglin 2014).

[24] See http://www.worldenergyoutlook.org/annexa/2016annexa

[25] Kenya's Demographic and Health Surveys (DHS) from 2014 found slightly higher electrification rates, 13% in rural areas and reaching 68% in urban (KNBS and ICF International 2015, p. 2).

[26] See World Bank data available at http://data.worldbank.org/indicator/EG.ELC.LOSS.ZS

[27] Although the cost of extending power may be lower in cities than rural areas, utilities agencies rarely prioritize poor urban households and the logistical or legal barriers to electrifying slums are often considerable (as noted above).

22 African nations. An average of 33% of these urban poor households had electricity, though ranging from 6-7% for poor city-dwellers in Uganda and Tanzania to 87% in South Africa and 88% in Nigeria (Kojima *et al.* 2016, p. 13). While the World Bank did not include Kenya in these surveys, Kenya's high connection costs and barriers to electrifying informal settlements are once again significant concerns.

Studies in Nairobi's informal settlement of Kibera suggest that informal electricity connections are widespread, but researchers typically overlook the providers themselves. A 2004 survey with 113 Kibera households found that 42% had electricity, often acquired communally or via illegal connections; common challenges included electrocution, meter tampering, and poor-quality wiring (Karekezi *et al.* 2008). By 2014, when a randomized survey was conducted with 650 grid-connected households in Kibera, just 5% of respondents had an individual meter and 88% paid a fixed amount for electricity (Figueroa 2016, p. 545). That is, 88% likely had an informal connection since a fixed fee suggests an un-metered connection, although respondents rarely admitted to this (*ibid.*).[28] Informal electricity was usually a taboo topic, with 73% of respondents saying electricity theft was 'extremely unacceptable', and just 35% confessed to 'borrowing' electricity (*ibid.*). When asked why they lacked a Kenya Power connection, 53% said that connecting was too expensive (confirming the above findings on high connection fees), while 16% said their current provider would not allow it, and 8% tried but could not secure a connection (other reasons not reported). In the next section, I explore related literatures on NSPs and electricity theft, before turning to key findings on gangs and informal labor that I suggest can offer additional insights into Nairobi's sambaza groups.

II. Conceptualizing Cartels: Non-State Providers, Thieves, Gangs, or Informal Workers?
Non-State Providers (NSPs)

Researchers have begun analyzing the profusion and diversity of NSPs in Africa, as well as exploring their often-ambiguous political or social impacts. This literature highlights the recent ascendance of NSPs: the "numbers, diversity, and importance of non-state providers [have expanded] enormously" in Africa as well as elsewhere in the Global South (Kushner and MacLean 2015, p. viii). Although NSPs have been influential throughout African history, their ongoing rise is linked to macro-trends such as democratization, weak state capacity, and the spread of market economies (*ibid.,* p. xi). Related work has analyzed the "diverse motives" of NSPs, including ethnic, community-based organizations (CBOs), kin and friendship networks, non-profit and profit-based organizations (Cammett and MacLean 2014, p. 259, also below). These NSPs vary in their level of personalization; profit orientation; local or national locus of operation; and inclusive or exclusive eligibility criteria (*ibid.,* p. 41). A relevant case study discusses the burgeoning NSPs in Kenyan and Ugandan renewable energy (including an array of NGOs, social enterprises, and for-profit firms) but is focused upon rural rather than urban energy providers (MacLean and Brass 2015). Other research indicates that African NSPs are frequently politicized and may have mixed or negative impacts upon state accountability, political participation, and equitable access to housing, healthcare, and other key services (Kushner and MacLean 2015, Katusiimeh 2015, Paller 2015). Taken together, these findings offer a helpful corrective to state-centered models of service delivery as well as a circumspect assessment of their effects upon political life and civil society in Africa.

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[28] For those paying a fixed amount, the monthly charge averaged Ksh. 414 (Figueroa 2016). Respondents averaged 12.6 hours per day of electricity use and 61% had a single bulb; 84% also used candles and 51% used kerosene lamps, suggesting problems with reliability and multiple coping strategies during blackouts (*ibid.*).

However, past studies may overlook the complex, fluid roles of NSPs, and I argue for an alternative framework that can better reveal providers' changing motives and dynamic relations with the state. While uncovering the diversity *between* NSPs, this literature has usually offered a rigid, static classification of providers that may miss their multiple motives and changes over time. As noted above, NSPs have been categorized as private-sector, ethnic/sectarian, faith-based, community-based, informal brokers, or family/friendship networks (Cammett and MacLean 2014). These authors also note that NSPs differ in their level of personalization (informal/personalized vs. formal/rule-based), locus of operation (local vs. international), profit orientation, and eligibility criteria (inclusive vs. exclusive). But according to my findings, *sambaza* providers in Mukuru are a multifaceted, evolving mix of types: they are personalized, local organizations that shifted from mono-ethnic to more inclusive eligibility criteria, while their profit orientation is strong but not absolute (see Section IV below). Furthermore, Mukuru's electricity cartels both collude with and undercut KPLC, suffering regular extractions but also taking advantage of the massive corruption that allows them to serve residents in the absence of formal providers. It should be acknowledged NSPs represent an emerging field of enquiry, and researchers have called for "more systematic data [to] illuminate the breadth and depth of non-state provision across Africa" (Kushner and MacLean 2015, p. xiii). Still, the concern to create crisp typologies may leave these authors ill-equipped to analyze NSPs that are not readily classified as profit-based, CBOs, ethnic, or other clear-cut categories. A framework more sensitive to the dynamics and complexities within NSPs can, I suggest, better explain Mukuru's electricity cartels, and below I develop an alternative approach by synthesizing work on electricity theft, gangs, and informal labor.

Electricity Theft

Electricity theft can lead to brownouts or blackouts, load shedding, and fire hazards, while also reducing utilities' revenues and contributing to a downward spiral in the quality of formal provision. Consumers may utilize several stratagems to reduce or eliminate their utility bills, such as 1) directly tampering with the meter, 2) bribing an engineer or agent to record a lower reading, and 3) combining legal electricity for small household purposes with illegal electricity for heavy loads like pumping water (Depuru *et al.* 2011, pp. 1008-9). Electricity theft can be widespread not just in low-income households, but also among influential governmental officials and industrial firms (Smith 2004). In turn, power companies can suffer major economic losses from a vicious cycle of reduced revenues and trust, leading to limited investments and expansion of generating capacity (*ibid.*). At a micro-level, illegal connections often produce "fire hazards and sporadically [lead to] the death of power thieves or even unsuspecting persons who are inadvertently electrocuted" (Lewis 2015, p. 121). Estimates of electricity theft are inevitably scarce and unreliable, but the World Bank's data suggest it is rising and extremely prevalent, especially in nations with weak rule of law and rampant corruption (Smith 2004, Lewis 2015).[29] These studies usefully highlight the far-reaching negative ramifications of electricity theft, and my fieldwork in Nairobi confirmed the widespread meter-tampering, hazardous connections, bribes to utility staff, and use of illegal electricity to pump water (see Section IV).

Existing literature has also identified key factors undergirding the incidence of electricity theft, yet usually overlooks *who* provides power in favor of developing technical solutions. Part of the challenge is methodological because, as noted above, electricity theft is often invisible and analyzed only at the national or state level. National data on T&D losses indicated that 50 out of 100

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[29] In 2011, World Bank data indicate that South Asia had the highest levels of T&D losses (20.4%), followed by Latin America (14.9%), Middle East and North Africa (12%), and sub-Saharan Africa (10.8%) (Lewis 2015, p. 131).

nations had higher levels of electricity theft in 2011 than in 1980 (Lewis 2015, p. 126, using World Bank data). In particular, Africa's T&D losses rose slightly from 9.1% to 10.8% (for 1980-2011) while Latin America's climbed from 12.5% to 14.9% and South Asia's ticked up from 19.4% to 20.4% (*ibid.,* p. 131). Offering a comparative analysis of electricity theft in Indian states, Gaur and Gupta (2016) conclude that electricity theft was more limited in states with lower corruption, higher levels of literacy and income, higher state tax to GDP ratio, and greater efficiency in collecting electricity bills (using data from 28 Indian states for 2005-2009). While such findings suggest the need to tackle political, socioeconomic, and organizational causes of electricity theft, most interventions adopt a narrowly-technological approach. Responses typically favor technical solutions like smart meters or automated meter-reading (Depuru 2011), but minimize psycho-social factors and the organizational culture of utilities agencies (see critique in Sharma *et al.* 2016).

Large-scale surveys in Indian and Brazilian informal settlements usefully explored patterns of electricity theft, but again largely neglect the informal providers themselves. These two surveys were conducted before slum electrification projects, helping to ensure more reliable findings on the sensitive topic of electricity theft. In a 2006 survey with 15,000 households in Belo Horizonte's favelas, 23% had illegal electricity, such as an irregular connection or illegally-obtained power from another dwelling (Mimmi and Ecer 2010, p. 5085). Multivariate analysis indicated that illegality was not only associated with household income, but also with poor electricity equipment and low-quality standards (*ibid.,* p 5093). Another large-scale study in 4 Mumbai slums gathered data for 1,400 respondents with informal electricity, alongside 1,300 with legal connections (Mimmi 2014). The survey identified several barriers to formal electrification, including higher monthly payments (32%), expensive connection costs (29%), illegal structure or lack of formal address (13%), or provision already offered by the landlord (14%). Furthermore, respondents stated that informal providers were either a) an influential community leader or business-person (75%); b) neighbors (19%); or c) other, unidentified provider (2%) (*ibid.,* p.74). Thus, informal electricity providers in Mumbai's slums were usually influential local leaders or businesspeople, with neighbors coming a distant second. The author rightly emphasizes the centrality of "unofficial governance...and the importance of recognizing the informal interactions at play" in slums' electricity (Mimmi 2014, p.74). Such tantalizing glimpses into informal electricity providers, however, are not examined further in these or other electricity theft studies.

In another shortcoming, electricity theft is usually viewed narrowly as a dyadic relationship between a consumer and utilities official, missing the vital roles of intermediaries and of other formal actors. Gulati and Rao (2007) carefully analyze electricity theft and multiple forms of corruption, but the main protagonists are limited to consumers, linemen, billing staff, or utility managers (see Appendix 1). They largely overlook intermediaries such as organized groups, politicians, or other officials, although findings from South Asia suggest these actors can play a significant part in electricity theft. For instance, in a Dhaka slum, local businesses and strongmen jockeyed for control over electricity distribution, and hefty bribes were needed to connect before they could informally distribute power (Hossain 2012).[30] These providers also cultivated political ties and regularly paid the power company as well as the police, so that the officials would turn a blind eye to their redistribution (*ibid.*). As discussed in Section IV, I uncovered similar patterns of bribery and collusion in Mukuru between electricity cartels, police, and Kenya Power. Another study in Dhaka's slums found that musclemen (*maastans*) pay the formal utility for shared 'pole meters,' and slum-dwellers pay *maastans* perhaps 3 times more per kWh than the formal tariff (Hossain Lipu and

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[30] Including bribes, an electricity connection in this informal settlement may cost $4000-$5000 (Hossain 2012, p. 73).

Waliullah Bhuiyan 2014, p. 6). Finally, residents of a squatter settlement in Islamabad pay the police and power officials to ignore their illegal connections, which were hooked from a nearby middle-class area (Naqvi 2016). In hopes of revealing the complex dynamics of Nairobi's informal electricity providers, below I draw selectively upon studies of gangs and informal laborers.

Urban Gangs and Informal Labor

Comparative analyses of gangs have recognized the mutability and complex motives of these groups, who may sometimes provide public goods or services but also destabilize and extract from fellow residents. Gangs have been defined broadly as displaying *institutional continuity* and routinely engaging in *violent behaviors* considered illegal in their societies, with members typically *youths* under the age of 25 (Rogers and Hazen 2014). Based on past studies of gangs in the Global South, researchers consistently find that the groups are chameleonic yet usually remain socially-embedded (Winton 2014). This literature indicates that gangs can change "several times over the lifetime of the group"; the groups can shape as well as respond to social, political, economic, and security activities in their communities (Rogers and Hazen 2014, pp. 13 and 17). For instance, the Bakassi Boys in Nigeria began as a locally-legitimate vigilante group that promoted public security, but was later coopted by state officials and adopted increasingly violent, extractive tactics (LeBas 2013). Gangs' key aims may vary over time and can extend beyond profit-seeking to creating a sense of brotherhood and family or promoting security (though perhaps opportunistically generating a need for their own security services). Importantly, however, gangs are only occasionally political and typically operate in a small community, rarely achieving a broader territorial scale (Hazen 2010). Unlike other armed groups, gangs "have not sought to overthrow governments" and instead will typically collaborate with government officials (including law enforcement) or seek to evade detection (*ibid.,* p. 378). I will argue that electricity providers resemble gangs in that cartels *regularly collude* with state actors *or seek to avoid detection*; *have changed* in their composition; *but remain socially embedded* in Mukuru (see Section IV).

Furthermore, gangs and militias in the Global South sometimes provide public services and infrastructure, with potential to foster local legitimacy while also profiting from state incapacity or neglect. In Haiti, gangs can assist residents in accessing medical care or garbage collection, making home repairs, or paying school fees (Winton 2014, p. 404). For well-established gangs or militias in Rio de Janeiro's favelas, these groups require at least a minimal amount of legitimacy and may therefore offer services like preventing or punishing crime, providing support for welfare, or sponsoring public entertainment (Arías and Barnes 2016, pp. 8-9). Perhaps most relevant, a state-linked militia in Rio's Zona Oeste took control of electricity, water, sanitation, cable TV, and internet delivery, as well as running several protection rackets (*ibid.*). Although some armed groups in Rio are exceptional for their ties to the lucrative drug trade, they are not unique in providing public services or infrastructure. Similarly, in Nairobi, the Kikuyu militia Mungiki has dominated some routes of local mini-buses (*matatu*) in addition to controlling water-taps and electricity distribution in the slum of Mathare Valley.[31] Gangs have their own particular histories and findings should not be generalized, since groups can be far less influential than Mungiki or other well-known cases. Nevertheless, there is ample evidence of some gangs delivering public services, especially in cases of governmental incapacity or unwillingness to serve informal settlements.

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[31] For matatu and Mungiki, see Rasmussen (2014), pp. 224-5; for Mathare water, see Corburn and Makau (2016), p. 175. In Chapter 4, I will also discuss crackdowns against Mungiki-dominated water cartels in Mathare.

But while gangs are defined in part by violent behavior, I argue that conflict is not central to *sambaza* and insights from the informal economy can explain these providers' multiple aims beyond profit or violence. In their Polanyian analysis of the informal economy, Hillenkamp *et al.* (2013) argue that profit is rarely the sole or paramount goal of informal enterprises. Along with market motives, other key principles of economic integration include *reciprocity* and *house-holding* (Hillenkamp *et al.* 2013, pp. 5 and 8). 'House-holding' occurs in a (typically domestic) group and involves sharing production to satisfy the group's needs.[32] 'Reciprocity' is defined as horizontal exchanges and complementary obligations among peers (*ibid.*), with reciprocal norms reflecting informal workers' patterns of mutual aid and their community embeddedness (Lemaître 2013, p. 28). For instance, in surveys with nearly 500 informal food vendors in Cape Town's townships, 58% offer their goods on credit (Battersby *et al.* 2017, p. 28). Even though these vendors are typically survivalist, 70% of those providing credit do so interest-free and usually give credit to their well-known customers. These informal workers not only seek profits but also aim to build social capital (*ibid*).[33] Finally, economic principles in the informal economy can be analyzed without assuming any *a priori* hierarchy (Hillenkamp *et al.* 2013, p. 8). I use these insights to explore how electricity providers are not solely profit-driven but can also utilize more inclusive, flexible approaches with customers or even occasionally with rival cartels. Although I do not downplay the profit-oriented facets of illegal electricity, I will highlight other logics like mutual aid that can produce unexpected outcomes such as extended repayment times or sharing transformers (Section IV).

III. Methods

I utilized interviews with over 50 providers rather than conducting surveys or focus groups, as the latter may have yielded inaccurate data about scale of provision, bribery, or other sensitive practices. A middle-aged woman from Mukuru provided translation in a private, secluded area inside a local school. Respondents were assured of strict confidentiality and that no one in Kenya Power or government would be informed of their responses. Although I recorded a few interviews (with providers' oral consent), I realized that I received more candid responses when interviews were unrecorded and I took detailed notes. Some providers were initially hesitant to discuss meter-tampering or other illegal practices, but they usually spoke openly when they realized I had already heard similar stories. For instance, a provider in Sisal said that his group had a meter and when asked if they actually use it, he smiled and replied, "only with inspection" (Nov 29th, 2016). As explained below, cartels may display a meter to give a veneer of legality during KPLC's periodic inspections, but meters rarely record actual consumption, similar to past electricity theft studies (Depuru *et al.* 2011). We interviewed providers residing in different villages as well as having various ethnic backgrounds and contrasting sizes of clientele, thanks to my research assistant's contacts and snowballing as we met additional providers. Interviews lasted 45 to 60 minutes and explored their ways of accessing electricity; connection, payment, and maintenance practices; and relations with Kenya Power, police, and other cartels. Respondents were also asked to discuss changes over time (in the groups' ethnic composition, levels of conflict, etc.); to compare water and electricity cartels; and to explain their perceptions of an ongoing slum electrification project.

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[32] *House-holding* denotes patterns of group support and self-provisioning, such as cartels who pay for fellow members' bribes (see Section IV). The other Polanyian principle is *redistribution*, implemented in vertical or hierarchical institutions and based upon centralized systems (Hillenkamp *et al.* 2013, p. 5) but such systems are less relevant in Nairobi's slums.
[33] Related research in Nairobi has analyzed how social and ethnic networks help informal workers to access credit, public space, or inputs and create a sense of community; see Totolo (2013), Lyons and Snoxell (2005), and Macharia (1997).

I also aimed to interview KPLC engineers, ex-cartel members, and high-ranking electricity providers who frequently interact with Kenya Power, but had more limited success with these groups. While I did interview 5 larger-scale providers who spoke candidly, I could not successfully recruit 'chairmen' at the transformers who interact most frequently with KPLC. Additionally, I recruited 5 ex-cartels to discuss why they left *sambaza*, their previous relations with Kenya Power or police, and other reflections. Besides these interviews with providers, I had a phone interview with a local expert who works at an energy NGO called AFREPREN and wrote his Master's on informal electricity in Kibera. I also spoke with a *Daily Nation* reporter who had interviewed water and electricity cartels in Kibera and a community leader at Map Kibera, who was again familiar with these groups. Finally, I interviewed a KPLC engineer who discussed his relations with cartels in Mukuru (unrecorded) and met with a World Bank official who was advising the electrification project. Unfortunately, I lacked time to interview other KPLC or World Bank staff, and could not examine the ongoing electrification project in detail. Fieldwork was conducted over about 4 months in total from 2015-2016, interspersed with my other case studies, and was complemented by a desk review of other slum electrification initiatives (see Chapter 5). In Section IV, I discuss my findings before offering conclusions and reflections in Section V.

IV. Findings on Multifaceted, Dynamic Electricity Cartels in Mukuru

I argue that cartels combine elements of gangs, electricity thieves, and informal workers, and I underscore their shifting motives and complex, often collusive relations to formal actors. With parallels to *gangs*, cartels establish territories, collude with the state (i.e., police, KPLC engineers) or else try to evade detection, and both gangs and cartels remain socially-embedded in their communities. *Electricity theft* literature has already analyzed meter-tampering techniques and individuals' collusive ties with the utilities, while I argue that literature on *informal workers* can help explain the coexistence of profit, reciprocity, and other non-market logics in informal electricity. Taken together, my findings indicate that cartels alternately 1) substitute for and undercut the formal utility, 2) clash and cooperate amongst themselves, and 3) offer a profitable service that is still flexible and tailored to poor customers. To support this multi-pronged argument, Section A) will analyze cartels' ties to formal actors, Section B) will explore changes within cartels and their heterogeneity, and Section C) will discuss their service and maintenance aspects. Providers' service dimensions help to differentiate cartels from gangs or electricity thieves, but their collusive ties to formal actors and changing roles over time represent other crucial facets. These overlapping logics may together help to explain why informal electricity in Mukuru has become a highly-entrenched system that serves multiple vested interests (see Section V).

Market motives only partly explain how electricity cartels operate, and their seemingly-contradictory pro-poor and mutual aid aspects are also significant. *Reciprocity* is an underlying current of sambaza, such as extending payment deadlines during crises (particularly for good customers) or providing free electricity to plot caretakers in exchange for bringing clients.[34] Providers connect new customers for a nominal wiring fee of perhaps Ksh. 150 to 300 ($1.50 to $3).[35] For instance, a provider serving 40 households and 10 businesses in Milimani will connect a new customer for Ksh. 200. When asked if he gives customers extra time to repay, this well-educated provider replied, "It would depend on the problem. [A customer] can go even 2 months without paying -and it depends

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[34] According to a provider in Sisal serving 30 households, a caretaker is given for free "because he's the one who has given the plot" [*i.e., as a reward for delivering the plot's customers*] (Nov 29th, 2016). Some providers only serve the caretaker for free if serving the entire plot, but it is common to give free or reduced rates to caretakers as a gesture of reciprocity.
[35] A provider in Sisal noted gloomily that new connections are a loss for his group (Nov 29th, 2016, 5 years in sambaza).

on how loyal the customer is" (Nov 30th, 2016). Payment extensions are extremely common, although other providers were less generous and give perhaps 5-10 days or an extra month. Additionally, most *sambaza* providers offer free security lights at the gate, corridor, and/or near a plot latrine; even small-scale providers typically offer at least 1 free bulb. In Zone 48, a provider with 80 households will give 1 to 4 free security lights (depending on the plot's size), which is "because of nighttime thefts, and it helps people going to the toilet" (Dec 9th, 2016). A smaller-scale provider with 30 households and 5 businesses in Milimani gives 2 free security bulbs per plot, explaining it was "because of marketing -if you want business to be good, you must market" (Dec 10th, 2016).[36] The use of *free* security lights as a 'marketing' tactic exemplifies the close interplay between sambaza's logics of profit and reciprocity. By providing free security lights, flexible repayment options, and low-cost connections, cartels demonstrate that they are deeply embedded in Mukuru and seek to serve their fellow residents. Below I continue to unravel electricity cartels' relations with police, KPLC, and customers, as well as their internal heterogeneity and changes over time.

A) **Collusion and Extraction:** Wires, Bribes, and Other Inextricable Ties to Formal Actors

By selling reduced-cost supplies to cartels, KPLC engineers tangibly demonstrate their links to informal providers, while cartels utilize different wires depending upon their desired safety levels. Along with wires, providers often obtain fuses from KPLC and enjoy steep discounts, as explained by a leader in Milimani (Sept 19th, 2015). His group can purchase a box of 24 fuses for Ksh. 1500 from Kenya Power, below the usual price of Ksh. 2500; wires cost Ksh. 30 per meter at the shop, but can be bought for just Ksh. 15 per meter from their Company contact.[37] Although the particular prices of wires depend on the groups' negotiations with engineers, the basic pattern of buying wires and fuses from KPLC is extremely common. A few well-connected cartels even received white jackets from KPLC to protect them from police,[38] offering an especially stark demonstration of the interwoven, highly collusive relations between formal and informal providers. Whether wearing a KPLC jacket or using their cheap wires and fuses, cartels are palpably tied to the formal utilities whom they simultaneously subvert. Furthermore, variations in wire types reveal the tensions in *sambaza* between customer safety and competitive, cost-cutting pressures. In public spaces, providers reduce costs by utilizing naked wires; copper wires can be stolen and are too expensive.[39] But on the plot, providers routinely use coated wires to promote safety (see photos in Chapter 1). A provider working for 6 years in Milimani said they initially used copper wires "but people were stealing, so we use aluminum [now]. *But you use coated ones on the plot?* Yeah" (Nov 26th, 2016, also below Section B for cartels' wire theft). Naked wires are of course more hazardous and cartels thus compromise on safety in public areas, while using higher-quality wires in closer proximity to their customers' homes.

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[36] Similarly, a provider with 75 households in Milimani gives 2 to 3 free bulbs (depending on the plot's size) and he again noted it is "for marketing –people see how your power is, whether it's bright or dim" (Dec 9th, 2016).

[37] I found the same practices in fall 2016: for instance, a large-scale provider in Vietnam typically purchases wires from KPLC engineers: "When an engineer comes to install a transformer, that's when you buy wires. *For a good price?* Yeah, it's a good price because it's not known *[i.e., a secret deal]*" (Dec 3rd, 2016). Similarly, a provider who has worked 4 years in Sisal usually buys wires from engineers when they repair a transformer; the price is usually 100m for Ksh. 500 or $5 (Dec 5th, 2016). Other providers buy wires from a shop, suggesting they are not as well-connected to KPLC.

[38] "*Do you also get jackets?* Yes, from Kenya Power during inspection. *How does Kenya Power explain the jackets?* They say in case of police, we should not be arrested. *So it's to protect you?* Yeah" (Aug 14th, 2015).

[39] In a rare exception, a large-scale ex-provider in Wape Wape used coated wires both outside and inside the plot. As he explained, "I was caring for the lives of people, children…if a child comes and touches it [naked wire], he'll just be killed. *What do the others say?* They say it'll be a loss—they use naked wires. They say it's expensive, but I used coated wires outside" (Dec 21st, 2016, provider from 2009-2016 before switching to garbage collection).

Cartels' major interactions with formal actors usually center upon bribery; the level of extraction will depend on the violation discovered, maintenance needed, and/or the group's own clout. Precise amounts are constantly renegotiated, but bribery is *de rigeur* for both KPLC officials and police in Mukuru.[40] Common payments to Kenya Power engineers include bribes for fixing or replacing a transformer; buying a dropline or meter; and reading or tampering with the meter. According to a large-scale provider in Milimani who has a meter (costing Ksh. 35,000), it is read monthly, but he bribes the KPLC engineer to charge him less than the meter's reading: "[the meter] reads a few houses -it can't read properly because I need to earn something. *Does KP check it regularly, like monthly?* Yes. *Do you give them chai?* He must get something from me because others are not read. *How much?* Ksh. 200 or 300 per month" (Dec 3rd, 2016). 'Chai' (or 'tea') is a small bribe, in this case Ksh. 200-300 for reading less than the metered amount. After paying Kenya Power, providers usually receive a prompt response, especially during a blackout when speedy restoration of power is crucial.[41] Cartels may also pay *kitu kidogo* ('something small,' a common phrase for bribery) so as to quickly install a transformer or dropline, which can be Ksh. 5000 to 10,000. A provider in Milmani explained, "To get a dropline, it's Ksh. 30,000. *Plus kitu kidogo?* Of course. That's 8,000 to 10,000. *I laugh and exclaim that's something big (kitu kubwa), not small.* If you pay, they must do it fast [*ni lazima haraka*]" (Aug 14th, 2015). Cartels' biggest payments are for new transformers: a medium-sized transformer is usually Ksh. 30,000 and a big transformer can be Ksh. 50,000-60,000 (according to long-term providers). KPLC engineers also charge for repairs, such as Ksh. 10,000 to 30,000 for fixing a transformer.[42] But for all their odious extractions, KPLC does offer concrete benefits to the cartels, such as discounted supplies and faster services.

By contrast, police have an almost entirely extractive relationship with *sambaza* providers, and the arrested member usually responds by mobilizing funds from his group or even asking for KPLC's help. Police typically demand smaller bribes for having pliers or electricity testers (Ksh. 200-500), but being caught on the transformer at night is far costlier (at least Ksh. 10,000). An arrested provider usually solicits payments from his group before being brought to a court at Embakasi, where fines are at least Ksh. 20,000. But for the most well-connected groups, Kenya Power officials may negotiate for a smaller bribe or even share these funds with the police. According to a member of an influential cartel locally called 'Njenga Power', KPLC often helped his group with the police and secured lower bribes:

> *Does Kenya Power ever help you with the police?* Yes, [names his engineer contact at KPLC] comes to the police and comes with Kenya Power's police. You have to pay him around Ksh. 10,000 [instead of 20,000] and he removes you [from the police station] with Kenya Power's police. *Has this happened many times?* Many times. *Does he negotiate with the police for less money?* He talks with inspector and says 'they don't have money,' so they share (Sept 4th, 2015).[43]

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[40] See Ranganathan 2014 for similarly collusive practices by Bangalore's 'water mafia' and Chapter 4 below for further comparisons between informal water and electricity providers.

[41] In contrast with other cities in the Global South, electricity generators are rare in Nairobi's slums and thus the prompt restoration of power after a blackout is essential.

[42] A large-scale provider in Zone 48 since 2008 complained that KPLC previously had lower charges for new transformers, but fees rose sharply: "*Is it cheaper for a transformer now?* [No]. Before, they asked for Ksh. 10,000 for a big transformer, now it's Ksh. 60,000!" (Dec 6th, 2016). A medium-sized transformer is now Ksh. 30,000 and cartels typically pay Ksh. 10,000 to 20,000 for repairing a transformer.

[43] Similarly, an experienced ex-cartel said that KPLC had negotiated with the police to release members of his group, sometimes taking a cut but other times not extracting anything: "When you talk to the police and they don't listen, we call Kenya Power. They take the guy at AA [a local landmark] in their Land Cruiser; then you negotiate so they don't

Alternatively, some groups regularly pay the police (either weekly or monthly), in hopes of staving off steep fines, but they were usually still harassed. Although an ex-Njenga Power leader admitted to making weekly payments to the police (totaling Ksh. 3,000 to 5,000 per month), the head police officers ('big fish') probably took the money and so his group was still harassed by the 'small fish' (Aug 12th, 2015).[44] Only a few cartel members reported police beatings, and this seems uncommon since most officers are content with regularly taking bribes. Thus, a few well-connected cartels can receive help from KPLC, but the typical pattern is paying sizable bribes to the police and often pooling funds from fellow providers (see Section B below).

In perhaps the starkest instance of collusion, KPLC officials usually alert cartels about upcoming inspections that ostensibly intend to eliminate informal provision. Rather than catching the informal providers unawares, inspections are almost invariably pre-announced. A KPLC contact will usually call a leader the day before an inspection, giving the group sufficient time to remove their wires and display their meters (if available). As a seller in Milimani with a meter explained, "Yeah, the very people we give money [from KPLC], they tell us they are coming [at inspection]. *Do they always tell you?* Yeah, it's a normal exercise. We remove illegal connections, remain with the genuine ones –when they leave, we start connecting" (Sept 3rd, 2015). Similarly, a provider in Sisal explained that before inspections, "the engineer told us…We had to remove all the wires and leave the meter to run—it's *as if it's legal*" (Nov 29th, 2016, emphasis added).[45] Many providers recounted this well-rehearsed routine of announced inspections, disconnecting illegal wires, displaying meters (if applicable), and immediately reconnecting *sambaza* wires as soon as KPLC leaves Mukuru. Although Kenya Power did impose fines, arrests, and large-scale disconnections in 2012, inspections are now rare or pre-announced so that they cannot hope to stamp out cartels. Indeed, one provider reported that as soon as KPLC officials ended the major inspection in 2012, they *re-sold the same confiscated wires back to his group*.[46] Further underscoring the rampant collusive relations, some providers made their initial contacts with Kenya Power during inspections.[47] Even when Kenya Power attempted to eliminate illegal connections at inspections, some officials instead forged new linkages with the cartels they purportedly are rooting out.

Many of the above-mentioned corrupt, collusive interactions were confirmed by a KPLC engineer who works in Mukuru, and he noted that until quite recently there was limited effort to eradicate cartels. This (unrecorded) interview took place in a café outside Mukuru with my research assistant; we happened to meet him a few weeks beforehand when he was doing repairs in the settlement. He is in operations and management, with 2 decades' experience at KPLC, but embittered from a past challenge when he was in Kibera and perhaps therefore was willing to talk. He confirmed that Kenya Power will call cartels before inspections, so the cartels "go remove

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take him to court. You don't pay police, you pay Kenya Power. *What's the price?* Depends on the guy; these things are negotiated…One day it's Ksh. 10,000, 20,000 but the next day it's nothing" (Aug 24th, 2015).

[44] Another interview uncovered a similar pattern of giving weekly but still not managing to avoid police harassment. "*Do you pay the police weekly, or only when caught?* We don't tell numbers but as leaders, we always give Ksh. 500 every Saturday because we want to facilitate things, for it to move well. *Does it make a difference to pay?* It gives some duration of time to operate business, but…*It just postpones the issues?* Yeah, it just gives something for that day" (Aug 11th, 2015).

[45] See Chapter 4 for further discussion of these 'trappings of legality.'

[46] When asked about the 2012 inspection, a cartel member explained that KPLC "arrested people and carried the wires but not for our group –we were not arrested. They just disconnected but they carried some [wires]. *What did it cost to replace the wires?* We were just giving them Ksh. 500 to get the same ones back" (Sept 16th, 2015).

[47] For instance, a cartel in Milimani met a KPLC engineer at an inspection: "We met through inspection –that's the time we started talking" (Sept 4th, 2015). Similarly, according to a leader in Wape Wape, "Mostly during inspections we follow them –we know who is senior or junior, that's how we come to know them" (Aug 25th, 2015).

[illegal] wires and when we go, they put them back" (Aug 25th, 2015). He also noted the police's complicity and bribe-taking rather than reporting any violations to Kenya Power: "Police are supposed to call us and say, 'I found the guy doing this' and take pictures…But they don't call; they take *kitu kidogo* [a bribe] and go ahead!" Finally, he confirmed the cartels' use of defunct meters that can be bypassed: "the meter is there and it's not counting." Literature on electricity theft has explored such practices of meter-tampering, and it seems that until quite recently, cartels in Mukuru had reached an uneasy accommodation with KPLC and the police. Neither the police nor Kenya Power sought to eliminate illegal connections; this engineer acknowledged that the police simply accepted bribes and let the cartels continue. Given the flows of bribery lubricating the *sambaza* system, such entrenched collusion will be challenging to eliminate (see discussion in Section V).

B) Conflict, Cooperation, Ethnic Mixing and Other Changes Within Cartels

Initially, providers were ethnically homogeneous and sometimes had links to the gang Mungiki, but cartels are now ethnically-mixed and open to all tribes. According to a provider with 6 years' experience in Milimani, "We are not tribal –we work in different tribes. [In my group, it's] Kamba, Oriya [i.e., Somali], Embu, Luo, Kisii, Kikuyu" (Nov 30th, 2016). A provider for 3 years in Sisal similarly explained that his group is mixed, listing members' tribes of "Oriya, Kamba, Kikuyu, Luo, Kalenjin. It was started by a Luhya, but the more work [in electricity] expands, you need many people to work with it" (Nov 29th, 2016). Electricity providers consistently noted that, unlike water cartels dominated by Kisii residents, *sambaza* is ethnically mixed and anyone can join.[48] In Zone 48, a long-term provider reported that initially Kisii and Kikuyu had dominated *sambaza,* but it became increasingly mixed 6 years ago (Dec 9th, 2016). He remembered that as new groups were established, conflicts broke out due to rising competition and territories were instituted to de-escalate tensions (see below). Similarly, an ex-cartel from Wape Wape recalled that *sambaza* in his area was Kikuyu-dominated at first, often with participation by the gang Mungiki, and conflicts over customers occurred as *sambaza* became ethnically mixed (Dec 21st, 2016).[49] Territories in his village again helped to resolve conflicts, which just entailed fighting rather than any killings, and even though he is Luo, he faced no challenges after Mungiki was rooted out.[50] In general, *sambaza* groups are comprised of friends from school or the same village in Mukuru; I found only a few instances of brothers or cousins working together. Providers can also employ assistants from all tribes to maintain the wires, offering a steppingstone into *sambaza* and creating employment opportunities to provide mutual aid for other youth.

Territories were divided either tacitly or via clear delineations, and respondents agreed that there are currently no major conflicts in *sambaza,* an important indication that cartels are not primarily violent actors. Plots were sometimes allocated to certain providers; elsewhere, territories were divided up based upon local features. According to a Zone 48 provider with 7 years' experience in *sambaza*, cartels in his area established territories by drainage and streets (Dec 6th, 2016). Other

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[48] Water cartels are often violent and ethnicity has remained more salient than in power (as explained in Chapter 4).
[49] "*Is it mixed at the transformer now?* [Yes] Kikuyu, Kamba, Kisii, I'm Luo [*laughs*], we're mixed. *When was it mixed, by the time you joined?* It was for Kikuyu. [*My research assistant interjects, it was Mungiki! Call a spade a spade.*] Then we started saying, we must work all of us because we were born here…[It changed] from Kikuyu to more mixed after fighting…[Fighting] for almost 2 weeks -fight at daytime and go somewhere else at night...[They] told customers not to pay-then we decided to sit down, have a dialogue -the fight was over. *So how did you resolve it?* We divided territory, the area where a person lives. *Can you get new customers in that area?* We divided in streets -you can't get a new customer in another street. *So territory resolved the conflict?* Territory resolved conflict…Just fighting, no killing" (Dec 21st, 2016, ex-cartel in Wape Wape).
[50] Kikuyu and Luo are 2 major tribes that are often at odds in Kenya's politics, such as during the 2007 post-election violence (see also Mueller 2011).

providers did not delineate territories at all, but rather decided amongst themselves who would serve a certain plot or near their transformers. For instance, in Sisal, a provider of 5 years said they divided up plots after having conflicts (cutting wires, but no violence) and plots did not correspond to features like drainage or streets (Dec 10th, 2016). A provider in Zone 48, who began in 2008 and now serves 200 households, explained that 4 years ago, new groups were established and competitors' wires were regularly cut. In his account, "Within your zone, you can sell anywhere, but you can't beyond your zone…*How did you make zones?* Our area -you can divide by streets, but in other areas without streets, you can't mark [zones]. It's where your transformer is [or near there]" (Dec 6th, 2016). As he noted, for areas without streets or other landmarks, cartels sell near their transformers while those with zones can sell within it but nowhere else. Moreover, respondents concurred that conflicts are now rare in electricity: according to a provider for 6 years in Milimani, "I've never seen a person killed in *sambaza*" (Nov 26th, 2016). Although the precise mechanisms for creating territories vary between groups or villages, perhaps based on levels of trust or competition, territorial divisions are widespread and likely helped to eliminate conflicts between groups.

Sambaza has a few pivotal junctures necessitating cooperation between different groups or members of the same group, including bribes to the police and to KPLC for repairing or replacing transformers. For instance, if a transformer malfunctions, the cartels dependent upon it may borrow from another transformer with the expectation of reciprocation in the future. According to a Milimani provider with 5 years' experience in *sambaza*, his group can borrow from other groups during blackouts: "*Do you ever share a transformer?* Yes, we do borrow. *Do you pay?* We don't pay -**it's just friendship**. *For how long?* Up until it comes back…even a couple weeks" (Dec 9th, 2016, emphasis added). These surprising acts of reciprocity among rival groups can help to cope with KPLC's intermittent provision. Such favors are sometimes reciprocated without payment, though other groups must pay. Relatedly, multiple groups usually share a large transformer, and members must typically pool funds to pay KPLC to replace or repair it (as discussed in Section A). Finally, within the same group, members regularly bribe the police for various infractions, and being caught on a transformer can cost Ksh. 10,000 or above, making group contributions essential. A provider in Milimani with 3 years' experience in *sambaza* observed thoughtfully, "For water, they apply their own meters but in power we just use one transformer. **You must work together to give service**" (Nov 30th, 2016, emphasis added). There are thus several compelling reasons for cooperation in *sambaza,* while water cartels have less need to cooperate and are much more individual (see Chapter 4 for further comparisons).

Individual providers can vary in their scale of provision, levels of education, and alternative livelihoods, while groups may differ in their levels of redundancy, possession of meters, and links to KPLC. For instance, poorer providers may have less education (e.g., class 8 or incomplete high school), lack other businesses, and serve fewer clients. Although a small-scale provider in Sisal (with 15 households and 5 businesses) will give up to 2 free security lights, he still charges the caretaker full price, and unusually his group expects to be refunded for any bribes to the police. In his pithy explanation for expecting repayment, "The reason is this group has small number of customers -we can't afford to contribute" (Dec 5th, 2016). Additionally, some groups have fewer back-up sources of electricity, lack meters, and have only weaker ties to Kenya Power. For example, a provider in Sisal with 17 households (plus 2 businesses) says he charges caretakers for power and only utilizes one transformer; his group has a meter that is never read (Dec 8th, 2016). During blackouts, his group will steal power (i.e., hook without paying) from a nearby factory or formal estate until power is restored. Yet he still gives 1 or 2 free security lights (depending on the plot's size) and a month-long

extension for good clients, suggesting that *even poorer providers offer flexibility and reciprocity*.[51] Meanwhile, large-scale providers serving 100 to 200 households may have additional training (e.g. certificates or courses in electrical engineering), and may eventually engage in water vending, electronics shops, or other ventures.[52] It should be noted that youths with limited education may still succeed in *sambaza*: for instance, a provider with 7 years' experience has 74 households and 30 businesses in Milimani and Zone 48, but only completed class 8 and welding courses (Dec 9th, 2016). Although research with additional sellers is needed to verify these findings, my interviews uncovered stark variations between *sambaza* providers and suggest corresponding differences in their levels of vulnerability.

C) Hazardous but Accessible Services

With profits intimately linked to electricity quality, most providers strive to enhance safety and reliability via prompt services and regular maintenance while still facing inevitable shortfalls. As a long-time provider declared proudly, "Our services are better than Kenya Power. Our services are good...If you call, we respond immediately, but Kenya Power can stay 3 days without coming [*after being called*]" (Dec 3rd, 2016, provider in Milimani since 2002). Other providers similarly claimed that they respond more quickly than KPLC and complained that the utility has ignored the slums.[53] Providers routinely leave their mobile numbers with plot caretakers and customers in case of emergency; during a crisis, other members of the cartel may be called if the main provider is away. Speedy response times and regular maintenance, reflecting a service culture as well as shared responsibilities within the group, can partly mitigate the safety risks. In Vietnam, a provider serving over 50 households typically checks his wires in daytime but fixes at night (to avoid encountering the police) and says he can perform emergency repairs for other group members if they are away (Dec 3rd, 2016).[54] Regular maintenance is also a mechanism to prevent rival cartels from stealing wires; furthermore, during the rainy season, maintenance is especially vital to avoid electrocutions or other accidents. As explained by a provider in Milimani, "We check now and then how the wire is -some wires are stolen [by other groups]. *How about in rainy season?* That's when I check the most -*when?* Day and night. You have to maintain so the wires don't touch the metal shacks [*mabati*]" (Nov 30th, 2016, 3 years in sambaza).

Although safety concerns remain significant, cartels have utilized several strategies to reduce risks such as installing fuses or circuit-breakers and even asking KPLC to turn off power during heavy rains. To improve safety on the plot and avoid overloading their lines, many cartels use fuses or circuit-breakers that they purchase from KPLC engineers (see Section A) above). Cartels no longer install wires underground, which had previously electrocuted children or livestock (according

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[51] Similarly, a provider in Zone 48 with 30 households and 7 businesses said that caretakers usually pay, and his group lacked meters (Dec 6th, 2016). But he permitted up to 2 months' extra time to repay, gave 2-3 free security bulbs, and connected new clients for just Ksh. 100.

[52] For instance, a large-scale ex-provider now runs a Safaricom shop within Mukuru; others have moved into garbage-collection or other enterprises.

[53] "*Can Kenya Power learn anything from your service?* They are very ignorant of people in the ghetto -they ignore slums. They should know how to give good service like we were doing...*like maintaining?* They should learn to maintain, even if it's night, like we do. They can't come quickly like us —they come in the daytime" (provider in Milimani, Dec 5th, 2016).

[54] "We put a circuit breaker and a fuse. I divide houses into 10 houses per fuse -if one of them uses a heater or coil, it breaks. *Do you check the wires?* Yeah, you have to check wires outside -if it's broken, you have to follow and get a wire. We maintain even for others if they're not around [to fix their wires]. If it has an emergency, I can repair [for others]. *What happens in an emergency?* We gave numbers to customers and to our group. *You come immediately?* Yeah, come quickly, and if you're not around, there's someone else who can maintain for the group" (Dec 3rd, 2016, see text for more on fuses).

to long-term providers[55]), and they now place wires above ground and utilize coated wires on the plot. During rainy season, cartels conduct additional maintenance and if rains are especially intense, they may cut their own supplies or ask KPLC to turn off power until the rain stops. For instance, an ex-provider in Wape Wape said his group would call Kenya Power during heavy rains to turn the electricity off, without needing to pay (Dec 21st, 2016). Several other respondents said that during heavy rains, they themselves will turn off power at the transformer. Of course, these efforts are woefully insufficient, with fire outbreaks remaining common and naked wires in public spaces representing a major safety concern. But cartels' attempts to mitigate fire risks are not negligible and, moreover, resonate with their use of flexible repayments or low-cost connection fees. I argue that such socially-embedded features and mutual aid to fellow residents are consonant with findings from the informal economy (cf. Hillenkamp *et al.* 2013), helping to distinguish cartels from mere thieves or militias. Below I summarize evidence from Kibera, the only slum in Nairobi where informal electricity providers were previously studied, in order to examine if the above findings may have broader relevance to other informal settlements.

Kibera residents rely upon both cartels and landlords for informal electricity, and these providers again seem to offer flexible, responsive services while also colluding with KPLC. In a survey with 650 electrified households in Kibera, just 7% had formal power and 46% used an electricity agent, 29% relied upon a landlord, and 17% utilized an informal group called Kibera Power (Figueroa 2016, p. 546). According to a researcher who wrote his Master's thesis on electricity in Kibera, many providers were landlords who had formal connections but illegally resold to their tenants (Aug 17th, 2015, phone interview). His survey with 24 landlords and 50 tenants in Kibera suggests that providers had advantages of affordability, flexibility, and maintenance as compared to KPLC (Majoro 2014). For instance, 95% of providers gave some form of credit to customers and 72% connect within a couple days of a tenant's arrival, indicating a responsive service similar to Mukuru (*ibid.*). Half of the providers reported electrifying houses that KPLC cannot reach, 34% charge lower rates than Kenya Power, and 12% did not charge any application fees (although these claims were not verified). Additionally, 79% of providers had a network of technicians who are either past or current KPLC employees, which suggests their entrenched links to the utility as well as a maintenance culture (*ibid.*). Relatedly, a community organizer at Map Kibera had often heard of cartels paying Kenya Power to repair transformers (May 1st, 2015). Finally, a *Daily Nation* reporter said that Kibera's cartels were local youths who often shared ethnic ties, and their leaders likely had political connections.[56] These scattered findings suggest that Kibera's informal providers offer affordable services with payment extensions, speedy connections, and regular maintenance, much as in Mukuru. Additionally, there is suggestive evidence of coercion not to change informal providers in Kibera,[57] and cartels likely collude with KPLC to fix transformers or perform other maintenance. Kibera appears to have a wide range of providers (e.g., landlords, agents, and cartels), and I conclude by noting possible avenues for research with these chameleonic non-state actors.

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[55] A provider since 2002 recalled that initially, copper wires were placed below ground (since naked wires cannot go underground), and safety concerns were worse: "*Were there more safety challenges at first?* Yeah, more safety challenges at first -you could step on a live wire" (Dec 3rd, 2016, Milimani). Similarly, a provider in Zone 48 since 2008 recalled greater safety concerns, such as shocked goats: "*Were there more safety challenges at first?* Yeah -even goats -we paid compensation to Oriya [i.e., paid Somali residents after goats electrocuted]. *Like how much for one goat?* Ksh. 12,000" (Dec 6th, 2016).

[56] According to this reporter, there is an ethnic dimension to Kibera's electricity cartels and he believed that top-ranking cartels had political connections to protect them (June 18th, 2015 phone interview). He found that Kibera's cartels were not landlords or ex-KPLC employees, just opportunistic youths.

[57] In the large-scale Kibera survey cited above, 15% of respondents said their current informal provider will not allow them to switch to another provider, suggesting that coercion is a significant concern (Figueroa 2016, p. 546).

V. Conclusions, Limitations, and Future Research

While not downplaying the past conflicts between groups or present-day hazards of *sambaza*, I suggest that cartels may offer several important benefits for low-income households. Connection fees are low and monthly costs typically below KPLC's bills; in Mukuru and Viwandani, average monthly payments to cartels were Ksh. 428 vs. Ksh. 527 for Kenya Power (Strathmore 2016, p. 22).[58] Cartels are readily available in case of emergencies, although this may also reflect their faulty wiring or other hazards, and they quickly connect new customers for a nominal fee. Other research has consistently found that high connection costs are a barrier to electrifying Africa's urban poor (Golumbeanu and Barnes 2013, Figueroa 2016). And unlike formal provision, informal electricity does not require residents to have tenure security or any other onerous documentation. Many providers give free security lights and free power to caretakers as a way of rewarding the latter for bringing new clients, while security lights serve as good marketing and help to ensure loyalty. Perhaps most importantly for households with low or erratic incomes, cartels can offer payment extensions for several days or even weeks. Thus, despite major shortfalls in safety and reliability, I argue that *sambaza* provision is often quite affordable, flexible, and well-tailored to poor households. It is worth noting several parallels to informal water vendors, who again closely-match their clients' ability to pay, sell on credit, and offer small quantities while also colluding with formal providers (Collignon and Vézina 2000, Kjellén and McGranahan 2006, Ranganathan 2014, also see Chapter 4). As fellow residents, informal providers are well-acquainted with the erratic incomes or unexpected crises that may befall households, helping to explain the profound tensions within these for-profit models *and* socially-embedded services.

To characterize these dynamic groups, I eschewed the rigid classifications of NSP literature, and I synthesize insights on informality, gangs, and electricity theft to elucidate the multiple logics in play. *Electricity theft* research has explored meter-tampering, hazardous wiring, and collusion with utilities (Lewis 2015, Gulati and Rao 2007), but missed intermediaries like cartels and usually recommends highly-technical responses. Mukuru's cartels established small-scale territories and alternately clash, bribe, or manage to evade detection by the police and KPLC, with parallels to *gangs or militias* (Hazan 2010, Schuberth 2015). The salience of ethnicity in *sambaza* has waned over time, and cartels do not seek to overthrow the state but remain socially-embedded, which may represent further similarities to gangs (*ibid.,* Winton 2014). A few electricity providers in Mukuru are current or former gang members, but unlike gangs or militias, I argue that electricity cartels are not defined by conflict. Before territorial divisions were imposed, cartels' confrontations were limited to fighting and cutting wires, without any killings or widespread violence. I emphasized electricity providers' unexpected commonalities with *informal workers,* who similarly meld profit-oriented and non-market principles (Hillenkamp *et al.* 2013). As argued above, cartels' logics of mutual aid and community embeddedness help explain their use of payment extensions, free security lights, or occasionally sharing transformers with rival groups. In sum, cartels are not merely thieves and have only some commonalities with gangs; they are more complex and dynamic than past literature on other NSPs. Seemingly contradictory impulses in *sambaza*, I suggest, confirm past findings from the informal economy, where again market motives combine with reciprocity and other non-market exchange principles (Hillenkamp *et al.* 2013, Lemaitre 2013). Ranganathan (2014) similarly characterized Bangalore's water mafias as alternately colluding with water utilities, exploiting residents, but also

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[58] As noted above, there may also be a 'poverty penalty' attached to informal electricity (Strathmore 2016) but it is difficult to calculate usage for unmetered connections. Additionally, even Mukuru residents with formal KPLC connections complained of unreliable services and surges (*ibid.,* p. 27).

promoting welfare (such as not raising prices for the poorest).[59] Her findings again underscore the need for a dynamic understanding of informal providers' multiple facets, and Chapter 4 will discuss other comparisons between water and electricity cartels.

My multifaceted analysis can also illuminate the vested interests seeking to maintain the status quo and serving to entrench *sambaza* provision in Mukuru. I argued that cartels alternately 1) substitute for and undercut the state, 2) clash and cooperate amongst themselves, and 3) offer a profitable service that is still accessible and appropriate for poor customers. Taken together, these distinct facets of cartels help to reinforce *sambaza* provision despite its poor safety record or other drawbacks. Regarding point 1), police and KPLC engineers have few incentives to eliminate *sambaza* since they benefit from regular flows of bribery. 'Electricity theft' certainly hampers reliability and stifles revenues for the utility overall (cf. Lewis 2015) but *at the settlement level*, both state and non-state providers both seek to preserve informal provision. *Sambaza* providers enjoy decent or even lucrative livelihoods, despite the odious bribes that inevitably reduce their profits. Meanwhile, point 2) suggests that cartels have their own interests in reproducing *sambaza*, a service that is dependent upon a measure of cooperation and interdependence between these groups. While they compete for customers and occasionally cut rivals' wires, cartels regularly pool resources for bribes, share transformers, and may borrow power during blackouts. Having already established territories and clienteles, altercations are now rare and most cartels likely wish to maintain their livelihoods. At the household level, point 3) suggests that it can be difficult to displace cartels because they are flexible, accessible, and socially-embedded; their customers may also be friends or neighbors. Thus, my multi-level findings suggest that *sambaza* provision has become entrenched because it simultaneously serves the interests of police, KPLC, cartels, and customers, so that these stakeholders all strive to reproduce rather than dislodge informal providers.

Most positively, my discussion may help to combat resistance to formalization and, if cognizant of cartels' heterogeneity, policymakers can avoid sidelining vulnerable electricity providers. To increase the appeal of formal electricity and smooth the transition, policymakers can mimic cartels by reducing connection costs, offering responsive customer services, and creating mechanisms to promote affordability (see Chapter 5 for further discussion of past slum electrification projects). Community outreach strategies can appeal to customers by highlighting enhanced safety, reliability, and security of provision, as well as helping to improve public perceptions of utilities staff. Meanwhile, poorer and less-skilled electricity providers may require additional interventions, such as access to credit or trainings in alternative livelihoods. Opposition from larger-scale providers is also likely, and policymakers should avoid favoring wealthy providers over lower-income cartels who lack other sources of income. The above approaches may offer practical benefits of preventing vandalism or sabotage, as well as channeling these youths' business acumen more effectively. By understanding cartels' heterogeneity and contributions, slum electrification projects can craft more appropriate strategies both with consumers and providers. My concluding chapter will consider how to replicate some consumer benefits during electrification, while also improving levels of safety, reliability, security, and other weaknesses of *sambaza*.

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[59] Bangalore's water mafias "may attempt to distance themselves from the formal state apparatus, [but] also engage in distinctly state-like behavior, including electoral lobbying, exploitation, social protection, and the provision of welfare to constituents…the extension of mafia power can be explained not only by the negotiation of boundaries between state and society, public and private, and formal and informal, but also by *multiple political strategies mafias deploy ranging from the coercive to the civic* – not unlike what we call 'the state' " (Ranganathan 2014, p. 102, emphasis added).

Despite several methodological challenges, I suggest that informal electricity providers may offer fertile ground for tracing the complexities of NSPs and developing mixed-methods research. Surveys may struggle to capture the prevalence of informal provision, but 'fixed monthly rate' can be an adequate proxy (Figueroa 2016). Large-scale surveys were conducted before slum electrification initiatives (Mimmi 2014, Mimmi and Ecer 2010), and this juncture may offer a key opportunity to analyze informal power providers and establish a baseline for changes after the interventions. Meanwhile, focus groups are ill-suited for exploring sensitive topics like profits or conflicts between cartels, but may instead analyze shared concerns like police harassment and any transformations over time. Interviews or focus groups with *ex*-providers can be especially valuable, as they may speak more openly and help in crafting messages to convince current providers to stop selling electricity. It can be difficult to observe covert, hazardous informal electricity practices (nighttime repairs, hook-ups etc.), which may endanger providers and researchers alike. Still, future researchers may gain valuable insights if they can attend cartels' meetings and observe provider-consumer interactions (also see below). To explore formal actors' perspectives more fully, interviews with engineers and police can trace their ties to informal providers, while higher-level utilities officials may explain any responses to these corrupt, collusive practices. I opted not to record my interviews, sacrificing some details in hopes of gaining candor from the providers, but future researchers will need to consider such trade-offs carefully.

Additional studies are needed to analyze a wider range of electricity providers and any changes over time, as well as consumer research to assess their service quality. Customer surveys or focus group discussions will be crucial to analyze informal providers' possible benefits in addition to fire hazards, coercive aspects, and other shortcomings. To understand dynamics over time, studies can examine if these providers expand into crime, water vending (since electricity is useful to water-pumps), or more licit activities. Comparative analyses could also consider other informal electricity providers like landlords and neighbors (cf. Majoro 2014), or more carefully examine involvement by gangs or militias in electricity. Not only have militias in Rio's favelas or musclemen in Dhaka distributed electricity informally,[60] but a recent *New York Times* article also explored how Taliban insurgents collect electricity bills to diversity their revenues.[61] Furthermore, researchers can explore alternative connection processes or other intermediaries providing informal electricity in middle- and upper-class neighborhoods. When and how do local politicians intervene in informal electricity? Do providers themselves change in ethnic composition, levels of violence, and links to state providers? Such findings may reveal if other electricity providers shift over time and adopt multifaceted aims, as I suggested for Mukuru, and can critically evaluate their contributions as well as extractive or coercive ties to residents. With these comparative insights, researchers can better illuminate these polyvalent informal actors who may play as many roles in their communities as does electricity itself.

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[60] See preceding discussion of Arías (2013) and Hossain Lipu and Waliullah Bhuiyan (2014).

[61] Mashal, M. and N. Rahim, "Taliban, Collecting Bills for Afghan Utilities, Tap New Revenue Sources", *NY Times,* Jan 28, 2017: "In addition to collecting electricity bills from thousands of homes in provinces such as Kunduz and Helmand, the insurgents levy taxes on potato harvests [or] flour mills...collection of electricity charges differed by district. In Kajaki district, the Taliban collect a fee once a year, from $60 to $150 depending on usage. In other areas, it is monthly."

Chapter 3
Clandestine Flows and Blockages: Disposing Excreta in Informal Settlements

I. Introduction: Towards an Understanding of the Sanitation Chain in Informal Settlements

In urban policy and academic research, sewerage networks in the Global South typically garner far more attention than non-networked waste streams, although the latter are more widespread. Reflecting the high costs of conventional sewerage, "most people" in cities of the Global South utilize *'on-site'* or *'non-networked'* sanitation, which discharges "either into a septic tank or pit, or directly into a drain, river, sea or open ground" (Ross *et al.* 2016, p. i).[62] Over 50% of African city-dwellers typically use on-site sanitation, especially pit latrines, and prevalence is even higher among low-income urban households (Nakagiri *et al.* 2016: 4). Meanwhile, in cities such as Addis Ababa, Mombasa, and Ouagadougou, at most 10% of the population has access to sewerage (Chowdhury and Kone 2012, p. 41). But African governments typically lack official standards or policy frameworks for on-site urban sanitation because sewers are considered the only option for cities, while rural residents are assumed to use on-site provision[63] (WRC 2015). Resource allocations are also biased in favor of sewerage: in 2010-2011, 41% of Africa's water and sanitation aid went towards large systems vs. 3% to waste management and disposal (*ibid.*, p. 27). Excreta disposal is again usually ignored in the literature on urban political ecology (UPE), which has focused upon unequal flows of water (Heynen *et al.* 2006), although geographers have recently offered some sensitive studies of sanitation.[64] To reveal the heterogeneity of non-networked excreta flows and inform future interventions in slums, I offer a detailed discussion of Mukuru's excreta disposal patterns. My mixed-methods approach can be replicated by sanitation NGOs and other local organizations, and I argue for jointly analyzing maintenance patterns, improvised behaviors, and fragile piped solutions as well as any variations within informal settlements.

Recent studies explore the 'sanitation chain' from user to disposal, but usually focus upon waste enterprises or how to develop byproducts rather than slum-dwellers' multiple disposal practices. The 'sanitation chain' incorporates all stages of sanitation services (see Figure 1 below) and is part of a much-needed comprehensive approach recently gaining traction among policymakers and practitioners in urban sanitation. Although the MDGs failed to monitor the disposal or treatment of excreta, the SDGs prioritize universal access to sanitation and seek to improve wastewater treatment[65], with vital potential to improve health and environmental quality (Hutton and Chase 2016). Relatedly, among academics and social entrepreneurs, there is newfound appreciation of excreta as a resource and rising attention to fecal sludge management or FSM (Ray and Murray 2009, Strande *et al.,* 2014). For instance, social enterprises and NGOs have pioneered eco-sanitation models based upon waste reuse, including in bio-centers producing cooking gas in Nairobi.[66] Other researchers have assessed the status of FSM enterprises in several African cities[67] and analyzed the complex 'modernized mixtures' of East African sanitation (Letema 2012, Van Vliet

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[62] *On-site* sanitation denotes options like pit latrines that retain excreta on the plot and are typically viewed as inferior to sewerage. But if well-maintained, on-site toilets may provide an affordable, hygienic option for the poor (also see discussion in Satterthwaite *et al.* 2015 of various sanitary options).

[63] This is also true in Kenya, which lacks a system to monitor its urban on-site sanitation (see WEDC and WSUP 2015).

[64] For a rare UPE analysis of sanitation, see chapter on London's clogged sewers by Marvin and Medd (2010). Recent urban geographies of sanitation include Lancione and McFarlane (2016), McFarlane *et al.* (2014), and Jewitt (2011).

[65] See www.un.org/sustainabledevelopment/water-and-sanitation/ and further discussion in Section IV.

[66] In Nairobi's slums, there are community-managed ecosan initiatives like Umande's bio-centers in Kenyan slums (Otsuki 2016, also below) and the entrepreneurial approach of Sanergy (O'Keefe *et al.* 2015, Esper and London 2014).

[67] See Chowdhury and Kone (2012), Sugden (2013), Murungi and van Dijk (2014), and WRC (2015).

et al. 2010). Applied research by Water and Sanitation for the Urban Poor (WSUP) and the London School of Hygiene's SHARE consortium has analyzed how to promote equitable access to urban sanitation.[68] Yet there is less attention to slum-dwellers' sanitation disposal patterns, a major oversight since ecosan providers, vacuum tankers, and other entrepreneurs may be unwilling to serve informal settlements or only reach a small proportion of residents.

Existing studies of fecal waste flows often utilize a city-wide scale or require extensive epidemiological data; by contrast, I propose a fine-grained yet feasible method for studying slums' excreta management. Practitioners and researchers have recently created Shit-Flow Diagrams (SFDs) in over 40 cities (see below for Maputo).[69] These diagrams offer a citywide snapshot of sanitation provision and the paucity of safe disposal practices: in Maputo, just 26% of fecal waste is safely-managed while the rest is discharged into the residential environment, drainage, or receiving waters. SFDs in Maputo and other cities typically find alarming levels of unsafely-managed waste, helping to galvanize future interventions (Peal *et al.,* 2014, Blackett and Hawkins 2016).
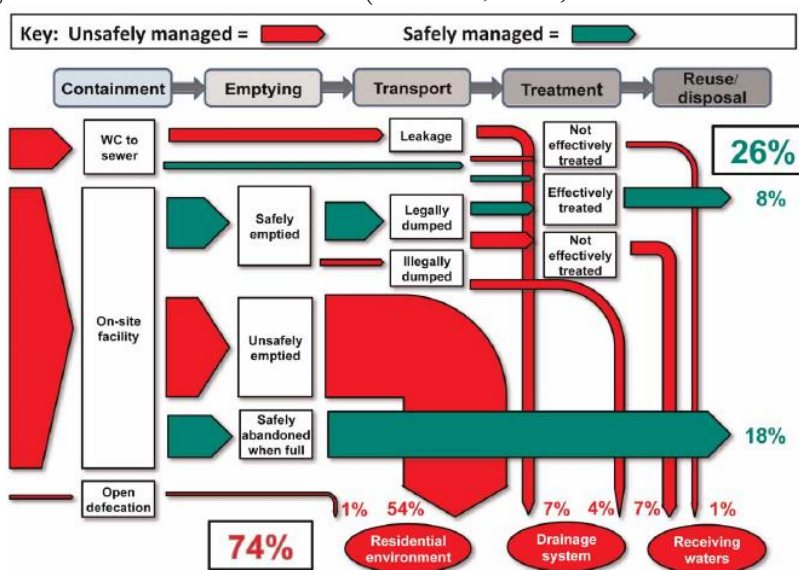
Figure 1: Shit-Flow Diagram for Maputo (see Peal *et al.* 2014, p. 376)

However, I suggest that SFDs are often limited by their use of secondary sources[70] and a lack of spatially-disaggregated analyses, while other methods of analysis can be prohibitively complex. SFDs fail to analyze the particular sites of unsafely-managed excreta and overlook the ensuing environmental or social impacts. While the diagrams starkly reveal the magnitude of cities' meager FSM, they provide only limited policy-relevant information and the effects of inadequate sanitation disposal remain obscure. Meanwhile, an approach called Sanipath has quantified exposure pathways to fecal contamination (e.g., Gretsch *et al.* 2016 for Accra's open drains), but requires extensive epidemiological data and simulations (see Section II below). In sum, SFDs are usually based on secondary literature and are aggregated at the city level, while Sanipath is prohibitively complicated

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[68] See www.wsup.com/programme/issues/sanitation/ and www.shareresearch.org/themes/urban-sanitation

[69] For SFDs from 40 African, Asian, and Latin American cities, see the database at sfd.susana.org

[70] However, see SFDs in Dhaka where slum-dwellers overwhelmingly dispose excreta in open drainage and in Hawassa, Ethiopia (a smaller city where slum-dwellers can still dig new pits). For Dhaka SFD, see http://sfd.susana.org/sfd-worldwide/cities/5 and for Hawassa, see http://sfd.susana.org/sfd-worldwide/cities/13

and technical for local organizations. These studies also miss the distinct spatial variations and covert practices that create slums' complex excreta flows, which I will explore in Mukuru.

My alternative approach will jointly analyze residents' behaviors, maintenance patterns, and tenuous built solutions to reveal heterogeneous disposal practices and possible entry-points for intervention. In contrast with citywide SFDs offering a panoramic lens, I narrow my scale of analysis and examine the diverse ways that excreta are disposed within Mukuru. Instead of a linear 'sanitation chain,' my findings suggest that Mukuru's excreta disposal is created by a scattershot and constantly shifting array of strategies. In particular, Mukuru's excreta flows are (re)shaped by 1) gendered maintenance relations, 2) improvised behaviors varying by season, age, or gender, and 3) fragile constructions like pipes to an open drain or water-course. I also discuss Mukuru's non-functional toilets and clogged sewers or open drains, suggesting the need for enhanced solid waste management and additional qualitative data on sanitation conditions (Section IV). Additionally, I examine a range of risky behaviors, seasonal patterns, and the pivotal roles of (usually female) latrine caretakers and male latrine-emptiers. As explained below, Mukuru residents typically use public toilets, ecosan, and/or shared pit latrines that can be connected informally to sewers. I focus mainly upon pit latrines since ecosan has unique technical and maintenance concerns, and my findings regarding on-site disposal practices may have relevance to other African informal settlements (see literature review in Section II). There is rising interest in changing residents' behaviors and eliminating open defecation in urban areas, especially in the literature on urban community-led total sanitation (CLTS).[71] By carefully discussing behaviors and maintenance patterns, alongside several built solutions and spatial variations in Mukuru, I aim to inform future interventions befitting the complexity of slums' sanitation.

My broader aims are 1) to create a *feasible method* for analyzing slums' excreta disposal, which can also help to 2) *re-conceptualize the 'sanitation chain,'* including more recognition for maintainers, and 3) spark *collaborations* to improve disposal. As noted above, I seek to create a practical method that can uncover slums' complex disposal patterns, in contrast with the expert-driven, technical methods such as Sanipath. My conclusion will distil my mixed-methods approach and identify ways that local organizations may subsequently build upon it (Section V). Furthermore, I argue that the 'sanitation chain' is highly misleading since it obscures the haphazard, variable forms of disposal in informal settlements. It is not that disposal patterns are entirely chaotic or wholly unpredictable, but rather that they are non-linear and poorly captured by past methods of analysis. I also underscore the often-invisible processes of maintenance undergirding other infrastructure networks (cf. Graham and Thrift 2007, Simone 2004), but are rarely considered in FSM or 'sanitation chain' literature (see Section II). My conclusion will build upon recent research that similarly underscores the flux and heterogeneities within sanitation for the urban poor (e.g., Lancione and McFarlane 2016). Thanks to a fuller picture of excreta flows (and blockages), my findings may spark new collaborations between sanitation providers, residents, policymakers, and other stakeholders (see Section V). I begin by synthesizing past studies of FSM, shared sanitation, and gender-sensitive strategies before explaining my methods and findings from Mukuru.

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[71] Practitioners of CLTS seek to 'trigger' feelings of disgust and to encourage poor households' participation in co-producing sanitation, with particular attention to changing behavior, eliminating open defecation, and advocating for improved provision (see Myers 2016). But the approach is still attempting to define itself in an urban setting and has only recently begun to scale-up in cities of the Global South (*ibid.*).

II. Shared Provision, FSM Methodologies, and Gender-Sensitive Sanitation:
A Critical Literature Review

Shared sanitation is widespread in African cities, but the complex disposal practices for slums' shared facilities are usually overlooked in favor of engineering or design considerations. Globally, an estimated 2.4 billion people lack access to improved sanitation (defined as private toilets with sewers or septic tanks, latrines with ventilation pipes, etc.), far exceeding the 663 million people without improved drinking water (JMP 2015).[72] The UN's Joint Monitoring Program (JMP) has defined *shared* sanitation as "sanitation of an otherwise acceptable type shared between two or more households", and shared options are always classified as 'unimproved' (Rheinländer *et al.* 2015). Although these options inevitably require careful maintenance to ensure hygienic provision, shared sanitation is "currently the only pragmatic solution in many densely-populated informal urban areas" (Mazeau *et al.* 2014 p. 594, also Rheinländer *et al.* 2015). Unsurprisingly, pit latrines quickly fill up in high-density informal settlements, and past research in African cities has focused on latrines' filling times, insect infestation, gas formation, and design concerns (Nakagiri *et al.* 2016, Still and Foxon 2012). Additionally, recent studies indicate that shared toilets vary widely in their levels of usage and maintenance, producing major differences in their implications for health, privacy, and dignity (Heijnen *et al.* 2014, Mazeau *et al.* 2014, Jenkins *et al.* 2014, also see below on maintenance).

Although emerging methods can capture micro-level sanitation conditions more effectively than SFDs, these approaches can be excessively complex for local organizations or may neglect qualitative aspects. For instance, the World Bank's Urban Sanitation Status Index (USSI) has generated detailed maps of Maputo's sanitation chain, while also incorporating complementary services like solid waste or storm-water management (Hawkins and Muxímpua 2015). Yet the USSI hinges upon extensive spatial data-collection (likely a barrier to local organizations) and its indicators may need further refinement. For emptying and transport, the USSI's indicators are merely 1) type of equipment used for latrine-emptying and 2) percentage of fecal material lost during transport to the treatment facility (*ibid.*, p. 47). Another recent approach is that of SaniPath, a methodology developed at Emory to measure sources and levels of fecal contamination in low-income settlements (see Gretsch *et al.* 2016 for Accra's open drainage and impacts upon children). While SaniPath can rank slums' key sources of contamination and thereby inform future interventions, this expert-led approach requires data on *E. coli* levels and complex simulations of transmission pathways. By contrast, a grassroots-led Rapid Participatory Sanitation System Risk Assessment (RPSSRA) was utilized to score sanitation risks in Maputo's slums at the household and community levels (Campos *et al.* 2015, Acker *et al.* 2016). It produced indicators on hazardous events, exposure, transmission, and vulnerability to sanitation-related illnesses (Campos *et al.,* 2015, pp. 381-2) but I suggest the ensuing rankings and other findings may benefit from more in-depth analysis.[73] Finally, as argued above, SFDs are meant to raise awareness about unsafely-managed sanitation at a city level (Peal *et al.* 2014), but are ill-equipped to capture the intricate disposal practices that prevail in African slums.

Gender-inequitable impacts of meager water and sanitation are widely acknowledged, but I argue for using a gender lens to reveal how toilets are maintained and how menstrual products are

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[72] Based on the JMP's global data, about 80% of city-dwellers have piped water on the premises and 17% have other improved water sources (JMP 2015). Meanwhile, 82% of city residents have improved sanitation globally and another 638 million people use shared sanitation, including 398 million in urban areas (*ibid.*). But with limited data on informal settlements, such statistics likely underestimate slums' deficits in both water and sanitation; see Satterthwaite *et al.* (2015) for other critiques of urban sanitation data.
[73] For instance, the indicator for high-risk desludging is "Pits are not de-sludged when full and overflow, or sludge is removed manually and dumped locally," lacking spatial analysis or more detailed discussion (Campos *et al.* 2016, p. 381).

disposed. According to extensive research, women and girls are particularly affected by the lack of privacy and dignity linked to meager toilets; endure long queues at water-taps (leading to lost productive time, risks of sexual assault etc.); and disproportionately shoulder the care burdens linked to diarrheal illnesses.[74] Recent literature on menstrual hygiene management (MHM) has begun exploring the challenges of menstrual waste disposal, which can result in sewer blockages or more rapid filling of pit latrines (see review by Sommer *et al.* 2013).[75] In South African cities, disposing pads, tampons, and other rubbish in pit latrines routinely generates major challenges in maintaining toilets, "making pit emptying by vacuum tankers almost impossible" (Still and Foxon 2012, p. 25). But in most MHM studies or other gender-sensitive sanitation studies, the focus is upon female *users* rather than utilizing a gender lens throughout the sanitation chain. In a rare exception, researchers analyzed the determinants of latrine cleaning in Kampala's slums where women are typically tasked with maintaining on-site sanitation (Kwiringira *et al.* 2014, Tumwebaze *et al.* 2014).[76] These authors argue for studying maintenance to help achieve sanitation's health benefits; with malodorous, dirty toilets, users may resort to open defecation or other insalubrious alternatives (*ibid.*). Much as in Kampala, I found that women in Mukuru usually clean toilets but pit latrines are always emptied by male 'manual emptiers.' I utilize a gender lens to reveal the pivotal (and gendered) roles of sanitation maintainers, as well as exploring the broader environmental impacts of slums' poor MHM. My methods are explained below, along with additional context on Mukuru's sanitation provision.

III. Methods and Study Setting

Although the extensive sewer networks in Nairobi are a key difference from many other Kenyan and African cities, Nairobi's slums resemble other urban areas facing acute shortfalls in safe excreta disposal. Sewer provision varies widely between and within Kenyan cities: 48% of Nairobi's population has sewerage, far above 9% in Kenya's second-largest city of Mombasa (WASREB 2016, p. 66). But in Nairobi's slum of Mukuru, recent research indicates that shared on-site provision is the most common form of sanitation (Strathmore University 2016). In Mukuru and Viwandani, nearly half of 2,700 survey respondents used a shared pit latrine, another 18% used Sanergy (with 2/3 of these eco-toilets located in Mukuru kwa Reuben), and 20% had a shared flush toilet (*ibid.*, p. 21). Shared sanitation is also common in smaller Kenyan cities, such as Nakuru where 84% of households in slums share pit latrines with at least 4 other households (WEDC and WSUP 2015, p. 28). Furthermore, in a sobering trend, Kenyan cities have been unable to expand their rates of sewerage and from 2010-2015, Kenya's overall level of sewer provision fell from 19% to 15% (WASREB 2016, p. 11). To reach the nearly 10 million underserved city-dwellers, Kenya's regulatory agency WASREB (**Wa**ter **S**ervices **Re**gulatory **B**oard) declared that the sector "should embrace the use of low-cost solutions [including] on-site sanitation" (*ibid*, p. 7). While Nairobi is atypical in its ecosan toilets and high levels of citywide sewerage, such options reach a small fraction of the urban poor and alternative strategies are urgently needed to improve FSM for the low-income majority.

Sanitation research in Nairobi's slums has focused on FSM enterprises, ecosan, or the need to promote access, while my approach can provide new information on excreta disposal methods.

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[74] See Ray (2007) for a review of gender and water; O'Reilly (2016), Burt *et al.* (2016), and Tilley *et al.* (2013) for gender and sanitation reviews; Chant and McIlwaine (2015) for gender, WASH, and other services in slums; and Carrard *et al.* (2013) for a gender-sensitive framework on the outcomes of WASH projects.

[75] In the Kenyan city of Mavoko, menstrual pads comprised 40% of the material hauled from blocked sewers and led to major disposal challenges for the utility agency (Sommer *et al.* 2013, p. 291).

[76] It is worth underscoring that such findings are scarce in the sanitation literature. As a recent FSM report observed, globally there are "millions of cleaners, mostly women, [who] have to clean toilets after they have been used. *Nowhere in the literature have we seen this problem, which is also a gender one, being addressed directly*" (WRC 2015, p. 4, emphasis added).

Although Nakuru and Kisumu have both been featured in SFD studies, there is no corresponding report for Nairobi. Recent literature in Nairobi has analyzed eco-sanitation models like Umande Trust's bio-centers (Otsuki 2016) and the social enterprise Sanergy (O'Keefe *et al.* 2015, London and Esper 2014),[77] as well as communal sanitation options in Kibera (Schouten and Mathenge 2010). Gender-sensitive research has highlighted women and girls' challenges when accessing toilets in Nairobi's insecure slums (Amnesty International 2010, Corburn and Hildebrand 2015). Furthermore, a relevant report analyzed Nairobi's fecal sludge enterprises alongside 9 other cities in Asia and Africa, estimating that Nairobi's annual FSM market exceeded $43 million (Chowdhury and Kone 2012, p. 55). In these 10 cities, local officials usually focus on infrastructure provision while "fecal sludge management [is] by and large *ignored by the public authorities…Emptying and transporting fecal sludge is dominated by private entrepreneurs…*Treatment and re-use of fecal sludge [is] either absent or very limited" (*ibid.,* p. 27, emphasis added). Additional studies have explored how landlord/tenant dynamics and land tenure concerns may affect sanitation provision, including in Nairobi or other African informal settlements with predominantly rental housing.[78] Finally, Eales (2005) offers a brief overview of pit-emptying in Kibera, where emptiers faced stigma, worked at night (especially in rainy season), and lacked protective gear like gloves or masks (see Section IV for similar findings in Mukuru). Meanwhile, other studies of waste disposal in Nairobi's slums typically analyze a single ecosan model or offer a business analysis of FSM provision. My findings can therefore help to fill gaps in the literature on Nairobi and, since my methods are another part of my intended contribution, I detail them carefully below.

To capture a wide array of sanitation stakeholders, I worked with a research assistant to conduct 5 focus group discussions (FGDs) with latrine emptiers, caretakers, and community health volunteers (CHVs) from several areas in Mukuru. An experienced community organizer facilitated these discussions in Swahili; she was encouraged to probe for stories or other details.[79] Our first 3 FGDs combined CHVs, *manual* emptiers, and *on-plot* caretakers; a fourth featured CHVs, *mechanical* emptiers, and *public toilet* caretakers; the final FGD was only for caretakers of on-plot toilets.[80] The latter caretakers usually receive free housing in exchange for maintaining latrines (as well as for managing tenant disputes or other plot-related issues) but rarely enjoy any support with cleaning and receive little recognition. Participants also had mixed gender composition: CHVs and caretakers are usually female, while manual and mechanical emptiers are uniformly male. These stakeholders were recruited from multiple villages in Mukuru kwa Njenga, helping to explore spatial variations across the settlement. Mukuru kwa Njenga has few Sanergy toilets but typically has some public toilets, with caretakers who participated in the 4th FGD. Subsequently, I transcribed the discussion as the facilitator translated the recordings into English. The FGDs lasted about 2 hours and were held at a community hall; residents were assured of anonymity and provided oral consent, given the low levels of literacy in Mukuru.

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[77] Sanergy's products include biogas, organic fertilizer, and insect-based animal protein that is sold to feed millers. The social enterprise also provided feedback on Kenya's new sanitation policy (see blog at http://saner.gy/archives/5650).

[78] See Scott *et al.* (2013), WSUP (2013), and Wegelin-Schuringa and Kodo (1997).

[79] She was born in another informal settlement and previously worked on sanitation with several organizations, including Sanergy. My other research assistant, who lives in Mukuru, helped to explain the research and recruit participants.

[80] The FGD solely with caretakers was conducted due to challenges in previous sessions, when caretakers were often sidelined or did not participate as openly. In retrospect, we could have recruited and sensitized caretakers more carefully, avoiding the need for an additional FGD. It is possible that caretakers do not view themselves as integrally involved in sanitation as CHVs and emptiers, or perhaps were simply not as comfortable talking around other stakeholders.

As a warm-up activity also intended to spark spatially-disaggregated insights, the facilitator asked participants to identify excreta dumpsites; open defecation areas; and blocked or overflowing sewers. A Google map was prepared with recent Muungano data on sanitation; participants used transparent Post-It notes to mark areas of concern (Figure 2 below). Residents also explained why toilets were non-functional, identified sites with particularly limited toilet access, and discussed the condition of local sewers. Other FGD topics included typical latrine-emptying practices, caretakers' cleaning routines, and any interactions with local authorities or environmental agencies. CHVs were asked to discuss the health impacts of inadequate sanitation, including during past cholera outbreaks. The sessions also sought to compare disposal practices (e.g., across different villages, during rainy season, and bans on excreta dumping), in hopes of revealing spatial and temporal variations in Mukuru. Finally, the FGDs asked participants to envision their preferred toilet design and disposal methods; desired support from government or landlords; and other priorities for interventions. Although I did not initially intend to examine menstrual hygiene or solid waste management, the FGDs often highlighted these concerns (including when participants gave their priorities for intervention) and as such will be featured in my analysis below.

Along with observations and photos of sanitation disposal methods in Mukuru, I conducted a very brief survey of manual emptiers and sought to analyze relevant Kenyan policies. I photographed and observed the drains, sewers, and rivers where waste is frequently dumped, in addition to photographing latrines (Figure 3 below). For about 2 months in 2015, I observed and interviewed several teams of emptiers (see Appendix 2) before broadening my focus to other excreta disposal methods. To understand relevant policies and interventions, I consulted published documents and interviewed local stakeholders, including two Nairobi Water officials who work in informal settlements; a sanitation program manager at GIZ; and staff at Umande Trust, Water and Sanitation for the Urban Poor (WSUP), Sanergy, and Muungano. From contacting experts at the World Bank's Water and Sanitation Program (WSP) and Sustainable Sanitation Alliance (SuSanA), I learned that there are few studies or SFDs exploring variations in slums' sanitation disposal. Additionally, Umande and Muungano currently lack data on disposal practices, so my findings may be useful for local practitioners. My photos illustrate typical pit latrines and disposal practices (see below), while Section IV will discuss these patterns in greater detail. Since manual emptiers are often stigmatized and face occupational hazards, I sought to assist them both with protective equipment and organizational support.[81] Finally, the area in Mukuru where I conducted fieldwork has a combination of public toilets, shared latrines, and ecosan options, but I focus mainly on the latrines that are widespread in other African informal settlements (Nakagiri *et al.* 2016). My largely qualitative methods were appropriate to explore topics that would be poorly-captured in a survey, such as open defecation patterns or flooding-out latrines (see Section V for additional reflections on methods). If my analysis is extended to the disposal of public toilets or other sanitary options, this approach may more fully encompass and respond to the cross-cutting challenge of slums' excreta flows.

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[81] In December 2016, my research assistants helped me to distribute gumboots, gloves, and masks to over 100 emptiers in Mukuru. A staff member of the financial NGO Akiba Mashinani Trust spoke at a small ceremony to encourage emptiers to join Muungano (Kenya's Slum-Dweller Federation and longtime Berkeley partner organization).

Figure 2: Sanitation Maps from Focus Group Discussions (FGDs)
Prepared by Kheleon Nyambuga using Muungano's sanitation data (superimposed upon a Google Earth map) and with labels from FGD participants

a) Map and labels: sewer (orange line above), **functional toilets** (blue dot above), and **non-functional toilets** (green dot above) with Mukuru's village names to help orient participants

b) Close-up of labels on map

c) Labels to mark map

FGDs began by asking participants to place the labels on the map (see c) to demarcate areas with blocked or overflowing sewers, where latrines are connected to rivers, major dumpsites for excreta, and 3 sites where access is most limited (e.g., where open defecation is common, fewer toilets are functional etc.). The facilitator encouraged both women and men to speak, as well as probing participants when necessary.

| a) | b) | c) |

Figure 3: Typical Latrines in Mukuru a) Ventilated latrine (see pipe in upper left) not yet full but with menstrual waste; b) latrine with raised structure and overflowing solid waste; c) nearly-full latrine with rusted sheets

Most latrines in Mukuru have a concrete slab and drop-hole, only a few have ventilation pipes (Figure 3, photo a) above), and some may have very battered superstructures made of rusted iron sheets (photo c) above). Plots in Mukuru usually have 1 or 2 latrines and a shower (a similarly-sized cubicle where residents must bring their own water). These cramped facilities serve anywhere from 8 to 25 or more households, depending on the plot's size and if the structure has two floors. Some latrines are located inside the plot and have electricity that can facilitate nighttime usage; others are located outside the plot. Filling times will depend upon factors such as the number of users, seasonality (latrines fill rapidly in rainy season due to the high water-table), and the extent of menstrual or other solid waste disposed inside. By contrast, two ecological toilets are pictured below: Sanergy's Fresh Life Toilets and a bio-center built by Umande Trust.
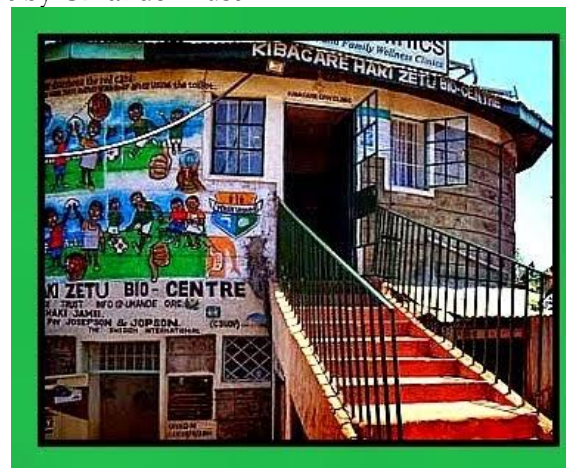
Figure 4: Worker collecting waste at a Fresh Life Toilet (left) **and Umande Trust Bio-Center** (right). At Umande Bio-Centers, cooking gas is produced from waste (Photo sources: http://saner.gy/our-work/our-stakeholders and umandetrust.blogspot.com/)

Figure 5: Selected Sanitation Disposal Methods in Mukuru
Below are multiple ways to manage excreta, including sewers and draining to a river or ditch.

1) **Drain directly to river (no pipe)**
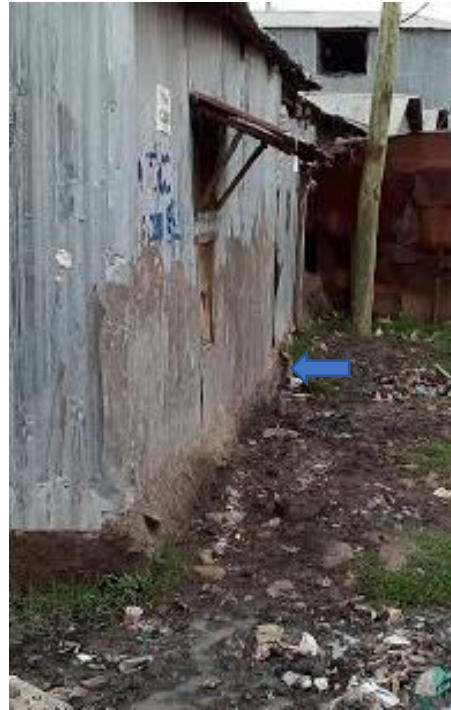
2) **Drain to ditch (see small pipe)**

3) **Drain directly to river (see pipe)**

4) **Overflowing manhole (near pipe to drainage)**

5) **Formal sewer at public toilet (usually covered)**

6) **Sewer near garbage and covered manhole**

Figure 6: Stages of Manual Emptying in Mukuru
These images follow the sequence of emptying from a shared latrine to disposal at a river

a) Emptying latrine waste into small bucket

b) Transferring small buckets to 200-liter drum (note the unusual use of gloves)

c) Filling up the 200-liter drum

d) Covering the drum with plastic sheeting

e) Transporting waste in the settlement (see pot of cooked food nearby, which may lead to conflicts with vendors over possible contamination)

f) Dumping excreta in a waste-clogged stream at the periphery of Mukuru

IV. Findings: Low-Quality Sanitation, Complex Disposal Practices, and Key Role of Maintenance

Excreta disposal in Mukuru is a patchwork of risky behaviors, paid emptying services, and fragile constructed solutions like jerry-rigged sewers, while maintainers can enable or hamper these flows. In the 'sanitation chain' parlance, I will explore 1) containment, 2) emptying, 3) conveyance by manual or mechanical emptiers, and 4) improvised disposal methods (but not treatment or re-use, which is only incorporated in ecosan models). However, I argue that the sequential 'sanitation chain' is highly misleading for Mukuru because the purportedly distinct stages of emptying, conveyance, and disposal may be blurred or overlapping (e.g., dumping waste to a river or open drain). I begin by discussing multiple causes of non-functional sewers and toilets, so as to underscore the need for qualitative data-collection on slums' sanitation. Next, my core findings will analyze the multiple ways of emptying and disposing excreta (as summarized in Table 1), including a gender- and age-sensitive discussion of how menstrual wastes or children's potties are managed. I also uncover seasonal and spatial variations in disposal practices that were overlooked in SFDs, but may inform more contextually-appropriate strategies. Furthermore, focus group participants often emphasized the interrelated challenges of minimal sanitation, drainage, and solid waste management, which will require intersectoral responses. I highlight gendered roles in maintenance, a cross-cutting concern usually omitted in 'sanitation chain' research, and I close with a discussion of Kenya's relevant policies as well as emerging entry-points that may help to enhance FSM.

Sanitation Quality and Multiple Causes of Malfunctioning Facilities

Mukuru appears to have extensive access to toilets and sewers, with only a few non-functional toilets (Figure 2 above with Muungano data), but FGDs found several challenges with low-quality provision. Sewers regularly block or overflow, and toilets may become non-functional due to concerns such as faulty or incomplete construction and poor maintenance. Participants in all focus groups agreed that sewers routinely malfunction, often stemming from inadequate menstrual hygiene and solid waste management. As a female CHV explained, for "toilets that connect to sewer, [residents] still throw Pampers and sanitary pads inside there" (Nov 28th, 2016). She blamed the regular blockages upon dumping of menstrual waste and diapers, and a manual emptier agreed that "most of the sewer systems have clogged" (Nov 28th, 2016). Furthermore, participants carefully identified multiple causes for non-functioning toilets and latrines:

> *Why are toilets non-functional?* Most of them are blocked. Others are not finished…[or] it's because the management is bad. Others, there is no security: you can go there and be hijacked *[i.e., raped]*.[82] There was no plan to construct toilets, so a lot of plots were just built anywhere and there isn't any place where we can put a toilet…Or in some areas, you build a toilet and it just sinks [*due to high water-table*]. Another reason is that, when they're so full, people don't use them because the toilet is very dirty (responses by caretakers, CHVs, and manual emptiers, Dec 1st, 2016).

Residents offered several reasons for nonfunctional pit latrines and public toilets such as 1) low-quality construction; 2) high water table; 3) insecurity; 4) minimal planning measures or available space; and 5) poor maintenance and management. Finally, 6) inadequate MHM and garbage collection usually result in diapers and menstrual waste being disposed into toilets, which create additional maintenance challenges like blocked sewers or rapidly-filled latrines. These findings may suggest new directions for research: instead of merely measuring the presence of sanitation

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[82] For insecurity, poor sanitation, and risks of gender-based violence in Nairobi's slums, see Amnesty International (2010); Corburn and Hildebrand (2015); also see Sommer *et al.* (2015) for gender-based violence and WASH.

hardware, in-depth qualitative data can reveal the myriad causes of poor provision and disposal. Informed by both qualitative and quantitative data on slums' sanitation, future initiatives can strive to remedy shoddy construction or disrepair, offer complementary services like solid waste management, and address related planning concerns in informal settlements.

Emptying and Disposal: Improvisations, Services, and Constructed Strategies in Mukuru

       Figure 5 (see above) includes constructed solutions like pipes to drains, but risky behaviors and paid emptying services are alternative, widely-utilized strategies for excreta disposal in Mukuru. In the following Table 1, I incorporate additional options that range from adults' covert, improvised tactics such as 'flying toilets' thrown haphazardly in the settlement (column 1) to several emptying services (final column). These paid options include manual emptiers (lowest-cost), mechanical emptiers using small pumps or, rarest of all, exhauster trucks. Trucks can only operate in Mukuru's few paved roads and are often prohibitively expensive, so they will not be discussed further here.[83] Table 1 also distinguishes between adults and children's behaviors, alongside the strategies utilized by caretakers. I suggest that carefully distinguishing between adults, children, caretakers, and commercial providers can help identify new entry-points for intervention (see Section V below). Below I elaborate upon Table 1's findings and draw comparisons to other cities when possible, as well as considering the spatial, gendered, and seasonal variations within Mukuru.

       Manual emptying, 'flooding-out' latrines, and other risky tactics are common in other informal settlements, but existing SFDs may miss these practices and other variations in disposal. As noted above, SFDs merely note that 'unsafely-managed' excreta are dumped in drains, residential environments, or receiving waters.[84] Case studies may include more thorough information on disposal, such as a survey with over 240 slum-dwellers in Dar es Salaam. The leading disposal methods in Dar are pit diversion, vacuum tankers, flooding-out (i.e., opening-up covertly during rains so that the waste is carried away), and emptying manually with buckets (Jenkins *et al.* 2014, p. 2593). The FGDs in Mukuru found similar but not identical strategies: this settlement is often too dense to accommodate new pits and tankers usually too costly, but flooding-out and manual emptying are common (see below). In some areas of Mukuru, the roads are extremely poor and housing is so congested that manual emptiers' drums cannot be brought inside. Instead, emptiers will carry waste using buckets, as they explained: "the roads are very bad in the two areas where we use buckets [*called Moto Moto and Koinange*]. There's no space to enter in between the houses" (Nov 22nd, 2016). Finally, for villages that are quite far from water-courses, emptiers admitted that they will dump excreta along the railways at night.[85] I continue to explore variations within Mukuru that can help to develop contextually-appropriate interventions with residents, maintainers, and other service providers.

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[83] See Chowdhury and Kone (2012) and Still and Foxon (2012) for further detail on FSM enterprises in African cities.
[84] Similarly, a study of 10 cities in Asia and Africa found that manual emptiers often use simple tools like a bucket or shovel to transport and bury fecal sludge, or dump it in fields and open drains (Chowdhry and Kone 2012, p. 46). Such practices may vary in their health and social implications, depending on whether excreta are safely buried or if residents are exposed to the sludge.
[85] "In Riara, we drain and just throw it on the railway. We wait until it's night -we drain and then throw it on the railway because it's very far, so you can't push the cart all the way down to the river. For Sisal and Vietnam, it's the same. In Wape Wape, we remove and dump in the river" (Nov 28th, 2016 FGD with manual emptiers).

TABLE 1: Types of Disposal Practices and Examples in Mukuru				
Adults' Improvised Behaviors	Children's Excreta Disposal	Constructed piped solutions	Caretakers' Options (both paid and unpaid)	Paid services (least to most expensive)
Open defecation (OD), especially at night	OD	Pipe to drainage (*see Figure 5*)	Emptying services (*see final column*)	Manual emptying to river or railway
'Flying toilets' or using a basin at home (*later disposed in latrine, ditch, etc.*)	Potty disposed in latrine or in drainage	Pipe to river (*see Figure 5*)	Covertly flood-out in rainy season (*such as removing a maize cob over drain pipe*)	Mechanical emptying with small pump (*only near sewer lines*)
Placing menstrual waste in pit latrine	Rags or diapers (*thrown in latrine or collected as solid waste*)	Sewer connection (*often blocked and emptied manually or mechanically after removing solid waste*)	Drain to river: wait for water levels to rise along river during rainy season (*see Figure 5*)	Exhauster trucks (*very rare due to expense and poor roads*)

Patterns of Open Defecation (OD) -Focus groups identified particular times and spaces of OD; the practice is common to men, women, and children, but is especially prevalent in areas with limited access to toilets. For instance, participants agreed that OD is pervasive at night in Koinange, a congested area of Milimani with few toilet facilities. According to a woman who is a caretaker and CHV in Koinange, "in my area, there are so many houses that don't have toilets. So at night, most of those people are forced to use the field. They actually go to shit in the open, and they do it because they don't have toilets" (Dec 20th, 2016). OD is also linked to poverty, as a male caretaker in Vietnam explained: "Lack of finances is a big contributor to open defecation. You'll find that a household can't afford to live in a plot with a toilet. So all these children and their parents are forced to go for open defecation" (Dec 20th, 2016). FGD participants agreed that open defecation occurs throughout the day, but mostly at night. The fields where OD is widespread often have trees to offer a bit more privacy, but residents said there are no designated spaces for women, men, or children. Such patterns differ from the gendered sites of OD in Mumbai's slums, where women and men defecate openly in separate areas of a garbage heap.[86] Moreover, Mukuru's sites with more extensive OD should be prioritized in future interventions, particularly given the elevated insecurity at night and associated risks of gender-based violence (cf. Amnesty International 2010). Heightened insecurity after nightfall may contribute to other improvised strategies, as discussed below.

'Flying' and home toilets -Due to challenges such as nighttime insecurity and lack of funds for pay-per-use sanitation, residents may opt for home toilets and flying toilets. According to a caretaker in Vietnam, at "the trench there [near my plot] around 6AM, you find people draining the waste from *kasuku* [small plastic container] and basins…If you ask them, they say 'this is for the child' but if you look, you see actually it's for an adult and the toilet is inside the plot" (Dec 1st, 2016). He surmised that these residents do not use their on-plot latrines because they located are near an insecure gate.

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[86] In Mumbai's slum Rafinagar, "the Deonar garbage dump [provided] a particularly suitable topography for creating *gendered separations for open defecation*. Men often used open spaces at the lower edges of the dump, especially along the water channel [while] women walked up onto the garbage dump, finding spaces behind garbage heaps or in the ditches [to] shield themselves from prying eyes…" (Desai, McFarlane, and Graham 2014, p. 16, emphasis added). Despite such gendered spatial patterns, some women were raped or assaulted while going to defecate (*ibid.*).

Similarly, a manual emptier noted that some people "are very scared of going out, so they just shit in the house. Security is an issue" (Dec 1st, 2016). Rather than disposing home toilets in the drainage, other residents will defecate in a plastic bag that is usually tossed willy-nilly outside ('flying toilets'). A CHV from Milimani bitterly exclaimed that the bags are just thrown anywhere: residents "don't care where it lands…There was one day I was taking a sick person to hospital, and a person threw a flying toilet on my back. I had to go back; the shit was hot" (Dec 1st, 2016).

<u>Children's excreta disposal</u>: As with adults, there are a variety of improvised methods for handling children's waste in Mukuru. For instance, some toddlers use a small portable potty that is typically disposed in a latrine or in open drainage. FGD participants agreed that most people drain potties "in the toilets…There are others who take it to the drainage. Others put it in the garbage. But mostly it's Pampers that they put in the garbage" (Dec 1st, 2016). If diapers are placed with other solid waste, local youth groups will collect it for a weekly fee of 20 shillings. However, many residents instead regularly dump diapers inside the latrines: as one caretaker bemoaned, "most of the time you put [diapers] inside the toilet. So you can imagine if there are 5 or 6 people who have put Pampers inside the latrine in one day, that toilet will start filling!" (a woman who is both a CHV and caretaker in Koinange, Dec 20th, 2016). Instead of purchasing diapers, a cheaper option is for parents to cut their clothes into rags: "Sometimes when you don't have money for Pampers, you have to use your clothes" (CHV, Dec 1st, 2016). Pit latrines can be difficult for children to use, and past research suggests that young slum-dwellers often avoid using pit latrines due to fear of falling inside, which may be linked to open defecation in their settlements (Bartlett 2003, p. 66).

When children suffer from diarrhea, caretakers may struggle to maintain clean latrines and their parents face heavy medical or other expenditures. A caretaker in Koinange explained their toilet is located outside the plot, and it "has a big problem because of how the children use it. Sometimes children have diarrhea, and they just go and have diarrhea anywhere" (Dec 20th, 2016). Children's diarrhea in and around the toilet thus leads to extra cleaning burdens for caretakers, as well as posing a hazard to other residents. Another way of managing diarrhea is to increase diaper purchases: parents typically buy 7 to 10 Pampers per day when children have diarrhea (Nov 22nd, 2016), totaling Ksh. 100 to 150 per day on diapers (Nov 28th, 2016). Parents may also incur extra costs purchasing water to rehydrate the child, soap to wash sullied clothes, fruit (considered a way to promote health), and of course medical treatment (Nov 22nd, 2016). Caretakers agreed that diarrhea is more prevalent among children during rainy season, when caretakers and other adults are more likely to engage in risky disposal practices like flying toilets (Dec 20th, 2016, also below).

Seasonal Variations: Greater Challenges with Disposal and Maintenance in Rainy Season
Heavy rains can result in rapid latrine-filling (due to Mukuru's high water-table), additional work for emptiers (who still struggle to cope with flooded roads), and more onerous cleaning duties for caretakers. Some caretakers say their latrines are emptied more often in rainy season, perhaps 1-2 times *per month*, as against every 1-2 months or more infrequently in dry season (Dec 20th, 2016). Manual emptiers therefore have more regular work in rainy season but lamented that they do not make extra money, as they work in bigger teams to cope with the flooded roads (see below). Additionally, a caretaker explained that she grapples with additional cleaning burdens during rains, which also fill up her latrine more quickly:

> During rainy season, most toilets are filled because water gets into the toilet and it fills them up very fast. *And cleaning?* Cleaning, you have to do almost all the time because people come

with mud, and others just come and shit on top, just doing it very fast. Others shit on top because they disrespect the caretaker (caretaker in Sisal, Nov 22nd, 2016).

Not only do toilets quickly reach capacity due to heavy rains, but she complained that tenants also track in mud and may deliberately misuse the facilities (see below for more on maintenance).

Alternatively, caretakers may employ mechanical emptiers, take advantage of being located near a river that can carry excreta away (see Figure 5), or covertly flood-out their latrines. For the latter, FGD participants explained that caretakers can make a hole at the bottom of their latrines so waste can flow to a nearby open drain at night.[87] A variation is to use a maize cob that can be removed to release waste: in some plots "they've put pipes inside the toilets so that when it rains they just open the pipes... *They cover the drainage with a maize cob, so when it rains they just remove it*...So many [caretakers] do that!" (Dec 1st, 2016, male caretaker in Vietnam, emphasis added). Another option is to engage mechanical emptiers, who can pump at night to a nearby sewer. Although mechanical emptiers also work during dry season, they are more regularly employed in rainy season when there is sufficient water to facilitate pumping.[88] Before employing mechanical emptiers, caretakers may first ask manual emptiers to remove solid waste so it does not break the workers' pumps. Latrine-emptying practices are thus strongly affected by the presence of solid waste, and there may be interdependencies between mechanical and manual emptiers (much as in other African cities[89]). The above alternatives not only reflect a toilet's location (near a sewer, river etc.) but also depend upon if a caretaker wishes to save money via flooding-out or instead empty the latrine using a paid service.

Tenants themselves may resort to insalubrious improvised solutions during rainy season, including greater use of flying toilets and home toilets. A caretaker in Vietnam said that people more commonly use flying toilets and dispose them in the drainage; "you can't see them because most of them are carried by the rains" (Dec 1st, 2016). As he explained, "people use that drainage because it's just outside the door and no one is coming outside because it's raining" (*ibid.*). Manual emptiers similarly observed that in rainy season, residents may utilize a bucket for waste and dump their feces in the drainage, especially at night (Dec 1st, 2016). While not creating immediate challenges as the waste is washed downstream, these strategies may only compound the risk of sanitation-related illnesses during Nairobi's rainy season. Below I explore the interrelated challenges of minimal solid waste management, open drainage, and water contamination, which may contribute to cholera outbreaks in rainy season.

Cholera Outbreaks Stemming from Open Drains and Contaminated Water
Several respondents noted that Mukuru's concatenation of open drains, low-quality water pipes, and meager solid waste management likely heighten the risk of cholera and water contamination. Thin 'spaghetti' water pipes readily break, and they usually pass through open drains clogged with solid waste (photo below). Particularly in rainy season, these fragile pipes can burst and

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[87] "They [caretakers] make a hole in the toilet, just below, where now everything flows…Because the drainage is there, they take advantage and the waste just flows with it because the water is moving very fast. So you just smell it, but you don't know where the shit is coming from. *This is usually during rainy season and there's a big smell. It's at night and then by morning, they've drained everything*" (Nov 22nd, 2016, discussion by a caretaker and a CHV, emphasis added).

[88] As a mechanical emptier in Vietnam explained, "I'm very happy during rainy season -I use a pumping machine and that's when the water is high. For the ones who use drums [i.e., manual emptiers], it's difficult because there's no work for them. But for those of us with pump, we get a lot of business and it's easy to drain" (Dec 1st, 2016).

[89] A comparative study in African cities similarly found that 'cooperative teamwork' between manual and mechanical emptiers, including in Dakar and Cotonou (Collignon and Vézina 2000, p. 40).

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typically water vendors make only perfunctory repairs. According to a CHV, most water connections "pass inside the sewer system and the drainage. When there is a leak, they [water vendors] just fix it with a rubber band" (Nov 28th, 2016). Another CHV recognized the elevated risk of cholera linked to water combining with sewage: water pipes "are broken and they mix in the sewer. So when we use the water without treating it, there are so many problems. *That's why sometimes we have cholera outbreaks*, and this happens a lot in the rainy season" (Dec 20th, 2016, emphasis added). As she thoughtfully noted, water vendors' poor maintenance and lack of water treatment only exacerbate the risk of cholera outbreaks during rainy season. She also recalled that during a cholera outbreak in 2015, public health officers brought Aquatabs to treat water but "when government leaves, that is the end of treating water" (*ibid,* also below on governance). A Nairobi Water official agreed that cholera outbreaks in informal settlements may stem from the shallow water pipes passing through open sewers: "there are issues of cholera -when they do illegal [water] connections, they do it badly. It *mixes water and sewer*" (Dec 21st, 2016, emphasis added).

Figure 7: 'Spaghetti' Water Pipe Passing through Open Drain and Solid Waste

Improving Solid Waste Management, Menstrual Hygiene, and User Behavior

The above findings already suggest the need for enhancing garbage collection and menstrual hygiene management; FGD participants also underscored the need to change tenants' behavior. Such challenges are interrelated: tenants may be unable or unwilling to pay for solid waste collection and are accustomed to disposing garbage haphazardly in the toilets or drains. According to a female CHV in Zone 48, "there are only two people in [my] plot who pay for garbage collection on Sundays. I contribute because I know that in the future it will be very hard [if we don't have collection]" (Dec 1st, 2016). While some residents fondly recalled the free clean-ups by Kenya's National Youth Service (NYS) in 2015, this service has been discontinued and community clean-ups are now rare.[90] Furthermore, caretakers often bemoaned tenants' habit of disposing sanitary pads, diapers, and other solid waste in the latrines. A male caretaker in Vietnam declared, "People should use tissue [and] stop using boxes, throwing Pampers and Always [sanitary pads] inside the toilet" (Dec 20th, 2016).[91] Tenants may deliberately misuse the toilets, sometimes out of drunkenness or from having minimal stake in these low-quality rental areas. As a female caretaker in Zone 48 explained, "if you ask [who messed up the toilet], nobody will accept responsibility. They'll just say 'you're the caretaker, so you just clean'...Most of the time, those who make it dirty aren't children, they're actually adults!" (Dec 20th, 2016).

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[90] As a female CHV explained, "during the time of NYS, the youths were doing a very good job. But as a community we didn't give them morale…immediately [after] they left, we were just dumping again" (Dec 20th, 2016).
[91] A female CHV similarly complained, "Women's pads have become too much. You find them everywhere, even in the toilets," and two manual emptiers concurred that they regularly find pads in the toilets (Dec 1st, 2016).

Participants frequently prioritized solid waste collection and improved roads, viewing these complementary services and infrastructure as integral to improving sanitation in Mukuru. The FGDs concluded by asking participants how to improve sanitation and priorities for intervention; I had expected them to discuss the need for sewers or improved toilet facilities. Instead, many participants underscored the importance of enhancing waste management and government partnerships to enhance waste-collection. For instance, when asked how to improve sanitation, a manual emptier said local youths should be organized to collect garbage and a CHV recommended that each village in Mukuru should have refuse bins that will be collected by Nairobi's County government (Dec 1st, 2016). Others suggested improving MHM and diaper collection, such as a female caretaker in Sisal who argued for collecting "Pampers and sanitation pads—this should [be] emphasized" (Nov 22nd, 2016). She also prioritized educating absentee landlords: "A lot of landlords don't live in the community and don't understand what people go through, so this means that educating them is very important" (*ibid.*). In another thoughtful response, a female caretaker in Koinange argued that government can help in constructing roads and drainage, while landlords should create space for toilets and connect to sewers (Dec 20th, 2016).[92] Below I continue exploring the maintenance challenges that may stem from Mukuru's absentee landlords.

Absentee Landlordism and Related Maintenance Challenges

While some residents were satisfied with structure-owners' timely payments for emptying services, others complained of landlords who fail to maintain and often delay emptying their latrines. Mukuru's landlords are usually wealthy and live off-site, as in other Nairobi slums (Gulyani *et al.* 2010), and owners may neglect latrine maintenance as part of a broader pattern of maximizing profits via low-quality rental housing (*ibid.,* Amis 1984). A CHV sharply criticized profit-driven landlords for failing to build or empty toilets: "landlords should build nice toilets...they should make sure [the latrine is] drained in good time. When it comes to draining the toilets, it's a big problem—but for collecting rent, [landlords] are very fast!" (Nov 28th, 2016). She incisively contrasted Mukuru landlords' inability to empty latrines quickly with their speedy collection of rents. In response to owners' delinquency, tenants may either withhold their rents until toilets are emptied, or collect money themselves to pay emptiers (manual emptier, Nov 28th, 2016). A female caretaker in Wape Wape confirmed the tenants can stop paying rent as protest: "There are times when people refuse to pay rent, but there's nothing you can do. You can't chase them away because it's actually the landlords' fault that [tenants] are not paying" [*i.e., due to the owner failing to empty the latrine*] (Dec 1st, 2016). Although protests may compel landlords to empty latrines, poorly-maintained or insufficient toilets reflect the entrenched power imbalances between absentee owners and low-income tenants relying upon them for cheap accommodation.

However, landlords' non-payment or delayed maintenance is not universal, as some caretakers can successfully reserve money from monthly rents and utilize it to pay for emptying. In the final FGD, several caretakers reported having no challenges with paying emptiers because they could regularly set aside money from rents (Dec 20th, 2016). Similarly, a female caretaker in Zone 48 noted that "once [the latrine is] full and people have paid, I just take from the rent and explain to the landlord" (Dec 16th, 2016). These findings suggest that management arrangements with proactive caretakers, in some cases, can promote adequate maintenance even in the face of longstanding

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[92] "The government can help us a lot on drainage and on constructing the roads. I don't think government will come and say they'll build toilets for us [*she notes that in the past, government didn't maintain public toilets*]…For me, I think the most important thing [for government to do] is the road and the drainage so that landlords can agree amongst themselves and create space for toilets" (Dec 20th, 2016).

landlord/tenant power imbalances. Below I delve further into the essential maintenance services provided by caretakers and emptiers in Mukuru.

Maintainers: A Profile of Manual Emptiers, Mechanical Emptiers, and Caretakers
Manual Emptiers

Manual emptiers engage in several distinct tasks, rather than merely emptying, and each stage can create occupational health hazards or expose residents to fecal contamination. In the typical sequence, 1) **emptying** is often a two-person job[93] in which a worker dips a small plastic bucket attached to a wooden pole into the toilet, filling up larger buckets, and his colleague then carries these buckets to a metal drum (see Figure 6 above). When full, the drum is covered with plastic sheeting, and subsequently the emptiers 2) **transport** it to a water-course, with one worker pushing and another pulling. Low-quality roads may puncture the cart's tires or workers' gumboots, and drums can leak on the road, which can anger nearby food vendors who fear contamination of their goods. Workers next 3) **dispose** waste usually in a stream adjoining a garbage heap, a site selected because it is somewhat removed from residential areas. After emptying, transporting, and disposing anywhere from 2 to 10 drums, the emptiers 4) **clean the toilet** with water and soap usually provided by the caretaker or landlord. Although teams differ in how thoroughly they clean the toilet, the plot's drainage is usually inadequate, and workers may inadvertently pour water back into the latrine as well.[94] In turn, even if they try to clean the latrine carefully, emptiers may leave stagnant water in open drains or a latrine already partly-refilled with graywater.

Emptiers' challenges in disposing excreta will depend upon the road's width and condition; state of the toilet and waste inside; and the latrine's distance to the dumpsite. Latrines are often slippery, poorly-ventilated with only narrow drop-holes and encased in brittle, rusted metal sheets that regularly cut the emptiers.[95] Although toilets with watery waste are relatively easy to empty, workers will face more challenges if the pit contains dense fecal matter or extensive solid waste. Workers may add water or wastewater to dilute thicker excreta and utilize a wooden pole to stir it, but they rarely own additional tools. Then, as they transport waste, they face a treacherous task because of the cramped, furrowed paths and highly inadequate drainage, especially in rainy season. In Mukuru's highest-density areas, as noted above, workers can only empty by carrying buckets rather than a drum since it cannot fit inside.[96] Such stresses of transporting are only augmented by spatial competition with pedestrians or other residents working along the congested roads, and by the stigma often attached to latrine-emptying (see below for community views of emptiers).

A brief survey with manual emptiers indicated they are not uniformly young or low-income; a sizable proportion has had the job for several years; and a few have accrued considerable savings. Emptiers' bimodal profile in Mukuru echoes findings from other cities, where these workers are typically divided into 1) professional, long-term, more successful workers and 2) more casual

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[93] Team size may vary based on the season, and harsher terrain or longer distance to the emptying site may require a bigger team. Emptiers may work alone in the dry season (when roads are less impassable), in rainy season they may partner with up to 3 workers and can change their composition based on emptiers' daily availability.

[94] This was again a concern in Kampala's informal settlements, where cleaning led to additional water entering the pit latrine and hastening of filling times (Nakagiri *et al.* 2015, p. 536).

[95] However, as seen in Figure 3 above, a few latrines in Mukuru do have raised, wider platforms and a ventilation pipe to help control odors or flies.

[96] These include Koinange and Moto Moto, areas with poor roads and congested structures (Nov 22nd, 2016).

laborers who often lack education or entrepreneurial skills.[97] Based on a survey conducted with 108 emptiers in Mukuru, they have the following profile:

Table 2: Demographic and Social Profile of Manual Emptiers (N=108)

Median age	Mean years of emptying	Median years of emptying	% with another job	% with savings
36	8.38	6	23%	62%

The median age was 36 years and emptiers had worked for a median of 6 years (though a mean of 8.38 years, showing the fairly skewed distribution). Emptying was the sole job for 77% of emptiers and just 6 emptiers reported owning a drum. Since Muungano will encourage emptiers to join savings groups, we asked about their savings levels. Of 108 emptiers, 67 had total savings of Ksh. 352,250 but, underscoring the stark internal divides, 9 wealthier emptiers saved from Ksh. 10,000-60,000 ($100 to 600) or Ksh. 213,000 ($2,300) in total. Meanwhile, the remaining 58 emptiers saved Ksh. 139,249 or a mean of just Ksh. 2400 per worker ($24).

Manual emptiers are commonly viewed as drunks who spread disease but are also recognized for offering an accessible service, and some emptiers recognize the concern of alcohol abuse. For instance, an FGD participant critiqued emptiers for spreading cholera and mishandling waste: "I don't like the way they carry that waste [because it] is just spilling off, so that drum is contributing to cholera in the community. They drain it and then the shit comes outside your business, the flies are all over your business" (male public toilet caretaker, Dec 20th, 2016). Emptiers acknowledged that their colleagues often drink and this is linked to major challenges, including a lack of professionalism or working for low rates per drum. In one manual emptier's complaint, "most of them [*i.e., fellow emptiers*] are drunkards...they leave work halfway [completed], they don't care...Sometimes these people even fall because they are drunk, and all the waste just goes on the road" (Nov 28th, 2016). Alcohol is a common coping strategy among manual emptiers in other cities (Sugden 2012), and sober workers certainly recognize the dangers of spillage and indiscipline. However, a CHV thoughtfully explained the community's ambivalent attitude towards manual emptiers, noting that they offer a key service that is far more accessible than exhauster trucks:

> *Do CHVs ever take deliberate action to target the pit emptiers?* Not necessarily, but we recognize that they do a very important role in the community. Even though they are highly feared by the community—when they are carrying the shit, people run away from them—[residents] recognize that if they were not there, then the community would be very filthy and the situation would be even worse. They also recognize that [emptiers] offer a very affordable service. If they relied on exhauster vehicles, first of all, [the trucks] wouldn't come to the community because of the roads [*i.e., being impassable for trucks*] and it would be too expensive (female CHV, Nov 22nd, 2016).

She contrasted exhauster trucks, which are more expensive and cannot readily enter due to Mukuru's poor roads, with manual emptiers working at cheaper rates. Although emptiers are "highly feared," she observed that they also provide an essential service that prevents Mukuru's environment from deteriorating further. As explained below, mechanical emptiers may compete with manual emptiers, although the latter can still collaborate by first removing garbage that otherwise can damage the pumps.

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[97] "Although many cities have a cohort of hardened and long-established professional manual pit emptiers, there are also people [who] can be considered temporary pit emptiers...'Temporary' pit emptiers have low educational levels, no business acumen or entrepreneurial drive...[while] professional pit emptiers already have a good business model and are comfortable with the way they operate" (Sugden 2012, p. 4).

Mechanical Emptiers

Mechanical emptiers typically work near existing sewer lines, and they face the challenge of unblocking the sewers as well as bribery threats from the police. Like manual emptiers, they experience seasonal variations in workload and often lack protective gear. However, mechanical emptying can be more lucrative and these workers only pump at night, so as to avoid bribing the police (see Chapter 4 for discussion of bribery in other sectors). Three mechanical emptiers participated in a FGD; I later interviewed one of them to learn more about their work. This emptier works on a team of 7 emptiers, of whom 2 are tasked with watching out for police while the others either work in the latrine or manage the pipe (interview with Vietnam emptier, Dec 3rd, 2016). He said they lack a permit, which would cost an unaffordable Ksh. 17,000 ($170). Typically, they earn Ksh. 4,500 for emptying 5 meters (rates reflect the length of pipe utilized) but some landlords only empty half of a latrine because of the high cost. He reported there are 6 groups in Mukuru with pumps; their machines usually cost Ksh. 25,000 to 30,000 ($250-300). When asked how to improve the business, another mechanical emptier replied, "If we get another 2 pumps for our group, I'd be very happy. Also safety gear, like gloves…most important, how we can actually deal with those people who are corrupt [i.e. police] so they can stop harassing us when we're doing our work" (Dec 20th, 2016). Although mechanical emptiers can enjoy higher profits than manual emptiers, these earnings can also attract the attention of corrupt police. Further research is needed with additional mechanical emptiers, but these initial findings suggest that they face occupational hazards and regular police harassment.

Caretakers

Caretakers are typically female and often lack respect from tenants, but these maintainers can play a pivotal role in ensuring that residents utilize toilets. In the FGDs, participants agreed that women are usually tasked with caretaking, although male caretakers may be expected to promote security on the plot.[98] When asked to explain this gendered division of labor, a male caretaker in Vietnam noted that women are usually at home and therefore can manage the toilets and their families (Dec 20th, 2016). Additionally, a female caretaker in Zone 48 argued that women are usually chosen since they are considered more stable tenants: "landlords look at the fact that you're a woman [and] you have children in school, so you won't be a person who moves around all the time. That's why they trust women" (Dec 20th, 2016). Caretakers usually (though not always) receive free lodging in exchange for their work, but they typically buy their own cleaning supplies and may face conflicts with tenants who misuse the toilets. For example, a female caretaker in Koinange bemoaned the fact that some adults "will shit everywhere, including on the wall, and they will not care!" (Dec 20th, 2016). Since many caretakers receive free lodging, tenants often view the cleaners as entirely responsible for maintenance and perhaps will require further education (or sanctions, in case of misuse) to avoid placing undue pressure on the maintainers. Regular cleaning can be critical to ensure utilization of shared private facilities *and* public toilets, as suggested by findings from Mumbai's slum of Rafinagar. When public facilities in Rafinagar are poorly-maintained, residents may resort to open defecation or pay extra for private toilet blocks, depending on their age and gender (Desai *et al.* 2014).[99]

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[98] "It depends on the landlord…In most plots that I know, *most of the cleaners are women,* but we have men who look like the overall security of the property. Especially in the big plots, that's what they do. *The mama cleans and the male caretaker does the general security*" (female caretaker in Koinange, Dec 20th, 2016, emphasis added).

[99] In Rafinagar, the cleanliness of public toilets is closely linked to usage patterns and when these facilities are dirty, women were more likely to pay for private blocks while men and children resorted to OD (Desai *et al.* 2014, p. 12).

Caretakers in Mukuru usually clean 1 to 3 times daily and some are quite invested in this health-promoting service, since they as well as their families utilize the toilet. Cleaning frequencies will depend on whether the latrine is misused by tenants, if it is rainy season when mud is ubiquitous, and/or the inclination of the caretaker. Some caretakers are not as diligent or work outside of Mukuru, resulting in less frequent cleaning. For instance, 2 of the 6 caretakers at the final FGD said they only clean once per day (Dec 20th, 2016). But according to another caretaker in Koinange, she will clean the latrine "in the morning, and then I have to look at it often to see if it's clean because I have grandchildren. So if I don't clean, they're the ones who fall ill and they're the ones that use that toilet" (Dec 20th, 2016). Her description underscores the close overlap between caretaking services and her household; she claimed to clean frequently to ensure that her grandchildren stay healthy. Additionally, a caretaker in Zone 48 highlighted their contributions in preventing cholera outbreaks in Mukuru, while the areas without caretakers are more prone to cholera or infestations:

> The caretaker is a very important person in the community because she cleans a toilet so that that toilet doesn't spread diseases. For example, the places where cholera has spread are where the toilet was dirty…In places with a caretaker, the toilets are well taken-care-of…In toilets that are not clean, they are so full of flies…there is a very big advantage to those caretakers (Dec 20th, 2016).

She emphasizes the need for ongoing maintenance to promote consistent toilet use and community health, yet cleaning is often overlooked in past sanitation research (as noted in Section II above). This lacuna may reflect the fact that caretakers are usually women and toilet cleaning is intimately linked to their reproductive labor, with the latter roles once again usually invisible and undervalued.[100] As discussed below, Kenyan government officials usually neglect slums' sanitation and FSM in particular, but I also note some promising openings in recent policies.

Cholera, Dumping Bans, and Other Government Interventions in Mukuru's Sanitation

Cholera outbreaks may result in emptying bans, additional outreach by CHVs, and inventions by utilities or public health officials, though such changes are often fleeting and superficial. During cholera, CHVs typically "walk door-to-door; we sensitize the community on the importance of good hygiene...you have to keep the toilets clean, keep the water clean, so that the disease [cholera] doesn't spread to the others. We put treatment [*dawa*] in the drainage" (CHV, Nov 28th, 2016). According to a Nairobi Water official, public health officers distribute WaterGuard, and Nairobi Water staff collect water samples to ascertain the source of contamination (Dec 21st, 2016). Although the water utility also deploys water-tankers during cholera (*ibid.*), these trucks stop operating after the outbreak and water treatment remains rare (see discussion by CHV above, Dec 20th, 2016). Additionally, Mukuru's area chief may prohibit manual emptying to halt the spread of cholera, but these bans seem ineffective since emptiers confessed to working in early-morning hours rather than fully complying (Nov 28th, 2016). Public health officers usually try to close the small restaurants or cooked-food sellers working in Mukuru, similar to other slums where food vendors are blamed for cholera outbreaks (Githiri *et al.* 2016). Another Nairobi Water official with experience in Mukuru reported that public health staff will close local shops during cholera and arrest their owners, but "they don't control dumping" (Dec 19th, 2016). Cholera is thus a rare instance when public health or Nairobi Water officials intervene in Mukuru's sanitation, but their response seems to have few long-term impacts upon dumping practices or water quality.

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[100] There is also a broader lack of attention to humble, sometimes hidden maintenance practices in other infrastructure sectors (although see Graham and Thrift 2007).

Otherwise, sanitation in Mukuru is only lightly regulated and infrequently attracts attention from the police, Nairobi Water, or the National Environmental Management Authority (NEMA). Previously, Mukuru's area chief designated two dump-sites in Vietnam (near the sewer line) and another near the river (see Figure 6 above). Emptiers will be arrested if caught disposing excreta elsewhere, according to a Nairobi Water official who works in Mukuru (Dec 19th, 2016). This official also noted that emptiers should pay Nairobi Water an annual fee of Ksh. 20,000 to dump at Njiru, the city's official waste-tipping site, but he acknowledged that they instead usually dispose excreta in the nearby river (*ibid*). At present, manual emptying remains illegal in Kenya, so emptiers are unlicensed and not monitored officially (WEDC and WSUP 2015: 22). Yet the police rarely harass manual emptiers in Mukuru, perhaps because their earnings are too low and because the dumpsite is now tacitly recognized.[101] Other agencies are similarly uninterested in slums' dumping, except for rare bans like NEMA's prohibition on manual emptying; this was part of a broader effort to stop the incineration of slums' solid waste from April to May 2016 (see Chapter 4).[102] Additionally, Mukuru's village elders occasionally intervene in sanitation, such as selecting disposal sites and dealing with youths who can opportunistically demand bribes from emptiers (Nov 28th, 2016). Apart from such rare official actions, Mukuru's excreta disposal is usually neglected and this policy vacuum regarding FSM is common elsewhere in the Global South.[103] However, some incipient policy changes in Kenya may foster recognition for on-site sanitation and support more sustainable disposal of execreta, as noted below.

Sectoral Fragmentation but Recent Openings in Kenyan Sanitation Policy

The SDGs provide new imperatives to improve the entire sanitation chain but still evince little concern for shared sanitation, and meeting these targets will entail major practical challenges. While upholding the MDG definition of 'improved' provision,[104] SDG 6 now aims to "ensure availability and sustainable management of water and sanitation for all." Its proposed definition of 'safely managed' sanitation includes "safe capture of fecal waste with isolation or treatment with safe disposal/reuse, either on or off-site" (Hutton and Chase 2016, p. 3). The SDGs' recognition of the sanitation chain, incorporating both on-site and sewered conveyance of waste, represents a key aspiration for future policymakers. Yet Mara (2016) emphasizes the staggering enormity of the task: to achieve SDG 6 and reach 3.4 billion people with safely-managed sanitation by 2030, an additional *600,000 people per day* will need to gain access from 2016-2030 (p. 349). He rightly notes that shared*, safely-managed sanitation will be essential to serve residents of burgeoning informal settlements, and he urges the UN to reclassify shared provision as improved.[105] If such lofty SDG targets for safely-managed sanitation are to be achieved, it will be essential to improve the maintenance and disposal of shared sanitation in dense slums like Mukuru.

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[101] A manual emptier with 15 years' experience says that the police did initially harass them they were given a dump-site, but this is no longer the case: "Before, we were harassed a lot by the police, arrested and taken with the drum to the police post. But now nobody bothers with us—unless you make a big mistake with where you dump it. But if you cover [the drum] nicely and dump it, nobody will ask you anything" (Nov 28th, 2016).

[102] I was given several explanations for NEMA's ban, but an experienced coordinator at Muungano (Jack Makau) believed the catalyst was incinerating solid waste in Mukuru and need to improve air quality, not a concern with excreta.

[103] According to a 10-country study, "Fecal sludge management related to household on-site sanitation emptying and transportation [is] *by and large ignored by the public authorities*. The business of emptying and transporting fecal sludge is dominated by private entrepreneurs...*Treatment and re-use of fecal sludge in these countries is also either absent or very limited*" (Chowdhury and Kone 2012, p. 27, emphasis added).

[104] In both MDGs and SDGs, 'improved' sanitation is defined as flush or pour-flush to piped sewer system; septic tank; pit latrine or Ventilated Improved Pit Latrine; pit latrine with slab; and composting toilet (Hutton and Chase 2016, p. 3).

[105] As he asked pointedly, "How can we possibly get safely-managed sanitation to all households in the world's slums by 2030 if we cannot count on well-managed shared sanitation?" (Mara 2016, p. 350).

Additionally, Kenya's Constitution and recent sanitation policy have confirmed the importance of universal access to safely-managed sanitation, but institutional fragmentation remains a significant concern. The Kenyan Constitution of 2010 establishes the right to sanitation, which incorporates physical access to an acceptable toilet; storage, collection and treatment of waste; evacuation of treated effluent; and a clean environment free of wastes (see WASREB 2016, pp. 6-7). Furthermore, Kenya's national development plan known as Vision 2030 has established a target of universal access to water and improved sanitation by 2030 (Ministry of Health 2016, p. 19). Amongst its recommended strategies are expanding urban sewerage; removing and treating fecal sludge; and encouraging the transition from traditional pit latrines to improved technologies (*ibid.*). However, my interviews often underscored that Kenya's WASH sector is highly fragmented with poorly-coordinated interventions, especially in the context of decentralization.[106] Sanitation services have been devolved to County Governments (including water, sanitation, storm-water, and solid waste management), while the National Government is responsible for policy, technical assistance, and formulating standards (*ibid.,* p. 18, pp. 49-50). In particular, the National Environmental Sanitation Coordinating and Regulatory Authority (NESCRA) will develop and enforce guidelines on wastewater, waste treatment, and disposal (working with NEMA and WASREB).[107] Unless these regulations are developed and implemented with County Governments and water utilities' support, such encouraging policy shifts may remain imperceptible on the ground.

In additional challenges, the Ministry of Health's sanitation policy is almost silent on informal settlements, and Nairobi officials are often uninterested in improving slums' drainage or sanitation. Kenya's sanitation policy calls for 'close coordination' between slum upgrading agencies, County government, operations and management, and local planners so that sanitation initiatives will be "more integrated and effective" (Ministry of Health 2016, p. 35). However, the policy includes no further discussion of interventions or particular strategies to improve slums' sanitation. According to a Nairobi Water official who previously worked in its informal settlements department, staff from the utility and Nairobi's County Government are "very reluctant" to provide anything besides sewers (Dec 7th, 2016). And although drainage is a County Government responsibility, this official argued that the County only provides drainage in the formal city rather than in informal settlements (*ibid.*). A GIZ sanitation program officer highlighted other challenges at the County level: for instance, County Governments now must approve WASH priorities, but they lack the requisite experience and capacities in this area (Nov 24th, 2016). Furthermore, many water utilities have not invested in slums, and the Ministry of Health has usually limited its focus to hygiene and marketing interventions like community-led total sanitation (*ibid*). Finally, County-level data on FSM are lacking since WASREB only monitors the Counties' sewer coverage, without providing information on the treatment or disposal of waste. Below I reflect upon my findings as well as identifying future directions for research and practice.

V. Conclusion: Methodological Reflections and Future Action-Research Agenda

Few studies consider how African slums' shared latrines are maintained or disposed, despite the predominance of these toilets, but my alternative approach can help reveal variegated disposal patterns. To create a multifaceted analysis of Mukuru's excreta management, I combined

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[106] Discussions with a GIZ program manager and a Nairobi Water official confirmed that fragmentation is a key obstacle to improving sanitation in Kenya (interviews Nov 24th, 2016 and Dec 7th, 2016).
[107] These guidelines will cover facilities "for the safe handling and disposal of human excreta...including excreta disposal facilities and systems for the conveyance (sewerage, vehicular, manual), treatment, and final disposal" (Ministry of Health 2016, p. 51).

observations and a brief survey with manual emptiers; interviews with Nairobi Water officials; and FGDs with emptiers, caretakers, and CHVs. Photos in the settlement complemented these findings, while document analysis helped to identify policy openings and stubborn gaps. FGD participants also provided basic spatial data (using a Google Earth map and Muungano's data), including the condition of toilets and sewers, sites of open defecation, and excreta dumpsites. My findings encompassed multiple disposal patterns, including ditches or watercourses, covert pumping to jerry-rigged sewers, and several improvised strategies. Tracing Mukuru's excreta flows helped reveal manual emptiers as a key vector in disposing waste and as a central entry-point for intervention. I suggest that waste flows (and blockages) are shaped by gendered patterns of maintenance, and FGDs also explored multiple causes of non-functional toilets. I distil my methods in Table 3 (next page) and local organizations may replicate or deepen these mixed-methods approaches. Sanitation NGOs, urban poor federations like Muungano, and other community organizations in the Global South could build upon my methods, since this approach does not require complex epidemiological data-collection. Residents in Muungano have already gathered ample spatial data on slums' toilets and sewer lines, which can create a vital foundation for additional data-collection (e.g., paid latrine-emptying services, local toilet conditions, and improvised behaviors). Further spatial and qualitative data-collection will be especially important in rainy season, when disposal patterns are particularly risky, emptying can be challenging, and water pipes highly prone to breakage. Although Table 3 centers upon on-site sanitation and residents' improvised disposal patterns, it can also be adapted to explore maintenance of public toilets, sewer conditions, and behaviors in other settlements.

Additionally, I argue that Mukuru's 'sanitation chain' is hardly a distinct sequence but rather a mutable, heterogeneous array of *improvised practices, maintenance services (paid and unpaid), and fragile piped solutions*. In this informal settlement, the 'sanitation chain' hardly resembles a predictable, orderly sequence unfolding from containment to treatment (as in Figure 3.1 above from Maputo). Instead, Mukuru's sanitation chain is an emergent co-creation of households, caretakers, and FSM providers who regularly shift in their interactions with (at times filthy) shared latrines and tenuous networks like open drains, jerry-rigged sewers, or brittle water pipes. Although this characterization resonates with literature on 'assemblages' in urban infrastructure (e.g. Farías 2010), my detailed findings extend beyond a description of complex socio-technical relations in the sanitation chain. I analyzed several constituent parts of Mukuru's excreta flows—behaviors, manual emptying, gendered maintenance relations, and fragile piped networks—but eschewed a linear 'chain' of stages. Studies in other slums may focus upon alternative elements (public toilets, mechanical emptying, etc.), and such detailed findings may better reveal the complex, scattershot ways of managing excreta than the misleading notion of a singular, sequential 'sanitation chain.' An innovative study in Mumbai and Turin (among slum-dwellers and the homeless, respectively) similarly highlighted the multiple forms and local processes that create sanitation. These authors argue that sanitation is "instantiated through quite different cultures around the body [and] entanglements with infrastructure …there is no 'a' logic [or] 'a' solution to the problem of sanitation" (Lancione and McFarlane 2016, p. 14). Researchers should unravel locally-specific heterogeneities and "*unsettle any stable understanding of what sanitation 'is'*"(*ibid.,* emphasis added). My analysis again underscored the flux and complexities of slums' excreta flows, which I suggest may help to transform unsafe practices.

Indeed, the elements identified in my findings can offer detailed entry-points for interventions, and analyzing the constituent parts of slums' variegated sanitation landscape can inform contextually-tailored solutions. Consider Nairobi's rainy season: unsafe disposal practices often proliferate but, crucially, occur for different reasons and will necessitate distinct responses. Toilets may be more likely to overflow (due to high water-tables and rising waters); caretakers may 'flood-

out' their latrines; and residents may be more inclined to throw 'flying toilets' in open drainage because rains will carry them away (Section IV). These elements all contribute to unsafe excreta management in the rainy season, precisely when cholera or other illnesses are more likely due to water contamination. By carefully disentangling improvised behaviors, maintenance patterns, emptying services, and piped networks in Mukuru (Table 1 and Table 3 below), my findings can inform nuanced and multipronged responses. Meanwhile, SFDs broadly categorize 'unsafely-emptied' sanitation as 'dumped in the local environment, drainage, or receiving waters', but I argue that this classification can obscure distinct practices that require different solutions. To address slums' array of unsafe practices, future interventions should be rooted in the particular behaviors, maintenance patterns, and other disposal methods that may require different planning strategies.

Table 3: Methods for Analyzing Improvised Practices, Maintenance, and FSM in Slums

	Photos & Observation of Facilities and Disposal	FGDs on Disposal Practices and Maintenance	Spatial Analysis	Profile of FSM Enterprises	Document Analysis & Interviews
Key Questions	-*Photos* of public toilets, shared latrines etc. -*Photos* of pipes to drains/river, excreta dumpsites, & other visible disposal methods	-*Identify disposal practices* and risky strategies for adults, kids, caretakers, & FSM providers -Causes of *non-functional toilets* -Discuss *emptying* frequency & gendered roles in *maintenance*	-In FGDs, *mark map* with key OD sites, dumpsites, flood-prone areas, & blocked sewers -Capture any differences in disposal *during rainy season*	-*Socio-economic surveys* with providers in slum (e.g., typical earnings, assets, length of time in business, other livelihoods) -*Observe* typical disposal practices & sites	-Analyze recent documents for any policy entry-points, inclusive initiatives, and remaining challenges
Extra Topics or More Resource-Intensive Strategy	-*Observe* levels of toilet maintenance, solid waste management, and drainage conditions	-*Crisis response* strategies in cholera -Discuss need for *complementary services* (drains, solid waste collection, menstrual hygiene etc.)	-*Verify the above* with additional mapping exercises *or* via key informant interviews (long-term CHVs, emptiers, etc.)	-*User satisfaction:* surveys or FGDs with clients (including service costs & quality) -*FGDs with emptiers* if unable to observe them (due to nighttime emptying)	-*Interviews* with utilities officials, health/environment ministry, sanitation NGOs, donor agencies, and other experienced practitioners
Output	Photos and observations that can be analyzed in FGDs or interviews	Typology of key stakeholders and disposal practices *(as in Table 1 above)*	Community-level maps of dumpsites, OD, flooding, or other hotspots	Profile of FSM businesses; levels of user satisfaction and expenditure	Identify policy and practice openings, constraints, and partnership opportunities

A multipronged response to improve FSM in informal settlements will need to encompass *household-level* initiatives, as well as *settlement-wide planning* and *institutional reforms*. At the household level, public health officials and sanitation NGOs could conduct outreach to tenants and caretakers regarding timely emptying patterns, ongoing maintenance, and appropriate toilet usage. Landlords should be encouraged to construct additional toilets; alternatively, more affordable co-produced solutions can be generated with residents (e.g., Hunga 2016 for community-constructed ecosan in Malawi). As argued above, it will also be crucial to enhance menstrual hygiene management and garbage collection, while health officers or sanitation NGOs may work with emptiers to minimize spillage and improve how they handle waste. CHVs are already a vital community resource but may need additional support and training, especially as they are unpaid volunteers. Beyond these household- and settlement-level interventions, advocates should develop appropriate alternatives with the County Government and Nairobi Water, such as forms of FSM that reflect Mukuru's high densities and low household incomes (see Chapter 5 for further discussion[108]). The above findings can encourage holistic interventions combining behavior change, toilet construction, and regular maintenance with improving complementary services and infrastructure delivery.

To take advantage of Kenya's policy openings, researchers and decision-makers can collect additional data and develop multi-sectoral solutions with attention to gendered, age, seasonal, and other variations. The SDGs and Kenyan recent sanitation directives still need to be translated into local-level action, and policymakers will require a fuller understanding of existing disposal patterns. There is also a need to overturn policymakers' longstanding bias in favor of sewerage and to challenge local officials' limited accountability to residents of informal settlements. Mukuru is a promising place to start, however, given the wide array of sanitation advocates and providers already active in the settlement. Additionally, I argue for developing gender- and age-sensitive strategies beyond inclusive toilet designs, whether improving disposal of children's potties or recognizing the key role of (usually female) caretakers. In one promising development, Kenya's sanitation policy has already recognized the need for complementary activities, including solid waste management, hygiene promotion, and better data-collection on waste flows (Ministry of Health 2016, p. 4). If researchers and advocates can reveal the heterogeneous, changing elements of slums' sanitation chain, they may catalyze vital collaborations across this usually fragmented sector. Since excreta flows are an urgent, cross-cutting concern (linked to environmental health, gender equality, and multiple infrastructure networks), uncovering these disposal patterns can potentially forge vital alliances and improvements in informal settlements that may finally transcend sectoral divides.

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[108] For example, WSUP and Umande Trust previously worked with Nairobi Water to develop an inclusive model for emptiers in Kibera, who utilized a Gulper (small mechanical pump) to transport excreta to a manhole in the settlement. The stumbling-block was that many Kibera residents had connected to the sewer directly or utilized public toilets, giving the emptiers few customers (see Chapter 5 for more discussion).

Chapter 4
The Formal/Informal Interface in Sanitation, Water, and Electricity

Introduction: Urban Informality and Formal/Informal Relations in Service Provision

Although urban informality is widely featured in past and recent literature, few scholars have analyzed the relations between government officials ('formal') and unregulated ('informal') actors. As two urbanists rightly noted, "Despite its centrality to how we think of cities, the informal-formal relation itself remains remarkably enduring and *under-investigated*" (McFarlane and Waibel 2012: 1, emphasis added). Existing research on formal/informal ties is dominated by economic accounts of firms' forward and backward linkages (Meagher 2013), sidelining other domains where informal and formal actors interact. 'Informality' has multiple definitions in city planning literature, including 1) a *spatial* categorization (informal settlements, other marginal urban spaces, etc.), 2) unorganized *labor* lacking social protection, 3) a *governmental tool* enabling certain interventions (e.g. a cut-off date establishing eligibility for services), and 4) the *negotiability of value* in which the designations of informality constantly shift (McFarlane 2012, also Roy 2005). At its most basic, 'informal' usually denotes activities that fail to comply with government regulations but urban informality is also constantly changing, contextually-determined and cross-cutting across multiple domains.[109] In turn, I argue there is a corresponding need to analyze formal/informal relations beyond the economic sphere, and my findings from Nairobi will explore a complex array of formal/informal ties. While focusing on formal/informal ties in Mukuru's electricity and sanitation provision, I offer illustrative comparisons from other sectors and other urban areas to encourage further comparative research of formal/informal relations.

Urban informality has reappeared in several guises, confounding initial expectations of its demise, and informality is especially pervasive in African cities. For instance, UN-Habitat's data suggest over 60% of African urban residents live in informal settlements ('slums')[110] and the ILO finds that over 80% of jobs are informal, among the highest rates globally[111]. Credited with coining the term 'informal' during his 1970s research in Ghana, Keith Hart recalls that it began "as a way of conceptualizing the unregulated activities of the marginal poor in Third World cities" but was later recognized "as a universal feature of the modern economy" (Hart 2006: 23). Informality in the Global South has continued generating interdisciplinary research by planners, urban theorists, and economists (among others), who regularly debate policy responses and ways of conceptualizing informality.[112] There is an ongoing resurgence of scholarship in African informal shelter and livelihoods,[113] as well as advocacy for more appropriate planning interventions in African cities where informality is predominant (Pieterse 2008, Watson 2009, Duminy 2011). Recent studies have

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[109] A seminal text by Castells and Portes (1989: 12-5) defined the informal economy as "unregulated by institutions of society" but with deep historical roots, constantly changing processes that "cut across the whole social structure," and "systematic linkages" to formal enterprises. Although referring only to economic activities, theirs is still a key contribution. Below I refer to *informality* as a heterogeneous, fluid set of unregulated activities with pervasive links to *formal* actors or firms (i.e. officially-regulated) and a thoroughgoing reach across social, historical, and political processes.

[110] UN data suggest that in 2014, about 56% of African city-dwellers lived in slums, far exceeding the levels of 31% in urban South Asia, 28% in urban Southeast Asia, and 21% in urban Latin America (UN-Habitat 2016, p. 203).

[111] While data on unregulated livelihoods are inherently unreliable, figures prepared for the ILO suggest that the bulk of employment in the Global South is informal (Charmes 2012). Africa's informal economy was "continuously growing" from 60% in the 1970s to over 70% by the late 1980s, perhaps exceeding 80% by the late 1990s (*ibid.,* p. 114).

[112] For recent reviews, see Paller (2016), Chen (2014), and Roy (2012).

[113] Key texts include Vaa and Hansen (2004) on informal African livelihoods and shelter; Groenewald *et al.* (2013) on informal settlements in southern Africa; and Hansen *et al.* (2013) on the urban street economy in the Global South.

analyzed how African informal laborers are incorporated into global production networks (Meagher 2016), informal workers' unions and transnational alliances (Lindell *et al.* 2010, Kabeer *et al.* 2013), and the state's increasingly repressive approaches to African informal workers (Brown *et al.* 2010, Morange 2015).[114] In this vast literature on African informality, most studies have focused upon shelter or livelihoods, lacking a comparative or cross-sectoral lens, and rarely interrogate the linkages between formal and informal actors.

Existing research on formal/informal ties has typically centered upon economic relations (at multiple scales), but with limited attention to other facets of informality. According to a recent review, literature on formal/informal ties has usually analyzed economic ties like forward/backward linkages between cities' formal and informal firms and informal vendors who sell formal items on commission (Meagher 2013: 6-12). Related work by economists and political scientists has analyzed how to link the formal and informal economies, such as utilizing appropriate state interventions that may fine-tune informal rules rather than replacing or crowding out informal norms (Guha-Khasnobis, Kanbur, and Ostrom 2006: 10).[115] Other research has centered upon the (often mixed) experiences of formalizing informal firms, such as past challenges with enhancing incomes and supporting worker associations following formalization.[116] In a thoughtful analysis of Delhi's street vendors, Schindler (2014) explored the production of the formal/informal divide and argued for understanding "how the boundary between formal and informal is produced and contested" (p. 2600). His useful discussion highlights the need to analyze the ongoing, conflictual creation of formal/informal relations, but still focuses on economic informality. Additionally, reviews have considered formal/informal linkages in global value chains and their often-inequitable impacts upon women or marginal groups, particularly transnational corporations using informal sub-contracted homeworkers or other precarious informal laborers (Meagher 2013, Chen 2014). While recognizing the heterogeneity in urban informality and the progressive as well as regressive potential of formal/informal ties, such research has usually overlooked how informal actors relate to government officials in domains beyond the urban economy.

Meanwhile, urban theorists have conceptualized the fluid boundaries and contestations between formal/informal actors, as well as revealing the inequitable logics that undergird these negotiations. For instance, research in Indian and Israeli cities has portrayed the state as an 'informalized' entity that selectively approves (elite residents') informal activities while excluding or punishing (poorer households') informal livelihoods or shelter (Roy 2009, Yiftachel 2009). African planning theorists have underscored the creativity of residents' informal strategies and also critiqued the colonial roots of the state's regressive stance towards informality (Simone 2004, Watson 2009). Grassroots resistance and transformation of official rules is a recurrent theme, including Brazilian residents' insurgent claims to urban citizenship or the 'quiet encroachment' of poor households in the Middle East (Holston 2008, Bayat 2004). But in these wide-ranging theoretical discussions, there is limited attention to formal/informal relations per se. A few relevant discussions analyze formal/informal relations in housing, such as criminals in Mumbai's mafia playing a powerful role in urban property markets and increasingly undercutting formal/informal distinctions (Weinstein

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[114] In other work on informal livelihoods, WIEGO has created multi-city profiles of vendors, home-based workers, and waste-pickers (see IEMS 2014). In Nairobi, Kinyanjui (2014) focuses on women in the informal economy, and other researchers have explored the role of social networks or access to credit (Totolo 2013, Lyons and Snoxell 2005).
[115] These authors emphasize the need for subsidiarity in multi-level systems and considering the state's implementation capacity, as well as tailoring approaches to the intended informal beneficiaries (Guha-Khasnobis *et al.* 2006).
[116] For instance, see Hillenkamp *et al.* (2013) on Ghanaian, Ecuadoran, and Rwandan efforts to formalize informal firms.

2008).[117] Additionally, an edited volume on the formal/informal divide included case studies of housing and livelihoods in African, Asian, and Brazilian cities, as well as more conceptual discussions of informal urbanization (McFarlane and Waibel 2012). Finally, a stimulating recent issue of *Current Sociology* explores qualitative processes and mechanisms of informalization, formalization, and re-informalization; the articles together show there are "several different ways that formal and informal are *connected, transcended, super-attenuated, or hybridized*" (Davis 2016, p. 6, emphasis added, also Bourdreau and Davis 2016, Arías and Barnes 2016). Apart from these recent exceptions, urbanists have typically failed to combine careful empirical research with theorization of formal/informal relations in the Global South.

My discussion will unravel key differences between Mukuru's informal service providers, and I propose a conceptual tool of an 'interface' to reveal variegated formal/informal ties in urban service delivery. I begin with key insights into hybrid security and governance in 'areas of limited statehood,' as well as political scientists' studies of informal institutions and hybrid local public goods (Section I). These studies have illuminated significant aspects of formal/informal relations, such as the prevalence of collusion and extraction when providing hybrid local public goods (Post *et al.* 2017, also below). The latter relevant study has analyzed the diverse configurations of state/non-state actors and direct/indirect service provision in cities of the Global South (Post *et al.* 2017, also Appendix 3). Meanwhile, I concentrate more narrowly upon the hybrid providers active in informal settlements. I create a typology of 4 informal providers in Nairobi's slums (Section II) before delving into their interactions with formal actors, which can be captured by tracing a *formal/informal interface* (Section III). I characterize the interface as a continuum varying in such aspects as 1) frequency of formal/informal interactions, 2) associated levels of bribery, and 3) likelihood of conflict. I also highlight crises or pivotal junctures (e.g., official bans on dumping excreta or disconnecting informal water hook-ups) during which formal actors adopt punitive strategies towards informal providers. Finally, I explore how some informal providers can deploy *trappings of formality* both to legitimate themselves and to thwart possible challenges by state actors. The 'interface' not only reveals how informality is created via starkly divergent ties to formal actors, but may also catalyze new research into the changing facets of informality and the inextricable links to formal actors. In Chapter 5, I will argue that understanding the interface can foster appropriate responses when intervening in slums, based on the distinct logics and changing ties between formal/informal actors.

My empirical discussion (Sections II-III) will synthesize findings from Mukuru's informal water, sanitation, and electricity providers as well as my interviews with Nairobi Water officials. A vast literature has explored informal water vendors and the politicized creation of inequitable urban water provision (e.g. Kjellén and McGranahan 2006, Heynen *et al.* 2006, Bakker 2010, Anand 2011) in addition to recent studies of formal/informal relations in the water sector (e.g., Ahlers *et al.* 2014, Burt and Ray 2014). Due to my time constraints and the already ample literature on water vendors, I focused largely upon informal electricity and sanitation providers in Mukuru. However, I did interview two officials at Nairobi Water and approximately 15 water vendors in Mukuru, including those who provide both water and electricity. As explained below, informal sewer connections are considered highly sensitive and proved challenging to study, but FGDs explored the topic as well as in my interviews with local leaders and casual sewer construction-workers familiar with the hook-up

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[117] Using bribes, threats, and violence, these groups recently financed land acquisition and developments in Mumbai ranging from residential buildings to hotels and malls (Weinstein 2008, p. 32). Moreover, boundaries between the state and criminal networks are breaking down as the latter are now defining regulatory frameworks or evicting vendors as part of the city's beautification campaigns (rather than protecting hawkers, as in the past).

process. In particular, I interviewed 7 unskilled youths who helped to connect sewers, 2 skilled sewer connectors, and 1 ex-chairlady in Mukuru. I also incorporate major findings from Chapter 2 and Chapter 3 on electricity cartels and latrine-emptiers, creating a multi-sectoral framework that could provide the basis for additional research.

I. Literature Review
A) Hybrid Security and Governance in Areas of Limited Statehood

Past literature on Africa's hybrid security governance has explored the fluid, contradictory, and always interrelated ties between state/non-state actors in promoting or undercutting public order. Studies of 'hybrid governance' in Africa examine how vigilante groups, traditional authorities, and other non-state groups can influence forms of public authority (see review by Bagayoko *et al.* 2016). Although these non-state actors vary widely, some researchers optimistically view vigilantes or similar groups as a constructive, potentially transformational alternative to the predatory African state (see discussion in Meagher 2012, pp. 1075-1077). But other researchers adopt a more critical stance towards hybrid security governance, although they agree that relations between state/non-state groups in Africa are constantly changing and "the distinction between state and society is always a moving target" (Lund 2006, p. 698, also Bagayoko *et al.* 2016). Meagher (2012) warns that hybrid security governance in Africa may only embed "violent or illegitimate forms of order [with] disastrous rather than transformatory consequences," and she advocates for "*a sharper rather than a more blurred analytical focus on regulatory shifts across the formal–informal divide*" (p. 1097, emphasis added). Her argument for additional research into the changing patterns formal/informal interactions resonates closely with my own focus, but the literature on hybrid governance in Africa remains centered upon security rather than considering other public goods.[118]

A related literature on gangs and militias in the Global South has explored their links to politicians or ethnic politics, changes over time, and economic impacts, but with usually limited consideration of service delivery. Schuberth (2015) offers a helpful conceptualization of community-based armed groups (CBAGs), including a careful discussion of militias, gangs, and vigilantes throughout the Global South. He notes that militias are often studied as part of clientelist political relations while gangs are viewed as mainly criminals or delinquents, even as these fluid groups frequently transform in their aims or political ties (*ibid.,* p.301). In his analysis of militias and gangs in Rio de Janeiro's favelas, Arías (2013) offers a useful sub-national discussion of violence by comparing differences in 1) levels of consolidation and 2) proximity to the state for these armed groups (see Appendix 3). With *weak* state-criminal relations, Arías finds greater levels of insecurity and violence while armed groups may clandestinely negotiate via civic groups to affect policymaking (p. 268). By contrast, in areas with *strong* state-criminal relations, state and armed actors usually cooperate to provide local security while armed groups directly control the policy process (*ibid.*). Arías also considers the impacts upon elections, civic organizing, and residents' mobility, as well as noting briefly that militias and gangs may even control services like electricity, cable TV distribution, etc. (*ibid.,* also Arías and Barnes 2016). His within-case variation and careful attention to local histories have created a nuanced analysis, but the focus is largely upon security and crime rather than non-state actors' roles in service delivery.

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[118] For a partial exception, see Rasmussen (2014) on the role of the Mungiki in controlling water, electricity, and some routes of Nairobi's *matatu* (mini-buses). This was also discussed in Chapter 2 above, although Rasmussen mostly focuses on matatu and the evolution of Mungiki rather than their role in providing other public goods.

Meanwhile, studies in 'areas of limited statehood' have analyzed how to deliver services despite major shortfalls in governmental capacity, but usually focus on *external* rather than *local* non-state actors. 'Areas of limited statehood' occur in both the Global South and North, and they are defined as parcels of territory or policy areas "where central state institutions are unable to effectively implement and enforce decisions" (Börzel and Risse 2016, p. 149). The authors helpfully recognize the prevalence of limited statehood, including at the urban level; Nairobi, Rio, and Washington DC are all cited as examples (*ibid*.) Additionally, a special issue of *Governance* examined how to provide infrastructure and services like vaccinations in areas of limited statehood or even failed states (Krasner and Risse 2014). The authors conclude successful service delivery is more likely if external actors are considered *legitimate* (particularly if they engage in contractual, well-defined relations with national governments, rather than imposed interventions); in cases of *lower task complexity* (e.g., one-off initiatives rather than complicated projects); and if *institutional design* is appropriate, well-resourced, and sustained over time. These studies usefully underscore the unevenness of state capacity, the need for legitimacy in providing services, and non-state actors' pivotal role in service delivery despite state weakness. However, this literature has largely overlooked cities and the role of *domestic* non-state actors, who may be viewed as illegitimate and unable or unwilling to collaborate with the state at all.

B) Hybrid Local Public Goods and Informal Institutions

Political scientists have usefully explored informal institutions, their relations with formal institutions, and selective enforcement of the law in urban areas. Levitsky and Helmke (2004) note that informal institutions can either 1) complement or 2) accommodate effective formal institutions, as well as 3) substitute or 4) compete with ineffective formal institutions (see Appendix 3).[119] These authors also recognize that informal institutions can be altered over time: for instance, substitutive and competing informal institutions are likely affected by changes in formal institutional strength (p. 732). Yet the authors do not analyze other aspects of formal/informal relations like collusion or extraction; nor do they discuss informal institutions at urban or other sub-national scales. More recently, Holland has analyzed why politicians in Latin American cities selectively enforce the law and illuminated how apparent state weakness has unexpected redistributive possibilities. Using cases of street vending and squatting in 3 Latin American cities, she examines why local politicians may utilize 'forbearance,' defined as intentional and revocable non-enforcement of law (Holland 2015). Local officials are less likely to enforce the law in areas with poor constituents (but more likely to do so in areas with wealthier populations), and she argues that forbearance may help to mobilize voters, reveal politicians' distributive commitments, and provide a source of rents (*ibid*.). Although Holland demonstrates the progressive possibilities of forbearance in Latin America, it is unclear if similar outcomes have occurred in settings like Nairobi where regressive extraction is more common than pro-poor redistribution (see below).

In a very relevant contribution, Post *et al.* (2017) analyze *hybrid local public goods* with attention to sectoral variation, and their typology encompasses multiple formal/informal relations, including collusive ties. Mainstream studies of public goods typically assume the state is the dominant provider; other studies explore how governments and civil society groups may engage in co-production (*ibid*., p. 6). But Post *et al.* argue that these literatures miss an array of *hybrid local public goods*, defined as systems "in which the state and non-state providers contribute to service delivery;

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[119] They define informal institutions "as socially shared rules, usually unwritten, that are created, communicated, and enforced outside of officially sanctioned channels. By contrast, formal institutions are rules and procedures that are created, communicated, and enforced through channels widely accepted as official" (Levitsky and Helmke 2004, p. 727).

state and non-state actors either deliver services simultaneously, or state agents regulate private service provision, either formally or informally" (*ibid.,* p. 3). They offer a typology that can support theory-building and comparative research of hybrid provision in the Global South (see Appendix 3). Alongside the well-known 1) *state-dominant* delivery and 2) *regulated provision* (e.g., concessions, privatized but state-regulated delivery), this typology includes 3) *supplemented state* and 4) *'free' market* modes of delivering local public goods. The 4 hybrids thus differ in the level of state provision (direct vs. indirect) and in the prevalence of non-sanctioned, private providers (marginal vs. dominant). Unlike past studies of informal institutions, this discussion is specifically focused on *local-level* public goods with direct applicability to the Global South. Post *et al.* (2017) also recognize the prevalence of collusion and extraction (again missed in existing studies) and they do not rigidly categorize the motives or orientation of non-state providers (NSPs).[120] Above all, their typology can guide comparative analyses of public goods and help to unravel formal/informal interactions throughout cities of the Global South. Below I continue discussing my findings in relation to this framework, before offering a more detailed analysis in Sections II and III.

C) Hybrid Local Public Goods and Overview of Findings from Mukuru

　　　　Several features of Mukuru's electricity cartels and latrine-emptiers are helpfully explained by Post *et al.* (2017), whose framework suggests that the groups represent 2 different types of hybrid providers. Like India's private water providers, electricity cartels are an example of 3) *supplemented state* provision (Post *et al.* 2017, pp. 17-19). Regarding Mukuru's electricity, there is extensive private involvement by cartels and direct provision by the state (Kenya Power or 'KPLC'), alongside recurrent collusion and extraction by both state and non-state actors. In particular, cartels collude with KPLC engineers to access and resell power informally, while the police regularly demand bribes from providers (see below). Meanwhile, manual latrine-emptiers engage in 4) *'free' market* provision, with parallels to Nairobi's *matatu* or mini-bus providers (Post *et al.* 2017, pp. 23-24). For matatu, there is only indirect state provision and minimal regulation; self-regulation is via matatu associations, which also engage regularly in collusion and extraction (*ibid.*). Similarly, Nairobi's on-site sanitation is characterized by indirect state involvement: the nearly-absent Nairobi Water and Ministry of Public Health hardly regulate or oversee disposal practices (see below). The 2 sectors of on-site sanitation and electricity are thus characterized by *extensive* private provision, but differ in that KPLC *directly* provides power while in on-site sanitation, state actors are at best *indirectly* involved. To adopt the typology in Levitsky and Helmke (2004), sanitation providers *substitute* for ineffective formal providers while electricity cartels usually *compete* with KPLC. But, importantly, Mukuru's electricity cartels also *collude* with KPLC engineers and police regularly *extract* bribes from providers, in addition to the informal payments demanded by utilities staff. Such collusive and extractive formal/informal ties are captured in Post *et al.* (2017), but missed in Levitsky and Helmsky (2004).

　　　　Although partly confirming expectations about *supplemented* hybrid providers, Mukuru's electricity cartels have fewer links with local politicians than predicted, suggesting the need for more precise studies of formal/informal ties. Like private water providers in India, electricity cartels regularly engage in collusion and extractive relations with state actors (Post *et al.* 2017 pp. 18-19). Just as predicted, state actors "prey upon" electricity cartels and charge for official supplies or market access (*ibid.*, p. 10), such as regular fees to police and bribes to KPLC officials for repairing or replacing transformers. In one difference, Indian politicians are directly involved in structuring informal water markets (*ibid.,* pp. 18-9) but my findings suggest that local politicians do not support

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[120]See Chapter 2 for further discussion of NSPs, in which I argue that past studies (e.g. Cammett and MacLean 2014) have utilized an unhelpfully rigid classification of NSPs as private nonprofit, sectarian, for-profit, etc.

cartels in Mukuru or foster access to electricity as a vote-banking strategy. When asked, cartels consistently stated that they have not received transformers or other support from local politicians. Some had requested additional transformers or assistance during blackouts, but to no avail: as a *sambaza* provider in Milimani complained, "there was a time when it was a very long blackout. We talked to Sumra [*the area MP*] but he cheated us, saying he was going to Kenya Power office. But he never responded" (provider with 5 years' experience in electricity, Dec 9th, 2016). Electricity cartels' hybrid model of *supplemented* state has more limited involvement by local politicians than may be expected, alongside ongoing encounters with the police and KPLC. In turn, these findings suggest the need to analyze informal providers' specific interactions with formal actors during challenges like blackouts and how these relations may change over time (see below).

Furthermore, Mukuru's latrine-emptiers differ significantly from *matatu* (mini-buses), another 'free market' hybrid, and such contrasts highlight the need for a new typology of hybrid providers. Nairobi's matatu industry has cohesive associations and can be quite lucrative (Post *et al.* 2017, McCormick *et al.* 2013) while emptiers are stigmatized, usually poor, and only weakly-organized, despite serving a sizable proportion of slum-dwellers.[121] My surveys with manual emptiers suggest that the typical worker has few assets, alongside a handful of wealthy outliers (see Chapter 3). In a highly significant contrast, matatu drivers often collude with police and politicians as well as engage in extraction (Post *et al.* 2017, Klopp 2012) but such formal/informal interactions are very rare in on-site sanitation (see below). Thus, Nairobi's matatu and on-site sanitation both involve *indirect* state provision and *extensive* provision by unregulated private actors, but differ in several respects. A highly-visible industry in Nairobi, matatu serve the urban poor as well as some middle-class households, and any disruptions will have significant impacts upon the city overall (Klopp 2012).[122] Meanwhile, state neglect of latrine-emptying disproportionately affects poorer residents with less political clout (a blatant environmental injustice), and compared to matatu, slums' meager FSM has fewer impacts upon wealthier households. Associational strength is another key factor: unlike matatu drivers' strong organizations, latrine-emptiers are unorganized (reflecting their stigma and alcohol abuse) and this helps to explain why emptying is so poorly-remunerated even in a free-market system.[123] Thus, providers' divergent *organizational strength*, alongside contrasts in the *sectors' visibility and profitability*, *users' political clout*, and *scale of impact*, may help explain differences in matatu and emptying despite both being free-market hybrids. But perhaps most importantly, the two sectors differ in their relations with formal providers, as explored below.

My contribution will compare the formal/informal ties that create hybrid local public goods in Nairobi's informal settlements, including how these links may change and any related impacts upon service delivery. As noted above, literature on hybrid security has highlighted the mutability of non-state armed groups (Meagher 2012, LeBas 2013) and their ties to official actors may also shift, as when politicians may co-opt these groups or engage in high-profile crackdowns around elections (*ibid.*, also Schuberth 2015). Similarly, my findings in Nairobi suggest that fluid, shifting

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[121] In surveys with over 2,600 households from Mukuru and Viwandani, nearly **50%** used a shared pit latrine (Strathmore 2016, p. 21). Although I lack evidence on the use of manual vs. mechanical emptying services, manual emptiers are cheaper and are likely the preferred option. The market for manual pit emptying, in turn, seems quite sizable in Mukuru.
[122] In Nairobi, "matatus are the most used form of motorized transport...matatus are an integral part of the urban economy and cater to the needs of the lower middle and under classes in Nairobi but also allow services that cater to the society as a whole" (Klopp 2012, p. 8).
[123] Emptiers do not engage in turf battles or power struggles, underscoring their poor organization and limited entrepreneurialism. Meanwhile, matatu drivers periodically battle for control, including clashes between gangs seeking to dominate profitable routes (Post *et al.* 2017, Rasmussen 2012).

formal/informal relations are common to hybrid local public goods providers. For instance, Kenya Power's 'inspections' would result in brief crackdowns and cutting illegal wires, though most cartels would quickly reconnect (see Chapter 2). But given residents' dependence on informal providers, some interventions may have deleterious impacts on community health or well-being. When NEMA prohibited excreta dumping in 2016, residents' health and quality of life were imperiled by overflowing latrines, while emptiers' livelihoods were nearly halted (see below). My comparative analysis will explore several informal providers in Mukuru and their ties to official actors; I also call for more detailed research into formal/informal relations and the effects upon residents who utilize informal providers. As a recent article noted, "Some of the most significant gaps in the literature in infrastructure investments, access, and governance concern the operations and scope of alternative providers (*and how they interact with state services*)…" (Acey 2017, p. 29, emphasis added). To help fill this gap, I analyze 4 of Mukuru's informal providers (Section II) and offer a conceptual tool that may encourage additional research into their ties with formal providers (Section III).

II. Comparative Analysis of Mukuru's Informal Providers of Hybrid Local Public Goods
A) Organizational Profile, the Centrality of Bribery and Collusion, and A New Typology

Mukuru's informal providers differ in their levels of *ethnic segmentation*, *organizational strength,* and *collective aspects,* which can affect service delivery as well as their relations to official actors. For instance, electricity cartels can be highly organized and act collectively, such as pooling funds to bribe the police and paying KPLC to fix transformers (Chapter 2). By contrast, latrine-emptiers rarely cooperate and are poorly-organized; they have little need to collaborate in dealing with official actors since the latter usually ignore them (see below). Water is highly competitive and individualistic but does involve coordinated price-setting and barriers to entry. Relative to informal electricity, water is a more atomized, individualistic sector and water cartels are more ethnically homogeneous (see below). Meanwhile, electricity cartels' ethnic cleavages proved far more malleable, with a wide range of tribes now participating.[124] In water, powerful providers are usually Kisii and sometimes Kikuyu; Kambas can sometimes be employed to operate water-taps, but rarely achieve the success of the other 2 tribes (also below). By contrast, in latrine-emptying, a mix of tribes participate and teams can be both single-tribe or mixed.[125] Thus, ethnic divides are more salient for water vendors than electricity cartels or latrine-emptiers (see also Section IIB). This section will continue comparing informal providers in Mukuru, as well as proposing a new typology (Table 1 below). My typology does not encompass non-state providers that *are* officially recognized (e.g., ecosan social enterprise Sanergy or licensed vacuum-tankers that dutifully pay to dump excreta in designated sites). Although these NSPs indeed engage with state actors and operate in informal settlements, I limit my analysis to informal providers in slums and explore their particular ties to official actors.

Reflecting widespread *collusion and extraction*, informal provision is typically contingent upon bribes to formal actors like police, utilities, and traditional authorities, but the *frequencies and levels of bribery differ markedly*. Bribery is essential to hook-up sewers informally (see below) and is also needed on a regular basis to access and maintain electricity provision. Bribes are a tangible exchange connecting informal actors with the state but undercutting the rule of law; payments cement the

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[124] As discussed in Chapter 2, *sambaza* began as a more homogeneous (Kikuyu-dominated) sector but has recently become far more mixed. Furthermore, new electricity entrants are often introduced by friends from other tribes and the business is rarely inherited by family members (see below). I lack similarly-detailed information on informal sewerage; informal sewer connections have utilized teams of casual laborers and a foreman with uncertain ethnic composition.
[125] Emptiers' key axis of segmentation is drum-ownership; the few owners are usually Kamba, who are resented since other workers must pay them sizable sums to rent the drums.

unequal relationships between formal/informal groups. In particular, water cartels may bribe the police when laying pipes, or if they are caught utilizing informal electricity to pump water into their tanks. Even water providers with a *legal* water connection may have to bribe the police for using *sambaza* to pump their water, but the typical amounts are just Ksh. 500-1000.[126] By contrast, electricity cartels must make larger payments both to Kenya Power and the police yet still experience greater harassment than water cartels. Informal electricity providers have especially complex ties to the formal utility: KPLC occasionally cracks down upon cartels but at other points sells them heavily-discounted wires or notifies the cartels before inspections (see Chapter 2). Frequent bribes by electricity cartels may have *different functions:* the police are purely extractive and give nothing in return to the cartels, but bribing KPLC can promote rapid service restoration after a blackout or faster delivery of a new transformer. Meanwhile, latrine-emptiers almost never pay bribes, suggesting that this sector is far less linked to formal actors (see below). Although such fees are uncodified and always negotiated, routinized bribery underscores the endemic collusion and extraction in hybrid local public goods provision (cf. Post *et al.* 2017).

Table 1 indicates that Mukuru's informal providers differ with respect to their substitutes, levels of collusion and harassment by formal actors, and potential for conflict with fellow providers or formal actors (see next page). The final column also proposes a new typology of formal/informal interactions, as follows: **Invisibly Parallel** (emptiers), **Invisibly Parasitic and Collusive** (sewers), **Visibly Parasitic** (water), and **Visibly Parasitic and Collusive** (electricity). Latrine-emptiers operate in a policy vacuum regarding on-site sanitation and in parallel with sewerage networks (Chapter 3) while being invisible to state actors, with few occasions for bribes or other interactions. Meanwhile, *invisibly parasitic and collusive* sewer connections significantly burden formal networks and initially required major collusion to connect, but afterwards remained hidden. This is an insidious, parasitic mode of informal provision requiring few interactions with formal actors (see below). By contrast, *visibly parasitic* water providers undercut Nairobi Water using shallow pipes that are more visible than sewerage, yet this hybrid configuration has entailed lower levels of bribery and collusion than electricity. Perhaps the lower levels of bribery reflect the fact that some water providers have a legal connection and water is viewed as a basic need (in contrast with electricity). Finally, *visibly parasitic and collusive* electricity cartels not only undermine KPLC's revenue-collection, but also require more frequent bribes to police and KPLC than the above counterparts in other sectors. Electricity cartels have the most extensive interactions with official actors, but lower levels of conflict with fellow providers than water cartels.

Table 1 also indicates that Mukuru's informal providers differ in their respective *substitutes' affordability and accessibility*, as well as whether these are *state, private for-profit, or nonprofit* alternatives. Currently, Mukuru lacks ongoing state initiatives to improve sanitation access and, as discussed above, sewers are prohibitively expensive. Meanwhile, emptiers in Mukuru do compete with other *non-state* providers, such as Sanergy and sanitation NGOs like Umande Trust (see Chapter 3). Public toilets are usually closed at night (thus less accessible than on-plot latrines), and as pay-per-use facilities, they may be too expensive for some households. Water cartels again face several alternative providers (including Nairobi Water, CBOs, and NGOs), and Mukuru's informal water providers are

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[126] For instance, a Kisii water vendor in Wape Wape said that even though he has a legal water connection, he must pay the police if caught using sambaza at his pump: "They don't want us to pump –we have to hide when we're pumping. We just carry the machine and go with it. *Do they bother you once you get legal connection?* You have to negotiate –pay Ksh. 500 on the low end" (Aug 25th, 2015).

notorious for cutting the pipes of state or non-state actors so as to quash any competition.[127] Finally, <u>electricity cartels</u> represent the sole alternative to Kenya Power, which only recently began a slum electrification project to enhance access to formal provision (see Chapter 5). Informal providers thus differ in the accessibility, cost, and type of their substitutes (state, nonprofit, or for-profit), with the unaffordable, inaccessible formal sewerage provision helping to explain the use of informal sewer hook-ups. Furthermore, I suggest that substitutes can affect formal/informal ties because state actors are more likely to collude with and/or punish their visible competitors in water and electricity than more invisible sewers or the parallel system of latrine-emptying.

Table 1: Typology of Informal Providers' Relations with Formal Actors in Mukuru, Nairobi

Sector	Availability of Affordable Formal or Non-State Substitute	Level of Collusion and Bribery with Formal Officials	Level of Police Harassment (Response Required, If Any)	Potential for Conflict with Officials and Fellow Providers	Type of Formal/ Informal Relations
Latrine-emptiers	*None* –no official provision of on-site sanitation; does challenge local sanitation NGOs and ecosan	*Very limited* – few bribes, largely invisible to sanitation, health, or environmental ministry officials	*Very limited* – emptiers may even receive support from police to deal with youth harassment	*Low* -only occasional restrictions on dumping, few conflicts between emptiers	**Invisibly Parallel**
Sewer	*Undercuts unaffordable sewer* -legal sewer is prohibitively expensive for slum-dwellers	*Extensive* - major bribes needed to chairmen, contractors, etc.	*Usually limited* -police often unaware of sewer connections	*Low*-covert connections do not lead to conflict	**Invisibly Parasitic and Collusive**
Water Cartels	*Multiple substitutes-* Nairobi Water has lowered its connection costs; several water NGOs/CBOs	*Usually limited-* Nairobi Water reads meters, may collude with big providers, but few other opportunities for collusion	*Limited* - small bribes if caught using sambaza for pumps; but usually limited harassment and small bribes (*individual* payments)	*High* intra-group conflict, *low* formal conflict -few clashes with Nairobi Water; elevated potential for conflict with fellow providers	**Visibly Parasitic**
Power cartels	*Undercuts newly-affordable official substitute* (*KPLC's ongoing slum electrification project*)	*Extensive* - large payments to Kenya Power for repairs, replacing transformer, etc. (*requiring* **pooled** *resources*)	*Extensive* - several opportunities for bribes when connecting (**group** contributions needed for larger bribes)	*Medium and declining* - conflicts with fellow cartels now rare and few crackdowns by KPLC	**Visibly Parasitic and Collusive**

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[127] For instance, a water seller in Wape Wape listed several ways that cartels tamper with his pipes: "*Do you have challenges from other groups?* Yeah, they block pipes, cut your pipes, put maize cob inside [to block it]. *How do you respond?* I cut the pipe and connect it again. You can't know who did it because people [selling water] are so many" (Aug 20th, 2015).

Emptiers (*invisibly parallel*) are largely ignored by officials at Nairobi Water, Ministry of Health, the environmental ministry NEMA, or police, and there are few internal conflicts. Even the disorderly drunkards can still empty: one emptier noted that the alcoholics are not prevented from working and "we just work with them because they are a part of us" (FGD Nov 22nd, 2016). As another emptier explained, "the community needs to understand that we deal with a smell that's not nice…Because they are drunk, they just push [the drum] in a hurry and they can't do it when they're not drunk" (FGD Nov 22nd, 2016). Meanwhile, emptiers rarely bribe formal officials and disposal is usually overlooked if workers utilize the designated dumpsites. In the past, staff from the environmental ministry NEMA had harassed emptiers about covering their drums and needing a designated dumpsite. According to an emptier in Vietnam, NEMA officials "were telling us we had to cover [the drums]. And also if you dump in the wrong place, you'll get into trouble with them. That was a long time ago… NEMA said we had to come together and get a space to dump. We used to move around a lot and have a lot of problems" (FGD Dec 1st, 2016). But with dumpsites now selected, emptiers' conflicts with formal officials are rare and bribery almost nonexistent (see below for infrequent exceptions).

Informal sewerage has entailed major bribery and collusion while undercutting costly formal provision, and its invisibility has entailed very few opportunities for official harassment. As noted above, official sewer connections are expensive and, unsurprisingly, informal connections proliferated near the main sewer in Mukuru.[128] I have limited information on this sensitive topic, but my findings suggest that sewer hook-ups require sizable bribes and continue to this day. The practice originally resulted from poor donor oversight and collusion with a local contractor in 2012-3, when the World Bank and EU funded Athi Water Board to lay the sewer. Athi Water's contractor Funam operated with minimal supervision, facilitating rampant corruption and sizable kickbacks to connect sewers informally.[129] Landlords bribed Funam contractors, local authorities, and the police but only if caught connecting (according to casual laborer, Aug 7th, 2015). A chairlady of one village in Mukuru admitted to taking around Ksh. 20,000 to 30,000 for herself; additionally, she said that village elders took Ksh. 20,000 to 30,000 and divided it between themselves, the foreman, and project team of unskilled local youths (Aug 11th, 2015). According to two workers on a sewer team, the idea to connect informally initially came from a politician who later was elected MP, though I could not verify this.[130] Foreman and casual laborers all concurred that informal hook-ups still take place; the ex-chairlady said that connections are now made with thin 'spaghetti' pipes (Aug 10th, 2015). Several residents said that neighbors have also connected nearby houses, at a smaller fee than

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[128] According to a Nairobi Water official, an official sewer connection "depends on the distance to the main trunk to wherever [you are connecting]…[A] 30-meter connection using the right materials costs Ksh. 400,000. It's very, very expensive. Then for 100m, it goes even to Ksh. 1 million plus" (July 27th, 2015). This official is believed to take bribes from water cartels but appears not to be involved in sewers, so he was surprisingly open about these practices. However, I lacked time to interview landlords in Mukuru, who could have confirmed such collusive relations.

[129] In a later interview with the same Nairobi Water official in Mukuru, he confirmed that there was no inspection during sewer construction: "after the contractor did the work, he went away -there was a gap between [completion and] handing over to Nairobi Water. It was 3 months -and that's when sewer connections made, before it was commissioned…No, Nairobi Water and World Bank didn't audit or follow-up" (Dec 19th, 2016).

[130] When asked who had the idea to connect informally, a casual worker who connected sewers explained that a politician (who later was elected the area MP) came up with the idea after seeing latrine-emptying in Mukuru. "*Was he involved later, or just at the beginning?* Involved at the beginning, [but] after giving the idea, then he left it to community. *Was there anyone else from government involved?* After coming from the MP, you must involve the Councilor. *So they just informally approved it?* Yeah" (Sept 20th, 2015, sewer connector in Milimani). It is difficult to verify such claims, and another casual laborer said that the MP and the area chief (not a Councilor) had the idea to connect (Sept 20th, 2015, sewer connector in Milimani now constructing houses).

the initial connection. Interviews with 2 Nairobi Water officials in autumn 2016 confirmed that informal sewer connections are widespread in Nairobi's slums and the Company has had few initiatives to encourage legal connections (see Section III). Sewers seem to be a 'supplemented state' form of hybrid delivery (Post *et al.* 2017), since extensive bribery and collusion by private actors has subverted direct public provision of sewers. However, sewers are mainly subject to self-regulation and remain shrouded in secrecy, rather than offering clear opportunities for political gain or electioneering. I therefore classify it as *invisibly parasitic and collusive* to underscore its hidden nature, burdens to the formal network, and the collusion initially required to connect.

Exposed wires and shallow pipes make both water and electricity *visibly parasitic* to utilities, but power cartels have more recurrent collusive ties with formal actors and are less violent than informal water sellers. Although connection processes vary between water providers, they typically gain access by colluding with Nairobi Water staff or by reselling water obtained from a fellow supplier. Some providers tap at the main after dark while colluding with a Nairobi Water engineer (see Section III below); alternatively, providers may access water from fellow sellers who already have a connection.[131] Others do have a legal connection: for instance, a provider who has sold for 10 years in Sisal initially paid Nairobi Water Ksh. 10,000 to connect at the water chamber; his group does not collude with the utility's valve-men to open taps during rationing, although he knows that other groups do so (Dec 24th, 2016, also below). However, compared to water sellers, electricity cartels more regularly collude with formal actors and pay larger-scale bribes (see below). Meanwhile, there is greater potential for intra-group conflict in water than power provision; electricity cartels have never engaged in killings and are not primarily violent groups (as argued in Chapter 2). But in water, conflicts can occur between sellers of the same tribe or from different tribes, and vendors recalled that some providers were killed during previous instances of water rationing.[132] Additional research is needed to explore how water providers' violent incidents can heighten insecurity or other impose other burdens upon residents. Below I discuss other differences between water and electricity providers, including attention to varying levels of collusion and harassment.

B) Comparing Group Solidarity, Ethnic Ties, and Official Harassment in Water and Electricity
Water and electricity providers differ in their *frequency of earnings and pricing*; in contrast with water, electricity providers do not raise prices and can enter the sector more easily. Compared to electricity, water vendors' earnings fluctuate more considerably and often spike on the weekends, when residents typically do their laundry or other domestic chores. For instance, a Kisii provider in Wape Wape has 2 taps (each with a 5000-liter storage tank) and on the weekends he usually sells a total of about Ksh. 1000, as compared to Ksh. 600 on weekdays (Aug 25th, 2015). To increase their profits or take advantage of water rationing, cartels typically will increase prices from Ksh. 5 to 10 or even Ksh. 20 per 20-liter jerrycan (see also Strathmore 2016, p22 for water purchases). Such extractive, opportunistic tactics inevitably create hardships for low-income residents. Meanwhile, *sambaza* providers collect payments monthly and negotiate prices in advance (see Chapter 2). Lower-income, less-educated youths can often enter *sambaza* easily: there may be a small fee to the group or to the transformer leader, but it is usually less than Ksh. 2000. It is also possible to enter as a 'fundi'

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[131] For instance, a woman who has sold water for 2 years in Zone 48 initially paid a Kisii provider who had a connection at the chamber. As she recalled, "I bought pipes and the Kisii put them for me," taking about 2-3 weeks to lay the pipes (Dec 22nd, 2016). She is one of the few female water providers, but appears quite successful with three 5000-liter tanks.
[132] According to a Kisii water provider in Milimani, who has sold for the past 5 years, past killings of providers are rare but can occur during water rationing when "competition is high and there is scarcity of water. *So violence isn't between different tribes?* It can be Kisii and Kikuyu, because they are selling in the same area [i.e., same village]. *Also in Moto Moto?* Yeah, there are lots of Kisii in Moto Moto, and lots of conflict" (Dec 24th, 2016).

(a repairman for another electricity provider), before later distributing power to his own customers. Up-front costs are thus fairly limited in electricity, but power providers must share the costs of accessing transformers and bribing police or KPLC officials (Chapter 2 and also below). Below I continue discussing the expenses needed in water provision as well as comparing the two groups' levels of solidarity, the salience of ethnicity, and ties to official actors.

Although water has higher up-front costs than electricity, water cartels encounter less harassment from government officials and may instead face conflicts with fellow water sellers. Water has more individualized and expensive sunk costs than electricity, given the need to purchase water tanks, pumps, and pipes in advance.[133] According to a Kamba water-seller in Wape Wape with two 10,000-liter tanks and two water-taps, laying pipes took 4 months because he lacked the money and could only buy the larger tanks after 1 year (Aug 25th, 2015). While he was arrested 3 times when laying pipes and also was fined for using informal electricity to pump, he only paid Ksh. 1000 for laying pipes and Ksh. 500 for utilizing *sambaza* (*ibid.*). Other water providers took years to buy and lay pipes, resulting in agonizingly-slow incremental construction.[134] But Nairobi Water's connection costs and associated bribes are relatively low: according to a Kisii provider, who now sells electricity but previously sold water, he paid just Ksh. 3500 for his water meter and Ksh. 1200 for a connection (Sept 3rd, 2015).[135] He also reported giving Nairobi Water staff a small bribe to reduce the meter's reading, with parallels to the collusive strategies by Bangalore's water mafias (Ranganathan 2014, also below). Despite having higher earnings in water than in electricity and facing limited official harassment in water, he stopped selling water due to ethnic-inflected conflicts *between* water cartels.[136] The small bribes demanded by Nairobi Water or police, as well as higher sunk costs paid by an individual water provider, all contrast starkly with electricity cartels' larger bribes as a group and more regular interactions with KPLC and the police.

I suggest that water providers' *higher individual cost burdens* and *more limited interaction with state actors*, as compared to electricity, may help to explain the greater *durability of ethnic divides in water than in electricity.* To mobilize resources for the significant bribes demanded by KPLC and the police, sambaza groups must repeatedly pool their resources. As a result, electricity providers can benefit from interdependence and incorporating residents from other ethnic groups to make these recurrent payments. By contrast, water providers have a greater stake in maintaining their individual investments (tanks, pipes, pumps, and taps) and preventing new entrants. A first-mover advantage and migration patterns could also help to explain Kisii dominance of water, since they often leave their distant rural homes in Western Kenya seeking urban jobs.[137] During my interviews with two

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[133] When asked to compare water and electricity, a sambaza provider in Milimani since 2013 thoughtfully noted that "For water, you can store it but for power, you can't. In water, you can't go and ask someone to give money…it's a daily service but for power, you have to go look for money, it's monthly. *Which is easier to start?* Power. *Why?* Because if you have Ksh. 2000, you can put your own line. For water, you have to get pipes, dig, and put a tank" (Sept 15th, 2015).

[134] For instance, another Kamba water-seller explained that because he was poor, it took him 4 years to lay his pipes: "I put 2 pieces per day. It took me 4 years to reach here because I used almost Ksh. 250,000" (July 29th, 2015).

[135] But there may sometimes be higher levels of bribery, perhaps depending on the whims of utilities officials. For instance, a provider selling in Sisal for the past 8 years recalled paying Nairobi Water Ksh. 3500 to connect but a sizable Ksh. 10,000 bribe to expedite the process (Dec 27th, 2016).

[136] He lamented that his fellow Kisii were very violent, which was why he left the sector for electricity even though there is more money in water: "I think water is better [than electricity]. I used to do water and I left it. There are lots of Kisii in the area but I left because of killings, so many youths killed. It's dominated by one tribe. Kisii are killing each other, they're jealous. Threats must be there -in business there must be threats" (Sept 3rd, 2015).

[137] A Kisii sambaza provider in Milimani who formerly sold water similarly noted that Kisii in cartels are often recent migrants seeking jobs in urban areas (Sept 3rd, 2015).

Nairobi Water officials, they confirmed that a single ethnic group is typically dominant in water cartels, but they offered slightly different explanations that may suggest areas for future research. One official in Mukuru explained the prevalence of Kisii by arguing that a Kisii who led the Water Ministry had brought in his co-ethnics to water provision, though this account is hard to verify (Dec 19th, 2016 interview). This Mukuru-based official claimed that Kisii dominate other slums' water provision and noted that Kisii sellers can leave their tanks or other supplies to a relative after leaving the sector; inheritance may cement the long-term ethnic dominance (*ibid.*). However, another Nairobi Water official who has worked in several slums agreed that the water cartels in a single village are usually from the same tribe but are not always Kisii; he suggested that ethnic dominance reflected a first-mover advantage (Dec 21st, 2016 interview). Interestingly, he also observed that slums' water cartels are becoming more ethnically-mixed over time as water access has become more affordable (*ibid.*). Although my findings remain tentative and may not apply beyond Mukuru or may change over time, such intriguing contrasts can spur future research into whether and how ethnicity may affect service provision in informal settlements.

Another consequence of sambaza's greater official harassment and the inability to store electricity (unlike water) is the *need to cooperate with fellow providers* to bribe KPLC or the police. Sambaza providers regularly contribute to make sizable group payments, such as to repair a transformer, because timely bribes are needed before Kenya Power will act. According to a provider in Zone 48 with 2 years' experience, repairing a transformer costs about Ksh. 25,000 and KPLC will come "after 1 to 2 days -*after you pay, they come quickly*" (Dec 6th, 2016, emphasis added). Customers can also halt their monthly payments in case of an extended blackout, which gives the cartels yet another reason to bribe Kenya Power quickly. To restore collective control and resume delivery, then, *sambaza* providers have several significant incentives to cooperate. Similarly, the police may demand large bribes before releasing a captured member, with particularly steep payments needed if the provider is caught at the transformer (perhaps Ksh. 10,000 to 20,000). In response, his fellow group members will contribute to ensure the police promptly free him; without such group solidarity, it would be impossible to generate the requisite payments and release from jail. According to a large-scale provider who has worked in *sambaza* since 2008, a wide range of bribes are required for different encounters with the police: "*What do you pay if you're caught on a transformer?* We pay Ksh. 5000 -that would be a good person [*i.e., a policeman who wasn't rapacious*]. It can be up to Ksh. 10,000 or 15,000. If caught on wires, it's Ksh. 500 up to 2000 [*the higher amount is if caught in public, not on the plot*]. *And if caught with pliers or testers?* Just Ksh. 200 or 500 -and he goes away with the pliers [*i.e., confiscates them*]" (provider in Zone 48, Dec 6th, 2016). Underscoring the police's routinized extractions, his testimony also confirms that bigger bribes may be required if members are captured on a transformer and require pooled resources, just as with KPLC repairs.

Finally, electricity differs from water in having many sources of redundancy, which increases the interdependency between sambaza providers and may even help explain electricity's greater ethnic diversity. Electricity providers may access several different transformers as a back-up, in order to cope with a blackout at one but not another transformer. Alternatively, cartels may steal power from the nearby factories (either bribing the guard or just hooking a line) and they can borrow from other groups, sometimes for a small fee or for free (on the understanding of future reciprocation, as noted in Chapter 2). According to a provider in Milimani for the past 5 years, "Yes, we do borrow [*from another cartel during a blackout*]. *And do you pay?* We don't pay, it's just friendship. *For how long do you borrow?* Up until it comes back -even a couple weeks" (Dec 9th, 2016, provider in Milimani for 5 years). By contrast, water cartels rely only on their own tanks in times of rationing, thus lacking a comparable array of alternatives or collective strategies to those in electricity. In another difference,

bribes are smaller and more rarely required in water, so that water vendors rarely need to support each other.[138] In sum, differences in storage capacities, redundancy, and harassment by official actors together create an urgent need for group solidarity in electricity but not in water provision. Relatedly, electricity cartels have become *more ethnically diverse* than water, and this inclusivity may again be linked to *collective risk-sharing aspects of electricity in contrast with water* (e.g., shared use of transformers, uniting to bribe formal actors, and coping with intermittency via borrowed alternative sources of electricity). Section III continues comparing Mukuru's informal providers but will focus on their spectrum of interactions with formal actors.

III. Formal/Informal Interface and Formality as a Stratagem

Informal providers differ in their relations to state actors, including in the levels of collusion, extraction, and conflict, and these interactions operate along a changing continuum rather than a fixed set of links. I argue that Mukuru's providers can be placed along a continuum as follows: 1. *latrine-emptiers* (with limited, intermittent interactions with formal actors) 2. *sewer connections*, 3. *water*, and 4. *electricity* (extensive, regular interactions). As illustrated in Figure 1, these interactions can be understood as the 'formal/informal interface' and analyzing this continuum can reveal key differences between hybrid local public goods providers. In particular, informal providers range from *invisible and parallel* to the state (emptiers) and *invisibly parasitic* (sewer) to *visibly parasitic* (water) and *visibly parasitic and colluding* with police and utilities (electricity). Only latrine-emptiers operate in parallel to the formal network, while I classified the others as parasitic since they undercut utilities' networks and revenue-collection. Importantly, such relations are not permanent; I utilize a continuum to underscore that formal/informal ties may change over time (see below). In electricity, the links between providers, police, and KPLC have created a sometimes conflictive but an overall uneasy coexistence contingent on regular bribery. By contrast, water providers can better avoid harassment by Nairobi Water or the police, but intra-group conflicts are more likely. Finally, I argue that water and power cartels can utilize trappings of formality (e.g., meters to fend off extractions by utilities staff) but this stratagem does not appear in other sectors, indicating the greater invisibility of informal emptiers and sewer connections.

Figure 1: Formal/Informal Interface in Mukuru, Nairobi

Invisibly Parallel	Invisibly Parasitic & Collusive	Visibly Parasitic	Visibly Parasitic & Collusive

Latrine-emptiers	**Sewers**	**Water Vendors**	**Electricity Cartels**
bribes rare	*big, one-off bribes*	*rarely bribe police or water agents*	*regular, large bribes to police and utility*
no trappings of formality	*no trappings of formality*	*may have meter (tampered/unread)*	*may have meter (tampered/unread)*
crackdowns rare	*no crackdowns*	*few clashes with state (just fellow sellers)*	*oscillate between collusion & crackdowns*
no official substitute	*subverts costly sewerage*	*challenge to state & non-state providers*	*challenge to recent formal electrification*
parallel system to sewers	*undercuts formal network*	*undercuts formal network*	*undercuts formal network*

Small or infrequent bribes	**Larger, recurrent bribes to formal actors**
No trappings of formality	**Trappings of formality like official meters**
Few conflicts/crackdowns	**Greater potential for conflict (state or non-state)**
Little impact on formal network	**Burdens the formal network**
Lack of affordable formal substitute	**Undercuts formal substitute**
Rare, limited links to formal actors	**Regular, often collusive ties to formal actors**

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[138] According to a landlady who has also sold water for 12 years, police usually charge just Ksh. 1000 if they catch water vendors with a pump or connecting at night; they are not taken to police post, unlike in electricity (Aug 11th, 2015).

Furthermore, I suggest that formal/informal ties may *shift over time* and can be *transformed during crises or crackdowns,* but their relations remain inextricably interwoven and often collusive. During cholera outbreaks, Mukuru's area chief may prohibit manual emptying as a health measure, but emptiers admitted to working early in the morning rather than stopping completely (FGD, Nov 28th, 2016).[139] For electricity cartels, relations with Kenya Power have oscillated between conflictive to more interdependent and collusive. In one opportunity for conflict that increasingly resulted in collusion, KPLC periodically conducted 'inspections' where illegal wires were cut and some providers displayed their legal meters in a canny ploy to avoid punishment (see below). However, several providers admitted that inspections are now very rare or announced in advance; KPLC engineers call the cartels beforehand, giving them time to remove wires or bring out their meters. For instance, a provider with 7 years' experience said that KPLC inspections were worse before: "they removed all the wires, but now they alert us" and an inspection had not occurred for the past 4 years (Dec 6th, 2016). Similarly, collusive practices are common in water, with inspections are again preannounced: a Nairobi Water official said that the utility's security team comes monthly to check for illegal practices, but often alerts the cartels in advance.[140] Furthermore, crackdowns in water can be short-lived and unsuccessful, according to another Nairobi Water official. As he argued, "if you go to arrest, disconnect, and carry their pipes, like in Mukuru, then as soon as you leave, they immediately replace them. It will never work!" (Dec 7th, 2016).

Nevertheless, some crackdowns become politicized and may have dire short-term health consequences; residents may need alternative provision if informal sources are suddenly eliminated. These sobering possibilities are best-illustrated by a crackdown on water cartels in Mathare Valley, another large informal settlement. In 2007, Nairobi Water took the drastic step of disconnecting Mathare's water so as to eradicate local cartels and, without alternative water sources readily available, diarrheal outbreaks increased rapidly (Corburn and Makau 2016). Widespread protests ensued and 26,000 households in Mathare were left without water, although the utility would later install free stand-pipes.[141] Ultimately, Nairobi Water worked with civil society groups, including Berkeley's partner Muungano, to create community-managed water kiosks that helped to eliminate the cartels (Lines and Makau 2017, pp. 55-57). But in the short-term, there were deleterious health impacts, and the example highlights the need to develop alternatives before seeking to eliminate informal providers. Water disconnections in Mathare were part of a larger effort to eliminate the gang Mungiki before the 2007 elections (Lines and Makau 2017); as noted above, Mungiki are a notorious gang involved in water, matatu, and electricity (Rasmussen 2014). This crackdown underscores the potential for the politicization of hybrid local public goods, as well as the changing salience of formal/informal ties at key junctures. Along with understanding these shifting ties, it will be crucial to assess the potential impacts upon residents and establish adequate alternatives before eradicating informal providers. Below I continue discussing the formal/informal interface for my 4 cases in Mukuru, including the impacts of a recent ban on excreta dumping that once again negatively affected residents' health in areas dependent on emptiers.

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[139] Meanwhile, public health officers do not halt excreta disposal during cholera: these officials may close restaurants or food kiosks but take no steps to control manual emptying (interview with Nairobi Water official, Dec 19th, 2016).
[140] According to this official, cartels are prepared in advance for Nairobi Water's inspections (highly collusive relations) so they remove their pumps, give the officials Ksh. 2000, and then the utilities staff leave (interview Dec 19th, 2016).
[141] Emergency measures entailed installing free public stand-pipes, intended as a temporary measure but they are "still in place…it has proved politically difficult to disconnect the stand-pipes" (Wachira Nyambura 2015, p. 2).

Manual emptiers (*invisibly parallel*) have rare, intermittent interactions with formal actors, and the paucity of state oversight or interventions likely contributed to health risks and indignities for both providers and users. Due to the policy vacuum surrounding Kenya's urban on-site sanitation (see Chapter 3), latrine-emptiers are usually governed by their own rules and occasional edicts from settlement-level authorities. For instance, a few years ago a village elder worked with police and emptiers to select a dumpsite.[142] During an unusual ban lasting a few months in 2016, the environmental agency NEMA sought to curtail excreta disposal as part of a broader effort to improve air quality from burning solid waste (according to staff at Muungano). Residents recalled that this ban led to rising levels of diarrhea (especially among children), proliferation of insects, and intolerable smells (FGD, Nov 28th, 2016).[143] More generally, the policy lacuna regarding on-site sanitation has resulted in occupational health hazards and wider public health risks (stemming from polluted watercourses and other contamination). Police in Mukuru usually ignore manual emptiers, perhaps because they are too poor to pay significant bribes, and emptiers are typically only harassed by youths or other residents (FGD, Dec 1st, 2016). This case reveals how informal providers have proliferated in the absence of state oversight or interventions and spawned hazards that are particularly acute in slums (even if downstream hazards are again highly problematic).

Sewer hook-ups (*invisibly parasitic and collusive)* were rooted in collusion between landlords, Athi Water's contractor, and settlement leaders, while mechanical emptiers dispose in sewers but risk police harassment.[144] As acknowledged above, informal sewer connections are difficult to research, although a Nairobi Water official confirmed the practice is not unique to Mukuru (Dec 7th, 2016). Another official in Mukuru stated that Nairobi Water is largely unaware or unconcerned with sewer hook-ups, as these occur at night when officials are away: Nairobi Water "doesn't catch many people, just once in a while, because you see, sewer is done at night, everyone is sleeping. *And because you can't see it?* Yeah -and it's done very poorly" (Dec 19th, 2016). These tenuous, jerry-rigged connections create major burdens upon the formal network, as well as localized blockages or overflows (see Chapter 3). By contrast, police may harass the mechanical emptiers serving households near sewers, as they pump excreta to the sewer (usually in rainy season) and typically have higher earnings than manual emptiers. In hopes of evading the police, mechanical emptiers work at night and thereby reduce the likelihood of paying bribes.[145] Much as in manual emptying, mechanical disposal is largely invisible to Nairobi Water or other agencies, but mechanical emptiers' greater profits can attract more extractions from the police. Nairobi Water is usually uninvolved in informal sewers, though the officials I interviewed are aware of the practice. In sum, *parasitic and collusive* providers take advantage of Mukuru's proximity to formal sewer networks and capitalize on the nonexistent policies to support affordable sewer connections in Kenyan cities.

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[142] According to an older emptier, the site was selected by village elders, the police, and emptiers. It was only approved after the police imposed a dumping ban and residents asked a village elder to find a solution. The elder went to Mukuru's chief, who then summoned police and other village elders; "we discussed with the police and finally were shown a place we could dump. It was the same, same place where we had been dumping!" (FGD Dec 1st, 2016).

[143] "*How was the community affected when they said you can't dump?* **Manual emptier**: There were so many bugs in the toilet, it becomes a problem because there are so many children in the community. **Female caretaker**: You'd put food out for your child, but flies would come all over the food…diarrhea was very high at that time. **CHV:** Inside the plots, it was very bad, like the toilets are full, the flies are everywhere and the kids are there. So it was really bad -a lot of diseases -the kids got sick…the smell was also very bad -it was very strong!" (FGD Nov 28th, 2016).

[144] Since I have information from just 4 mechanical emptiers, I opted not to classify them on the interface.

[145] For instance, a mechanical emptier complained, "When the police find us or the chief finds us, we are arrested. They don't realize that we're actually helping those that connected toilets to sewers…They ask you for like Ksh. 10,000 and then when you negotiate, you pay like Ksh. 3,000" (FGD Dec 20th, 2016).

Power cartels and some water vendors may have highly collusive ties to utilities staff, and such relations underscore the need for carefully analyzing the formal/informal interface. Power cartels (*visibly parasitic and collusive*) regularly collude with KPLC engineers, who often provide low-cost wires or fuses and alert them about upcoming inspections (Chapter 2). In an especially stark instance of collusion, some well-connected cartels may call KPLC to negotiate with the police if they have been arrested.[146] Meanwhile, water providers were classified above as *visibly parasitic* because compared to electricity cartels, they typically have lower levels of collusion and fewer interactions with the utility. However, for some powerful water providers, collusion can indeed be quite stark and damaging to low-income customers. As a Nairobi Water official explained, wealthy water providers can bribe the utility's staff to turn off the valves and create scarcity:

> *Who controls the valves?* A distribution team, controlled by [gives the name of Nairobi Water engineer]...*Where do they work, several areas?* They work in several areas, but they take a bribe [*kitu kidogo*]…they interfere with rationing. The cartels send money to these men; they are very, very corrupt! You can go for 1 week [without them allowing water to flow]…They tell him to open [the valve] (Dec 19th, 2016).

Another Nairobi Water official confirmed that cartels collude with utilities staff to create scarcity, noting that the payments to a valve operator could reach Ksh. 60,000 for 2 weeks of artificial scarcity, with clear parallels to Indian water mafias[147] (Dec 21st, 2016). This official also reported that cartels can tap Nairobi's water mains even if these networks serve a *hospital or army barracks*, as long as the informal provider pays a hefty sum of Ksh. 100,000.[148] Although I cannot verify such incendiary claims, these two low-ranking officials are unlikely to be involved in grand corruption; their accounts seemed credible to me. The above instances, while extreme, should be understood as part of the broader patterns of collusion and rampant bribery uncovered in other sectors. Furthermore, well-connected water providers could perhaps be classified as *visibly parasitic and collusive* (like electricity cartels), underscoring that the formal/informal interface is a continuum that can vary over time or based upon the particular providers' relations with state officials.

In another facet of the formal/informal interface, cartels can strategically deploy *trappings of legality*, thereby staving off harassment and gaining legitimacy but still subverting formal providers. For instance, electricity meters are often just for show or display falsified readings; water vendors can similarly pay Nairobi Water staff a small bribe to reduce their meter readings.[149] Aspects of legality can thus give informal actors a claim to legitimacy and recognition, but these groups often utilize highly instrumental, obfuscating tactics such as falsifying or tampering with meters from

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[146] When asked if KPLC ever helped with police, a provider in Sisal explained that his group's contacts at the utility had indeed negotiated for lower bribes to police: "It's when a person is arrested on transformer. *What would police usually ask?* Ksh. 30,000 if you're up there [on transformer]. *But then Kenya Power would negotiate for how much?* Ksh. 5,000 or 10,000. *Who negotiated?* It's Kenya Power engineers who negotiate. *How often does Kenya Power help?* Just when you're caught and police ask for more money…*Did anyone in your group ever work at Kenya Power?* Yes, the chairman used to work there—he read meters" (Dec 10th, 2016). I heard a few other instances of KPLC assisting cartels with police, but it seems rare.

[147] See Ranganathan (2014) for discussion of water mafias' artificial scarcity and collusion with valvemen in Bangalore, as well as related discussion in Post *et al.* (2017) pp. 16-19.

[148] "*How much would they pay for tapping the main?* Ksh. 100,000 -because they know immediately [i.e., as soon as] they get water from the lines, they won't miss the water -like they take from a hospital or armed services…Like in Kibera, there is a line in between Langata Barracks and Kibera -they can tap water there even when there's rationing" (Dec 21st, 2016).

[149] For instance, a Luhya water and sambaza provider in Milimani reported giving KPLC staff a small bribe ('soda') not to read the meter correctly: "*How much does it come to at the end of month?* It depends on how you use –it can be Ksh. 10,000 to 20,000. *Do you give soda to read the meter?* Yes, because when they take the paper, they should not read the real amount" (Sept 19th, 2015). An ex-water seller in Milimani who now just provides power similarly reported paying Nairobi Water to reduce his meter reading (Sept 3rd, 2015).

KPLC. Electricity providers have clearly recognized that the guise of legality can be useful in pre-empting harassment, and they use various stratagems to mix aspects of formality with the underlying informality. Several electricity sellers reported paying KPLC's field staff to read a smaller amount on their meters than the actual consumption.[150] A Luhya sambaza provider admitted that his group does two wirings: one goes to the meter but the other does not, thereby helping to avoid punishment during KPLC's inspections (Sept 19th, 2015). Others may pay Kenya Power for part but not all of their metered customers, as explained below by a wealthy ex-electricity provider. Importantly, KPLC is more likely to deal with leaders who have meters; for instance, a provider with a meter usually negotiates with a KPLC engineer to restore provision after a transformer burst.[151] A meter can thus generate additional influence and gravitas with KPLC, although the device rarely if ever performs the intended function of measuring usage.

The strategic decision to acquire meters or droplines legally before reselling illegally, in hopes of preventing harassment and augmenting cartels' bargaining power with KPLC, was best explained by a large-scale provider in Milimani who has gradually left *sambaza*:

> For droplines, you get them legally but you later use illegally. It has to be legal so you can connect illegally. You can't negotiate. You pay the normal price. *How much?* Ksh. 34,950, but to get quickly, you need to pay [*i.e., another bribe for the installation*]. When you're arrested, you say 'I have papers,' it gives you something to negotiate…you can escape being arrested...*How did you get the meter?* It cost me Ksh. 34,950 each. I had 9 meters but I've given them all away *[to my brother and others]*. You can have a shield: 'these are my papers.' I always had a meter. *Do they ever read the meter?* They do read the meter –sometimes you hear they've come. If you don't know they're around, you call and say, 'I want to pay something' so you can shield yourself so somebody cannot accuse you. I started from the word go, I used a legal meter. I've never in my whole life used a hook [*i.e., a fully illegal connection*]. I don't like it and I don't recommend it. It destroys our name here –you need some people [to be] genuine. It taints your name when you do it 100% illegally, it will taint your name. You get genuine so that you use their name to get something from Kenya Power. You need a legal account to be charged like if a service line has fallen, you get charged Ksh. 500… (Aug 24th, 2015).

Formal documents in this account perform multiple functions, including a smokescreen during a police arrest or inspection by Kenya Power ('you can have a shield'); by contrast, harassment is far more punitive for those without any legal papers. Legality also helps informal providers to secure maintenance from KPLC, such as repairing service lines or burst transformers ('You need a legal account to be charged' for repairs). Perhaps most surprisingly, the documents help in bolstering the legitimacy and reputation in the community; meanwhile, fully illegal hook-ups 'will taint your name.' Alongside these instrumental reasons for legal connections—improving maintenance, reducing harassment, avoiding arrest—legal connections create a veneer of respectability for status-conscious providers living in the same communities where they work. Although he has basically left the

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[150] "*When do you deal with Kenya Power?* The transformer, when it blows up, you have to deal with them direct. You bribe so they can exchange for you…If the meter has gone high, you give bribe so they can reduce the bill. All of us come together –whoever calls Kenya Power must have a meter –like me, I can call them, they know I have a meter" (Sep 3rd, 2015, Kisii provider in Milimani).

[151] For example, a provider in Milimani who has sold sambaza since 2013 does not deal with KPLC because he lacks a meter, explaining that instead "the one with meters deals with them" (Sept 3rd, 2015).

business, his brother remains a large-scale *sambaza* provider and reported that his meter is still not read, just providing 'defense' in case the police or Kenya Power come to Mukuru.[152]

The trappings of formality are only brandished by *visible* water and electricity providers, while *invisible* sewer hook-ups and latrine-emptying remain largely covert or ignored. Similar to the *sambaza* providers, some water vendors have a formal connection from Nairobi Water but resell illegally or with a major mark-up. For example, a water vendor in Sisal for the past 3 years has a meter (costing Ksh. 24,000) and it is read every month without giving Nairobi Water a bribe. However, he makes a sizable profit by increasing the unit price from 50 cents to 5 shillings per 20 liters (Dec 23rd, 2016). Meanwhile, other water providers obtain their illegal connection from another seller with a legal connection and have fewer ties to the utility. According to a large-scale Luhya provider (who inherited water and *sambaza* from his father), he does not regularly deal with Nairobi Water. Instead, he accesses water by contributing with other sellers to a Kisii vendor; the latter has a legal connection in the nearby Imara Daima formal settlement.[153] These variations suggest the need to carefully analyze the interface within a single sector, as noted above. Meanwhile, in on-site sanitation, there are fewer opportunities to interact with formal actors and the guise of formality does not appear. Manual emptiers (*invisibly parallel*) are typically ignored and have no occasion or need to display any trappings of formality. Regarding mechanical emptiers, one provider said his group lacked a permit since it costs a prohibitive Ksh. 17,000 or $170 (Dec 3rd, 2016), and their main tactic to fend off official harassment is emptying after nightfall. Finally, sewer hook-ups initially required major bribes but as a largely invisible service otherwise underprovided by the state, there was little need to display vestiges of formality to gain legitimation. I conclude below with reflections and an agenda for additional research into formal/informal ties.

IV. Conclusions and Future Research Agenda

To encourage comparative work and deeper understanding of hybrid local public goods, I proposed a typology of informal providers in Nairobi's slums as well as the concept of a 'formal/informal interface.' The interface helps reveal how diverse official actors interact with informal providers; these relations can be traced across multiple sectors and in other settlements to refine my framework. In Mukuru, I uncovered key variations along the interface such as the levels of bribery, likelihood of conflicts, and frequency of interactions between formal/informal groups. As well as underscoring the mutual imbrication of formal/informal service providers, I emphasized that informal actors' ties to state actors are always in flux and may not always correspond to the typology sketched above. Water providers usually have lower levels of collusion than their counterparts in electricity, but their collusive practices may vary over time or depend upon the providers in question. As noted above, some influential water cartels reportedly pay massive bribes to Nairobi Water's valve-men, but these practices appear to be uncommon. Formal/informal interactions can also assume greater importance at critical junctures, such as periodic prohibitions on latrine-emptying or crackdowns on cartels. Furthermore, when seeking to eradicate cartels, policymakers should seek to

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[152] His brother said in a separate interview that the meter is still not read: "There is some harassment, but at the end of the day, we support ourselves with it [i.e., *sambaza*]. In case you are caught by police, they can come and check. Kenya Power doesn't read the meter; it is not read up to today. The Kenya Power guys just pass! *[laughs]* Even if we have it [meter], we don't regularly use it, it's just there for defense" (Sept 6th, 2015).

[153] "There is a challenge from the [water] main in Imara [a nearby formal settlement]–you have to go and talk, and pay to open [it]. The main chamber is there. *What do you pay?* Ksh. 1000 from each group –we can pay 15,000 altogether. *When do you pay?* After 2 months. *To Nairobi Water?* We don't know where it goes –after going and water is open, it's enough. *Do you deal with Nairobi Water?* No…I just deal with the person in Imara –he has a legal connection. *Is he Kisii?* Yeah. *Are there lots of Kisii selling in your area?* Yeah" (Sept 19th, 2015).

prevent negative community impacts and learn from past experiences in Mathare, where households reliant on water cartels initially lacked adequate alternatives (Lines and Makau 2017). I also suggested that cartels sometimes deploy formality as an obfuscating or defensive strategy; the 'trappings of formality' can be manipulated by the very informal providers who both depend upon and subverting their formal counterparts.

It is important to note that formal/informal distinctions do not lose meaning, and I also argue that analyzing the 'interface' can help create more appropriate interventions in informal settlements. Taken together, my cases indicate that informality should not be conceived as simply a mirror or negative image of the formal, which obscures a far knottier reality. The fluid and porous boundary between formal/informal is ill-captured in past studies of economic 'linkages,' although I drew upon hybrid security governance and political science literature for relevant insights (Section I). When they deploy the 'trappings of formality,' informal providers use formality as a resource while simultaneously undercutting official rules. Formal/informal relations may appear ever more blurred as cartels acquire formal meters but resell illegally, tamper with meters, or only use meters in inspections to prevent disconnections. However, I argue that informal providers' cunning stratagems only underscore the need to understand the precise modalities along the interface, rather than viewing formal/informal ties as a chaotic, indistinct morass. On a policy and practice level, I suggest that an understanding of the formal/informal interface can help to craft appropriate interventions. For instance, eliminating the pervasive corruption and collusion in *sambaza* will require thoroughgoing reforms, but analyzing the interface can identify major points of contact and develop appropriate responses with both informal providers and utilities (see also Chapter 5).

I sketched some changes over time as well as the heterogeneity between and within informal providers, but these changing dynamics and alternate political ties will merit additional research. My discussion explored the variations in informal providers' ease of entry, salience of ethnicity, possible substitutes, and other axes of difference. While I briefly noted some changes over time in formal/informal relations, future studies could examine life-cycle characteristics and other temporal shifts. For instance, as young men mature and leave cartels, how does this alter the providers' ethnic profile or other characteristics? Political cycles may also affect informal providers, such as heightened crackdowns upon water cartels around elections (cf. Lines and Makau 2017 for Mathare's water cartels). Additional research could examine whether and why the sectors are perceived as legitimate, which may help to explain greater harassment of some informal actors (e.g., electricity providers but not water). Furthermore, it will be important to analyze informal providers' ties to a broader array of formal actors. In Mukuru, I explored informal providers' relations with police, utilities, and village elders but missed the role of national or local politicians. Studies from India's water provision suggest that local politicians often shape informal water markets (Ranganathan 2014, Post *et al.* 2017), and such relations in other sectors certainly will require additional investigation.

At a broader scale, research can continue tracing the interface in other sectors and uncover the ongoing co-constitution of informality by formal/informal providers across urban areas. Additional studies can explore how models of hybrid local public goods may differ across cities or between sectors in the same city (cf. Post *et al.* 2017, p. 13), perhaps exploring relations between state officials and informal providers in middle- or upper-class areas. As noted already, 'electricity theft' research indicates that poorer and wealthier residents commonly steal electricity (Lewis 2015) and unraveling these ties would add nuance to this literature. Studying the 'interface' can also complement research into the complexities of informal water provision: a special journal issue

already included cases of how a single water service provider varies in the extent to which it is formal or informal (Ahlers *et al.* 2014).[154] Finally, it will be crucial to complement a settlement-level analysis of hybrid provision with *multi-scalar* discussions of infrastructure networks. Informal providers who redistribute electricity or overload sewers are a single side of the coin; they can only be understood in relation to collusive, corrupt practices at several scales and formal providers' pervasive failure to serve informal settlements.

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[154] One case study already examined informalities within Hubli-Dharwad's formalized water delivery, such as continued storage of water or using water without paying bills (Burt and Ray 2014).

Chapter 5
Conclusions and Policy Lessons

<u>Overview</u>

In closing, I reflect upon methods, remaining gaps, and areas for comparative research on informal providers while also discussing their implications for future initiatives. Drawing upon my findings in Mukuru, I ask how to improve data-collection on informal provision and I highlight the importance of mixed-methods approaches (with an emphasis on qualitative aspects often overlooked in past studies). As in my sanitation chapter, I argue for studying a constellation of improvised behaviors and informal providers to better address the complex unmet sanitation needs in African slums. Additionally, I examine how a fuller understanding of informal providers and the formal/informal interface may enrich urban policymaking and future interventions. I acknowledge that informal providers may have unsavory or unhealthy practices (e.g., latrine-emptiers, caretakers) and may exploit residents or heighten levels of insecurity in informal settlements (cartels). Electricity cartels and emptiers also undercut formal utilities and compete with environmentally-sustainable alternatives like ecosan or solar energy, leaving few advocates in their respective sectors. While not denying such concerns, I argue for developing a nuanced portrait of informal providers and synthesize lessons for slum electrification projects, based upon initial findings in Mukuru and a desk review of past electricity initiatives in the Global South.

Additionally, I discuss how an analysis of informal providers and the formal/informal interface can offer key insights for urban policymakers, including international aid agencies. Understanding the 'interface' can help uncover the *drivers* of informal provision as well as *variations between* these providers, and I propose 5 reasons why these actors should be acknowledged in urban initiatives. For instance, understanding informal provision can 1) create useful diagnostic tools and 2) avoid challenges in implementation or, more positively, 3) build upon providers' accessible services or other positive aspects. In turn, findings on informal provision can help 4) identify policy entry-points and partnership opportunities. By understanding informal providers in several sectors, policymakers may 5) develop comparative insights and holistic approaches, such as joined-up initiatives with informal providers of sanitation, drainage, and garbage collection (see below). I also discuss practical insights from understanding the 'interface,' which can help ensure that cartels are not dismissed as mere thieves, but also recognize the role played by corrupt utilities staff. Below I begin with policy lessons about informal electricity, including how to preserve some benefits of Mukuru's cartels and how to address possible challenges during formalization. I then offer some broader methodological reflections regarding data-collection and how to study informal providers, alongside some related lessons for practitioners in the Global South.

I. <u>Slum Electrification in Nairobi and Lessons from Past Projects</u>
<u>A) Literature Review on Previous Slum Electrification Initiatives in the Global South</u>

The following discussion of electrification projects will synthesize academic and gray literature, particularly from the World Bank's Energy Sector Management Assistant Program (ESMAP) and Global Project on Output-Based Aid (GPOBA). I also consulted reports on urban energy access from USAID, University of Cape Town, and UNEP's Global Network on Energy for Sustainable Development (GNESD),[155] alongside peer-reviewed case studies (e.g. Brazilian *et al.* 2012, Baruah 2015). While focusing on the ways these initiatives have dealt with informal electricity

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[155] See publications available at http://www.gnesd.org/PUBLICATIONS/Urban-Peri-Urban-Theme

providers, I also identify broader lessons and opportunities for achieving far-reaching gains such as political inclusion, improved health, or other co-benefits in informal settlements. The following section will analyze experiences with urban energy initiatives in Indian, South African, Brazilian, and other cities of the South, while Section B) will analyze the ongoing electrification project in Nairobi's informal settlements.

The World Bank's GPOBA has supported several energy initiatives, including in Nairobi's slums, but there are few successful precedents in informal settlements. Since 2006, GPOBA has spent over $57 million on 17 energy projects in 15 nations and devoted nearly half of its portfolio to energy (GPOBA 2016a, p. 2). This results-oriented approach stipulates that donors' payments are conditional on reaching key targets, such as constructing or rehabilitating power sub-stations. In Nairobi's slums, the project seeks to electrify 174,000 new customers by December 2017 and by September 2016, it had already connected 120,000 new consumers in slums.[156] The project is instituting prepaid meters and a total of 255,000 meters had been installed by September 2016 (handily meeting the target for December 2017). GPOBA payments are triggered after verifying households' working connections with pre-paid meters and thanks to subsidies from the Bank and KPLC, Nairobi households pay just $15 to connect (GPOBA 2016b, p. 2). The project also incorporates low-cost, 'ready-boards' equipped with CFL bulbs to promote energy efficiency (KPLC 2016, p. 31). Although these inclusive designs and rapid progress in meter installation are promising, it may be difficult to ensure residents will remain with KPLC. As discussed below, GPOBA's only prior slum electrification project in Mumbai encountered major challenges, partly due to cartels' activities, and GPOBA experiences in rural areas may not be directly applicable in urban areas. There are also lingering concerns with electricity losses in Nairobi, which have increased since the start of the GPOBA project.[157] This section will analyze lessons from other slum electrification projects, focusing upon how to preserve the benefits of informal provision while tackling their shortfalls in safety or other key concerns.

GPOBA's project struggled in Mumbai due to unaffordability, exclusionary tenure requirements, informal connections, and poor project design, suggesting key errors to be avoided in subsequent initiatives. The intervention electrified a mere *15* households in Mumbai's slums by project closure, far below the target of 26,500 households (GPOBA 2014). Residents could not afford to formalize electricity, partly due to increased costs of wiring, and they often preferred existing informal providers (*ibid.*).[158] GPOBA admitted its "failure to manage the strong informal network" of existing providers, who charge a flat rate of just $2–$4 per month for 3 to 4 electricity points, as compared to utilities' charges of $7-$10 for 50-100 kWh (*ibid.,* p. 2). Much like cartels in Nairobi's slums,[159] the flat fees and lower costs of informal providers proved a major challenge in electrifying Mumbai. A GPOBA report thoughtfully identified urban poverty, illegal connections, and utilities' faltering finances as interrelated challenges to slum electrification: the urban poor have low consumption levels and cannot pay "for the full cost of supply. *High levels of illegal connections and theft caused by households' limited affordability and/or their ineligibility to be connected exacerbate this problem.* The

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[156] Findings in this paragraph utilize the latest GPOBA results for Kenya's slum electrification, available here: http://projects.worldbank.org/P125388/gpoba-w3-kenya-electricity?lang=en&tab=results

[157] According to GPOBA's baseline data for June 2010, annual electricity losses in the project area were 16.3% but actually rose to 19.4% in June 2016, making it unlikely to meet GPOBA's target of 15.9% by December 2017. See http://projects.worldbank.org/P125388/gpoba-w3-kenya-electricity?lang=en&tab=results

[158] "Cost escalations during implementation increased the end-user contribution to $72…[they instead] opted to pay the full connection fee of $34 [and] organize their own wiring through local contractors" (GPOBA 2014, p. 2).

[159] See Chapter 2 and Figueroa (2016) on Kibera's informal electricity, where flat monthly fees are again common.

weak financial position of utilities reduces their chance to access the financing required…" (GPOBA 2016b, p. 15, emphasis added). Finally, Mumbai households were required to furnish proof-of-residency documents for a legal electricity connection, leading to rejection of nearly 750 applicants (GPOBA 2014). However, as noted below, the latter obstacle has been successfully addressed in other projects that utilize inclusive tenure strategies.

Slum upgrading in Ahmedabad included large-scale electrification, and several utilities have emulated Ahmedabad's model of community outreach, alternative tenure, and appropriate technologies to expand access. Ahmedabad's slums were electrified via inclusive strategies and partnerships with the Self-Employed Women's Association (SEWA) and its housing micro-finance agency Mahila Housing Trust or MHT (Baruah 2010 and 2015). The project issued bills to female household heads and created a supportive legal framework, while avoiding onerous tenure regularization processes.[160] Moreover, SEWA and MHT were able to sensitize residents, negotiate with the utility for monthly bills (more affordable than every 2 months), and facilitate communication (Baruah 2015). From 2001-2008, the project electrified 100,000 households and its approach was later replicated in smaller Indian cities (*ibid.*). Similarly, in Delhi, slum electrification combined local outreach with inclusive tenure strategies, as well as instituting tamper-proof meters and enhanced customer services. Delhi's 3 privatized utilities have expanded slum-dwellers' electricity access by 1) simplifying documentation requirements; 2) providing temporary addresses; and 3) reducing opportunities for theft or corruption via automated meter-reading and tamper-proof meters (Criqui and Zérah 2015). Recognizing that technical solutions are insufficient, enhanced customer services in Delhi now include easy-pay facilities, paying bills in instalments, and 24/7 call centers for complaints (*ibid.,* p. 183). Although some customers persist in informally hooking wires (*ibid.*), technical losses fell dramatically and official electricity coverage has reached 99% of Delhi, suggesting that even privatized utilities can successfully expand electricity access.

Electrification in Sao Paulo's favelas has promoted safety, affordability, energy efficiency, and recognition as citizens, while also successfully smoothing the transition to formal provision. The utility AES Electropaulo has electrified over *1.75m* people in favelas from 2004-2011, and beneficiaries' satisfaction rates reached 83-98% thanks to reduced fire risks, greater reliability, and access to an address via utility bills (Luque-Ayala 2016, p. 179). AES Electropaulo's model was replicated by other Sao Paulo utilities, who again utilize 1) meters, anti-theft cables, transformers and other neighborhood-level electricity distribution mechanisms, and 2) strategies to lower consumption and thereby promote affordability (*ibid.,* p. 175). To facilitate the transition, households are 3) not billed immediately but rather given baseline data on usage and 4) community facilitators promote energy-efficient appliances and identify ways to lower consumption (*ibid.*). Creating further political and social benefits, the project has improved access to credit and enhanced

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[160] According to Baruah (2015, p. 192), the municipality AMC issued a <u>No Objection Certificate (NOC)</u> stating that beneficiaries "would not be evicted by the AMC for a period of 10 years [and] would be used as the support document in lieu of other proofs of ownership and residence. Since such letters could only be provided for slums that had received the SNP [later renamed Parivartan] infrastructure, the AEC [utility agency] introduced an <u>indemnity bond</u> to specifically undertake electrification in non-SNP slums at a later stage in the project. The indemnity bond basically required slum residents to sign an agreement stating that they would not pursue legal proceedings against AEC if they were evicted from their homes or relocated in the future by the AMC. The combination of *NOCs and indemnity bonds provided an adequate legal framework for the provision of legal electricity to slums"* (emphasis added).

official recognition,[161] thereby fostering social inclusion in these previously-marginalized areas. While meters remain controversial and illegal connections have not been fully eliminated (Luque-Ayala 2016), the scale and rapidity of transformation in Sao Paolo still represent a significant achievement. Key consumer benefits include enhanced safety, affordability, and energy efficiency, as well as social inclusion and access to credit. Furthermore, AES Electropaulo facilitated the transition to formal electricity via community educators; appropriate and energy-efficient technology; and phased implementation before billing.

Prepaid meters were again instituted in Mozambique and South Africa, with the latter also offering a progressive Free Basic Electricity (FBE) policy, but expanding access and eliminating informal connections are stubborn concerns. In an evaluation of Cape Town's electrification, households often continued using multiple fuels while affordability varied depending on household size and access procedures (Tait 2015). These surveys with over 200 households in townships[162] found widespread use of paraffin ('fuel stacking'), neighbors often reselling electricity informally to backyard shack-dwellers, and challenges with overloading, fires, or unreliable supply (especially in winter). Additionally, larger households could not always benefit from FBE since their higher consumption levels typically exceeded their FBE allocation.[163] Although eligible low-income households receive 50kWh per month in free electricity, this is often criticized for being insufficient, and the South African regulator even lacks data on the number of FBE recipients (Tait 2015, p. 6). Furthermore, von Schnitzler (2013) has critiqued South Africa's use of prepaid meters to discipline citizens and explored how low-income Johannesburg households often subvert their meters. South Africa's mixed experiences with meters and FBE, particularly for larger households or backyard shack-dwellers, suggest the long-term and contextually-specific challenges of electrification. Meanwhile, prepaid electricity meters in Maputo were not necessarily experienced as regressive and low-income customers became accustomed to estimating their consumption (Baptista 2016).[164] Although the cases suggest greater recognition for enhancing urban energy access in Africa, they also underscore the need for locally-tailored efforts to reach vulnerable households and to address informal provision.

B) Lessons from Case Study and Nairobi's Ongoing Electrification Project
Nairobi's electricity cartels allow unmetered use, low-cost connections, and extended repayment times (Chapter 2), making some customers loath to formalize and creating a need for additional interventions. Although the World Bank has recognized the need for lower connection costs to reach the urban poor (Golumbeanu and Barnes 2013), complementary initiatives may ease the transition to formal electricity. Following the example of Sao Paulo, efficient appliances can be part of the solution as well as outreach measures seeking to transform residents' consumption practices. As Figueroa (2016) noted for Kibera, an unchanging flat rate for informal electricity may constitute a barrier to adopting energy-efficient technologies. Residents of Nairobi's slums may already own several appliances; for instance, in Mukuru and Viwandani, 49% of households have a

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[161] Utilities' strategies to promote local buy-in included 1) donating goods and community facilities; 2) partnerships with local NGOs or community leaders; and 3) bringing local government representatives to launch the project in favelas (Luque-Ayala 2016, p. 184).

[162] Surveys were conducted in Manenberg (with about 1200 informal dwellings in total) and Masilunge, a small settlement of 100 informal households in Gugulethu (Tait 2015).

[163] See additional information available at http://www.energy.gov.za/files/faqs/faqs_freebasic.html

[164] While acknowledging the controversy surrounding prepaid meters in the Global South, Baptista (2016) argues that low-income customers in Maputo learned to create a "sense of disciplined autonomy" and that traveling technologies are always shaped by their local context, so their impacts are not predetermined (p. 14).

TV plus 65% have a radio and 93% have a phone (Strathmore 2016, p. 34). Given the widespread access to appliances without previously incurring higher consumption costs, the shift to metered usage may be painful and a potential source of resistance. Residents with informal electricity are accustomed to flexible repayment times (Chapter 2), and below I argue for small loans or other customer assistance to ensure continuous access to power during households' unexpected crises or income fluctuations.

To encourage formalization, KPLC may strengthen its advantages over cartels with respect to safety, reliability, and lower unit costs, plus its standing fees could be eliminated. Low-quality wiring in Nairobi has regularly led to shocks, fires, and electrocution, including of children,[165] while also imposing economic losses. For instance, Kibera has an average of 5 power surges per month, and 81% of respondents said these surges typically result in burn-out of incandescent bulbs (Figueroa 2016, p. 544). Kenya Power also imposes a standing fee of Ksh. 120 and a regressive charge of Ksh. 2 per kWh below 50 units (AMT *et al.* 2014, p. 75), which may further discourage formalization. Abolishing these fees and charges could promote more equitable access to energy, while also signaling that Kenya Power is serious about reducing costs for the poor.[166] Other research found a price penalty for informal electricity; Mukuru residents pay Ksh. 10 per kWh for informal electricity while corresponding price for KPLC is Ksh. 4.40 (Strathmore 2016, p. 25). This price penalty of 128.6% is based on an average consumption of 43 kWh per month, costing about Ksh. 434 from informal providers (*ibid.*). But given the unmetered consumption of *sambaza*, it is difficult to know precise usage levels and residents may also need help to lower their consumption (as noted above). Finally, low-quality provision has been problematic even for Mukuru residents with KPLC connections; they still complained of rationing and surges, claiming that informal providers had better capacities than Kenya Power (Strathmore 2016, p. 27). Improving KPLC's reliability, affordability, and safety may help to convince additional slum-dwellers to formalize their provision.

Table 1 seeks to capture the contributions and drawbacks of informal power provision in Nairobi, as well as possible responses and emerging opportunities during slum electrification projects (see next page). It begins with the cartels' 5 benefits of affordability; flexibility; no requisite documentation; source of livelihoods; and prompt, accessible services, which may complicate formalization if these features are not replicated or carefully considered. Table 1 also incorporates informal providers' shortcomings of poor safety; unreliability; energy inefficiency; and lack of official recognition and concomitant links to insecurity. Emphasizing these present-day challenges and potential benefits of formalization can build community support for electrification, inform public messaging, and help to shape complementary strategies in informal settlements. If conceived holistically and executed successfully, electrification can significantly enhance safety and quality of life in informal settlements while overcoming local resistance. Electrification can promote energy efficiency, access to credit, social and political integration (cf. Luque-Ayala 2016), as well as co-benefits of climate mitigation and improved health outcomes (WHO 2016). Additionally, improving customer services such as 24/7 call helplines (cf. Criqui and Zerah 2015) may foster public trust in the utility while also emulating the proximity and responsive services of informal provision. Below I elaborate on the proposed strategies in Table 1 by synthesizing my findings in Mukuru and other relevant literature. Future research may examine parallels to formalizing informal water providers,

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[165] For a recent example of a fatal fire caused by an electric fault in Mukuru, see "Toddler Burns to Death in Mukuru Slum Fire," *Daily Nation,* nairobinews.nation.co.ke/news/toddler-burns-to-death-in-mukuru-slum-fire (Feb 7, 2017).
[166] These standing charges were critiqued in my interview with a well-educated former electricity cartel in Mukuru, who also noted that these fees may discourage landlords from electrifying their tenants (Dec 16th, 2016).

who may similarly offer flexible services, sell in small quantities to the urban poor, but also can be linked to insecurity and contaminated provision (cf. Collignon and Vézina 2000, Ranganathan 2014).

Table 1 Policy Lessons: Key Aspects of Informal Electricity and Responses in Formalization

Feature of Informal Electricity	Example in Existing Informal System	Opportunities or Obstacles in Formalizing	Potential Responses in Formalization
Affordability	Low connection fees, flat monthly costs	Painful adjustment from un-metered use, especially if household already owns multiple appliances	Subsidized connections, efficient appliances, education to reduce consumption
Flexibility	Payment extensions, which can be a major benefit during crises or income fluctuations	Difficult to replicate in prepaid systems, which will shut off in case of nonpayment	Offer small loans or facilitate sharing via SMS
No required tenure documents	Unlike formal utilities, no documentation needed to connect informally	Key obstacle if inclusive alternatives are not instituted (*particularly in areas with informal tenants*)	Adjust requirements, develop intermediate tenure or alternative residency criteria
Source of livelihoods	Creates jobs for large- and small-scale informal providers, plus maintainers	A likely flashpoint and source of grievance, sabotage, or intimidation	Employ community agents, offer trainings or other support for new livelihood strategies
Nearby and timely services	Speedy repairs, rapid connections for new customers, offer free security lights	Residents accustomed to seeing *sambaza*; utility may lack public trust or similar presence in slums	24/7 call line or other enhanced customer services; floodlights and public lighting
Safety hazards	Fires, shocks, and death by electrocution (including children, other residents, and providers themselves)	Formal power is a significant opportunity to improve health and safety	Can build support among providers *and* residents by emphasizing safety improvements
Unreliability	Blackouts and surges are inconvenient, unsafe (especially at night) and linked to lost earnings, study time, leisure etc.	Highlight enhanced income-generating opportunities and cost savings to consumers (e.g., no longer needing to buy new bulbs after surges)	Formalization can promote reliability by improving utility's revenue-collection (longer-term) and installing connections more effectively (shorter-term)
Energy inefficiency	Un-metered informal connections can encourage wastage (Figueroa 2016)	Opportunity to promote energy savings and enhance community education	Enhance access to CFLs and efficient appliances, conduct outreach to reduce consumption (*also promoting affordability*)
Unrecognized provision and linked to insecurity	Cartels regularly pay bribes, sometimes fight amongst themselves or clash with police and utility officials	Formalization can reduce conflicts while promoting official recognition and enhancing public trust in utility agencies	Promote benefits like access to addresses, create partnerships to enhance political integration (*as in Brazil*)

While customers may appreciate safer, more reliable formal electricity, they may miss *sambaza's* flexibility and affordability; additional interventions may halt a reversion back to informality. Slum-dwellers in Nairobi already buy small quantities of water or airtime, but flat *sambaza* fees enabled limitless consumption that may conflict with the unyielding exactitude of prepaid meters. Even if community outreach activities are conducted and efficient appliances distributed, ensuring timely payments could be challenging for vulnerable groups like large households or those with erratic incomes. In the absence of free electricity or other subsidies (as in South Africa), the utility may offer small loans that will be deducted from the next payment (perhaps up to a threshold, such as Ksh. 50 or 100). This would resemble the payment extensions granted by informal providers, while ensuring that households' arrears do not accumulate excessively. Alternatively, KPLC could emulate the Kenyan telecom provider Safaricom and offer sharing mechanisms via SMS, in which friends and family transfer airtime values from Ksh. 5 up to Ksh. 10,000.[167] Coincidentally, this service is called *'sambaza'* ('spreading' in Swahili) and KPLC could repurpose it as a way of avoiding cut-offs. Improvements in safety, reliability, and customer service will undoubtedly appeal to *sambaza* customers and encourage a switch to formal power. But the lack of flexibility and affordability may be unsupportable for some households, making informal electricity appear more tempting. In response, I suggest that loans or sharing via SMS may help to ensure the continued use of formal electricity.

Although providers in Mukuru sometimes recognized that formal electricity will benefit the community, they were afraid of losing their livelihoods and may require support in finding alternatives. According to a provider with 3 years' experience in Milimani, his clientele has already fallen from 80 to 48 households and prepaid electricity "is going to make us suffer…*Has there been any resistance?* We didn't resist. *Why?* You can't resist a government project -it's development [*maendeleo*] but our livelihoods will be down" (Nov 30th, 2016).[168] For vulnerable providers with few customers and no alternative sources of income, the loss could be especially disruptive and may heighten the appeal of criminal activities. A small-scale electricity provider in Sisal (now serving 20 households and 5 businesses) has worked in *sambaza* for 6 years, without another job and just having completed Form II. When asked about the village elders' role in slum electrification, he critiqued them for not involving *sambaza* providers, who were "getting their daily bread from it. Some had reformed from stealing, but now they will *go back to stealing*" (Dec 8th, 2016, emphasis added, also below). In response, utilities can strive to develop new income-generating strategies and I suggest these initiatives should be mindful of the heterogeneities within informal electricity providers. As noted in Chapter 2, informal electricity providers may vary substantially in their levels of education, scale and of provision, and ethnic profile, among other differences.

Additionally, utilities may learn valuable lessons from gang interventions and can partner with current or ex-providers to encourage cartels to embrace more respectable, secure livelihoods. Research has suggested that initiatives with gangs are more likely to succeed if they work with existing groups, rather than adopting a harshly punitive approach.[169] Based on interventions with gangs in the Global South, members wishing to remain in the group would cite their feelings of belonging, excitement at the lifestyle, or a fatalistic acceptance; for those who *did* want to leave, they

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[167] For more information, see www.safaricom.co.ke/personal/calls-sms/prepay/sambaza

[168] A large-scale provider with 10 years' experience similarly noted that the process of electrification "isn't bad, but the problem is so many youths are going to be jobless" (Nov 30th, 2016).

[169] By contrast, top-down and punitive approaches with violent groups "are ineffective and may, in some cases, radicalize gangs and militia groups" (Muggah 2014, p. 353).

would do so only if they were offered alternatives (see Winton 2014, pp. 411-412). Informal electricity providers may not be as closely-knit as gangs and may already have several reasons to leave *sambaza*, such as rampant bribery, safety hazards, or clashes with official actors (Chapter 2). Similar to gang members, however, the need for an alternative livelihood may be paramount, given the poverty and lack of decent work for Nairobi's slum-dwellers. Providers may be more likely to abandon *sambaza* if they have enterprise trainings and a respectable livelihood alternative. For example, a youth who sold electricity for 7 years before leaving it in 2016 explained he had become a local leader and wanted to be an example to others. He grew tired of bribing the police, plus he had the respectable job option of garbage collection: "*I didn't feel bad [leaving electricity] because I already had something else. I make Ksh. 22,000 per month for garbage collection, so I didn't feel bad when I left sambaza. For sambaza,* I'd get Ksh. 40,000 [monthly] but Ksh. 20 or 30,000 was for police [when] I was arrested. For garbage collection, everything is yours" (Dec 21st, 2016, emphasis added). This youth was previously involved in a gang but had reformed, and partnering with ex-cartels like him to craft arguments may convince current providers and provide a model for them to emulate subsequently. Furthermore, group loans and capacity-building efforts could redirect cartels' business acumen and I argue for targeting such activities to poorer providers with few livelihood alternatives.

An equitable, transparent selection process for local agents may enhance trust between the utility, residents, and former cartels, while KPLC's customer services can seek to emulate the accessibility of *sambaza*. Electricity agents serve as a key intermediary between KPLC and residents, in addition to offering a mechanism for incorporating ex-cartels, and their selection should be carefully scrutinized. I suggest that KPLC prioritize vulnerable ex-cartels, and agents' profile should reflect Mukuru's ethnic mix. But to date, KPLC's selection process in Mukuru has been perceived as illegitimate and prone to tribalism, or as favoring better-off providers. Although the process was still ongoing, my interviews found that village elders had sometimes selected electricity agents who were members of their own tribe or who already had other sources of income. For instance, a provider in Milimani complained of favoritism and tribalism by village elders: "The problem with elders is they call their own people—even if they don't work in *sambaza*—or they call their own guys in *sambaza*. So it's not fair? Not fair" (Nov 26th, 2016).[170] Many providers felt isolated and aggrieved, or else unclear about how the selection of agents was being conducted. Improving the selection process' transparency, giving priority to poorer ex-cartels, and creating an ethnically-inclusive mix of agents may rectify such concerns. Selections should be vetted by CBOs or other neutral actors familiar with existing *sambaza* provision, helping to ensure a legitimate process and ethnically-balanced cohort of agents. Furthermore, the utility can enhance customer service via SMS or low-cost help-lines (cf. Criqui and Zerah 2015) and conducting additional outreach in informal settlements. These strategies could help transform local perceptions of corrupt or inaccessible KPLC staff, while also building upon the past network of nearby *sambaza* providers.

Careful sequencing of formal electrification and use of tamper-proof technologies can help with short-term implementation, although it will be a longer-term challenge to tackle corruption in the sector. One way of promoting success is to construct infrastructure speedily and then replace *sambaza* with formal, tamper-proof technologies.[171] But in some of Mukuru's villages, the installation of poles and meters was quite slow and my interviews suggested that cartels had seized upon the

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[170] Another provider in Sisal similarly complained that in his area, village elders chose people from their own tribes and favored those with other jobs (Dec 10th, 2016).

[171] This argument comes from a member of AMT's staff, who recommended constructing the new infrastructure and meters quickly, then removing the cartels who would not have time to tamper in the interim (Nov 14th, 2016).

delay to tamper with meters (although few providers admitted to doing so themselves). A large-scale provider in Milimani observed that the electrification process had dragged on for months, which had emboldened some providers to cut wires and tamper with meters (Dec 5th, 2016).[172] But more fundamentally, extensive reforms and capacity-building strategies are needed to address KPLC's corruption, rather than solely blaming electricity theft upon households or cartels. Past studies suggest that corruption is pervasive in the electricity sector (Gulati and Rao 2007, Sharma *et al.* 2016), and my findings underscored the collusive ties and bribery that undergird informal provision (Chapter 4). Below I discuss other policy and methodological implications of my dissertation, as well as outlining possible directions for future research.

II. *How* and *Why* Should Informal Providers Be Studied? Lessons for Research and Practice
A) Existing Gaps and Methodological Reflections

There is a need for more detailed (often qualitative) data on infrastructure in African slums, in order to complement official statistics and to reveal usually-hidden modes of informal provision. As noted above, past research on a 'poverty penalty' indicates that Mukuru's informal providers offer lower-quality but higher unit-prices for shelter and infrastructure (Strathmore University 2016). However, I suggest that future studies of informal provision should encompass a wider range of indicators. For instance, ESMAP (2015) developed a multi-dimensional matrix to measure energy access incorporating *capacity*; *duration* and *reliability* of supply; *quality; affordability; legality; health and safety;* and *convenience.* This framework rightly acknowledges the complexities of improving energy access, and adapting its multidimensional criteria could help to assess informal provision. In my analysis of electricity cartels and latrine-emptiers, informal providers emerged as *convenient and affordable* but often with *poor health and safety* standards, and may have other quality concerns such as links to *insecurity* (cartels) or *environmental hazards* (both cartels and latrine-emptiers). Meanwhile, *flexibility* and *responsiveness* are key benefits of cartels, who may extend payment deadlines and are readily available for repairs (Chapter 2). Gathering additional data on infrastructure in informal settlements, including on informal providers' multiple facets, can add nuance to existing data on electrification rates, (un)improved sanitation, and other indicators. In the following section, I continue to explore ways of enhancing data-collection on informal providers while identifying key lessons from my chapters.

I examined multiple excreta disposal practices and informal modes of accessing electricity, all of which can promote nuanced, locally-appropriate indicators as well as comparative research. Instead of SFDs' generic category of 'unsafely-managed disposal,' I identified an array of methods and specific behaviors utilized to dispose human waste in Mukuru. My discussion delineated between constructed and improvised solutions, risky seasonal patterns like 'flooding-out', and common ways of disposing diapers or menstrual materials, among other practices (Chapter 3). However, subsequent studies should be tailored to local conditions in informal settlements, including seasonal variations and alternative sanitation technologies or services. Other informal settlements may have wider prevalence of public toilets, mechanical emptying, or eco-sanitation, which will require in-depth analyses of their respective disposal and maintenance practices. Regarding electricity, past studies have usually failed to examine *who* provides informal connections, including collusive relations between utilities and individuals or groups informally distributing

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[172] "*Is electrification still going on?* It still hasn't finished [*bado imeisha*]. They're still cutting because the wires aren't live. If it was live, people would fear to cut [the wires]. *Do you think Kenya Power could do anything to avoid the cutting?* They could have been quicker to wire and to commission power, because even some places have waited 4 months! *How long is the wait in your area?* Two months –it started in October" (Dec 5th, 2016, large-scale provider in Milimani).

power. Patchy findings suggest a range of actors may be involved, including landlords and neighbors in Kibera (Figueroa 2016, Majoro 2014) while in Dhaka, businessmen and local musclemen informally resell power (Hossain 2012). Such complex modes of accessing informal electricity may not be readily distilled into indicators, but further case studies can spur comparative research and enhance understanding of these covert practices (see also below).

Studying risky or taboo excreta disposal practices may require qualitative research (perhaps complementing surveys or observations), and these findings can inform future behavior-change interventions. For instance, women in Mukuru typically throw sanitary pads in latrines, reflecting the lack of affordable waste-collection services or dignified facilities during menstruation (see Still and Foxon 2012 for similar findings in South Africa). Although the prevalence of such practices can be confirmed by observing latrines with menstrual waste, FGDs or other qualitative methods may offer a more supportive avenue for exploring such practices and analyzing ways to transform unhygienic patterns. My chapter focused only on existing disposal practices rather than how to promote behavior change, and the latter topic remains a key area for future research. Additionally, caretakers in Mukuru may 'flood-out' latrines during rains to avoid paying for emptying services, though this is also acknowledged as insalubrious and problematic (Chapter 3). Such findings were echoed in a survey of over 660 residents in Dar es Salaam's slums, where 43% of respondents confirmed that flooding-out was practiced in their community (Jenkins *et al.* 2014, p. 136). But just 4% of respondents in Dar admitted to flooding-out their own toilets and this appears to be a major underestimate, as 28% of latrines were observed to have an emptying pipe likely used for this purpose (*ibid.*). Since surveys may underreport the prevalence of such risky behaviors, I suggest that FGDs among peers may better reveal these practices and inform subsequent behavior-change interventions (while also taking care to avoid sparking shame or stigma among participants). As discussed below, these findings can help to shape future interventions in African slums and perhaps encourage more rigorous comparative research.

B) Policy and Practice Implications: *Why* study informal providers and formal/informal interface?
Filling the lacunae on informal provision can improve interventions in African slums by creating detailed situational analyses, identifying priorities, and helping to anticipate potential sources of resistance. As argued in Chapter 3, the 'sanitation chain' misleadingly suggests a linear progression and obscures the unsafe disposal patterns in informal settlements. But equipped with an analysis of slums' (typically) informal sanitation practices, as proposed in my chapter, practitioners may gain a valuable diagnostic tool. A more comprehensive account will be essential to improve slums' sanitation, particularly as this sector is fractured between multiple official agencies, NGOs, and informal providers comprising a dizzying array of players (cf. Ministry of Health 2016). Strategies to overcome a lack of appropriate regulations and even basic data regarding on-site sanitation will be quite challenging, but may benefit from a fuller analysis of current practices. Regarding Mukuru's electricity, informal providers are again widespread and experience suggests that cartels can stymie or at least significantly complicate electrification initiatives, as in Mumbai (GPOBA 2014). Before launching slum electrification projects, it may help to map the landscape of informal electricity providers, including landlords, middlemen, neighbors, and cartels, all of whom may have strong vested interests in preserving the status quo. Additionally, my findings suggest that Mukuru's cartels differ along axes such as scale, profitability, and alternative income-generating activities; capturing these distinctions can help to develop new livelihoods for vulnerable providers (as noted above).

Nor are informal providers always a potential threat to interventions; instead, these actors can contribute to intermediate solutions benefiting the poor, as in a sanitation model from Kibera. I

suggest that incremental approaches are necessary in the near-term, such as upgrading slums' shared on-site sanitation. In the short-term, transforming disposal patterns (including practices by emptiers and caretakers) may significantly improve community health and quality of life, without necessarily aiming for sewers or other improved provision from the outset.[173] Especially for utilities lacking experience with slums' on-site sanitation, informal providers can offer valuable contributions that may help reach low-income households more effectively. For instance, I observed an innovative example in Kibera, where the NGOs Umande Trust and Water and Sanitation for the Urban Poor (WSUP) worked with manual emptiers to collect fecal sludge using a pump called a Gulper (visit Sept 2nd, 2015).[174] Although initially opposed to working with on-site sanitation, Nairobi Water later accepted the idea of decentralized 'sludge mixing chambers' that incorporate a screen to separate the sludge from solid waste (according to WSUP staff). Workers were given protective equipment and duly transported fecal sludge to these designated mixing chambers in Kibera. Additionally, Nairobi Water and NEMA trained emptiers on dumping regulations, while the NGOs sought to improve their business skills. Unfortunately, Kibera has too many competing sanitation options for this approach to remain financially viable, but it may still offer a valuable model in settlements with a higher prevalence of on-site sanitation. Similarly, as argued above, slum electrification projects may consider some present-day providers as assets, including the use of ex-cartels as electricity agents following a transparent selection process.

Through understanding the formal/informal interface, policymakers may better grasp the roots of inadequate provision in slums and launch more appropriate interventions. This possibility is especially significant for *sambaza*: if cartels are only viewed as electricity thieves, policy responses may be excessively narrow and miss the pivotal role of corrupt KPLC officials. But through an analysis of formal/informal relations, particularly the collusive ties and bribery that underlie informal electricity, more nuanced strategies can be developed. Tackling the deeper roots of *sambaza*, perhaps via capacity-building and strategies to deter corruption at Kenya Power, may be an important goal for donors seeking to promote accountability. For instance, a World Bank official who is familiar with GPOBA's electrification project remarked in disgust that cartels 'are just stealing electricity,' seemingly unaware that utility staff are partly to blame as well (Nov 24th, 2016). By contrast, collusion is not an underlying cause of unsafe on-site sanitation disposal; Mukuru's manual emptiers are instead 'invisibly parallel' and largely ignored by official actors (Chapter 4). Similar to other cities in the Global South, poor FSM in Nairobi's slums is rooted in official neglect and institutional fragmentation (Chowdhury and Kone 2012). I found only sporadic interactions between informal sanitation providers and agencies like NEMA or Nairobi Water, leaving emptiers and caretakers to assume leading roles in excreta disposal. Although informal providers can be valuable entry-points, it will also be essential to overcome institutional fragmentation, clarify and enforce regulations, and develop strategies for safe containment and disposal in informal settlements. This is of course a tall order, particularly given the lack of governmental experience with Nairobi's on-site sanitation, but intermediate solutions (discussed above) can offer a promising way forward in the short-term.

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[173] A similar argument was made about the need to enhance water vendors' provision while avoiding excessively high standards in the short-term, but displacing them in the long run: "There may be cases [in which] improving services from unacceptable options (including water vendors) can make a bigger difference to the well-being of the most deprived than can striving for 'ideal' solutions, such as universal piped water....nor is there anything contradictory about a water strategy that aims to get vendors to provide improved water [in] the short run, and *to drive vendors out of business by way of providing better utility services in the long run*" (Kjellén and McGranahan 2006, pp. 2 and 19, emphasis added).
[174] For photos of these formerly manual-emptiers working with a Gulper and protective gear, see
https://www.flickr.com/photos/gtzecosan/sets/72157629487403117/comments/

C) Multi-sectoral approach to encourage comparative research and holistic interventions

     While manual emptiers and electricity cartels have few commonalities, they both compete with safer, better-regarded providers and this may partly explain why the 2 unsavory informal groups are often ignored. Cartels and emptiers vary markedly in their relations with formal providers as well as their profitability, organizational strength, and other key dimensions (Chapter 4). Yet they are both considered problematic groups and lack clear advocates within their sectors.[175] Emptiers are often seen as drunkards who pollute the environment, while the work itself is highly repugnant or locally stigmatized.[176] In the sanitation sector, manual emptiers only appear in scattered studies[177] and their "low social status may explain why so little has been published about this type of worker, though they do the lion's share of the pick-and-shovel work" (Collignon and Vezina 2000, p. 39). Furthermore, emptiers are rivals to improved options like sewerage or ecosan that enjoy greater recognition and offer indisputable health benefits. Similarly, electricity cartels are rarely analyzed, but as part of the broader challenge of 'electricity theft' they are regarded as miscreants undercutting formal utilities (cf. Lewis 2015). While cartels or emptiers are understandably viewed as more troublesome than sustainable alternatives or formal provision, at present these informal groups can often reach the urban poor more effectively. To be clear, these informal providers still have profound shortcomings and I do not seek to romanticize their hazardous, extractive, or other negative aspects. But I do suggest these groups should be carefully analyzed rather than ignored or dismissed, and additional research should create a more detailed portrait of informal providers, however unsavory they may be.

     Indeed, it is common to highlight informal actors' creativity and resilience in African cities, but the unpalatable aspects of informality should be recognized and carefully analyzed as well. Partly to counter the conventional tropes of African decay or pathological urbanization, urban theorists sometimes celebrate African informal livelihoods and ongoing improvisations in the face of tremendous obstacles.[178] This positive valence attached to informal shelter or livelihoods has reappeared in some literature on 'hybrid' or 'non-state' security governance, such as vigilante groups or militias seeking to counter internal threats and reassert order (Bagayoko *et al.* 2016, also Chapter 2). But other researchers warn of potentially illegitimate or violent non-state security actors: "informal institutions and their outcomes can be illegitimate as well as legitimate in the eyes of local people" and non-state orders may be comprised of "*unsavory actors*, including warlords, militias, [and] gang leaders" (Meagher 2012, p. 1081, emphasis added). Similarly, I suggest that a circumspect analysis of informal providers, whether in infrastructure delivery or security governance, is vital to reveal the multiplicity of roles and their positive as well as negative impacts. My case studies of informal electricity and sanitation providers can encourage researchers to cast a more critical eye on other, frequently-overlooked facets of informality. For instance, researchers can examine the spread of Nairobi's informal tenements and any links to corrupt land-grabs or city planning officials.

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[175] According to a WSUP practitioner who worked with manual emptiers in Sierra Leone, emptiers are viewed negatively "both by the general public and WASH practitioners for being drunkards that can't be worked with" (email correspondence, June 7th, 2015). He also believed that they should be rehabilitated and their "wealth of local knowledge on sanitation" may prove valuable in future interventions.

[176] According to a leading practitioner, "Better pit-emptying devices and the liberal use of disinfectant can make the work less disgusting, but *it will never be considered either a desirable or a high-status job*" (Sugden 2013, p. 201, emphasis added).

[177] For instance, see Sugden (2013), Jenkins *et al.* (2015), and Eales (2005).

[178] Pieterse observes that Marxist theorist Mike Davis and donors like the World Bank, despite starkly divergent ideologies, both highlight African development problems like poverty or corruption while striving to fix these extensive pathologies (Pieterse 2010: 207). For alternative and more positive analyses of African urbanization and informality, see especially Simone (2004) and Robinson (2006).

Huchzermeyer (2011a) discussed the emergence of tenements in Nairobi, though this predates the recent collapse of high-rise buildings in May 2016.[179]

From a practical standpoint, a comparative analysis of informal providers can motivate holistic approaches that challenge sectoral silos and promote well-being. Sanitation practitioners have underscored the "strong parallels" between FSM and solid waste management (Coffey 2011, p. 36, also Sugden 2011) and there are encouraging precedents of municipal partnerships with waste-pickers. For instance, municipal governments in Brazil have improved waste-pickers' conditions and encouraged the creation of cooperatives to eliminate middlemen (Gutberlet *et al.* 2013). A local government partnership in Londrina resulted in Brazil's highest recycling rates, including door-to-door collection, municipal centers for waste-pickers to sort materials, and city trucks that transport wastes to another center for processing (Fergutz *et al.* 2011, p. 606). Additionally, sanitation providers can emulate garbage collectors' 'split' solution of 1) transporting fecal sludge to a site within a slum (using a simple tractor, rather than an unwieldy trucker) and 2) a larger vehicle can later bring sludge to a bigger, more distant tank (Coffey 2011). Another useful example comes from eThekwini (Durban), where the local government provides latrine-emptying services for free every 5 years using a franchise model with manual emptiers, who were trained and given protective gear (Still and Foxon 2012).[180] With additional cross-sectoral learning, local governments can launch partnerships with multiple informal providers to improve health and quality of life: "Bringing drainage, sewerage, and independent informal providers of sanitary services into the picture, [the] *chances of holistic policies as well as environmental and health improvements on the ground are far greater*" (Kjellén and McGranahan 2006, p. 19, emphasis added). These integrated initiatives not only can strengthen providers' livelihoods but also recognize the essential links between drainage, roads, and solid and liquid waste management in informal settlements.

III. Final Reflections and Lessons for SDGs

My findings also underscore the need to recognize gendered maintenance roles and to create locally-tailored responses to informal providers. A review helpfully identified key principles for improving access to clean energy, such as 1) ensuring *maintenance*; 2) focusing on *energy services* instead of just improving supply; and 3) developing *customized approaches* with *appropriate technologies* (Bazilian *et al.* 2012, pp. 102-3). These recommendations for improving maintenance, supporting service delivery, and crafting locally-rooted strategies are all consistent with my research.[181] Additionally, I suggest that a gender lens can reveal the distinct contributions of maintainers, who may be both paid and unpaid. In Chapter 3, I highlighted the essential but hidden roles of caretakers (usually women) and latrine emptiers (always men). Public health or utilities staff may need to train these groups to ensure well-maintained toilets; there is a further need for conducting outreach about risky practices (e.g., flooding-out) and encouraging tenants to respect caretakers. For electricity cartels, service and maintenance contributions are again significant even if their overall safety record is alarming. These providers take some steps to improve safety on the plot (utilizing coated wires, circuit-breakers, etc.), promptly connect new tenants, and come quickly in case of emergency (Chapter 2). Of course, cartels' safety record can be very poor and the need for speedy responses may bespeak their own

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[179] See Mwiti, L., "Blame Game Continues for Years as Buildings Keep Tumbling Down," *The Standard*, May 5th, 2016 Kakah, M., "Countrywide Building Checks to Start Next Week," *Daily Nation*, May 5th, 2016.

[180] Durban has 35,000 VIP latrines requiring emptying, but mechanical services were impractical due to sloping terrain and solid waste inside (Wilson 2011). Its model uses teams of 6 ex-manual emptiers, who receive a sub-contract and empty a community's latrines in one sweep; waste is buried if possible or reused such as pelletizing sludge (*ibid.,* p. 26).

[181] Although I did not discuss appropriate technologies in detail, my emphasis on improving latrine maintenance (rather than solely focusing on access to expensive, often impractical sewers) resonates with this recommendation as well.

faulty wiring practices. Still, their efforts are a reminder that utilities will need to bolster their own service delivery while ensuring that maintainers are finally recognized for their contributions to the community.

Although inequitable service delivery is hardly new to African cities, it now coincides with progressive policy frameworks that could create useful entry-points for future interventions. Kenya has adopted slum upgrading targets and other inclusive urban strategies in its national development plan;[182] its Constitution of 2010 recognized essential rights to a clean environment, health, and shelter. In particular, Article 42 of the Constitution states that "Every person has the right to a clean and healthy environment" including the right to "the highest attainable standard of health...to accessible and adequate housing, and to reasonable standards of sanitation...to clean and safe water in adequate quantities." [183] Furthermore, the SDGs have prioritized slum upgrading as well as universal access to clean energy and improved sanitation. The SDGs have been criticized for being too ambitious (see Mara 2016 for WASH) and for missing the urban dimensions or interconnections between goals (e.g. Battersby 2016 on urban food security). It is unlikely that the far-reaching 2030 Agenda for Sustainable Development will be fully implemented, especially in African slums with profound infrastructure deficits. And in a sobering precedent, some African governments previously used MDG 7 to legitimize evictions, as the urban targets were misinterpreted as calling for 'slum-free cities' (see Huchzermeyer 2011b). The transformative potential of the SDGs should, therefore, be tempered by an understanding of past shortfalls and avoiding overly-lofty initiatives that may only entrench the disadvantages in African slums.

But as long as the SDGs are treated as an overarching guide and can encourage holistic interventions, the 2030 Agenda may inspire key improvements in informal settlements that resonate with my discussion. For all the dangers of policy overreach, ambition is not inherently problematic and the SDGs' interrelated aims should indeed be embraced. Taken together, the SDGs underscore the myriad unmet needs that will require multi-sectoral responses in informal settlements. However, local decision-makers should craft practicable ways to implement this daunting agenda, without resorting to exclusionary policies and inappropriate standards of infrastructure or services. For instance, my call for working with informal providers and addressing risky sanitation practices may help to craft more feasible strategies. I also discussed ways to advance data-collection and comparative research, which may inform alternative strategies and help to monitor future interventions in African slums. Perhaps the greatest challenge will be to implement the SDGs' interconnected 169 targets in an urban policy landscape better-known for rigid silos and institutional fragmentation than coherence or flexibility. Recognizing and seizing upon opportunities for holistic initiatives will be essential, and I argued that initiatives can also benefit from a fuller analysis of informal providers. If informed by a careful analysis of current conditions and informal providers, integrated upgrading initiatives may help to advance these equitable, interconnected goals and spark far-reaching gains in African slums.

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[182] For instance, Kenya's Vision 2030 includes targets for upgrading slums in 20 urban areas and producing 200,000 additional housing units annually (see http://www.vision2030.go.ke/social-pillar/)

[183] See text available at http://www.kenya-information-guide.com/kenya-constitution.html

References

Acey, C. (2017). Hybrid Governance and the Human Right to Water. *Berkeley Planning Journal, 28*(1), 10-39.

Acker, W., *et al.* (2016). Assessing health risks associated with municipal sanitation systems in Maputo, Mozambique. *Waterlines*, *35*(4), 397-411.

African Population and Health Research Centre (APHRC) (2014). *Population and Health Dynamics in Nairobi's Informal Settlements: Report of the Nairobi Cross-sectional Slums Survey*. APHRC, Nairobi.

Ahlers, R., *et al.* (2014). Informal Space in the Urban Waterscape: Disaggregation and Co-Production of Water Services. *Water Alternatives*, 7(1), 1-14.

Akiba Mashinani Trust (AMT), University of Nairobi, Katiba Institute and Strathmore University (2014). Mukuru Situation Analysis, IDRC, unpublished.

AMT, University of Nairobi, Katiba Institute and Strathmore University (2015). Mukuru Modelling Report, IDRC, unpublished.

Amendah, D. D., *et al.* (2014). Coping strategies among urban poor: evidence from Nairobi, Kenya. *PLoS ONE* 2014;9:e83428.

Amnesty International (2010). *Kenya: Insecurity and Indignity: Women's Experiences in the Slums of Nairobi, Kenya*. London.

Amis, P. (1984). Squatters or tenants: the commercialization of unauthorized housing in Nairobi. *World Development*, *12*(1), 87-96.

Anand, N. (2011). Pressure: The politechnics of water supply in Mumbai. *Cultural Anthropology*, *26*(4), 542-564.

Anderson, D. M. (2001). Corruption at City Hall: African housing and urban development in colonial Nairobi. *AZANIA: Journal of the British Institute in Eastern Africa*, 36(1), 138-154.

Arías, E. D. (2013). The impacts of differential armed dominance of politics in Rio de Janeiro, Brazil. *Studies in Comparative International Development*, *48*(3), 263-284.

Arías, E. D., & Barnes, N. (2016). Crime and plural orders in Rio de Janeiro, Brazil. *Current Sociology*, online before publication.

Bagayoko, N., Hutchful, E., & Luckham, R. (2016). Hybrid security governance in Africa: rethinking the foundations of security, justice and legitimate public authority. *Conflict, Security & Development*, *16*(1), 1-32.

Bakker, K. (2010). *Privatizing water: governance failure and the world's urban water crisis*. Cornell University Press.

Baptista, I. (2015). 'We Live on Estimates': Everyday Practices of Prepaid Electricity and the Urban Condition in Maputo, Mozambique. *International Journal of Urban and Regional Research*, *39*(5), 1004-1019.

Bartlett, S. (2003). Water, sanitation and urban children: the need to go beyond "improved" provision. *Environment and Urbanization*, *15*(2), 57-70.

Baruah, B. (2015). NGOs as Intermediaries for Pro-Poor Electrification in India. *Asian Journal of Social Science*, *43*(1-2), 178-204.

_____ (2010). Energy services for the urban poor: NGO participation in slum electrification in India. *Environment and Planning C: Government and Policy*, *28*(6), 1011-1027.

Battersby, J., M. Marshak, & N. Mngqibisa (2017). Mapping the Invisible: The Informal Food Economy of Cape Town, South Africa. Urban Food Security Paper No. 2. Available at www.afsun.org/wp-content/uploads/2016/11/AFSUN24.pdf

Battersby, J. (2016). MDGs to SDGs–new goals, same gaps: the continued absence of urban food security in the post-2015 global development agenda. *African Geographical Review*, 1-15.

Bayat, A. (2004), "Globalization and the Politics of the Informals in the Global South", in *Urban Informality: Transnational Perspectives from the Middle East, Latin America, and South Asia*, N. AlSayyad, and A. Roy (eds.), Lanham: Lexington Books, pp. 79-102.

Bazilian, M., *et al.* (2012). Improving access to modern energy services: insights from case studies. *Electricity Journal*, 25(1), 93-114.

Beguy, D., *et al.* (2015). HDSS Profile: the Nairobi Urban Health and Demographic Surveillance System (NUHDSS). *International Journal of Epidemiology*, dyu251.

Blackett, I. and P. Hawkins (2016). Fecal Sludge Management Tools: Diagnostics for Service Delivery in Urban Areas. Data Collection Instruments. WSP, Washington DC, 77 pages.

Blanton, E., *et al.* (2015). A rapid assessment of drinking water quality in informal settlements after a cholera outbreak in Nairobi, Kenya. *Journal of Water and Health*, 13(3), 12 pgs.

Börzel, T. A., & Risse, T. (2016). Dysfunctional state institutions, trust, and governance in areas of limited statehood. *Regulation & Governance*, 2(10), 149-160.

Boudreau, J. A., & Davis, D. E. Introduction: A processual approach to informalization. *Current Sociology*, online before publication.

Brown, A., Lyons, M., & Dankoco, I. (2010). Street traders and the emerging spaces for urban voice and citizenship in African cities. *Urban Studies*, 47(3), 666-683.

Buigut, S., *et al.* (2015). Catastrophic health expenditure and its determinants in Kenya slum communities. *International Journal for Equity in Health*, 14:46, 12 pgs.

Burt, Z., K. Nelson, and I. Ray (2016), Towards Gender Equality through Sanitation Access, Discussion paper for UN-Women, available at http://www.unwomen.org/en/digital-library/publications/2016/3/towards-gender-equality-through-sanitation-access

Burt, Z. and I. Ray (2014). Storage and Non-Payment: Persistent Informalities within the Formal Water Supply of Hubli-Dharwad, India, *Water Alternatives* 7(1) 106-120.

Butera, F. M., *et al.* (2016). Urban Development and Energy Access in Informal Settlements. A Review for Latin America and Africa. *Procedia Engineering, 161*, 2093-2099.

Cammett, M., & MacLean, L. M. (Eds.). (2014). *The Politics of Non-State Welfare*. Ithaca: Cornell University Press.

Campos, L. C., *et al.* (2015). Development and application of a methodology to assess sanitary risks in Maputo, Mozambique. *Environment and Urbanization*, 27(2), 371-388.

Carrard, N., et al. (2013). A framework for exploring gender equality outcomes from WASH programmes. *Waterlines*, 32(4), 315-333.

Castells, M. and A. Portes (1989), "World Underneath: The Origins, Dynamics, and Effects of the Informal Economy" in *The Informal Economy: Studies in Advanced and Less Developed Countries*, A. Portes, M. Castells, and L. A. Benton (eds.), Baltimore: Johns Hopkins University Press.

Cervero, R., & Golub, A. (2007). Informal transport: A global perspective. *Transport Policy*, 14(6), 445-457.

Chant, S., & McIlwaine, C. (2015). *Cities, Slums and Gender in the Global South: Towards a Feminised Urban Future*. London: Routledge.

Charmes, J. (2012). The informal economy worldwide: trends and characteristics. *Margin: The Journal of Applied Economic Research*, 6(2), 103-132.

Cheeseman, N., *et al.* (2016). Decentralisation in Kenya: the governance of governors. *Journal of Modern African Studies*, 54(01), 1-35.

Chen, M. (2014). Informal employment and development: patterns of inclusion and exclusion. *European Journal of Development Research*, 26(4), 397-418.

_____. (2006). Rethinking the Informal Economy: Linkages with the Formal Economy and the Formal Regulatory Environment, in Guha-Khasnobis, B., & Kanbur, R. Elinor Ostrom, eds. 2006. *Linking the Formal and Informal Economy: Concepts and Policies*. Oxford University Press, 75-92.

Chen, M., *et al.* (2005), *Progress of the World's Women: Women, Work and Poverty*. New York: UNIFEM.

Chowdhry, S. and D. Kone (2012). *Business Analysis of Fecal Sludge Management: Emptying and Transportation Services in Africa and Asia*. Prepared for the Gates Foundation, 116 pages.

Coffey, M. (2011). The critical cost consideration. Sludge transfer and transport, in *What Happens When the Pit is Full? Developments in On-site Faecal Sludge Management (FSM) Seminar Report*. Water Information Network, Stockholm Environmental Institute *et al.*, pp. 35-36.

Collignon, B. and M. Vézina (2000). *Independent Water and Sanitation Providers in African Cities: Full Report of a Ten-Country Study*. Washington DC: Water and Sanitation Program, 63 pages.

Corburn, J., & Hildebrand, C. (2015). Slum sanitation and the social determinants of women's health in Nairobi, Kenya. *Journal of Environmental and Public Health*, 6 pgs.

Corburn, J. and J. Makau (2016). Coproducing Slum Health in Nairobi, Kenya, in J. Corburn and L. Riley, eds., *Slum Health: From the Cell to the Street*, University of California Press, pp 153-188.

Corburn, J. and A. Sverdlik (2016). Informal Settlement Upgrading and Health Equity, in J. Corburn and L. Riley, eds., *Slum Health: From the Cell to the Street*, University of California Press.

Courtard, O. & J. Rutherford, eds. (2015). *Beyond the Networked City: Infrastructure Reconfigurations and Urban Change in the North and South*. Routledge.

Criqui, L., & Zérah, M. H. (2015). Lost in transition? Comparing strategies of electricity companies in Delhi. *Energy Policy*, *78*, 179-188.

Crow, B. and Odaba, E. (2010). Access to water in a Nairobi slum: women's work and institutional learning. *Water International*, 35(6): 733-747.

D'Arcy, M., & Cornell, A. (2016). Devolution and corruption in Kenya: Everyone's turn to eat?. *African Affairs*, 115(459), 246-273.

_____. (2014). Plus ça change? County-level politics in Kenya after devolution. *Journal of Eastern African Studies*, 8(1), 173-191.

Davis, D. E. (2016). Informality and state theory: Some concluding remarks. *Current Sociology*, online before publication.

Depuru, S., Wang, L., & Devabhaktuni, V. (2011). Electricity theft: Overview, issues, prevention and a smart meter based approach to control theft. *Energy Policy*, *39*(2), 1007-1015.

Desai, R., McFarlane, C., & Graham, S. (2015). The politics of open defecation: informality, body, and infrastructure in Mumbai. *Antipode*, *47*(1), 98-120.

Duminy, J. (2011). Literature Survey: Informality and Planning. Prepared for Women in Informal Employment Globalising and Organising (WIEGO), Cambridge, MA: 65 pages.

Eales, K. (2005). Bringing pit emptying out of the darkness: A comparison of approaches in Durban, South Africa, and Kibera, Kenya. Business Partners for Development, 9 pages.

Eberhard, A. *et al.* (2011). *Africa's Power Infrastructure: Investment, Integration, Efficiency*. World Bank, Washington DC.

Energy Sector Management Assistance Program (ESMAP), 2015. *A new multi-tier approach to measuring energy access*. World Bank, Washington DC, available at www.esmap.org/sites/esmap. org/files/DocumentLibrary/Multi-tier%20BBL_Feb19_Final_no%20annex.pdf

Fergutz, O., Dias, S., & Mitlin, D. (2011). Developing urban waste management in Brazil with waste picker organizations. *Environment and Urbanization*, *23*(2), 597-608.

Figueroa, A. R. (2016). Efficient lighting uptake among the urban poor: evidence from a Kenyan informal settlement. *Environment and Urbanization*, 28(2), 535-552.

Freund, B. (2007). *The African City: A History*. Cambridge: Cambridge University Press.

Gaur, V., & Gupta, E. (2016). The determinants of electricity theft: An empirical analysis of Indian states. *Energy Policy*, *93*, 127-136.

Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS). 2015. Kenya. Geneva: WHO, www.who.int/entity/water_sanitation_health/glaas/2014/kenya-12-oct.pdf?ua=1

GPOBA (2014). Lessons Learned: Challenges in Formalizing Supply of Electricity in Mumbai's Slums, OBA Lessons, Note 6, www.gpoba.org/sites/gpoba/files/LL06_MumbaiElectricity.pdf

Global Project on Output-Based Aid (GPOBA) (2016a). OBA Approaches: Output-Based Aid for Energy Access, Note No. 52, 4 pages.

GPOBA (2016b). Energy Sector Experience of Output-Based Aid, Report ACS 18763, Washington DC, 36 pages.

Golumbeanu, R. and D. Barnes (2013). Connection Charges and Electricity Access in Sub-Saharan Africa, World Bank Policy Research Working Paper 6511, Washington DC, 31 pages.

Graham, S., & Thrift, N. (2007). Out of order: understanding repair and maintenance. *Theory, Culture & Society*, *24*(3), 1-25.

Gretsch, S. R., *et al.* (2016). Quantification of exposure to fecal contamination in open drains in four neighborhoods in Accra, Ghana. *Journal of Water and Health*, *14*(2), 255-266.

Guha-Khasnobis, B., & Kanbur, R. Elinor Ostrom, eds. (2006). *Linking the formal and informal economy: concepts and policies*. Oxford University Press.

Gulati, M., & Rao, M. Y. (2007). Corruption in the electricity sector: A pervasive scourge. In J. Edgardo Campos and Sanjay Pradhan, eds. *The many faces of corruption: tracking vulnerabilities at the sector level*, World Bank, Washington DC, 115-157.

Gulyani, S., Talukdar, D., & Jack, D. (2010). *Poverty, living conditions, and infrastructure access: a comparison of slums in Dakar, Johannesburg, and Nairobi* (No. 5388). World Bank, Washington DC.

Gulyani, S., *et al.* (2014). A tale of two cities: A multi-dimensional portrait of poverty and living conditions in the slums of Dakar and Nairobi. *Habitat International*, 43, 98-107.

Gupta, A. (2015). An Anthropology of Electricity from the Global South. *Cultural Anthropology*, *30*(4), 555-568.

Gutberlet, J., *et al.* (2013). Participatory research revealing the work and occupational health hazards of cooperative recyclers in Brazil. *International Journal of Environmental Research and Public Health*, *10*(10), 4607-4627.

Hake, A. (1977). *African Metropolis: Nairobi's Self-help City*. Chatto and Windus for Sussex University Press; Toronto: Clarke, Irwin.

Hansen, K. and M. Vaa, eds. (2004), *Reconsidering Informality: Perspectives from Urban Africa,* Uppsala: Nordiska Afrikainstitutet.

Hart, K. J. (2006). Bureaucratic form and the informal economy. In Guha-Khasnobis, B., & Kanbur, R. Elinor Ostrom, eds. 2006. *Linking the formal and informal economy: concepts and policies*. Oxford University Press*,* 21-35.

Hawkins, P. and O. Muxímpua (2015). *Developing Business Models for Fecal Sludge Management in Maputo,* Water and Sanitation Program, Washington DC, 56 pages.

Hazen, J. (2010). Understanding gangs as armed groups. *International Review of the Red Cross*, *92*(878), 369-386.

Heijnen, M., *et al.* (2014). Shared sanitation versus individual household latrines: a systematic review of health outcomes. *PLoS One*, *9*(4), e93300.

Helmke, G., & Levitsky, S. (2004). Informal institutions and comparative politics: A research agenda. *Perspectives on politics*, *2*(04), 725-740.

Heynen, N. C., Kaika, M., & Swyngedouw, E., eds. (2006). *In the Nature of Cities: Urban Political Ecology and the Politics of Urban Metabolism*. Routledge.

Hillenkamp, I., *et al.* eds. (2013). *Securing Livelihoods: Informal Economy Practices and Institutions*. Oxford University Press.

Hillenkamp, I., F. Lapeyre, and A. Lemaître (2013). Informal Economy, Vulnerabilities, and Popular Security-Enhancing Practices. In I. Hillenkamp *et al.,* eds., *Securing Livelihoods: Informal Economy Practices and Institutions*, Oxford University Press, 1-24.

Holland, A. C. (2015). The distributive politics of enforcement. *American Journal of Political Science*, *59*(2), 357-371.

Holston, J. (2008). *Insurgent citizenship: Disjunctions of democracy and modernity in Brazil*. Princeton University Press

Hossain, S. (2012). The production of space in the negotiation of water and electricity supply in a bosti of Dhaka. *Habitat International*, *36*(1), 68-77.

Hossain Lipu, M. S., & Waliullah Bhuiyan, A. M. (2014). Electricity access in urban slum households of Bangladesh: A case of Dhaka. *Journal of Renewable and Sustainable Energy*, *6*(5), 053112.

Huchzermeyer, M. (2011a). *Tenement Cities: From 19th Century Berlin to 21st Century Nairobi*. Africa World Press.

_____. (2011b). *Cities with Slums: From informal Settlement Eradication to a Right to the City in Africa*. Juta Academic/University of Cape Town Press.

Hunga, W. (2016). Financing sanitation for low-income urban communities: Lessons from CCODE and the Federation in Malawi. IIED Working Paper. IIED, London.

Hutton, G., & Chase, C. (2016). The Knowledge Base for Achieving the Sustainable Development Goal Targets on Water Supply, Sanitation and Hygiene. *International Journal of Environmental Research and Public Health*, *13*(6), 536.

Hutton, G., & Varughese, M. (2016). The Costs of Meeting the 2030 Sustainable Development Goal Targets on Drinking Water, Sanitation, and Hygiene. Washington DC: WSP, 43 pages.

International Energy Agency (IEA) (2016). *World Energy Outlook 2016*. IEA, Paris.

IEA and World Bank (2015). *Sustainable Energy for All 2015: Progress Toward Sustainable Energy*. World Bank, Washington, DC.

IEMS 2014: a 10-city Informal Economy Monitoring Study (IEMS) on street vendors, home-based workers, and waste-pickers, available http://wiego.org/wiego/informal-economy-monitoring-study-iems

ILO (2016). *World Employment and Social Outlook: Trends 2016*, Geneva, 94 pages.

Jaglin, S. (2014). Urban Energy Policies and the Governance of Multilevel Issues in Cape Town. *Urban Studies*, *51*(7), 1394-1414.

Jenkins, M. W., Cumming, O., & Cairncross, S. (2015). Pit latrine emptying behavior and demand for sanitation services in Dar Es Salaam, Tanzania. *International Journal of Environmental Research and Public Health*, *12*(3), 2588-2611.

Jenkins, M. W., *et al.* (2014). Beyond 'improved': towards 'safe and sustainable' urban sanitation: assessing the design, management and functionality of sanitation in poor communities of Dar es Salaam, Tanzania. *Journal of Water, Sanitation & Hygiene for Development*, *4*(1), 131-141.

Jewitt, S. (2011). Geographies of shit: Spatial and temporal variations in attitudes towards human waste. *Progress in Human Geography*, *35*(5), 608-626.

Joint Monitoring Program (JMP) (2015a). *Progress on Sanitation and Drinking Water: 2015 Update and MDG Assessment*, Geneva: UNICEF and WHO.

JMP (2015b). Kenya 2015 Water and Sanitation Updates, UNICEF AND WHO, available at www.wssinfo.org.

Kabeer, N., Milward, K., & Sudarshan, S., eds. (2013). *Organizing Women in the Informal Economy: Beyond the Weapons of the Weak*. Zed Books.

Karekezi, S., Kimani, J., & Onguru, O. (2008). Energy access among the urban poor in Kenya. *Energy for Sustainable Development*, *12*(4), 38-48.

Karekezi, S. *et al.* (2013). *GNESD 2013. Country report (Kenya)*. Energy poverty in developing countries' urban poor communities: assessments and recommendations. Report prepared for the Global Network on Energy for Sustainable Development (GNESD) by The Energy, Environment and Development Network for Africa (AFREPREN/FWD). Roskilde, Denmark.

Katusiimeh, M. W. (2015). The non-state provision of health services and citizen accountability in Uganda. *Africa Today*, *62*(1), 84-105.

Kjellén, M. and G. McGranahan (2006). Informal water vendors and the urban poor. Human Settlements Discussion Paper Series, London: IIED, 26 pages.

Kenya National Bureau of Statistics (KNBS) (2015). Facts and Figures 2015, available at http://www.knbs.or.ke.

KNBS and ICF International (2015). *2014 KDHS Key Findings.* Rockville, Maryland, USA: Kenya National Bureau of Statistics (KNBS) and ICF International, 20 pages.

Kenya Power and Lighting Company (KPLC) (2016). *Kenya Electricity Expansion Project Additional Financing: Slum Electrification Component, Environmental & Social Management Framework*, Nairobi, 161 pages.

Kinyanjui, M. N. (2014). *Women and the Informal Economy in Urban Africa: From the Margins to the Centre.* Zed Books.

Klopp, J. M. (2012). Towards a political economy of transportation policy and practice in Nairobi. In *Urban Forum,* Vol. 23, No. 1, pp. 1-21.

Kojima, M. *et al.* (2016). Who Uses Electricity in Sub-Saharan Africa? Findings from Household Surveys. World Bank Policy Research Working Paper 7889, Washington DC, 70 pages.

Krasner, S. D., & Risse, T. (2014). External actors, state-building, and service provision in areas of limited statehood: Introduction. *Governance*, *27*(4), 545-567.

Kushner, D. C., & MacLean, L. M. (2015). Introduction to the special issue: the politics of the non-state provision of public goods in Africa. *Africa Today*, *62*(1), vii-xvii.

Kwiringira, J., *et al.* (2014). Gender variations in access, choice to use and cleaning of shared latrines; experiences from Kampala Slums, Uganda. *BMC Public Health*, *14*(1) 1180.

Lancione, M., & McFarlane, C. (2016). Life at the urban margins: Sanitation infra-making and the potential of experimental comparison. *Environment and Planning A*, *48*(12), 2402-2421.

LeBas, A. (2013). Violence and urban order in Nairobi, Kenya and Lagos, Nigeria. *Studies in Comparative International Development*, *48*(3), 240-262.

Lemaître, A. (2013). 'Popular Cooperatives' and Local Development in South-East Brazil: Towards Socio-Economic Pluralism. In I. Hillenkamp *et al.* eds. *Securing Livelihoods: Informal Economy Practices and Institutions.* Oxford University Press, 24-46.

Letema, S. C. (2012). *Assessing Sanitary Mixtures in East African Cities*, PhD Dissertation, 166 pages, Wageningen University. Available at edepot.wur.nl/221843

Lewis, F. (2015). Costly 'Throw-Ups': Electricity Theft and Power Disruptions. *Electricity Journal*, *28*(7), 118-135.

Lindell, I., ed. (2010). *Africa's informal workers: collective agency, alliances and transnational organizing in urban Africa.* Zed Books.

Lines, K. & J. Makau (2017). Muungano Nguvu Yetu (Unity is Strength). 20 Years of the Kenyan Federation of Slum Dwellers, IIED Working Paper, London, available at pubs.iied.org/pdfs/10807IIED.pdf

London, T., & Esper, H. (2014). Assessing poverty-alleviation outcomes of an enterprise-led approach to sanitation. *Annals of the New York Academy of Sciences*, *1331*(1), 90-105.

Lund, C. (2006). Twilight institutions: public authority and local politics in Africa. *Development and change*, *37*(4), 685-705.

Luque-Ayala, A., & Silver, J. (Eds.). (2016). *Energy, Power and Protest on the Urban Grid: Geographies of the Electric City.* Routledge.

Luque-Ayala, A. (2016). From consumers to customers: regularizing electricity networks in Sao Paulo's favelas. In M. Hodson and S. Marvin, eds., *Retrofitting Cities: Priorities, Governance and Experimentation*, Routledge, 171-192.

Lyons, M., & Snoxell, S. (2005). Creating urban social capital: some evidence from informal traders in Nairobi. *Urban Studies*, *42*(7), 1077-1097.

Macharia, K. (1997). *Social and Political Dynamics of the Informal Economy in African cities: Nairobi and Harare*. University Press of America.

MacLean, L. M., & Brass, J. N. (2015). Foreign aid, NGOs and the private sector: new forms of hybridity in renewable energy provision in Kenya and Uganda. *Africa Today*, *62*(1), 56-82.

Majoro, L. (2014). *An Assessment of Informal Power Distributors in Low Income Urban Areas: The Case of Kibera, Nairobi*. Master's dissertation, United States International University-Africa, available at http://erepo.usiu.ac.ke/handle/11732/64

Mara, D. (2016). "The all-inclusive sustainable development goals: the WASH professional's guide (or should that be 'nightmare'?)." *Journal of Water, Sanitation, and Hygiene for Development*, 349-352.

Marvin, S. and W. Medd (2010). Clogged Cities: Sclerotic Infrastructure in S. Graham, ed., *Disrupted Cities: When Infrastructure Fails*, Routledge, pp. 85-96.

Mazeau, A., *et al.* (2014). Emerging categories of urban shared sanitation. *Water and Environment Journal*, *28*(4), 592-608.

McCormick, D., *et al.* (2013). Paratransit business strategies: a bird's-eye view of matatus in Nairobi. *Journal of Public Transportation*, *16*(2), 7.

McFarlane, C. (2012). Rethinking informality: Politics, crisis, and the city. *Planning Theory & Practice*, *13*(1), 89-108.

McFarlane, C., Desai, R., & Graham, S. (2014). Informal urban sanitation: Everyday life, poverty, and comparison. *Annals of the Association of American Geographers*, *104*(5), 989-1011.

McFarlane, C., & Waibel, M. (Eds.). (2012). *Urban informalities: reflections on the formal and informal*. Ashgate.

Meagher, K. (2016). The scramble for Africans: demography, globalisation and Africa's informal labour markets. *Journal of Development Studies*, *52*(4), 483-497.

_____. (2013). Unlocking the informal economy: a literature review on linkages between formal and informal economies in developing countries. *WIEGO working paper 27,* Cambridge, MA: WIEGO.

_____. (2012). The Strength of Weak States? Non-State Security Forces and Hybrid Governance in Africa. *Development and Change*, *43*(5), 1073-1101.

Mikhael, G. *et al.* (2014). Methods and Means for Collection and Transport of Fecal Sludge. In Strande, L., *et al.* (Eds.). *Fecal Sludge Management: Systems Approach for Implementation and Operation*. London: IWA Publishing, 67-96.

Mimmi, L. M. (2014). From informal to authorized electricity service in urban slums: Findings from a household level survey in Mumbai. *Energy for Sustainable Development*, *21*, 66-80.

Mimmi, L. M., & Ecer, S. (2010). An econometric study of illegal electricity connections in the urban favelas of Belo Horizonte, Brazil. *Energy Policy, 38*(9), 5081-5097.

Ministry of Health (2016). *Kenya Environmental Sanitation and Hygiene Policy 2016-2030*, Nairobi, 112 pages.

Morange, M. (2015). Street trade, neoliberalisation and the control of space: Nairobi's Central Business District in the era of entrepreneurial urbanism. *Journal of Eastern African Studies*, *9*(2), 247-269.

Mueller, S. D. (2011). Dying to win: Elections, political violence, and institutional decay in Kenya. *Journal of Contemporary African Studies*, *29*(1), 99-117.

Muggah, R. (2014). Deconstructing the fragile city: exploring insecurity, violence and resilience. *Environment and Urbanization*, *26*(2), 345-358.

Murray, A., and Ray, I. (2010). Commentary: back-end users: the unrecognized stakeholders in demand-driven sanitation. *Journal of Planning Education and Research*, *30*(1), 94-102

Murungi, C., & van Dijk, M. P. (2014). Emptying, Transportation and Disposal of fecal sludge in informal settlements of Kampala, Uganda: the economics of sanitation. *Habitat International*, *42*, 69-75.

Mutinda, M. W., & Otieno, S. (2015). Unlocking Financing for Slum Redevelopment: The Case of Mukuru. *Africa Policy Journal*, *11*, 44.

Muungano Support Trust (2015). SEPU-Riara, Mukura kwa Njenga Enumeration Report and Initial Planning Guidelines, Nairobi, 53 pages, unpublished.

Mutonga, D., *et al.* (2013). National surveillance data on the epidemiology of cholera in Kenya, 1997–2010. *Journal of Infectious Diseases*, *208*(suppl 1), S55-S61.

Myers, G. (2015). A World-Class City-Region? Envisioning the Nairobi of 2030. American Behavioral Scientist, 59(3), 328-346.

Myers, J. (2016). Urban community-led total sanitation: a potential way forward for co-producing sanitation services. *Waterlines*, 35(4), 388-396.

Nairobi City County (2016). *Budget Review and Outlook Paper*, Nairobi, 62 pages.

_____ (2014). *Nairobi County Integrated Development Plan 2014*. Nairobi, 280 pages.

Nakagiri, A., *et al.* (2016). Are pit latrines in urban areas of Sub-Saharan Africa performing? A review of usage, filling, insects and odour nuisances. *BMC Public Health*, *16*(1), 1.

_____. (2015). Performance of pit latrines in urban poor areas: A case of Kampala, Uganda. *Habitat International*, *49*, 529-537.

Naqvi, I. (2016). Governance as an emergent compromise: Modernization and flexibility in the Pakistani electrical power sector. *Current Sociology*, in press.

Ndunda, J. (2015). Cholera kills 6 in Mukuru kwa Reuben slum. *The Star*. 9 May, 2015.

Nyambura, R. Wachira (2015) *The impact of conflict and fragility on public service delivery: lessons from Mathare water project, Nairobi.* Available at http://cega.berkeley.edu/assets/miscellaneous_files/51-ABCA_-aConflict_Mathare_Paper.pdf

O'Keefe, M., *et al.* (2015). Opportunities and limits to market-driven sanitation services: evidence from urban informal settlements in East Africa. *Environment and Urbanization*, *27*(2), 1-21.

O'Reilly, K. (2016). From toilet insecurity to toilet security: creating safe sanitation for women and girls. *Wiley Interdisciplinary Reviews: Water*, *3*(1), 19-24.

Otsuki, K. (2016). Infrastructure in informal settlements: co-production of public services for inclusive governance. *Local Environment*, 1-16.

Paller, J.W. (2016). Informal Practices of Accountability in Urban Africa, *Oxford Bibliographies Online.*

_____. (2015). Informal networks and access to power to obtain housing in urban slums in Ghana. *Africa Today*, *62*(1), 30-55.

Peal, A., *et al.* (2014). Fecal sludge management (FSM): Analytical tools for assessing FSM in cities. *Journal of Water, Sanitation and Hygiene for Development*, *4*(3), 371-383.

Pieterse, E. (2010). Cityness and African urban development. *Urban Forum*, Vol. 21, No. 3, pp. 205-219.

_____. (2008). *City Futures: Confronting the Crisis of Urban Development*. Zed Books.

Post, A., V. Bronsoler, and L. Salman (2017) Hybrid Regimes for Local Public Goods Provision: Insights from the Water and Transportation Sectors. Manuscript provided by the author, 73 pages.

Potts, D. (2008). The urban informal sector in sub-Saharan Africa: from bad to good (and back again?). *Development Southern Africa*, *25*(2), 151-167.

Ranganathan, M. (2014). 'Mafias' in the waterscape: Urban informality and everyday public authority in Bangalore. *Water Alternatives*, *7*(1).

Rasmussen, J. (2014). 'We are the True Blood of the Mau Mau': The Mungiki Movement in Kenya, in J. Hazen and D. Rodgers, eds. *Global Gangs: Street Gangs Across the World,* University of Minnesota Press, 213-235.

_____ (2012). Inside the system, outside the law: operating the Matatu sector in Nairobi. *Urban Forum*, *23*(4), 415-432.

Ray, I. (2007), 'Women, Water and Development.' *Annual Review Environment and Resources* 32:421–49.

Rheinländer, T., *et al.* (2015). Redefining shared sanitation. *Bulletin of the WHO*, *93*(7), 509-510.

Robinson, J. (2006). *Ordinary Cities: Between Globalization and Modernity*. Routledge.

Rodgers, D., & Hazen, J. M., eds. (2014). *Global Gangs: Street Violence Across the World*. University of Minnesota Press: Minneapolis.

Ross, I. *et al.* (2016). *Fecal Sludge Management: Diagnostics and Guidelines for Service Delivery in Poor Urban Areas,* Summary Report, Report No. ACS17931, Water and Sanitation Program (WSP), Washington DC, 73 pages.

Roy, A., & AlSayyad, N. (Eds.). (2004). *Urban Informality: Transnational Perspectives from the Middle East, Latin America, and South Asia*. Lexington Books.

Roy, Ananya (2012). Urban Informality: The Production of Space and the Practice of Planning, in *The Oxford Handbook of Urban Planning,* R. Weber and R. Crane (eds.), Oxford: Oxford University Press.

_____ (2009). Why India cannot plan its cities: Informality, insurgence and the idiom of urbanization. *Planning theory*, *8*(1), 76-87.

_____ (2005). Urban informality: toward an epistemology of planning. *Journal of the American Planning Association*, *71*(2), 147-158.

Rutherford, J., & Coutard, O. (2014). Urban energy transitions: places, processes and politics of socio-technical change. *Urban Studies*, *51*(7), 1353-1377.

Satterthwaite, D., *et al.* (2015). Is it possible to reach low-income urban dwellers with good-quality sanitation?. *Environment and Urbanization*, *27*(1), 3-18.

Schindler, S. (2014). Producing and contesting the formal/informal divide: Regulating street hawking in Delhi, India. *Urban Studies*, *51*(12), 2596-2612.

Schouten, M. A. C., & Mathenge, R. W. (2010). Communal sanitation alternatives for slums: A case study of Kibera, Kenya. *Physics and Chemistry of the Earth, Parts A/B/C*, *35*(13), 815-822.

Scott, P., Cotton, A., and Sohail, M. (2015). Using tenure to build a "sanitation cityscape": narrowing decisions for targeted sanitation interventions. *Environment and Urbanization*, 27(2): 389-406.

Schuberth, M. (2015). The challenge of community-based armed groups: Towards a conceptualization of militias, gangs, and vigilantes. *Contemporary Security Policy*, *36*(2), 296-320.

Sharma, T., *et al.* (2016). Of pilferers and poachers: Combating electricity theft in India. *Energy Research & Social Science*, *11*, 40-52.

Silver, J. (2015). Disrupted Infrastructures: An Urban Political Ecology of Interrupted Electricity in Accra. *International Journal of Urban and Regional Research*, *39*(5), 984-1003.

Silver, J., & Marvin, S. (2016). Powering sub-Saharan Africa's urban revolution: An energy transitions approach. *Urban Studies*, online before publication.

Simone, A. M. (2004a). People as infrastructure: intersecting fragments in Johannesburg. *Public Culture*, 16(3), 407-429.

_____. (2004b). *For the City yet to Come: Changing African life in Four Cities*. Duke University Press.

Singh, R., *et al.* (2015). Electricity (in)accessibility to the urban poor in developing countries. *Wiley Interdisciplinary Reviews: Energy and Environment*, *4*(4), 339-353.

Smith, T. B. (2004). Electricity theft: a comparative analysis. *Energy Policy*,*32*(18), 2067-2076.

Sommer, M., Kjellén, M., & Pensulo, C. (2013). Girls' and women's unmet needs for menstrual hygiene management (MHM): the interactions between MHM and sanitation systems in low-income countries. *Journal of Water, Sanitation and Hygiene for Development*, 3(3), 283-297.

Sommer, M., *et al.* (2015). Violence, gender and WASH: spurring action on a complex, under-documented and sensitive topic. *Environment and Urbanization*, *27*(1), 105-116.

Still, D. and K. Foxon (2011). *Tackling the Challenges of Full Pit Latrines, Vol 1: Understanding Sludge Accumulation in VIPs and Strategies for Emptying Full Pits*, Report to the Water Research Commission, 156 pages.

Strande, L., *et al.* (Eds.). (2014). *Faecal Sludge Management: Systems Approach for Implementation and Operation*. London: IWA Publishing.

Strathmore University (2016). Unlocking the Poverty Penalty and Up-Scaling the Respect for Rights in Informal Settlements in Kenya: A Situational Analysis, unpublished, Nairobi, 48 pages.

Sugden, S. (2013). The importance of understanding the market when designing pit-emptying devices. *Waterlines*, *32*(3), 200-212.

_____. (2012). Reflections on Business Models and Technology Designs for Pit-Emptying Services. Water for People, 22 pages, available at: waterfund.go.ke/safisan/Downloads/Business%20Model%20for%20Pit%20Emptiers(1).pdf

_____. (2011). Sanitation for the billions. Making it work in the global context, in *What Happens When the Pit is Full? Developments in On-site Faecal Sludge Management (FSM) Seminar Report*. Water Information Network, Stockholm Environmental Institute *et al.*, pp. 8-9

Tait, L. (2015) Evaluating the electrification programme in urban settlements in South Africa. Energy Research Centre, University of Cape Town, 29 pages, available at www.erc.uct.ac.za/outputs/2011-15#sthash.0dSlluX9.dpuf

Tilley, E., *et al.* (2013). Sanitation in developing countries: a review through a gender lens. *Journal of Water Sanitation and Hygiene for Development*, *3*(3), 298-314.

Totolo, E. (2013). Exploring the Black-Box of Economic Informality: Social Networks and Institutional Change among Micro and Small Enterprises in Nairobi. In I. Hillenkamp *et al.,* eds., *Securing Livelihoods: Informal Economy Practices and Institutions*, Oxford University Press, 167-190.

Tumwebaze, I. K., *et al.* (2014). Determinants of households' cleaning intention for shared toilets: Case of 50 slums in Kampala, Uganda. *Habitat International*, *41*, 108-113.

UC Berkeley *et al.* (2016). Mukuru, Nairobi 2016 Situational Analysis, 79 pages, unpublished draft.

UC Berkeley, University of Nairobi, Muungano Support Trust, and Slum-Dwellers International (2011). Mathare Valley 2011 Collaborative Upgrading Plan, 60 pages.

UN-Habitat (2016). *World Cities Report 2016. Urbanization and Development: Emerging Futures,* Nairobi, 247 pages.

USAID (2016). Power Africa Annual Report, September 2016. Washington DC: USAID, 36 pages.

Van Vliet, B., *et al.*, eds. (2010). *Social Perspectives on the Sanitation Challenge*. Dordrecht: Springer.

Von Schnitzler, A. (2013). Traveling technologies: infrastructure, ethical regimes, and the materiality of politics in South Africa. *Cultural Anthropology*, *28*(4), 670-693.

Water and Sanitation Program (WSP) (2015). State of Sanitation in Nairobi County, WSP and Ministry of Health County Sanitation Profiles, 2 pages.

_____. (2014) The Missing Link in Sanitation Service Delivery: A Review of Fecal Sludge Management in 12 Cities, WSP: Research Brief, 8 pages.

_____. (2012). Economic Impacts of Poor Sanitation in Africa: Kenya Loses Ksh. 27bn Annually to Poor Sanitation, WSP, 6 pages.

Water and Sanitation for the Urban Poor (WSUP) (2013). Dealing with land tenure challenges in water and sanitation services delivery. Topic Brief 6, 11 pages, available at

www.wsup.com/resource/dealing-with-land-tenure-and-tenancy-challenges-in-water-and-sanitation-services-delivery/

Water, Engineering, and Development Centre (WEDC) and WSUP (2015). SFD Report: Nakuru, Kenya, 38 pages, available at www.sfd.susana.org.

Water Research Commission (2015). *The Status of Fecal Sludge Management in Eight Southern and East African Countries,* WRC Report No. KV 340/15, prepared for the Sanitation Research Fund for Africa Project of the WRC and the Bill and Melinda Gates Foundation, Pretoria, 74 pages.

Water Services Regulatory Board (WASREB) (2016). *Impact: A Performance Review of Kenya's Water Services Sector 2014-2015*, Issue No. 9, WASREB, 83 pages, Nairobi.

Watson, V. (2014). African urban fantasies: dreams or nightmares?. *Environment and Urbanization*, 26(1), 215-231.

_____. (2009), " 'The planned city sweeps the poor away…': Urban Planning and 21st Century Urbanization", *Progress in Planning, 72*(3), 151-193.

Wegelin-Schuringa, M. & Kodo, T. (1997). Tenancy and sanitation provision in informal settlements in Nairobi: revisiting the public latrine option. *Environment and Urbanization*, *9*(2), 181-190.

Weinstein, L. (2008). Mumbai's development mafias: globalization, organized crime and land development. *International Journal of Urban and Regional Research*, *32*(1), 22-39.

Weru, J. *et al.* (2015). Confronting Complexity: Using Action-Research to Build Voice, Accountability, and Justice in Nairobi's Mukuru Informal Settlements." *World Bank Legal Review,* 233-255.

Weru, J. (2004). Community federations and city upgrading: the work of Pamoja Trust and Muungano in Kenya. *Environment and Urbanization*, 16(1), 47-62.

Wilson, D. (2011). Lessons from eThekwini's Pit Emptying Programme- From Pilot to Full Scale. *What Happens When the Pit is Full? Developments in On-site Faecal Sludge Management (FSM) Seminar Report*. Water Information Network, Stockholm Environmental Institute *et al.*, pp28-30.

Winton, A. (2014). Gangs in global perspective. *Environment and Urbanization*, *26*(2), 401-416.

World Bank (2016a) *Kenya Economic Update*, March 2016, Edition No. 13, Nairobi, 87 pgs.

_____. (2016b). *Republic of Kenya: Kenya Urbanization Review,* Washington DC, 178 pages.

World Health Organization (WHO) (2016). *Burning Opportunity: Clean Household Energy for Health, Sustainable Development, and Wellbeing of Women and Children,* Geneva: World Health Organization.

_____. (2015). Investing in Water and Sanitation: Increasing Access, Reducing Inequalities. GLAAS 2014 Findings -Special Report for Africa, UN-Water **Gl**obal **A**nalysis and **A**ssessment of **S**anitation and Drinking Water, Geneva, 25 pages, available at: http://www.who.int/water_sanitation_health/publications/glaas-2014-africa/en/

Yiftachel, O. (2009). Theoretical notes on gray cities': the coming of urban apartheid?. *Planning Theory*, *8*(1), 88-100.

Appendices

Appendix 1: Modes of Electricity Theft

TABLE 4.5	Vulnerability to Corruption: Theft of Electricity	
Activities	**Mode of theft**	**Beneficiaries of corruption**
Generation	Theft of fuel camouflaged as auxiliary consumption in thermal generation plant Unauthorized use in the homes of generation plant staff	Staff of the generation plant Labor union leaders
Transmission	Tapping of overhead transmission lines by large consumers Defective meters	Large consumers Politicians Bureaucrats Utility managers Transmission line staff
Distribution	Tapping of distribution lines	Consumers Distribution utility staff
	Unauthorized supply of energy	Consumers Utility managers Distribution utility staff
	Organized resistance to paying for electricity	Labor union leaders Politicians Groups of consumers acting in concert (farmers, industries, residential areas, and the like), Local mafia with political protection
	Nonbilling and underbilling of energy	Consumers Billing staff
	Tampering with or bypassing meters	Consumers Linemen
	Billing the consumer at a lower rate	Consumers Billing staff Utility managers

Source: Gulati and Rao (2007), 'Corruption in the Electricity Sector: A Pervasive Scourge', World Bank, p. 127. While noting multiple forms of electricity theft, the authors neglect the role of organized intermediaries and of government actors beyond utility officials (except during 'organized resistance to paying for electricity').

Appendix 2: Key Challenges Facing Manual Emptiers as Informal Workers

With minimal equipment, low or erratic earnings, minimal organization, and pervasive occupational health hazards, latrine-emptiers face several challenges that are often shared by other informal workers. Their earnings vary seasonally but are usually low and falling recently, due to increased competition or the rise of informal sewers. Emptiers' poverty is epitomized by their inability to afford their main piece of equipment: a metal drum attached to two (usually wobbly) tires and handles, costing an exorbitant Ksh. 7000 to 10,000 in total ($70-$100) while a rented drum usually costs 200 shillings ($2) per day.[184] The following picture is from Korogocho,[185] another slum in Nairobi, and in both areas waste is disposed in polluted water-courses:

The above emptiers do not have gumboots, in contrast to most workers in Mukuru[186], but their drum has an identical design to those pictured in my fieldwork. Typically, emptiers lack gloves (costing Ksh. 100-300 per pair), or may not wear them regularly because they make for slippery handling when transporting excreta. Payments per drum range widely and depend on negotiations with the structure-owner, the latrine's location, and the season. That is, emptiers may receive Ksh. 500-600 per drum in rainy season and for toilets away from the main road or the stream where waste is dumped; but in more central locations or in dry season, they make just Ksh. 250 or 300 per drum. Dividing these earnings by the 2 to 4 men per group, then subtracting rent for drums and other fees (e.g., youths can opportunistically extort 100-200 shillings if they see a full drum), profits will rapidly disappear. In the FGDs, some workers claimed to make more money in dry season since they can work solo or in smaller teams, despite having more regular work in rainy season.[187]

Scholars of informal labor have usually overlooked sanitation providers, who may pose an unusual set of challenges for labor organizers and sanitation advocates. Except for manual scavengers in India,[188] sanitation workers are rarely featured in past research and thus contrast with oft-studied sectors and advocacy networks targeting vendors, home-based workers, and waste-

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[184] The number of drums emptied during each job will depend on the structure-owner's budget and size of the toilet, but may require 8 or more drums per latrine. The drum and cart's costs are comprised of Ksh. 1000 for the *drum itself*, the *2 tires* are together Ksh. 1200, plus Ksh. 1200 for *2 rims* on the tires. The *shaft* is another Ksh. 1000, Ksh. 1500 for metal *frame* or Ksh. 1000 for wood frame, and *welding* is another Ksh. 1,000. For two emptiers who eventually managed to buy a complete drum with the above components, it took 5 years of saving (September 12th, 2015).

[185] Photo by Doreen Mbalo, available at https://www.flickr.com/photos/gtzecosan/6975450175/

[186] Emptiers in Mukuru typically own a pair of gumboots that may last perhaps 4-5 months for better-quality boots.

[187] "Work that you'd finish faster in sunny season becomes harder to finish in rainy season because of the road and because of passing and pushing and all that. So you have to push like 3 people, 4 people, and it's just the same 400 and you have to split it among 4 people!" (FGD discussion with 3 emptiers on Nov 22nd, 2016).

[188] Extensive literature has explored (largely female) manual scavengers in India; caste and gender discrimination have led to workers' entrenched marginalization, even after scavenging was declared illegal in 1993 (see Burt *et al.* 2016).

pickers.[189] Similar to other informal laborers, sanitation workers lack official recognition, often have erratic earnings, may lack the time or resources to participate in collective strategies, and are highly segmented amongst themselves (Chen *et al.* 2005). Sanitary laborers vary in their scale, level of profitability, and access to equipment: manual emptiers usually endure poorly-paid work without any mechanized tools or protective equipment, while exhausters utilize pumps and trucks that may allow them to serve higher-paying or larger-scale customers (Mikhael *et al.* 2014).

However, sanitation workers may have additional features making them especially difficult to organize or garner public recognition. For instance, manual latrine-emptiers often abuse alcohol and drugs to help cope with the smell of human waste and discrimination linked to the job (Sugden 2012, Eales 2005). Stigma is common in other informal trades, of course, but the potent taboos surrounding human waste may stymie workers' collective strength and result in a profound lack of respect among their customers. In a further complication, sanitation workers may undercut other interventions (e.g., emptiers can compete with NGOs' improved toilets and eco-sanitation enterprises like Sanergy). Emptiers may therefore lack clear advocates in the sanitation sector, while the environmental health concerns may be especially noxious and thwart any efforts to organize sanitary workers. For all of these reasons, sanitation providers have been largely sidelined in the research and advocacy literature on WASH or informal labor.

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[189] See publications by Women in Informal Employment: Globalizing and Organizing (WIEGO) at www.wiego.org, which seeks to organize waste-pickers, vendors, home-based workers, and domestic workers.

**Appendix 3:** Alternative Typologies of Formal/Informal Interactions

		Prevalence of Non-Sanctioned, Private Providers	
		Marginal	*Extensive*
Type of State Involvement	*Direct Provision*	State-Dominant Electoral, regime-maintenance, and bureaucratic politics	Supplemented State Electoral, regime-maintenance, and bureaucratic politics *and* Collusion, extraction (from state *and* non-state providers)
	Indirect Provision	Regulated Provision Formal regulatory politics	"Free" Market Self-regulation And Collusion, extraction (from providers)

Post, Bronsoler, and Salman 2017, 'Hybrid Systems of Local Public Goods Provision,' p. 31

A typology of informal institutions

Outcomes	Effective formal institutions	Ineffective formal institutions
Convergent	Complementary	Substitutive
Divergent	Accommodating	Competing

Levitsky and Helmke 2004, p. 728 'A Typology of Informal Institutions'
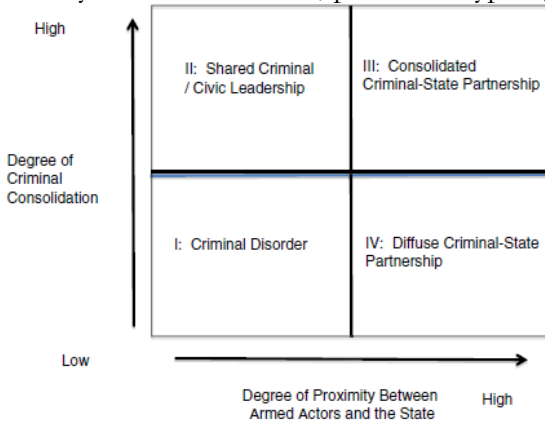
Aŕias 2013, p266 Criminal consolidation and state proximity: localized armed regimes (in Rio de Janeiro)

Appendix 4: Abbreviations and Key Terms

AMT: Akiba Mashinani Trust, the financial support NGO to Kenya's slum-dweller federation and longtime partner to UC Berkeley in Nairobi

APHRC: Africa Population and Health Research Centre

CHV: community health volunteer

FGD: focus group discussion

FSM: fecal sludge management

JMP: Joint Monitoring Program of UNICEF and WHO for water and sanitation (www.wssinfo.org)

KPLC: Kenya Power and Lighting Company (also called simply 'Kenya Power')

MHM: menstrual hygiene management

Muungano wa Wanavijiji: Kenyan slum-dweller federation and member of SDI (see below)

sambaza: informal electricity provision (literally to 'spread' in Swahili)

SDI: Slum/Shack-Dwellers International, a global network of urban poor federations (http://knowyourcity.info/who-is-sdi/about-us/)

SDI-Kenya: technical support NGO for Kenya's slum-dweller organization *Muungano* and UC Berkeley partner

SFD: shit-flow diagram (http://sfd.susana.org/)

Village: A smaller neighborhood within a slum. As discussed in Chapter 3, even neighboring villages in Mukuru may differ markedly in their levels of sanitation or other service provision

WASREB: Water Services Regulatory Board (wasreb.go.ke/about-us)

WIEGO: Women in Informal Employment: Globalizing and Organizing (www.wiego.org)